(No Model.) 4 Sheets—Sheet 1.

E. F. STECK.

EXTENSION LADDER.

No. 348,594. Patented Sept. 7, 1886.

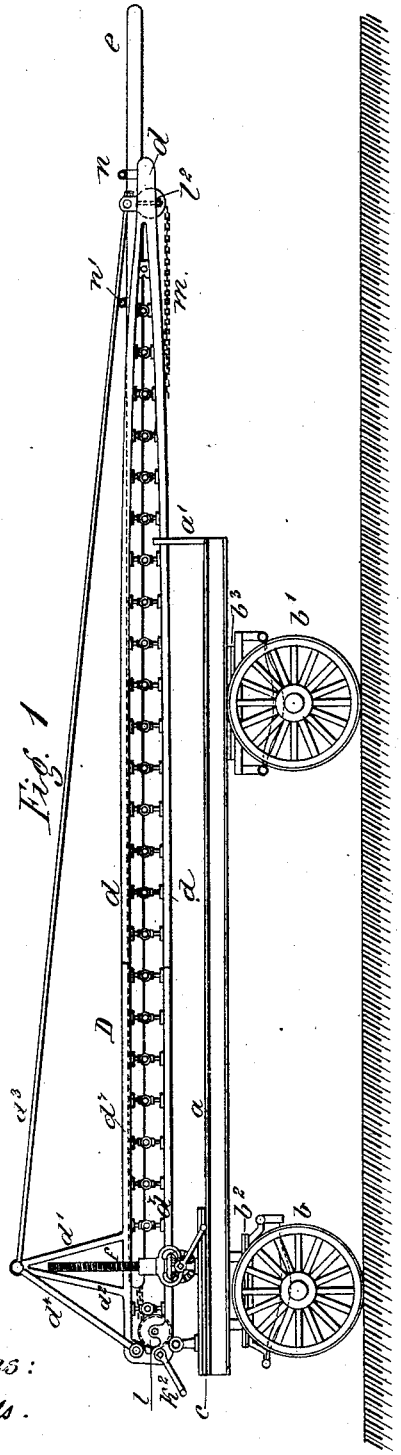

Fig. 1.

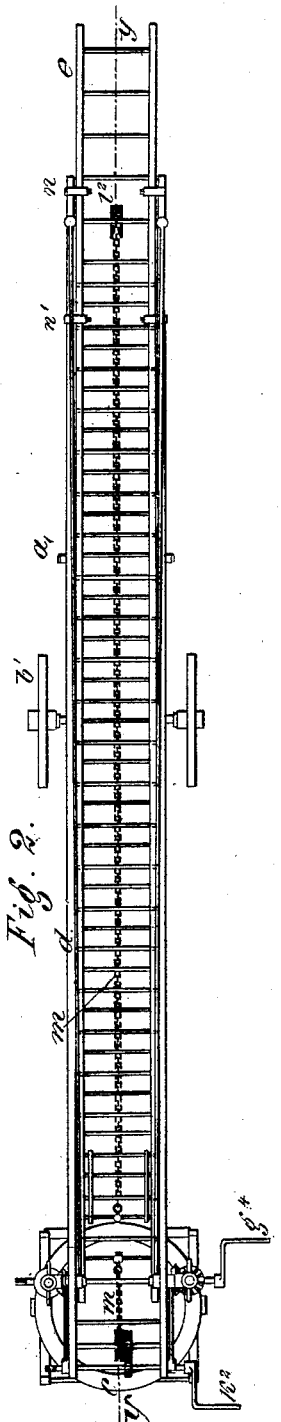

Fig. 2.

