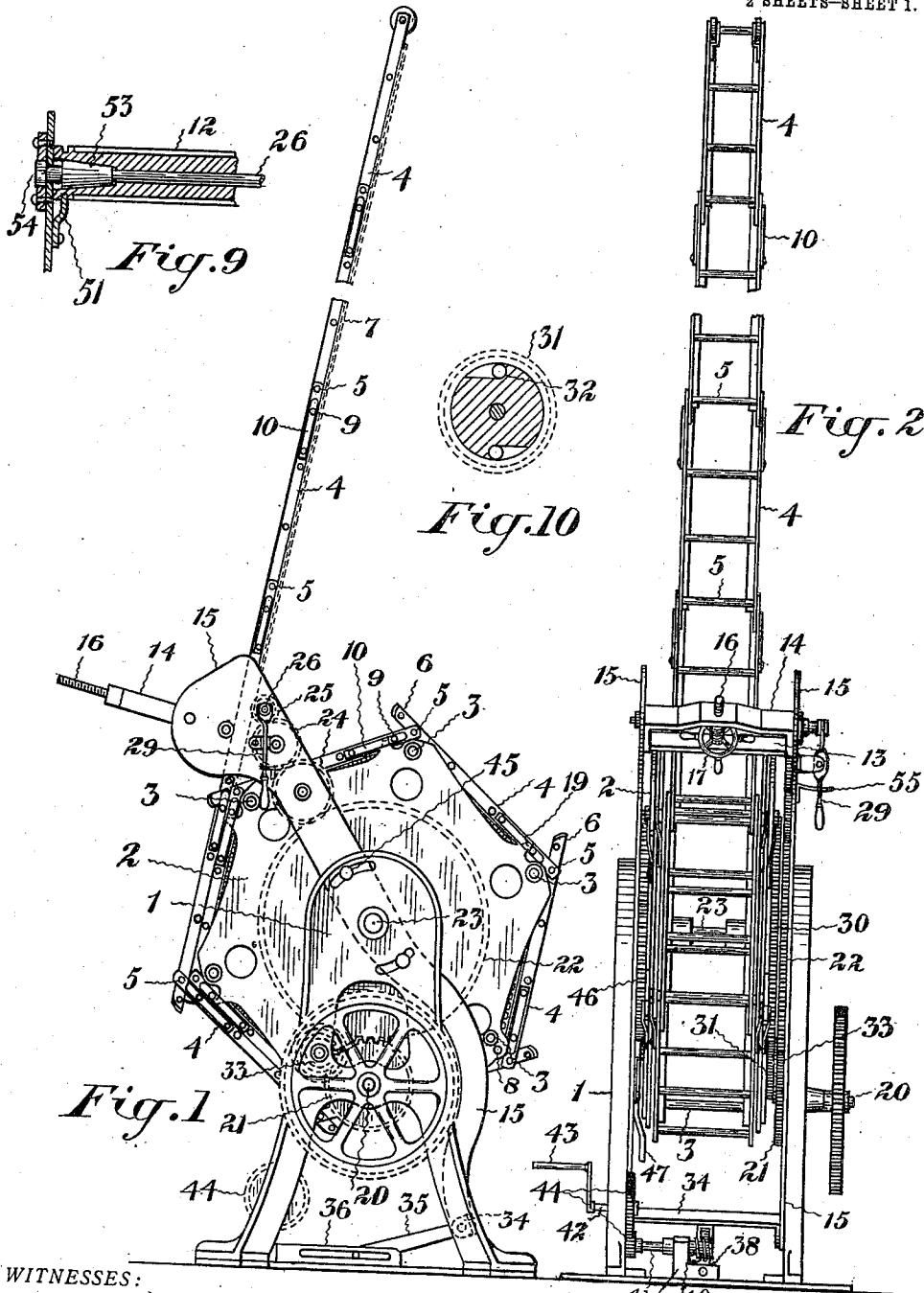


G. W. MOHRSTADT.
EXTENSION LADDER.
APPLICATION FILED JUNE 14, 1909.

989,389.

Patented Apr. 11, 1911.

