

H. EPSTEIN.
EXTENSION LADDER.

APPLICATION FILED FEB. 10, 1909.

949,529.

Patented Feb. 15, 1910.

3 SHEETS--SHEET 1.

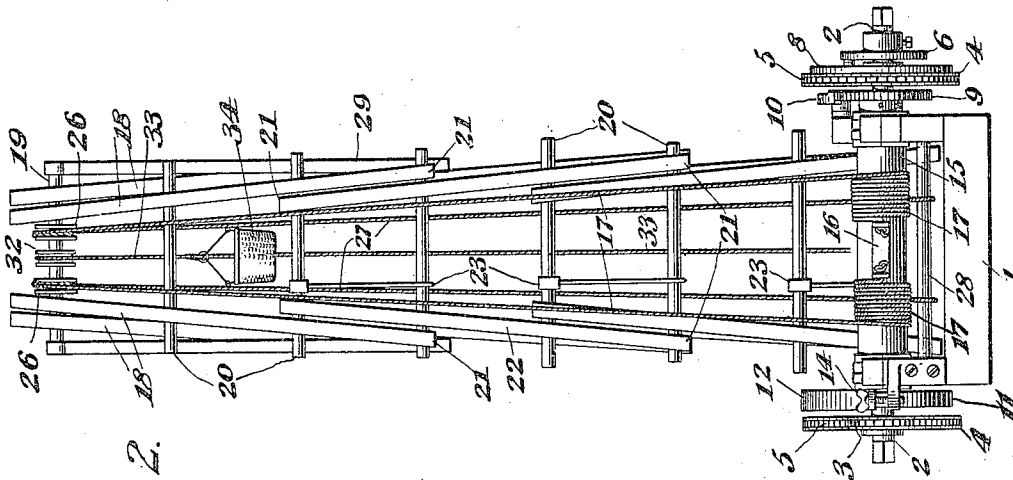


Fig. 2.

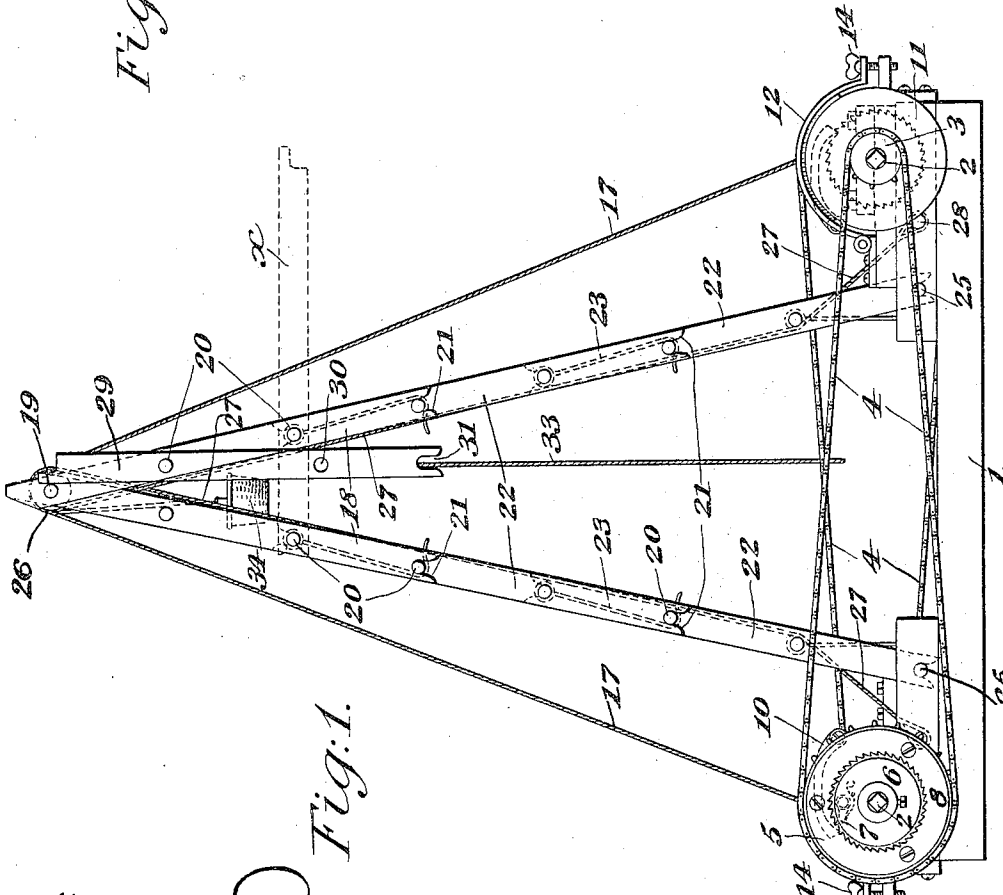


Fig. 1.