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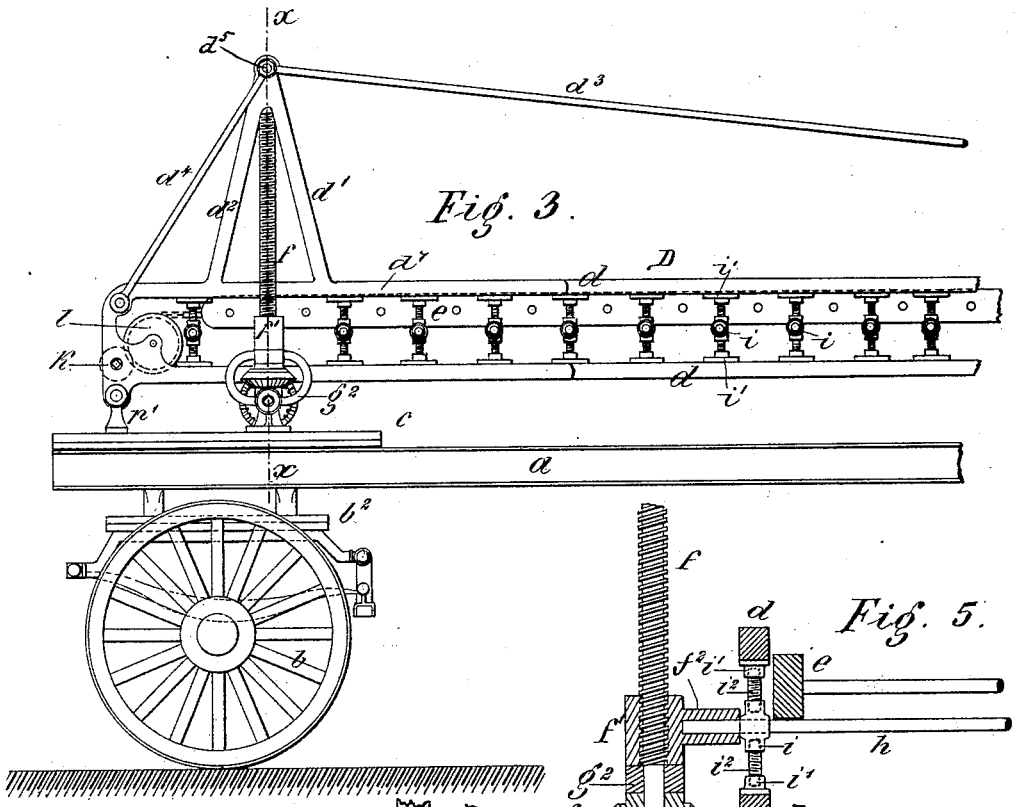

Fig. 3.

Fig. 5.

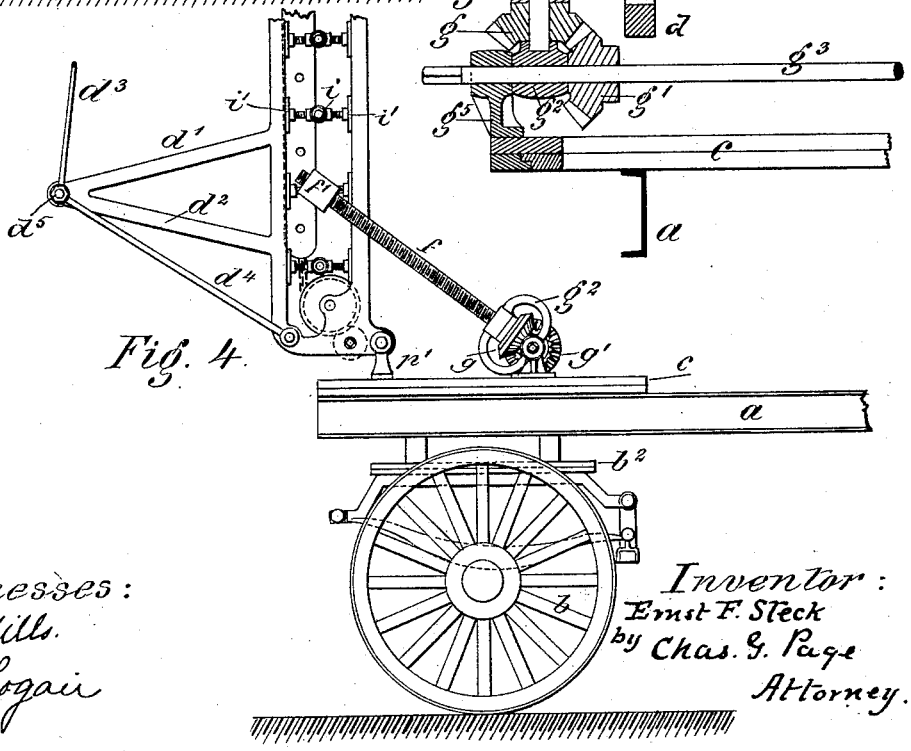

Fig. 4.