2 SHEETS—SHEET 1.



WITNESSES:

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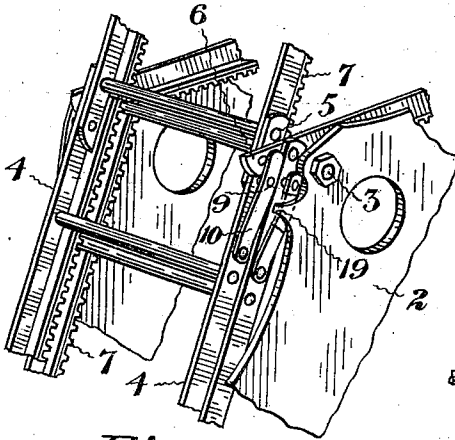


Fig. 5

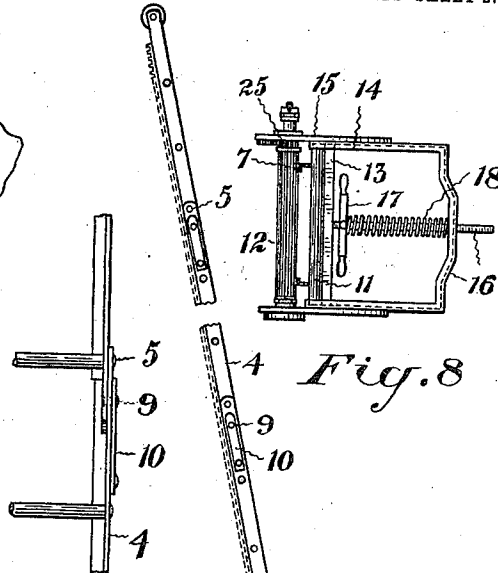


Fig. 8

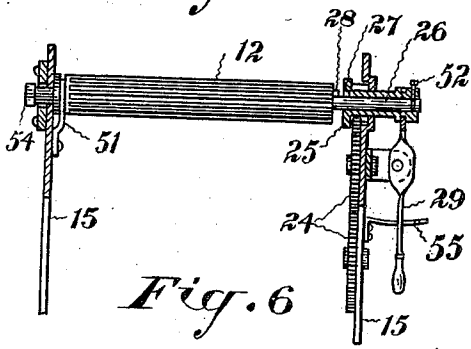


Fig. 6

Fig. 4

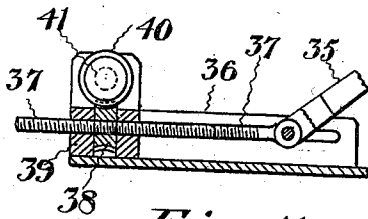


Fig. 7

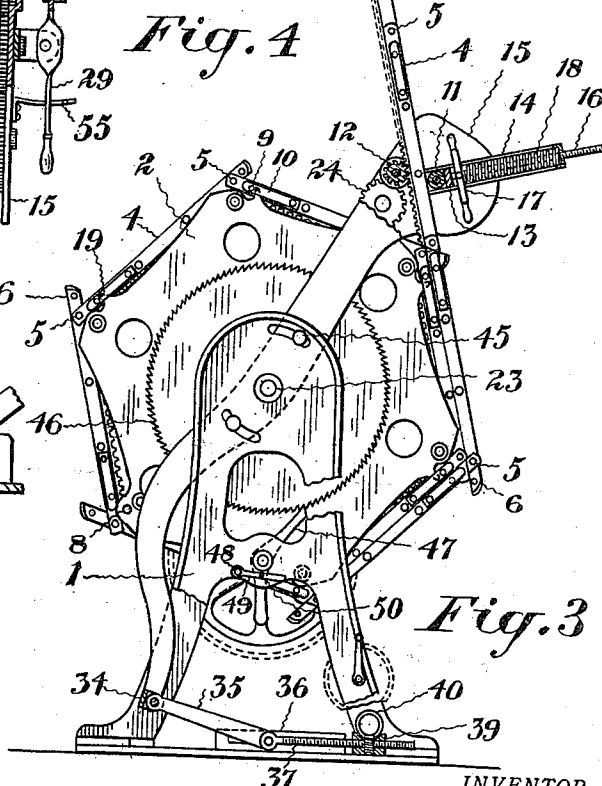


Fig. 3

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EXTENSION-LADDER.

989,389.

Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed June 14, 1909. Serial No. 502,098.

To all whom it may concern:

Be it known that I, GUSTAV W. MOHRSTADT, of the city of Toronto, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Extension-Ladders, of which the following is a specification.