Witnesses:

A. F. Connelly
J. M. Long

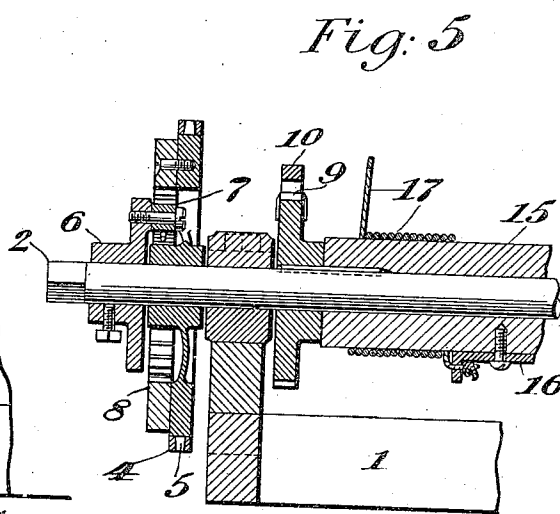
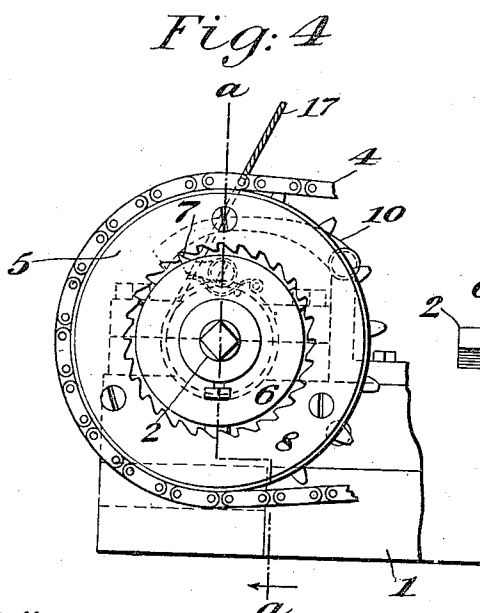
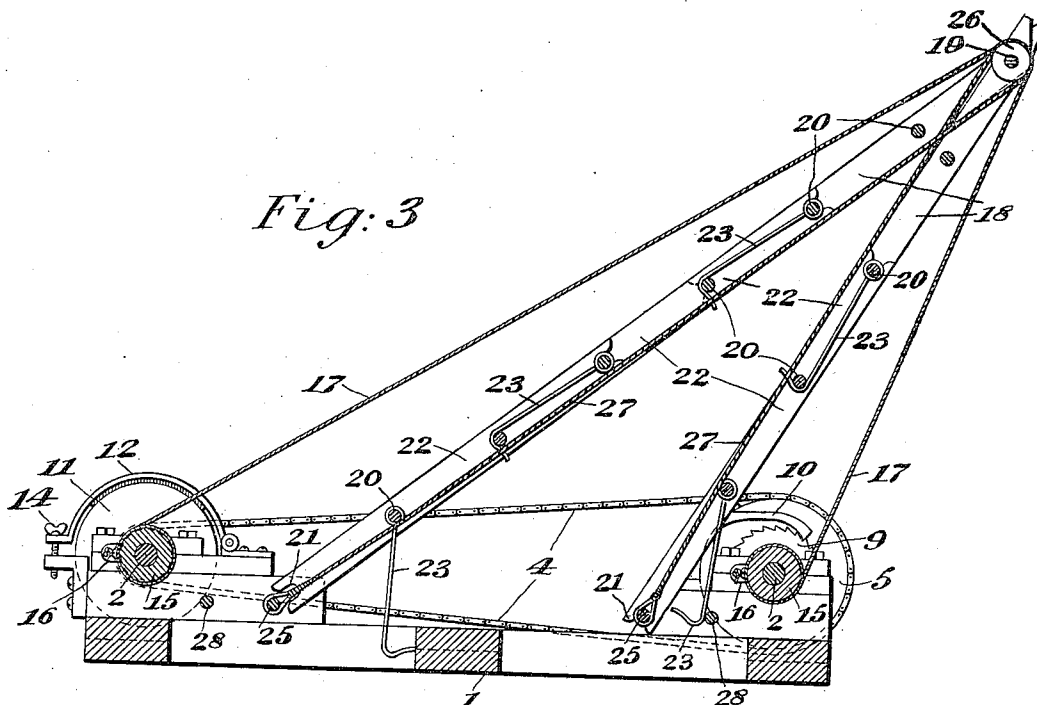
Inventor:

Harry Epstein
By *W. H. Kaplan*
his Attorney.

