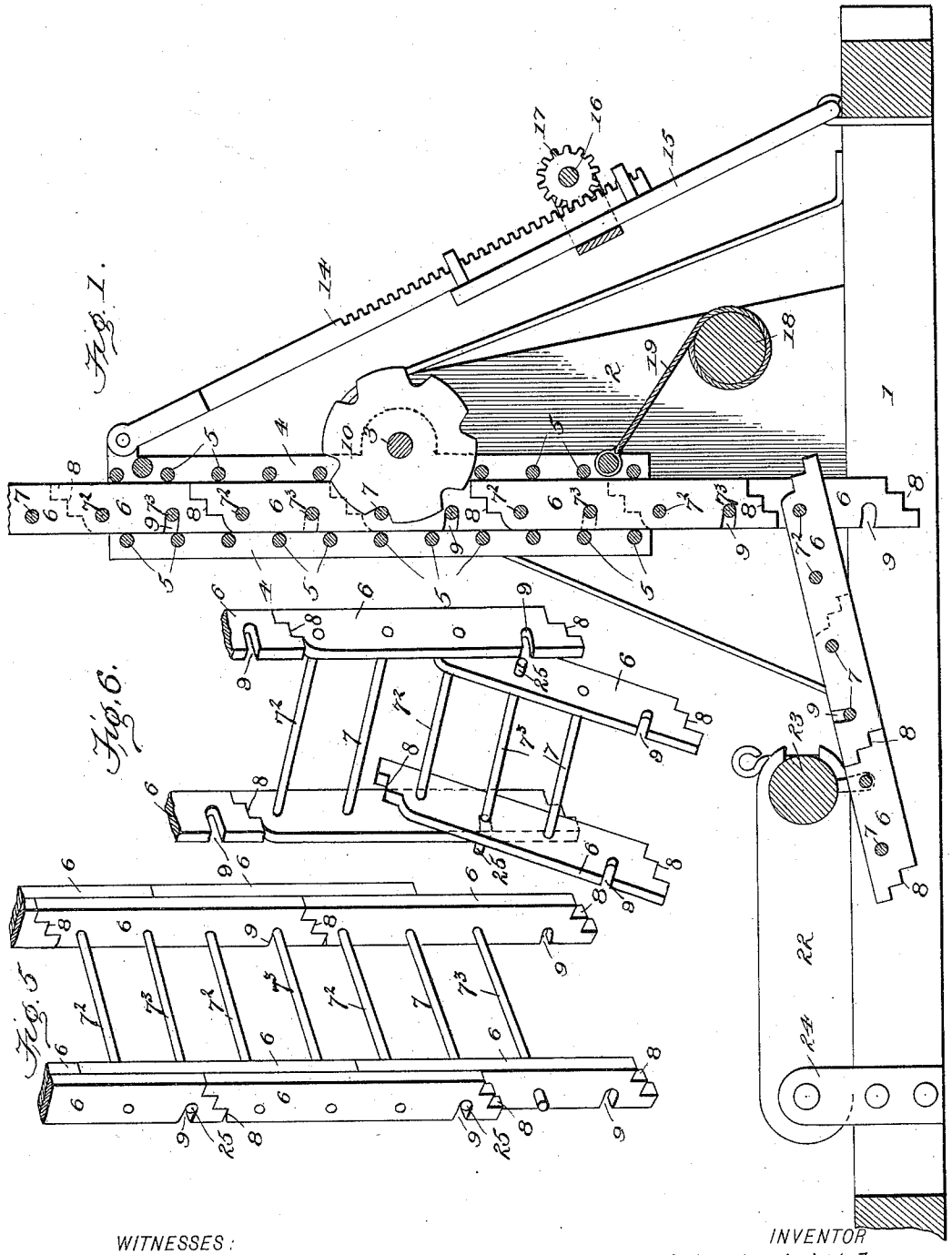
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F. S. MILEY.

EXTENSION LADDER.

No. 598,615. Patented Feb. 8, 1898.