This invention relates to ladders which are adapted to be carried in compact form or extended to any desired length within their limits. Such ladders have usually been formed either in separate connectible sections or in sections slidable upon one another.

I attain the desired result by forming the ladder in sections hinged together and adapted to be wound on a drum, means being provided for automatically locking the sections in alinement as they are unwound from the drum. Means are also provided for rotating the drum in either direction and for varying the inclination of the ladder as may be desired.

Figure 1 is a side elevation of a ladder constructed in accordance with my invention. Fig. 2 is a front elevation of the same. Fig. 3 is a side elevation of the opposite side of the apparatus. Fig. 4 is a detail illustrating the automatic lock between the ladder sections. Fig. 5 is a perspective detail illustrating the automatic locking and interlocking of the sections. Fig. 6 is a front elevation partly in section. Fig. 7 is a side sectional elevation of the mechanism for altering the angle of the ladder. Fig. 8 is a plan view of the guide roller of the ladder. Fig. 9 is a sectional detail of the brake. Fig. 10 is a detail of the clutch connection employed between two of the pinions of the operating gear.

In the drawings like letters of reference indicate corresponding parts in the different figures.

1 is a frame in which is journaled a drum 2. The frame 1 will usually be mounted upon a suitable vehicle whereby it may be transported from place to place, but as such vehicle forms no part of the present invention it is not illustrated.

The drum is preferably polygonal composed of side plates connected by cross bars 3. The ladder is formed of a plurality of sections 4 hinged together at 5. The sides of the ladder sections are preferably angle bars, as shown. Portions of the lower part of each angle bar of each section are cut

away at the joints so that they overlap, as shown in Figs. 4 and 5, the tongue which is at the lower end of each angle bar of each section resting in contact with the lower side of the adjacent angle bar of the next section. The sections are thus prevented from hinging one on the other except in the direction necessary to wind them on the drum.

The method of joining the sections also brings the lower part of the sides of each section in alinement with the corresponding parts in the other section. A rack 7 may thus be formed on or connected to the sections in such a manner that when the sections of the ladder are in alinement the rack is in effect continuous throughout the length of the ladder.

The first section of the ladder is pivotally connected with the drum by means of the cross bar 8. As the sections of the ladder overlie one another, as shown, they necessarily increase regularly in length from the inner end to the outermost or top section.

The sections of the ladder are held in alinement by suitable locks which operate automatically as soon as a section has been brought into alinement with an adjacent section. I show for this purpose at each side of the ladder at each joint a pin 9 connected to a spring 10. These pins are adapted to enter holes formed in the sides of the sections where they overlap (see particularly Figs. 4 and 5). The sections of the ladder as they are unwound from the drum pass between the guide rollers 11 and 12. The latter is preferably formed as a gear pinion engaging the racks 7 on the ladder sections. The purpose of this arrangement will hereinafter appear. The roller 11 is journaled on a slide 13 movable in the guide 14 carried on a part of the frame 15 which will be hereinafter described. This slide 13 has a spindle 16 connected therewith passing through a cross bar of the guide 14. A nut 17 is threaded on this spindle and serves to adjust the tension of a coil spring 18 located on the spindle between the nut 17 and the cross bar of the guide 14. The ladder is thus firmly but yieldingly pressed into engagement with the gear roller 12. The result of this arrangement of the guide rollers with the drum is that when the sections are drawn from the drum and as the drum is rotated the sections are consecutively straightened into alinement and are automatically locked by the means already de-

scribed. It is also desirable that when the ladder is being re-wound on the drum that the sections should be automatically unlocked as soon as a joint has passed below the guide rollers 11 and 12. For this purpose I provide near the corners of the polygonal drum the knife edge projections 19 and I also sharpen to a knife edge each tongue 6. The result of this is that as the sections are wound on to the drum the projections 19 and the tongues 6 engage beneath the ends of the springs 10 and withdraw the pins 9 sufficiently to unlock the joints and allow the sections to bend on one another as they are wound on the drum. It is evident also that as each section is unwound the springs 10 of its joints are successively disengaged from the tongue 6 or the projections 19, as the case may be, and the spring left free to automatically lock the joints as the sections are brought into alinement again.

It follows that the method of unlocking the sections which I employ, that the step-wise reduction of the sections in width combined with the progressive increase in length is of the greatest importance and indeed is essential to success.