949,529.

H. EPSTEIN.
EXTENSION LADDER.
APPLICATION FILED FEB. 10, 1909.

Patented Feb. 15, 1910.
3 SHEETS—SHEET 2.



Witnesses:
A. F. Cornell
J. M. Long

Inventor:
Harris Epstein,
By
J. H. Springer
his Attorney.

949,529.

Patented Feb. 15, 1910.

3 SHEETS—SHEET 3.

Fig: 7

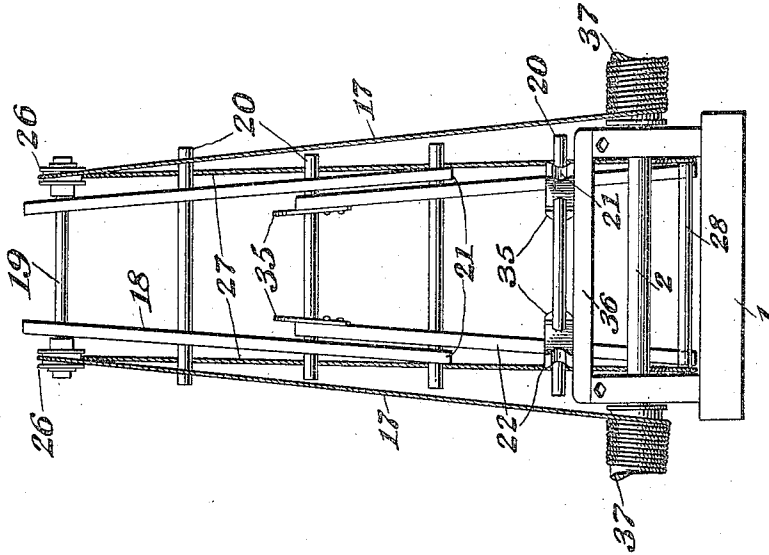
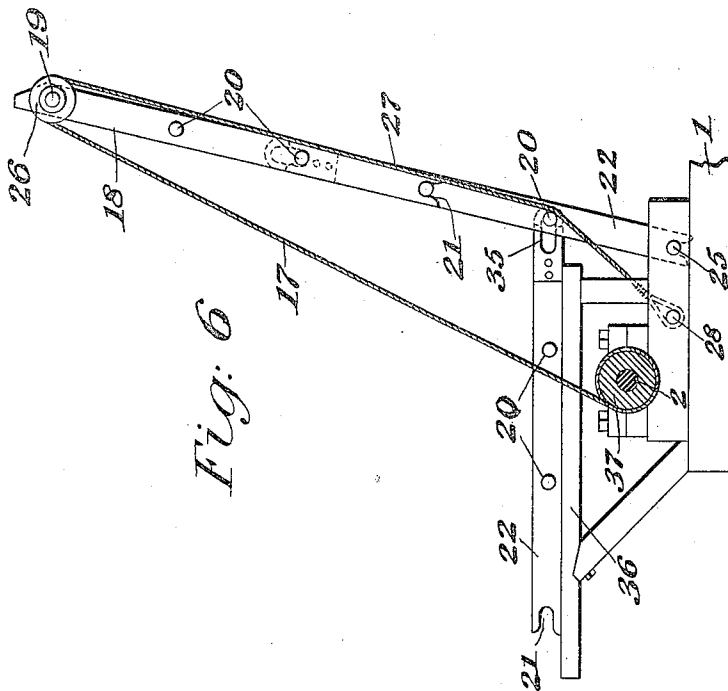


Fig: 6



Witnesses:
A. F. Conner
J. M. Long

Inventor:
Harris Epstein
By
J. E. Long
his Attorney.

UNITED STATES PATENT OFFICE.

HARRIS EPSTEIN, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO DAVID LUBINSKY, OF BROOKLYN, NEW YORK.

EXTENSION-LADDER.

949,529.

Specification of Letters Patent.

Patented Feb. 15, 1910.

Application filed February 10, 1909. Serial No. 477,053.