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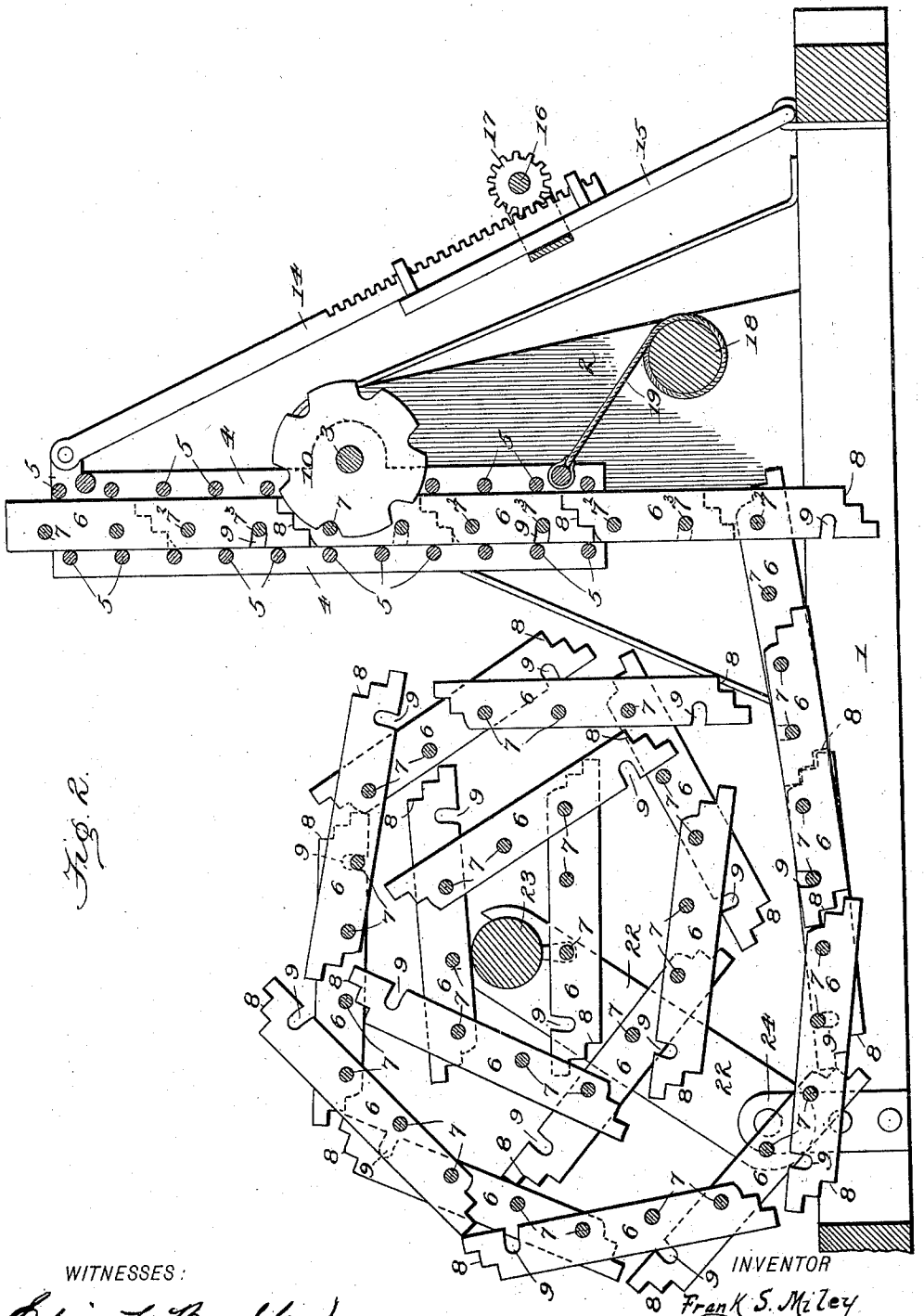


Fig. 2.

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Fig. 4.