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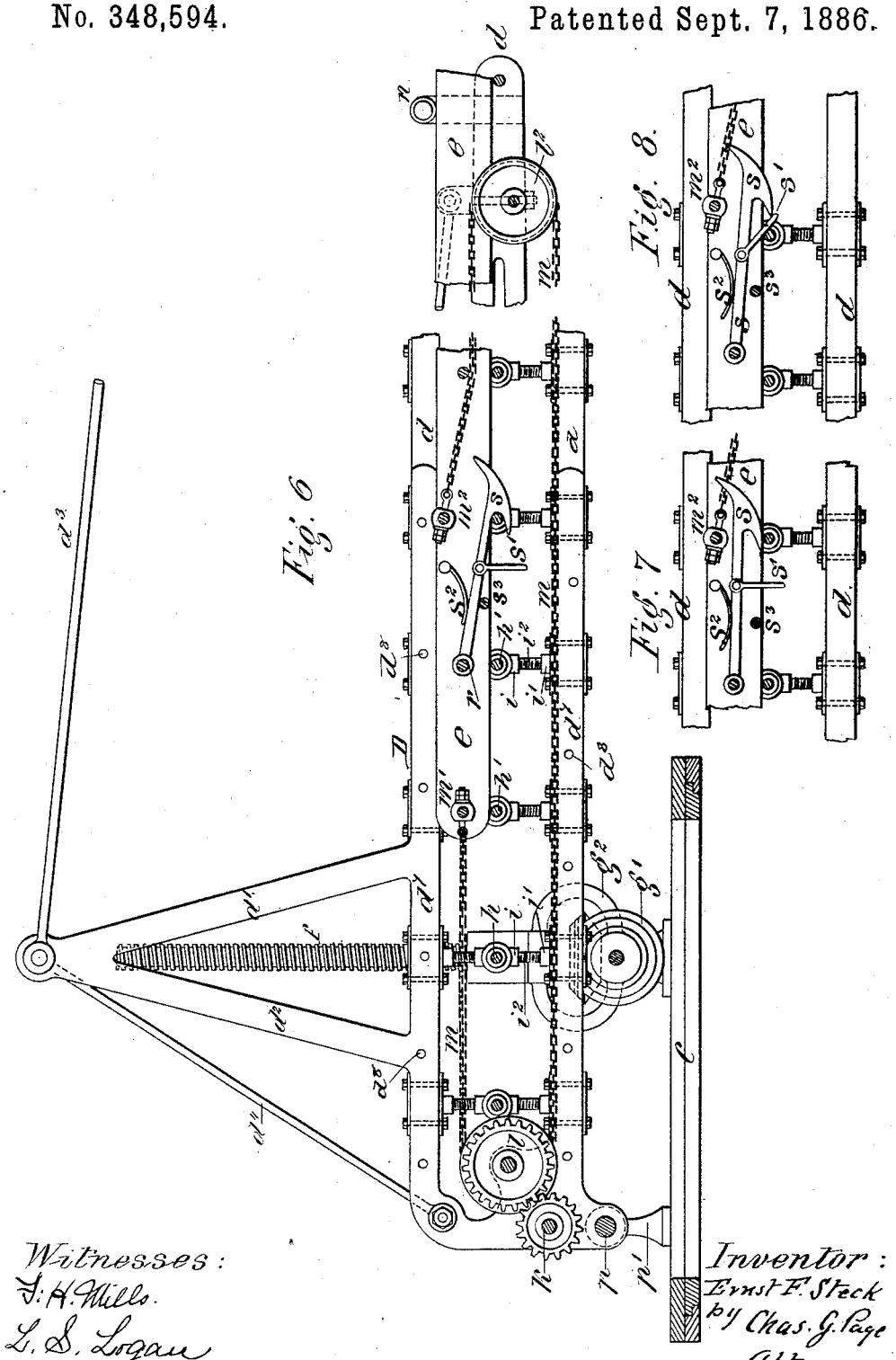

Fig. 6

Fig. 8.