To all whom it may concern:

Be it known that I, HARRIS EPSTEIN, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Extension-Ladders, of which the following is a specification.

This invention relates to certain improvements in extension ladders, and more particularly in that class of such devices which are especially designed and adapted for affording access to lofty buildings and the like, and the object of the invention is to provide a ladder of this general character of a simple and comparatively inexpensive nature, and of a strong and durable construction which shall permit of being compactly folded or collapsed so as to occupy but small bulk when not in use, and which shall be capable of convenient extension so as to permit of being quickly raised to such an elevation as may be desired during use.

The invention consists, in part, in a ladder of this general character having two connected members capable of alternate tilting or rocking operation, and means for alternately rocking or tilting said members so as to permit them to be alternately elevated to an extent sufficient to permit the introduction of extension sections beneath them.

The invention also consists, in part, in a ladder having a member capable of pivotal movement toward and from a horizontal position, and comprising sections capable of disconnection to vary the length of the member, and means for pivotally moving said member to permit the same to be elevated and lowered.

The invention also contemplates certain novel features of the construction, and combinations and arrangements of the several parts of the improved extension ladder, whereby certain important advantages are attained, and the device is rendered simpler, less expensive, and otherwise better adapted and more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In order that my invention may be the better understood, I will now proceed to de-

scribe the same with reference to the accompanying drawings, wherein—

Figure 1 is a side elevation of an extension ladder embodying my improvements; Fig. 2 is an end elevation of the ladder constructed as shown in Fig. 1; Fig. 3 is a central longitudinal section taken vertically through a ladder constructed according to my invention, and showing certain features of novelty which will be hereinafter referred to; Fig. 4 is a fragmentary side elevation, drawn to an enlarged scale, and showing certain features of construction of the tilting and lifting means; Fig. 5 is a fragmentary sectional view taken in the plane indicated by the line *a—**a* in Fig. 4, and showing certain features of construction which will be hereinafter more particularly referred to; Fig. 6 is a fragmentary side elevation showing a modified form of the extension ladder embodying my invention, and Fig. 7 is an end view of the device constructed as illustrated in Fig. 6.

Referring first to Figs. 1 to 5, inclusive, the improved extension ladder is therein shown as provided with an elongated base 1, which may obviously be mounted upon wheels, if desired, in order to facilitate transportation of the device from place to place for use. At the opposite ends of the base are arranged opposite alined upwardly extended bearing portions spaced apart from each other, and in said bearing portions at the opposite ends of said base are journaled horizontally directed shafts 2, 2, which are transversely extended across the said opposite ends of the base, each such shaft 2 having at one end a small sprocket wheel 3 fixed upon it, and at its opposite end a larger sprocket wheel 5, loosely mounted upon the said shaft, and having a lateral boss or extension 8 of annular form provided with internal ratchet teeth, as clearly shown in Figs. 1, 4 and 5 of the drawings, the said ratchet teeth of said boss or extension 8 being engageable by a spring actuated pawl or click 7, carried upon a disk or collar 6 fixedly held upon that end of the corresponding shaft 2, when said sprocket wheel 5 is turned in one direction, whereby the said shaft 2 is locked to turn in unison with said sprocket wheel during movement of the lat-

ter in that direction, but being adapted to ride freely over said pawl or click 7 during the movement of the said sprocket wheel in a reverse direction, whereby, during such
5 reverse movement, the said sprocket wheel is permitted to turn freely upon and around the said shaft 2 without imparting its rotatory movement thereto.

The sprocket wheels 3 and 5 upon the
10 respective transversely extended shafts 2, 2 are arranged at reverse sides of the base 1, the wheel 3 of one such shaft 2 being at that side of the said base at which the wheel 5 of the other shaft 2 is located, and vice versa,
15 and endless chains 4, 4 are arranged at the opposite sides of the frame, each such chain 4 having one end extended around the small sprocket wheel 3 upon one shaft 2, and its opposite end extended around the larger sprocket wheel 5 upon the other shaft 2.
20 Said shafts 2, 2, as herein shown, have squared ends adapted for engagement with detachable crank handles, (not shown) in a well known way, whereby either shaft may
25 be rotated, and the arrangement of the sprocket wheels 3 and 5 and chains 4 is such that when a crank handle is applied and operated to turn one shaft, the movement thereof is imparted through the smaller
30 sprocket wheel 3, thereon, and through the corresponding chain 4, larger sprocket wheel 5 upon the other shaft, and corresponding ratchet ring 8, pawl 7 and disk 6, to turn such other shaft 2 in unison with the
35 first-named shaft, the larger sprocket wheel 5 upon said first-mentioned shaft 2 meanwhile turning loosely upon the shaft to permit the free rotation of the driven shaft 2 at a greater speed than that to which the
40 movement is initially imparted by means of the crank handles.