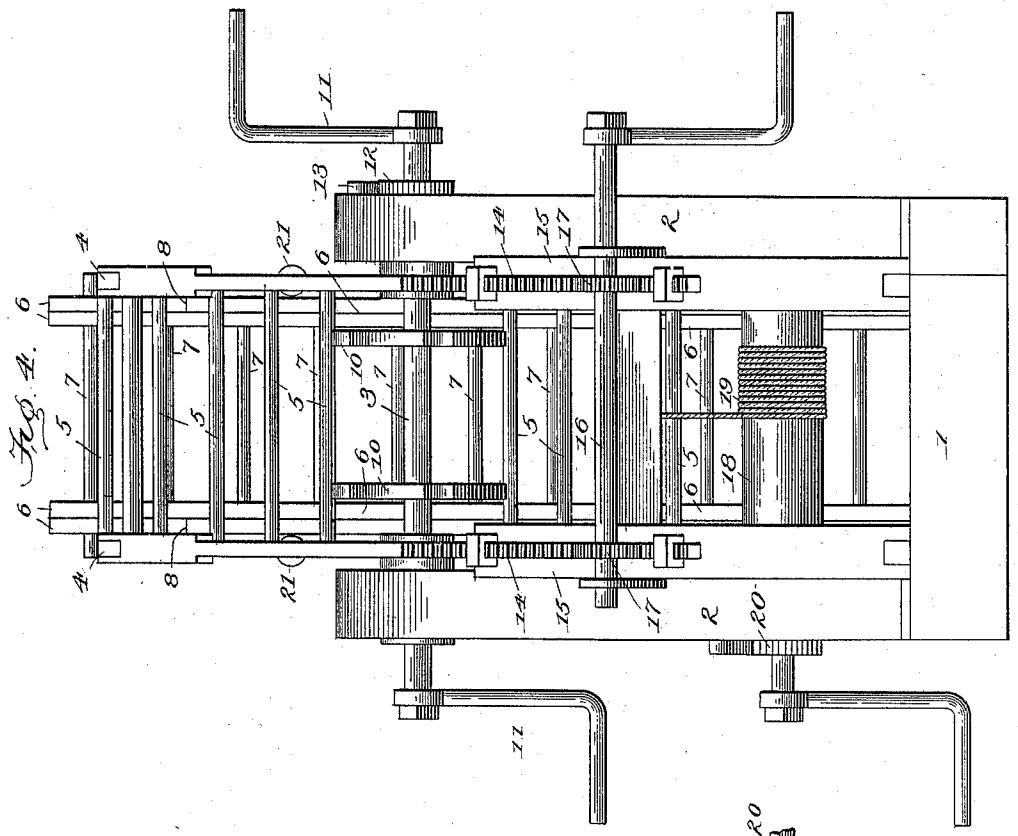
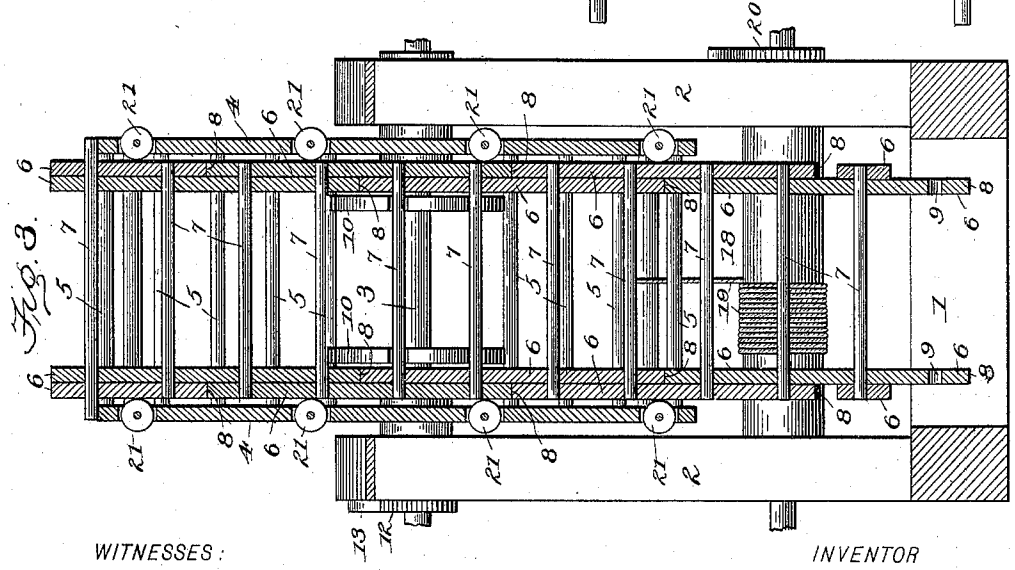


Fig. 3.



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UNITED STATES PATENT OFFICE.