The sections being all parallel to the opposite sides of the drum, the joints of those sections wound directly on the drum are kept closer to the sides of the drum than if the sections tapered in width which is important as these sections are unlocked by the projections 19. Furthermore, the step-wise reduction in width permits the lower ends of certain sections to be projected as the tongues 6 to engage and unlock the joints of overlapping sections which is a very simple, cheap and effective arrangement.

To rotate the drum and to extend the sections I provide the following mechanism: A shaft 20 is journaled on one side of the frame and carries a gear pinion 21. This shaft may be rotated by hand, but in large sizes of the apparatus will probably require to be motor driven. This pinion 21 meshes with a gear wheel 22 loose on the spindle 23 of the drum. This gear wheel 22 meshes with a train of gearing 24 journaled on the frame 15 and meshing with the gear pinion 25 loose on the spindle 26 of the gear roller 12. This pinion is adapted to be put into driving connection with the gear roller preferably by being provided with a recess 27 adapted to engage the projection 28 at the end of the gear roller 12. An ordinary clutch shifter 29 is provided to place the pinion 25 into and out of clutch with the roller. From this arrangement it follows that by rotating the shaft 20 the gear roller 12 may be rotated to draw the ladder sections from the drum as required.

As the weight of the ladder will assist the rewinding process I am enabled to utilize quicker acting gearing to rewind the ladder.

For this purpose I secure to the drum the gear wheel 30. Meshing with this gear wheel is a pinion 31 which is connected by means of an ordinary free wheel clutch 32 with a pinion 33 on the same spindle. This pinion 33 meshes with the pinion 21. Owing to the free wheel clutch the pinion 30 is inoperative when the ladder is being raised, but becomes operative to reverse the drum when the pinion 21 is reversed and this reverses the direction of the movement of the pinion 33.

It is necessary to alter the inclination of the ladder according to the height to be reached and the distance of the apparatus from the building to be reached. The frame 15 is therefore made to swing on the spindle 26 of the drum. The lower end of this frame is provided with a cross bar and has connected thereto a link 35 pivotally connected to a cross head 34 movable in the guides 36 secured to the base of the frame 1. A screw 37 is connected to this cross head and has a nut 38 thereon which is held from endwise motion by being fitted in a recess in the bearing block 39 through which the screw 37 passes. This nut 38 is also formed exteriorly as a worm pinion engaged by the worm 40 on the spindle 41 journaled in the bearing block 39 and part of the frame 1.

A spindle 42 provided with a crank handle 43, or other means whereby it may be rotated, is journaled in the frame 1 and is connected by a train of gearing 44 to the spindle 41. By operating the crank handle the link 34 through the intermediate parts may be moved in either direction to rock the frame 15 and thus alter the inclination of the ladder. Of course power means might be employed if desired to operate the spindle 42, or indeed other means might be employed for rocking the said swinging frame.

Clamp screws 45 working through arc shaped slots in the frame 1 and screwing into the frame 15 may be used to clamp the ladder if desired in a rigid position.

To lock the drum in any desired position I prefer to employ a ratchet wheel 46 secured to the drum at the opposite side to the gear wheels 22 and 30. This ratchet wheel is engaged by a spring actuated pawl 47. A pin 48 connected to a spring 49 operates through a hole in the frame 1 and is adapted to enter a hole 50 in the pawl to hold the ladder out of mesh with the ratchet wheel when the drum is to be operated to rewind the ladder.

It will have been noticed that when the clutch shifter 29 has been moved to disengage the pinion 25 from the gear roller 12 that there is nothing to support the weight of the extended part of the ladder. The weight of the extended ladder would therefore tend to strip from the frame the section

wound thereon adjacent to the extended portion of the ladder. In order to overcome this difficulty I provide in connection with the gear roller 12 a brake which is brought
5 into operation by the disengaging movement of the clutch shifter 29. This brake effectually counterbalances the weight of the ladder and enables the sections of the ladder to be wound upon the drum, as hereinbefore described. The construction of this brake is
10 best seen on reference to Figs. 6 and 9.