Each shaft 2 is further provided with a ratchet wheel 9 the teeth whereof are engageable by a pivoted dog or pawl 10, so
45 that such shaft may be locked against rotatory movement in one direction whenever desired by merely dropping said pawl or dog 10 into engagement with the teeth of such ratchet, and the detent devices at opposite ends of the base are reversely arranged,
50 as shown in dotted lines in Fig. 1, so that when both dogs or pawls are engaged with their ratchet wheels, both shafts 2, 2 are effectively locked against movement in either
55 direction. This arrangement, however, permits the employment of either dog or pawl, the other being thrown out of function, as a safety device to prevent back rotation of the driven shaft during use of the improved
60 extension ladder. Each shaft 2 is also provided with a friction disk 11, the perimetral surface of which is adapted for engagement with a shoe carried by a hinged strap 12, one

end of which has connection with a screw device 14 whereby said shoe may be actuated to exert regulated pressure upon the rim of said disk 11 in order to impede the rotation thereof. These braking devices are capable of convenient manipulation to check
70 and retard too sudden movement of the parts during use of the improved extension ladder, as will be readily understood.

The central part of each shaft 2, between the corresponding oppositely arranged bearing portions of the base 1 carries a drum 15
75 secured upon it, the central part of each such drum having an attached clip 16, the ends of which afford means for the secure attachment of the ends of cables or flexible connectors 17 which are thereby adapted to
80 wind in opposite directions upon said drums, there being, as shown herein, two such cables or connectors employed in connection with each drum 15.

In connection with the base and actuating
85 means constructed as above described, two ladder like members are employed, said members being supported upon the base between the drums 15, 15 with their lower ends separated, as clearly shown in the drawings,
90 and their upper ends pivotally connected by a cross shaft or rung 19 with which the upper ends of the stiles of the respective ladder like members have common pivotal
95 connection, so as to permit said members to be adjusted at their pivotal connection to various desired positions, such, for example, as those shown in Figs. 1 and 3 of the drawings.

Each ladder like member is constructed
100 in a plurality of sections or parts, of which the upper parts or sections 18, 18 are similar and have pivotal connection with each other by means of the cross shaft or rung 19.
105 Each ladder member may include, in addition to the upper part or section 18, any preferred number of the lower parts or sections 22, 22, and since these are all exactly similar, as herein shown, it is evident that they may be interchangeable, used in con-
110 nection with either of the ladder members.

Each part or section 18 and 22 of each ladder member comprises inclined stiles connected at intervals by rungs 20, 20, the
115 extremities of which are extended beyond the sides of the inclined stiles, as clearly shown in Fig. 2. The inclinations of the stiles of the several parts or sections are similar, so that the narrower end of one part or section may be inserted between the
120 stiles at the wider end of another part or section, and the opposite ends of the several stiles are notched out as shown at 21, 21 upon the drawings, so that when the narrower end of one part or section is inserted
125 between the stiles at the wider end of an-

other part or section, the notched ends of the stiles of such inserted section may be engaged over the terminal rung of the other section, while the notched ends of the stiles of such other section may be engaged over the outwardly projecting extremities of the adjacent terminal rung of said inserted section, so as to afford an effective connection of the parts, there being hooks or equivalent fastenings 23 pivoted upon the terminal rungs of each section with their free ends engageable with the terminal rungs of inserted sections in such a manner as to permit of securely holding the parts or sections in relation after the co-engagement of their notched ends and rungs as above described.

The lower notched end 21 of the stiles of each ladder member, irrespective of the number of sections comprised therein, are adapted to be engaged over a cross bar 25 extended across the base 1, there being such a cross bar 25 adjacent to each end of the base, so that when the ladder members are of equal or similar lengths, they are caused to extend normally, upwardly from said base at similar inclinations to the vertical, and the construction and arrangement is such that the hooks or fastenings 23 at the lower part of each ladder member is capable of engagement with the corresponding cross bar 25 to prevent accidental dislocation of the members during use of the device.