FRANK S. MILEY, OF FORREST CITY, ARKANSAS, ASSIGNOR OF ONE-HALF TO CHARLES H. SANDERS, OF SAME PLACE.

EXTENSION-LADDER.

SPECIFICATION forming part of Letters Patent No. 598,615, dated February 8, 1898.

Application filed June 14, 1897. Serial No. 640,716. (No model.)

To all whom it may concern:

Be it known that I, FRANK S. MILEY, a citizen of the United States, residing at Forrest City, in the county of St. Francis and State of Arkansas, have invented certain new and useful Improvements in Extension-Ladders, of which the following is a specification.

In the production of an extension-ladder adapted to be reeled and unreeled in its use I have devised a novel construction whereby the ladder side bars are made double and pivoted together in sections in a way to allow them to be separated and swung apart at their ends and to swing together in alinement by the engagement of their ends 8 in erecting the ladder within and through a guideway or cage to insure absolute rigidity and security of the ladder when erected. In such construction the ladder-sections are not connected at their ends, but are pivoted by the rungs 7^2 to the end of the inner section at about mediately of the length of the next contiguous outer section, the ends of the side bars of each section being adapted for engagement by oppositely or reversely formed shoulders standing transversely of the ladder-bar. The link-sections have a free front-edge-interlocking engagement with each other at 9, below the pivots upon which the several link-sections swing, so that as the link-sections are caused to swing into alinement to enter the cage or guideway, in so doing they become rigidly locked to each other by the reverse oblique end abutting formations and the said edge-interlocking engagements and pass out of the cage stiffly connected. In this operation the cage forms a coacting element to maintain the ladder-sections in solid alinement both within and above the cage. The provision for erecting and lowering the ladder is applied directly to the rungs of that part of the ladder which is braced and supported within the cage, whereby the ladder-rungs are utilized as a rigid rack and made a part of the elevating-gear, the power of which is applied at the pivotal mounting of the cage, so as not to interfere with the adjustment of the inclination of the ladder.

In these and other particulars my invention consists of certain novel parts and combinations of parts which are particularly pointed out in the claims concluding this specification.

By referring to the accompanying drawings my invention will be fully understood from the following description.

The drawings show, in Figure 1, a vertical section of the ladder in raised position. Fig. 2 is a like view showing the ladder-sections as coiled upon the reel in position ready to be erected. Fig. 3 is a vertical section taken at right angles to Fig. 1, showing more particularly the guideway or cage within which the links of the ladder are interlocked at their free ends, and each section is engaged by a rung 7^3 of one section entering an edge notch or recess in the front of its connecting-section and within which cage the ladder is supported in being erected. Fig. 4 is a rear elevation of the ladder. Fig. 5 shows the coupling of the ladder-sections and the way in which they are interlocked to make a stiff ladder as seen looking at the rear of the ladder, and Fig. 6 is a like view as seen looking at the front of the ladder.

I have shown the ladder as mounted upon and carried by a foundation-frame, but it will be understood that this frame is mounted upon a wagon or truck for transportation. This foundation-frame consists of strong connected sill-timbers 1, upon which, near one end, are secured strong pillow-blocks 2 2, suitably braced, in the upper ends of which is mounted a transverse shaft 3, whereon between the pillars is pivotally mounted or hung on a transverse shaft a guideway or cage wherein the ladder is erected and supported. This cage is constructed of side plates 4 4, secured together by transverse rods 5, arranged in two rows, a front row and a back row, and between these rows of rods and the side plates the guideway or cage is formed open at the top and at the bottom and through which the ladder is raised and lowered and by which it is supported when erected. This cage is preferably mounted mediately of its length and is of a length sufficient to give a firm support to the ladder in erecting and in lowering it and forms a fixed ladder part by which to reach the extension-ladder. Upon its supporting-shaft the cage can be tilted to give the

ladder the proper inclination, and, the cage being mounted between the pillow-blocks, the latter serve as side braces to the cage, so that this cage becomes a braced hollow trunk, within which the ladder is reared and lowered and supported in every direction by the mere operation of bringing the ladder-sections in alinement engagement within the cage.