The spindle 26 is loose in the gear roller 12. The gear roller is held from endwise movement without interference with its rotation by the retainer 51 which is secured to the frame 15 and engages a groove in the roller. The spindle 26 is however rotated independently of the pinion 27 but is so connected with the latter that the longitudinal movements of the pinion relative to the gear roller are imparted to the spindle. For this
20 purpose I show a set screw 52 screwed through the hub of the pinion and engaging the groove in the spindle. The other end of the spindle has a tapered friction clutch member 53 secured to or formed thereon adapted to engage a similar shaped recess formed in the end of the gear roller 12. Outside the clutch member 53 the spindle 26 is suitably shaped to engage the frame 15 to prevent rotation of the spindle when the latter has been moved to engage the clutch member 53 with the recess in the gear roller. For this purpose I show a square end 54 on the
35 end of the spindle adapted to engage a similarly shaped recess in the frame. From this construction it follows that when the pinion 27 is thrown out of engagement with the roller 12 the clutch member 53 will simultaneously be engaged with the roller to apply a brake to the movements of the latter.

The clutch shifter 29 may be held as moved by being sprung into the notches of a notched quadrant 55 secured to the frame 15 as shown in Fig. 6.

From the above description it will be seen how compactly the ladder may be carried and how simple is the operation of extending or retracting the same.

50 In practice many of the details of construction may be varied without departing from the spirit of my invention.

What I claim as my invention is:—

55 1. An extension ladder comprising a suitably journaled polygonal drum; a series of ladder sections hinged together, an end section being connected to the drum and the length of the sections progressively increased and their widths decreased stepwise according to their distance from the said end section; means for locking the sections in alignment; means on the drum adapted to engage and release the locks of the sections wound directly on said drum; and tongues on the
65 inner sections adapted to engage and release

the locks on the sections wound over them on the drum, said tongues being formed by projecting the lower ends of the sides of the sections past the pivots between these sections. 70

2. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; a movable frame, pivoted intermediate its ends on the same axis as the drum; a guide roller on said frame over which the ladder sections pass; and means for adjusting said frame to adjust the angle of the ladder, applied to the lower end of said frame. 75

3. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; a movable frame, pivoted intermediate its ends on the same axis as the drum; a guide roller on said frame over which the ladder sections pass; and means for adjusting said frame to adjust the angle of the ladder, comprising a screw pivotally connected to the lower end of the frame; a journaled nut through which the screw is threaded; and means for rotating the nut. 80

4. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together with sides overlapping, and provided where they overlap with holes which are in alinement when the sections are extended; springs connected to the outer section at each joint; pins secured to said springs adapted to enter the alined holes; and knife edge projections on the drum, adapted to engage beneath said springs to unlock the sections wound immediately on the drum. 85

5. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together with sides overlapping, and provided where they overlap with holes which are in alinement when the sections are extended; springs connected to the outer section at each joint; pins secured to said springs adapted to enter the alined holes; knife edge projections on the drum, adapted to engage beneath said springs to unlock the sections wound immediately on the drum; and knife edge tongues formed on each section, adapted to engage the springs of sections wound over them to unlock the same. 90

6. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; rack sections formed on the ladder sections; a gear roller engaged by the rack sections; an operating shaft geared to the roller, and also to the drum; 120

a releasable clutch connection in the gearing between the shaft and one of the parts to which it is geared; and a free wheel clutch in the gearing between said shaft and the other part to which it is geared.

7. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; rack sections formed on the ladder sections; a gear roller engaged by the rack sections; an operating shaft geared to the roller and also to the drum; a releasable clutch connection in the gearing between the shaft and the gear roller; and a free wheel clutch in the gearing between the said shaft and the drum.

8. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; rack sections formed on the ladder sections; a gear roller engaged by the rack sections; an operating shaft geared to the roller and also to the drum;

a releasable clutch connection in the gearing between the shaft and the gear roller; a free wheel clutch in the gearing between the said shaft and the drum; and a brake for controlling the roller when the releasable clutch is disengaged.

9. An extension ladder comprising a suitably journaled drum; a series of ladder sections hinged together and adapted to be wound on the drum; means for locking the sections in alinement; rack sections formed on the ladder sections; a gear roller engaged by the rack sections; an operating shaft geared to the roller; a clutch connection between the gear roller and said gearing; a brake; means for simultaneously applying the brake and disengaging the clutch; and rewinding means directly actuating the drum.

Toronto, this 8th day of June 1909.

GUSTAV W. MOHRSTADT.

Signed in the presence of—

J. EDW. MAYBEE,

D. S. TOVELL.