The cross shaft or rung 19 which forms the pivotal connection at the upper ends of the ladder members carries sheaves or drums 26, 26, and the cables or flexible connectors 17, 17 from each drum 15 of the device are carried upward along the outer surface of the adjacent ladder member, as shown in Figs. 1 and 2 and are carried around said sheaves or drums, after which they are carried downwardly along the inner or under surfaces of the ladder members, and have their lower ends secured to the base 1 in any preferred way. As shown in Figs. 1 and 2, the lower ends of the inner runs 27 of said cables are secured upon cross bars 28 extended parallel with the cross bars 25 wherewith the notched lower ends of the ladder members are engaged, but it will be evident that said cables may be secured to said cross bars 25, if desired, as shown in Fig. 3.

In the practical use of the device, the cables of each drum 15, being passed upwardly and around the upmost rung 19 of the corresponding ladder member, and being thence extended downwardly and connected with the base, afford a simple and effective means for rocking or tilting such ladder member upon its pivotal connection with base 1 at the cross bar 25, and by alternately turning the shafts 2 as above described, it

will be understood that first one and then the other of said ladder members may be rocked from its normal inclined position to such a position, for example, as is shown at the right hand side of Fig. 3, the ladder member opposite to that which is rocked in this manner being lifted upwardly off the cross bar 25 and supported upon the inner runs 27 of its cables 17 so as to permit the introduction of an additional extension section 22 beneath it, as shown at the left hand side in Fig. 3. By this alternate lifting of the respective ladder members, and the corresponding introduction of extension sections 22, it will be seen that the ladder may be quickly and conveniently raised to a considerable height, the several inserted sections being securely locked and held in position by means of the hooks or fastenings 23, so that the several sections comprised in each member afford an extremely strong and substantial structure. By reversely operating the parts, and removing the lowermost sections from the alternately tilted members, the ladder may be quickly and conveniently collapsed, and after the extension sections 22 shall have all been removed, one of the pivoted sections 18 may be disengaged from the cross bar 25 so as to permit the connected sections 18, 18 to be folded down compactly upon the base 1.

When desired the ladder after being elevated to the required height, may be thrown over to an inclined position such as is shown in Fig. 3 so as to permit of being brought closely adjacent to or in leaning position against a building to afford access to the upper part thereof, or if desired the cross beams 29 may be employed as supports between which short planks may be laid to produce a laterally extended bridge affording access from the ladder structure to a building. As shown herein said beams 29, are apertured at 30 to receive the projecting outer ends of the rungs 20, and have notched ends 31, which are capable of engagement with a rung 20 of one member when the apertures 30 are engaged with the rungs of the other member so that the beams may be securely upheld in a horizontal position as shown at *x* in Fig. 1. When desired, the planks laid across these laterally extended beams may also be used as a scaffold upon which workmen may stand alongside a building.

32 represents a central sheave upon the topmost rung 19 of the ladder, and 33 represents a cable passed around said sheave and serving as a means whereby a basket or receptacle 34 may be elevated to the top of the ladder. This may be employed as a means of descent for persons, when the device is used as a fire ladder, or may be used for

hoisting tools, etc., when the device is otherwise employed.

The construction shown in Figs. 6 and 7 is very similar to that above described except that the cables 17 are thrown apart so as not to interfere with free use of the rungs, the upper sheaves 26, 26 being held upon the outwardly directed ends of the rung 19 and the shaft 2 being provided with two drums 37, 37 arranged at opposite sides of the base, and whereon said cables are arranged to wind. The ladder sections are also provided with slotted plates 35 affording connections between them when the notches 21 are disengaged from rungs 20, so that the sections may be folded over each other upon a platform 36 upon the base when not in use.

From the above description it will be seen that the ladder constructed according to my invention is of an extremely simple and comparatively inexpensive nature, and is particularly well adapted for use by reason of the facility with which it may be operated and of the compactness with which it may be arranged when not in use, and it will also be obvious from the above description that the device is susceptible of considerable modification without material departure from the principles and spirit of the invention, and for this reason I do not desire to be understood as limiting myself to the precise formation and arrangement of the several parts of the device herein set forth in carrying out my invention in practice.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A ladder structure having a base, a member mounted for pivotal movement thereon, and extended above the base, flexible connections extended from said member toward opposite ends of the base, devices capable of alternate operation for drawing upon said connections for reversely rocking said member upon the base, a ladder member connected with the upper part of said pivotally movable member and having its lower end engageable for support upon the base when said pivotally movable member is rocked in one direction, but adapted to be lifted from the base when said pivotally movable member is rocked in a reverse direction, and an extension ladder section insertible beneath said ladder member when the same is lifted from the base.