The ladder is constructed of comparatively short sections, each section being composed of links 6, arranged in pairs separately side by side and united by rungs 7, the links of one section lapping with the links of the other section, whereby the ladder has its side bars formed of a chain of outer sections adapted to interlock with each other and side bars of inner sections formed to abut with each other, making, in effect, a ladder within a ladder united by the rungs. The links of these inner and outer sections are in joining relation sidewise, and each pair of links are rigidly joined by the rungs. The ends of the links of each section have shouldered or step-like or similar formations, the steps 8 of one end of each section standing obliquely across the bar, the reverse of the steps of the other end, so that the links of each section will join in alinement, the steps of the links of one section abutting with the steps of the links of the contiguous section when the sections are placed in alinement, so that the links lap with each other at their stepped or oblique ends. The links of the sections respectively lap with each other for about half their length, and each section is connected, preferably, by several rungs, one of which pivotally connects both sections; but to allow the sections to be connected with each other, so that each will be free to be separated at their ends and to swing away from the other upon one of its connecting-rungs, the rungs connecting the upper ends of each section standing upward in the cage form the pivots, and the rungs next below in each section engage corresponding recesses 9 9 in the front edges of the links of each section, whereby the sections will be free to open or separate at their ends and swing separately in relation to each other.

It will be understood that the rigidity of the ladder-sections to each other when erected is effected by the relation which the pivot-forming rungs have to the stepped, shouldered, or intermatching formation of the ends of the links and to the rungs of each section, which freely engage the recesses of each section. In further explanation of this and referring to Fig. 5 it is seen that each ladder-section is pivoted to the other by its upper rung, whereby the lower end of each ladder-section is free to swing away from the section next above it in being drawn into the cage, and it is this construction, in connection with the edge recesses 9 9 and rungs engaging said recesses, that the oblique stepped ends are caused to coact to lock the sections together as a rigid structure within the cage and as the ladder is erected from the cage. The mere bringing of the ladder-sections in alinement within the cage causes them to be rigidly connected by the action of the oblique stepped ends and the edge engagement of one link with the other at points between the end engagements. It is important to notice that while the ends of the side bars of the ladder-section stand transversely oblique this oblique termination faces to the front side at the upper ends of the several ladder-sections, while at the lower ends of said side bars the oblique terminations face to the rear side of the ladder. It is also important to notice that the surfaces of these oblique ends are broken by a stepped formation, and that the matching form of the steps is such as to present abutting surfaces at right angles to the length of the bars. This allows the ends of the bars to swing together as the sections are drawn into the cage, and that, although the steps stand transversely oblique when the sections are in alinement, the square form of the steps gives the ends of the ladder-sections a square support upon each other in the line of the ladder, as seen in Figs. 1 and 2. It is this construction of the ladder by which its sections are caused to be separated at their ends, so that they will freely dive under and enter the lower open end of the guideway or cage and cause their ends to be brought together, the oblique shouldered end of one engaging the oblique shouldered end of the other. This construction of the ladder also allows it to be rolled upon a reel, from which it is unrolled in the operation of erecting the ladder. This provision for erecting a ladder carried upon and delivered from a reel to the erecting mechanism, in which the oblique ends of the links-section are separated and brought together, forms a feature of my invention, as I will more particularly presently describe.

It will be understood that the cage itself by its front rods forms a ladder by which to reach the ladder proper when erected, and for this purpose the front cage-rods form rungs by which a person can ascend the cage and step from its rungs to those of the ladder.

For erecting and for lowering the ladder I provide the transverse shaft 3, on which the cage is mounted, with a pair of toothed wheels 10, adapted to engage the rungs of the ladder, and for this purpose the cross-rods at the rear side of the cage are interrupted to allow the toothed wheels to pass within the guideway of the cage to engage the ladder-rungs. This shaft is operated by cranks 11, and the shaft has ratchet-wheels 12, which are engaged by pawls 13 on the pillow-blocks, whereby to hold the ladder in its erected position.

A rack-bar 14 pivotally connects the upper end of the cage at each side thereof, and each bar has a sliding connection with a bar 15, which is hinged to the base-frame. A crank-operated shaft 16 is transversely mounted upon the lower hinged bars and has pinions

17, which engage the rack-bars, whereby the latter may be raised and lowered to tilt the cage to give the desired inclination to the ladder, because the tilting of the cage controls the position of the ladder.