Fig. 7

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Fig. 9

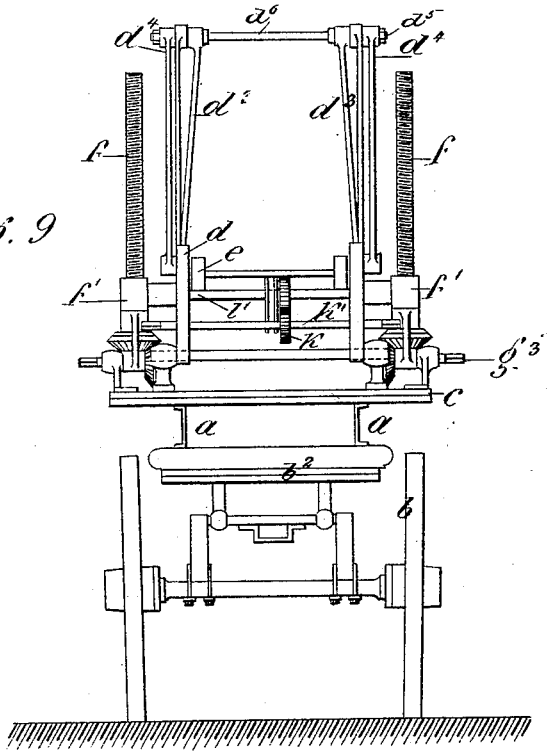
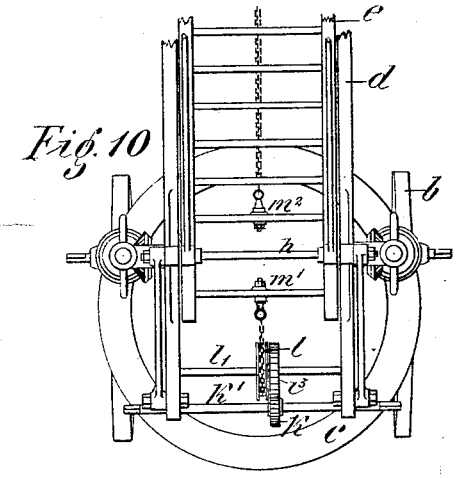


Fig. 10



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UNITED STATES PATENT OFFICE.

ERNST F. STECK, OF CHICAGO, ILLINOIS.

EXTENSION-LADDER.

SPECIFICATION forming part of Letters Patent No. 348,594, dated September 7, 1886.

Application filed March 11, 1886. Serial No. 194,909. (No model.)

To all whom it may concern:

Be it known that I, ERNST F. STECK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Extension-Ladders, of which the following is a specification.

The objects of my invention are, first, to provide a construction of ladder that shall be exceedingly strong without adding to the weight of the ladder to an objectionable extent, and to adapt the ladder to withstand, without breaking, swaying, or materially bending, any and all weight to which it may be subjected while in use; second, to provide an improved and simplified means for raising and lowering the ladder, so as to apply the lifting-force in a line at right angles to the plane of the ladder when the latter is down in a horizontal position, so as to facilitate the raising of the ladder, and also render the raising and lowering mechanism stronger and more effective; third, to provide a better construction of apparatus as a whole, and to provide certain improved details, all adding to the general efficiency of the ladder.

To the better understanding of a construction involving my improvement and illustrating its several important features, I will describe the same in connection with the annexed drawings.

In the drawings, Figure 1 represents in side elevation the truck with the extension-ladder in a horizontal position thereon. Fig. 2 is a top plan view of the same. Fig. 3 is a side elevation on a somewhat larger scale of a portion of the truck and extension-ladder with the said extension-ladder in the position of the preceding figures. Fig. 4 is a view similar to Fig. 3, with the exception that the extension-ladder is raised to a vertical position. Fig. 5 is an enlarged detail section taken on the line x x, Fig. 3, and serves to illustrate one-half of the mechanism for raising and lowering the ladder. Fig. 6 represents an enlarged section taken on the line y y, Fig. 2, with a portion of the extension-ladder broken away for convenience of illustration. Figs. 7 and 8 represent like portions of Fig. 6, and, respectively, illustrate different positions of the catch or hook for locking the extensible or sliding ladder-section in position. Fig. 9 represents, on a scale somewhat larger than that of Fig. 1, a front end elevation of the truck with the extension-ladder down. Fig. 10 is a top plan view of the front portion of the truck and extension-ladder.

Referring by letter to the several figures of the drawings, in which like letters denote like parts, a indicates the truck-body, which desirably consists of a long rectangular frame composed of double-flanged angle-iron strengthened by cross-braces arranged at appropriate intervals. This frame or body is spring-supported from the front and rear wheels, b and b', through any suitable construction of running-gear, indicated at b^2 and b^3, and serves to constitute as a whole a light and strong construction of truck.