2. A ladder structure having a base, a plurality of members pivotally connected at their upper parts and having their lower ends spaced apart and supported for alternate rocking movement upon the base, means for rocking said members, and extension sections insertible beneath said members and adapted for pivotal connection with the base.

3. A ladder structure having a base, members pivotally connected at their upper parts and having their lower ends spaced apart and supported for rocking movement upon the base, means for alternately rocking said members, extension sections capable of detachable engagement with the members and insertible beneath the same and adapted for pivotal engagement with the base, and means for locking the inserted extension sections to said members.

4. A ladder structure having a base, members pivotally connected at their upper parts and having their lower ends spaced apart and supported for alternate rocking movement upon the base, devices at opposite ends of the base and connected with the respective members and adapted for operation to reversely rock the same, and extension sections insertible beneath the members when the same are rocked.

5. A ladder structure having a base, members pivotally connected at their upper parts and having their lower ends spaced apart and supported for alternate rocking movement upon the base, devices at opposite ends of the base and connected with the respective members and adapted for operation to reversely rock the same, and extension sections insertible beneath the members when the same are rocked, and having means for interlocking engagement with said members and with the base.

6. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a pivotally supported part mounted to rock upon the base and connected with the ladder member, and adapted, when rocked in one direction, to elevate said ladder member and disengage its lower end from the base, and when rocked in a reverse direction, to lower said ladder member into supported engagement with the base, means for rocking said pivotally supported part in reverse directions upon the base, and an extension ladder section insertible beneath said ladder member when the same is elevated and also adapted to be supported at its lower end upon the base.

7. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, releasable means for locking the ladder member against being lifted above the base, a pivotally supported part mounted to rock upon the base and connected with the ladder member, and adapted, when rocked in one direction, to elevate said ladder member and disengage its lower end from the base, and when rocked in a reverse direction, to lower said ladder member into supported engagement with the base, means for rocking said

pivotally supported part in reverse directions upon the base, and an extension ladder section insertible beneath the ladder member when the same is elevated and also adapted to be supported at its lower end upon the base.

8. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a longitudinally extensible pivotally mounted part mounted to rock upon the base and connected with the ladder member and adapted, when rocked in one direction, to elevate said ladder member and disengage its lower end from the base, and when rocked in a reverse direction, to lower said ladder member into supported engagement with the base, means for rocking said pivotally supported part in reverse directions upon the base, an extension ladder section insertible beneath said ladder member when the same is elevated and also adapted to be supported at its lower end upon the base, and means for locking said extension ladder section to the base.

9. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a part mounted to rock upon the base and connected with the ladder member, and adapted, when rocked in one direction, to raise said ladder member out of supported engagement with the base, and when reversely rocked, to lower the ladder member into contact with said base, means for reversely rocking said part, an extension ladder section insertible beneath said ladder member, when the same is raised out of contact with the support, and an extension section insertible beneath the said rocking part to extend the length thereof, and also adapted to rock upon the base.

10. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, means for lifting the ladder member to elevate its lower end out of supporting contact with the base, an extension ladder section insertible beneath said ladder member when the same is lifted and also adapted to be supported at its lower end upon the base, said lifting means including longitudinally extensible flexible connections extended from the upper part of the ladder member to opposite ends of the base and adapted to support said ladder member.

11. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, means for lifting the ladder member to elevate its lower end out of supporting contact with the base, an extension ladder section insertible beneath said ladder member when the

same is lifted and also adapted to be supported at its lower end upon the base, said lifting means including flexible connections extended from the upper part of the ladder member to opposite ends of the base and adapted to support the ladder member, and drums mounted to turn upon the opposite ends of the base and whereon said flexible connections are adapted to be wound.

12. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, means for lifting the ladder member to elevate its lower end out of supporting contact with the base, an extension ladder section insertible beneath said ladder member when the same is lifted and also adapted to be supported at its lower end upon the base, said lifting means including flexible connections extended from the upper part of the ladder member to opposite ends of the base and adapted to support the ladder member, drums mounted to turn upon the opposite ends of the base and whereon said flexible connections are adapted to be wound, and means for driving said drums in unison but at different velocities.

13. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, means for lifting the ladder member to elevate its lower end out of supporting contact with the base, an extension ladder section insertible beneath said ladder member when the same is lifted and also adapted to be supported at its lower end upon the base, said lifting means including flexible connections extended from the upper part of the ladder member to opposite ends of the base and adapted to support the ladder member, drums mounted to turn upon the opposite ends of the base and whereon said flexible connections are adapted to be wound, and means for driving one drum from the other drum at an increased velocity.

14. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, means for lifting the ladder member to elevate its lower end out of supporting contact with the base, an extension ladder section insertible beneath said ladder member when the same is lifted and also adapted to be supported at its lower end upon the base, said lifting means including flexible connections extended from the upper part of the ladder member to opposite ends of the base and adapted to support the ladder member, drums mounted to turn upon the opposite ends of the base and whereon said flexible connections are adapted to be wound, and means, controlled by the direction of movement of the drums, for driving each

drum from the other at an increased velocity.

15. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a part pivotally supported upon the base and connected with the ladder member, and adapted, when rocked, to elevate said ladder member and disengage its lower end from the base, an extension ladder section insertible beneath said ladder member when the same is elevated and also adapted to be supported at its lower end upon the base, and flexible connections engaged with said pivotally supported part and oppositely directed therefrom to the base and adapted to be drawn endwise to reversely move said pivotally supported part.

16. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a part pivotally supported upon the base and connected with the ladder member, and adapted, when rocked, to elevate said ladder member and disengage its lower end from the base, an extension ladder section insertible beneath said ladder member when the same is elevated, and also adapted to be supported at its lower end upon the base, flexible connections engaged with said pivotally supported part and oppositely directed therefrom to the base and adapted to be drawn endwise to reversely move said pivotally supported part, and drums mounted to turn upon the base whereon said connections are adapted to be wound.

17. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a part pivotally supported upon the base and connected with the ladder member, and adapted, when rocked, to elevate said ladder member and disengage its lower end from the base, an extension ladder section insertible beneath said ladder member when the same is elevated, and also adapted to be supported at its lower end upon the base, flexible connections engaged with said pivotally supported part and oppositely directed therefrom to the base and adapted to be drawn endwise to reversely move said pivotally supported part, drums mounted to turn upon the base and whereon said connections are adapted to be wound, and means for driving said drums in unison.

18. A ladder structure having a base, a plurality of members pivotally connected at their upper parts and having their lower ends spaced apart and supported for rocking movement upon the base, flexible connections oppositely extended from the upper parts of said members to the base and adapted to be drawn endwise to impart reverse

rocking movement to said members, and extension sections insertible beneath the respective members and having lower ends adapted to be supported upon the base.

19. A ladder structure having a base, a plurality of members pivotally connected at their upper parts and having their lower ends spaced apart and supported for rocking movement upon the base, flexible connections oppositely extended from the upper parts of said members to the base and adapted to be drawn endwise to impart reverse rocking movement to said members, drums mounted on the base and whereon said flexible connections are adapted to be wound, and extension sections insertible beneath the respective members and having lower ends adapted to be supported upon the base.

20. A ladder structure having a base, a plurality of members pivotally connected at their upper parts and having their lower ends spaced apart and supported for rocking movement upon the base, flexible connections oppositely directed from the upper parts of said members to the base and adapted to be drawn endwise to impart reverse rocking movement to said members, drums mounted on the base and whereon said flexible connections are adapted to be wound, means for driving said drums in unison, and extension sections insertible beneath the respective members and having lower ends adapted to be supported upon the base.

21. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a part pivotally supported upon the base and connected with the ladder member, and adapted, when rocked, to elevate said ladder member and disengage its lower end from the base, an extension section insertible beneath said pivotally supported part and adapted to extend the length thereof, an extension ladder section insertible beneath said ladder member when the same is elevated, and also adapted to be supported at its lower end upon the base, and flexible connections engaged with said pivotally supported part and oppositely directed therefrom to the base and adapted to be drawn endwise to reversely move said pivotally supported part.

22. A ladder structure having a base, a ladder member extended above the base and supported at its lower end thereon, a longitudinally extensible part pivotally supported upon the base and connected with the ladder member, and adapted, when rocked, to elevate said ladder member and disengage its lower end from the base, an extension section insertible beneath said ladder member when the same is elevated, and also adapted to be supported at its lower end

upon the base, and flexible connections engaged with said longitudinally extensible pivotally supported part and oppositely directed therefrom to the base and adapted to
5 be drawn endwise to reversely move said pivotally supported part.

In witness whereof I have hereunto signed

my name, in the presence of two subscribing witnesses.

HARRIS EPSTEIN.

Witnesses:

A. F. CONNETT,

J. M. LONG.