For supplementing and coöperating with the rack-bars for adjusting the ladder-carrying cage I provide a windlass-shaft 18, the rope 19 from which connects the lower end of the cage and holds it with certainty in the position to which it is set by the rack-bars, and should the height of the ladder be such as to endanger its tilting over with its cage this rope will prevent such danger, and the winding of the rope assists to tilt the cage, as may be desired, to fix the inclination of the ladder. A ratchet 20 on the windlass-shaft and a pawl serve to hold this windlass. Upon their inner walls the cage-plates have small rollers 21, against which the outer sides of the ladder move and which steady its movement and reduce friction and prevent binding.

The reel on which the ladder is coiled is preferably pivotally mounted upon the base-frame a suitable distance from and in front of the cage. The reel consists of the swing-arms 22, which carry a hub or drum 23 and which are pivoted to lugs 24 on the base-frame. The links of the terminal section of the ladder are pivotally connected to the reel-drum by one of the rungs, so that by turning the drum by the cranks the links of the ladder are rolled up, so as to carry that part of the ladder when lowered which is not contained and held in the cage.

The object of pivoting the reel-supports is to allow the reel to be swung toward the cage in unrolling the ladder-sections to the cage when the ladder is being erected and to hold the link-sections in position to cause the oblique ends of the link-sections to come together as they approach alinement.

Extra ladder parts may be carried upon separate reel-hubs by a truck and mounted in the reel-supporting arms when an extra height of the ladder is necessary, the reeled ladder lengths being connected to the elevated ladder lengths by the pivot-forming rung, as I have described. In doing this the erected ladder is detached from the reel-hub, the latter removed from the reel-arms, and the extra reel-drum mounted in the place of the empty reel and the ladder-section of the reel coupled together with the erected ladder-sections, and in this way by piecing the ladder can be extended to the desired height.

It is obvious the ladder can be raised and lowered by other than hand-power and that the ladder can be used for all purposes for which it may be adapted.

Various changes in the form, proportions, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of my invention, and for this reason I do not wish to be understood as limiting myself thereto in precise detail and construction, and while I have described and prefer to pivotally mount the cage or guideway, whereby to render it adjustable, yet it may be otherwise mounted, so long as it is adapted to recive and support the ladder in the operation of erecting it and closing the ladder-sections, one engaging the other, so that they are rigidly engaged together at their oblique ends within the cage.

While I prefer to pivotally mount the reel from which the ladder-sections are unrolled for delivery to the erecting-cage, yet the reel may be otherwise adapted to hold and to give off the ladder-sections for erection and to cause the ladder-sections to be compactly reeled.

Referring to Fig. 1 of the drawings, it will be seen that the last uncoiled link is connected to the swing-reel by one of the ladder-rungs and that the side bars of the inner and outer terminal ladder-sections are formed with shouldered ends, so that with the terminal outer sections another reeled length of ladder may be coupled by removing and replacing the fastening ladder-rung seen in the terminal link-section and mounting the full reel in place of the empty one upon the swing-reel arms. This provision for having separate reeled ladder-lengths in readiness for being coupled with a ladder already erected renders it convenient for quickly obtaining the desired height of a ladder constructed of pivotally-connected sections adapted to be wound and unwound from a reel. This advantage I obtain by the employment of the swing-reel and the manner of connecting the ladder with it, so that such connection may be separated from the empty reel and made with the end of a reeled ladder length, and in this way the desired number of reeled ladder lengths may be properly mounted and connected for erection in the cage.

I claim as my invention—

1. In an extension-ladder, a ladder composed of links forming double side bars of sections, the sections being pivotally connected so that such sections will lap with each other side by side and disconnected at their ends, whereby to allow them to swing separately of each other and to open and close with each other, the end of the links of one section being stepped or formed to engage a like construction in reverse at the end of the links of the contiguous section whereby to render the ladder stiff when erected, and means for interlocking the side bars between the pivotal connections of the sections.

2. In an extension-ladder, a ladder composed of two parallel sets of links forming double side bars of connected lapping sections, the sections being pivotally connected together, the links of each section having recesses into which the ends of the corresponding rungs of the sections engage, the links at one end having forward standing shoulders or steps and the other ends of the links having rearward standing shoulders or steps, whereby the sections when erected to form

the ladder are locked together in rigid alinement.