The turn-table c, upon which the supports for the extension-ladder and the raising and lowering mechanism are mounted, is secured upon the truck-body a, adjacent to the front end of the same, and is, as usual, constructed so that its upper half or section may turn upon its lower half or section which is rigidly secured upon the truck-body.

The extension-ladder herein shown comprises the two sections D and e, it being understood, however, that more than two section can be employed should it be desired to provide a ladder of great length.

The ladder-section D is hinged or pivotally supported at one end upon the turn-table, while the ladder-section e is arranged to slide between the sides of the pivoted ladder-section D, so as to provide an extensible portion of the ladder that may be run out to the required extent.

The features of strength and rigidity involved in the construction of the ladder-section D are attained as follows, to wit: Said ladder-section has each one of its two sides formed of two bars, d d, that are set somewhat apart at the lower or pivotal end of the ladder-section, and arranged to converge toward the upper or free end thereof, as illustrated in Fig. 1. These bars are tied together in pairs and braced by a series of braces or ties, and the rounds are secured at their ends to the connecting media.

With regard to the employment of the four

bars *d*, connected together in pairs with the rounds secured at their end to the connecting devices, a variety of mechanical contrivances for connecting together the bars could obviously be adopted; but with respect to the special construction of said connecting media that herein shown is exceedingly strong and efficient and is the one that is herein preferred. According to the present construction these braces, ties, or connections consist of socketed pieces or couplings *i* that are adapted to receive the rounds *h'* of the ladder-section D, and these couplings are in turn connected by threaded rods i^2 with socket plates or pieces *i'* that are bolted to the side bars, *d*, as best shown in Fig. 6. Each coupling is provided with a socket for the end of a round of the ladder-section, and at opposite sides of said socket it is provided with threaded sockets for the threaded rods i^2, which are screwed both into said threaded sockets and into the threaded recesses of the socket-pieces that are secured to the side bars. By means of such construction the connections between the bars *d* can be properly adjusted, and provision made for supporting the rounds in a plane passing between each pair of side bars. A ladder of such construction obviously involves great strength and durability, and is practicably rendered absolutely rigid, it being seen that in addition to the strength acquired by the four side bars the system of bracing renders any bending or breakage of the ladder impossible under any weight or strain that a ladder under any or all circumstances would be called upon to sustain. The converging side bars are secured together at their meeting ends in any suitable and substantial way, and desirably the two pairs of side bars will be tied together at the free end of the ladder by one or more tie-rods in place of ordinary wooden rounds, the tie-rods in such case being preferably inclosed by a metal or other suitable casing. As a further means, however, for bracing the ladder-section D against any possible tendency to bend, and to increase its durability, said section is provided with stringer or stretcher rods or wires d^3 d^4 that serve to connect or tie together the free end of the ladder-section with the upper portions of two standards that are secured to the ladder-section near its pivoted end, and preferably over the point where the power for raising the ladder is applied. The two standards are respectively applied to one and the other of two corresponding side bars of the ladder-section, and are arranged laterally to the plane of the ladder, as herein illustrated. Each standard is desirably composed of the two inclines *d'* and d^2 converging outwardly from one of the bars *d*, so as to form an inverted-V shaped standard, of which the two ends are attached to the ladder. The outer end portions of these standards are connected together by a brace that may consist of a tie-rod, d^5, arranged to pass through a tubular casing, d^6, Fig. 9, which being arranged with its ends against the standards will hold the same apart, and also permit them to be tightened up against the ends of the said tubular casing by the nuts upon the tie-rod. Each standard is further provided with two bearings respectively arranged on opposite sides of the standard, the one being for one of the rods d^3 and the other for one of the rods d^4. Said rods can, if desired, be threaded at their ends and provided with tightening-nuts, it being observed that in such case bearings similar to those on the standards can also be provided on the ladder-section for the outer terminals of the rods or wires, as will be readily understood without special illustration. The location of the standards involves the employment of long stringers or stretching rods or wires extending from the free end of the ladder-section to the standard, and of short rods or wires extending from the standards to the pivotal end of the wire. Since the standards are over a positive support, and are braced by the short rods or wires d^4, any tension upon the wires d^3 caused by weight upon the ladder-section D when the same is in a raised position will be resisted by the standard and its short braces d^4, and the strain be practically opposed by a portion of the ladder resting upon a support that is afforded by the raising and lowering mechanism hereinafter described.

As a desirable and substantial means for further connecting together the two bars *d* of each pair at the pivotal end of the ladder-section D, and also for providing bearings for certain parts hereinafter specified, two U-shaped plates, d^7, are provided, one being at each side of the ladder-frame. The bent portions of these plates may extend somewhat back of the pivotal end of the ladder-section D, while their arms are bolted to the side bars, *d*, for example, by bolts d^8, Fig. 6. Each standard can, if preferred, be formed in one piece with one of the arms of one of these U-plates, thus adding to the strength and rigidity of the structure.

The extension-ladder is supported, raised, and lowered by the following means: The ladder or ladder-section D is hinged or pivotally supported at one end upon a horizontal pivot, *p*, (see Fig. 6,) which is in turn supported in short standards *p'*. These standards are secured upon the rotary section of the turn-table, and are in point of location with relation to the front end of the truck and the turn-table on the side of the turn-table that is nearest said end of the truck. The pivot may of course pass through any suitable attachment applied to this end of the ladder, but desirably, and as herein shown, passes through the plates d^7, hereinbefore described.

The raising and lowering mechanism comprises a pair of screws or threaded rods, *f*. One of these screws is stationed opposite each side of the ladder, and arranged to pass through a nut, *f'*, that is swiveled on the side of the ladder-section. Fig. 5 illustrates one of these swiveled nuts, the said nut being fitted to turn

upon a pivot that is conveniently formed by a rod, h, arranged to take the place of one of the ladder-rounds. Each screw is provided near its lower end with a bevel-gear, g, fixed upon a stem portion of the screw, and these bevel-gears are engaged by bevel-gears g' upon a rotary shaft, g^3, that is mounted in bearings g^5 upon the upper oscillating section of the turn-table. The ends of this shaft extend beyond the bearings g^5, and are adapted to provide arbors for a suitable key or handle, so that the shaft g^3 may be rotated in order to turn the screws through the mediation of the gears g and g', and thus raise or lower the ladder. It will be understood that like connections are provided between each screw and the shaft g^3, and that the shaft g^3 can be operated from either end. The lower stem portions of the screws are stepped in bearings g^2, one of which is provided for each screw. Taking for example one of said bearings g^2, its construction is proximately that of an annulus having its lower portion made in the nature of a collar or hub that is fitted to turn upon shaft g^3, while the upper portion of this annulus is perforated to permit the passage of the stem portion of the screw, as shown in Fig. 5. These bearing-pieces thus provide bearings for the screws at points above and below the bevel-gears g, that are rigid with the screws, and by supporting the bearing-pieces upon shaft g^3, so that they can turn thereon, the screws can tilt from an upright to an inclined position when they are turned in a direction to raise the ladder. As, for example, Fig. 3 shows one of the screws in an upright position with the ladder down, while Fig. 4 illustrates the ladder in an upright position with the screw somewhat inclined.

As has hereinbefore been observed the bearings p' for the pivot, upon which the ladder-section D is fulcrumed, are arranged on the turn-table at the side thereof that is nearest the front end of the truck, thus bringing the ladder-fulcrum at one side of the turn-table. The bearings g^5 for sustaining the power or raising and lowering mechanism are on the contrary located upon the opposite side portion of the turn-table, and said mechanism is so arranged that when the ladder is down the lifting-screws stand in an upright position and at right angles to the frame of the ladder. By such arrangement a more even distribution of weight upon the turn-table is effected and a direct lift attained, it being obvious that in raising the ladder the greatest resistance is offered during the initial portion of the lift, and that the screws serving to direct the lifting-power at right angles to the plane of the ladder render it an easier matter and are the better supported to withstand the weight than if they should occupy an inclined position when the ladder occupies a horizontal position.

The bearings for the rod h (or what is substantially the same thing, the pivots that enter the lateral hubs f^2 on nuts f') may be formed by two of the couplings i, or by any appropriate connections between the arm portions of the U-shaped plate d^7.

The sliding ladder-section e can have its sides constructed in a manner similar to the ladder-section D; or it can be formed similar to an ordinary ladder, as herein shown. This sliding ladder-section is arranged to slide over the rounds and between the sides of the pivoted ladder-section, and is held thereon by appropriate guides or cross-bars n secured to the ladder-section D.