3. The combination with the shaft 3, the cage or guideway loosely mounted thereon, gear 10 fixed on said shaft arranged to enter one side of said cage, and a ladder the side bars whereof are double and form inner and outer ladder-sections pivotally connected by the rungs, the ends of the link-sections standing oblique in opposite directions, stepped and free to swing toward and from each other, each section having one of its rungs adapted to engage and lock with the contiguous section, the said gear adapted to engage the rungs, and the cage holding the ends of the ladder-sections in stiff engagement with each other and the ladder itself in rigid engagement with the gear.

4. The combination with a ladder composed of pivotally connected or coupled link-sections, of a pivotally-mounted cage or guideway arranged and adapted to receive and support the ladder in its erection, means for supporting and adjusting said cage and gear-wheels arranged upon the cage-mounting engaging the ladder-rungs for raising and lowering the ladder.

5. The combination with a ladder composed of pivotally connected or coupled link-sections, of fixed pillow-blocks, a shaft mounted therein, a cage or guideway pivotally mounted mediately of its length upon said shaft, a rigid support pivotally connecting the upper end of the cage for adjusting its inclination, a windlass-operated rope connecting the lower end of said cage, and means whereby the ladder is raised and lowered within said cage.

6. The combination in an extension-ladder of a pivotally-mounted cage or guideway, a ladder of pivotally-connected sections, and means whereby the ladder-sections are erected within the cage, of rigid supports connecting the upper end of said cage, a windlass-operated rope connecting the lower end of said cage and crank-operated gear-wheel upon the cage-mounting engaging the ladder-rungs whereby to control the erection and descent of the ladder.

7. In combination a ladder composed of separate and distinct link parts extending one within the other the length of the ladder, the links of each section pivotally connected and forming when erected a ladder within a ladder, the ends of the link-sections being disconnected and having stepped terminations which lap with each other crosswise of the links when engaged, the abutting surfaces of the steps being at right angles to the length of the links, a cage or guideway to receive and cause the stepped ends of the ladder-sections to be brought into abutting engagement and means for interlocking the ladder sections between their pivots whereby the ladder is held by the cage as a rigid structure.

8. In an extension-ladder the combination with a pivotally-mounted cage or guideway, of a ladder the side bars of which are double and form inner and outer ladder-sections pivotally connected by the rungs, the ends of the link-sections being oblique, facing in opposite directions and stepped, forming shoulders at right angles to the length of the links, the links of each section having the edge recesses 9, 9 and the links of each section having side projections 25, 25 adapted to engage the said edge recesses whereby the ladder-sections are made rigid when erected.

9. In an extension-ladder, the combination with a cage forming ladder part pivotally mounted upon fixed bearings and having an interior way open at each end, of a ladder of pivotally-connected sections, a swing-reel pivotally mounted in front of said cage in position to be swung down to deliver the ladder-sections into the lower open end of the cage and means whereby the ladder-sections are drawn into said cage and erected above the same.

10. The combination in an extension-ladder, with a pivotally-mounted cage or guideway open at each end, of a ladder of pivotally-connected sections, means whereby said ladder-sections are caused to enter the lower end of said cage and to be drawn up and erected therein and therefrom, a windlass-operated rope connecting the lower end of said cage, the rack-bars pivotally connecting the upper end of said cage, the hinged bars having a sliding connection with the rack-bars and a shaft mounted upon said hinged bars and having pinions engaging said rack-bars, whereby the inclination of the cage is adjusted and secured to maintain the ladder at the desired position.

11. In an extension-ladder, the combination with the swing-reel arms pivotally mounted, of a reel hub or drum mounted in the free ends of said reel-arms, and a ladder of pivotally-connected sections connected with said hub, the said ladder being adapted for mounting in the place of the empty reel-hub, whereby separate ladder lengths may be connected with the erected ladder to give it a height greater than that of a single reeled ladder.

12. In an extension-ladder, the combination with a cage or guideway, of a ladder composed of pivotally-connected sections, the ends of the links of each section constructed to be separated and brought together for rigidly engaging the sections with each other in the operation of elevating it within said cage, a rung of one section engaging the links of the contiguous section to lock the ladder-sections, and means adapted for rotatively engaging the ladder-rungs whereby to control its erection and descent and means for locking the elevating mechanism.

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Witnesses:
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