The sliding or extensible ladder-section is run out or drawn back by means of a chain, m, arranged to pass around sprockets l, Fig. 10, and l^2, Fig. 2, the ends of said chain being connected with the sliding ladder-section near the inner end of said section. As herein shown, one end of the chain is attached to a round or cross-bar, m', while the other end is attached to a cross-bar, m^2, as shown, for example, in Fig. 10.

The sprocket l is provided at one side with a gear, l^3, which is engaged by a gear, K, upon a shaft, K', that is journaled in the ladder-section D, or, in what is the same thing, the U shaped strengthening-plate d^7, which for the present purpose may be regarded as a portion of the ladder-section D.

The shaft K' is extended beyond its bearings, and, like the shaft g^3, has its ends adapted to receive a key or handle so that it can be turned in order to operate the gearing and cause a travel on the part of the chain with a view to running out and backing the sliding ladder-section.

In Figs. 1 and 2, g^4 denotes a key or handle applied to the shaft of the raising and lowering mechanism, and K^2 denotes a handle applied to the shaft K'.

The devices for locking the extensible ladder-section in its adjustment consist of two spring-controlled hooks, s, that are hung upon one of the rounds, or an equivalent bar secured to the sides of the sliding ladder-section e. The hooks are normally depressed by springs s^2 so as to lie in position to engage the rounds of the pivotal ladder-section when the sliding extensible ladder-section is retracted, their front edge portions being rounded, so that when the sliding ladder-section is run out the hooks will ride over the rounds of the ladder-section D. Each hook is provided with a pivoted guard or finger, s', adapted to close the hook when it is desired to permit the hooks to ride over the rounds of ladder-section D during the retraction of the pivotal ladder-section. Fig. 6 shows one of the hooks resting upon a cross-rod, s^3, and engaging one of the rounds of the pivoted ladder-section, the guard or finger being free to hang down from the shank of the hook. Fig. 7 shows the hook in the act of riding over the round. A slight forward movement of the sliding ladder from this position will be sufficient to bring the hook in position to engage the round, said engagement being effected by a slight retrac-

tion of the sliding ladder-section after the hook end of what is herein generally denominated as a "hook" has cleared the round. To detach and close the hook, the sliding ladder-section can be farther advanced so as to permit the guard to likewise clear the round, after which the sliding ladder-section can be retracted, during which movement the guard will be successively raised by the rounds of ladder-section D, as in Fig. 8. As indicated in Fig. 1, the truck-frame is provided with a rest, a', for the free end portion of the ladder when the same is in a horizontal position.

Heretofore it has been proposed to raise and lower a combined tower and ladder by means of vibratory raising and lowering screws arranged to work through nuts upon the ladder and operated by gearing; but in such instances the nuts have been so arranged that when the ladder was brought into a horizontal position the lifting-screws would stand at an acute angle to the plane of the ladder. By such arrangement so great power has been necessary to raise the structure that the presence of an engine for operating the screws has been necessitated. It will be observed, however, that in that part of my improvement relating to the raising and lowering mechanism the nuts are swiveled to the ladder at points which, when the ladder is down, are within such length of radius from the fulcral support of the screws as to cause the screws to stand upright and at right angles to the plane of the ladder, in which way a ladder of any desired size can be readily raised by hand-power applied to the gear mechanism, which serves to rotate the screws.

What I claim as my invention is—

1. The ladder or ladder-section having each side composed of two bars converging toward one end of the ladder and combined with the rounds and supports therefor which connect said side bars together in pairs, substantially as described.

2. The ladder-section D, having each side composed of two bars converging toward the ends of the ladder, and combined with and connected together by screws, that are arranged in pairs, with their outer ends engaging in sockets on the bars, and their inner ends screwed into a coupling, said couplings being provided with sockets in which the ends of the rounds are received, substantially as described.

3. The ladder-section having each side composed of two bars converging toward one end of the ladder-section, and secured together by connections, that also provide supports for the rounds, combined with the plates d', secured to the separated end portions of said bars as a means for strengthening the ladder-section, substantially as described.

4. As an improvement in means for raising an extension-ladder with a direct lift, the combination, with the swinging, raising, and lowering screws fulcrumed upon the turn-table, and means, substantially as described, for operating said screws, of the pivoted ladder provided with swiveled nuts located thereon at points which, when the ladder is in a horizontal position are, with relation to the fulcral support of the screws, within a radius therefrom, which brings the screws into an upright position, and at right angles to the plane of the ladder, substantially as and for the purpose specified.

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