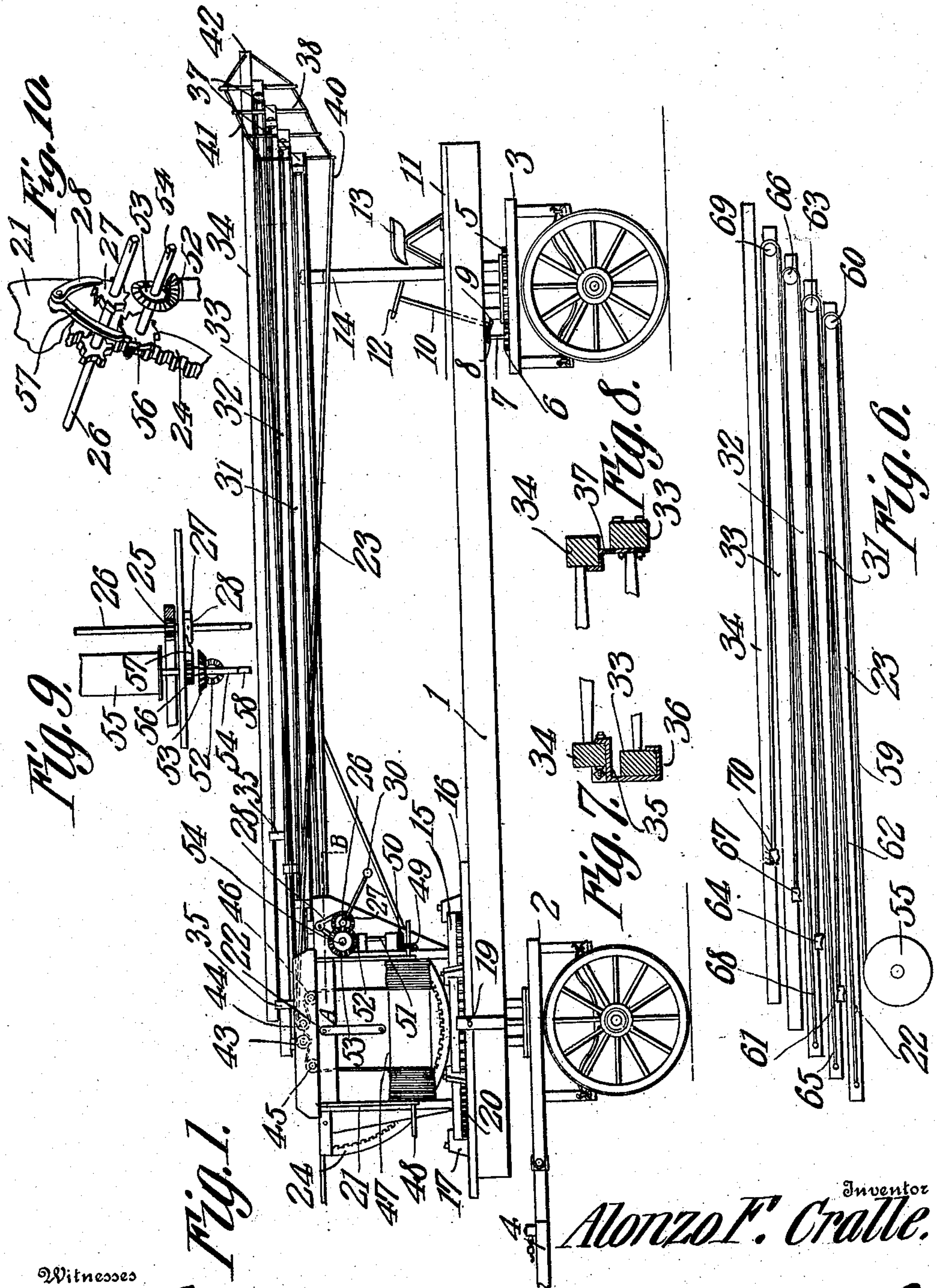


A. F. CRALLE.
EXTENSIBLE LADDER.
APPLICATION FILED APR. 2, 1908.

Patented June 8, 1909.
2 SHEETS—SHEET 1.

923,815.



Witnesses
E. H. Clavett
Herbert Lawson.

Inventor
Alonzo F. Cralle.
384
C. Snow & Co.
Attorneys

A. F. CRALLE.
EXTENSIBLE LADDER.
APPLICATION FILED APR. 2, 1908.

Patented June 8, 1909.

2 SHEETS—SHEET 2.

923,815.

Fig. 2.

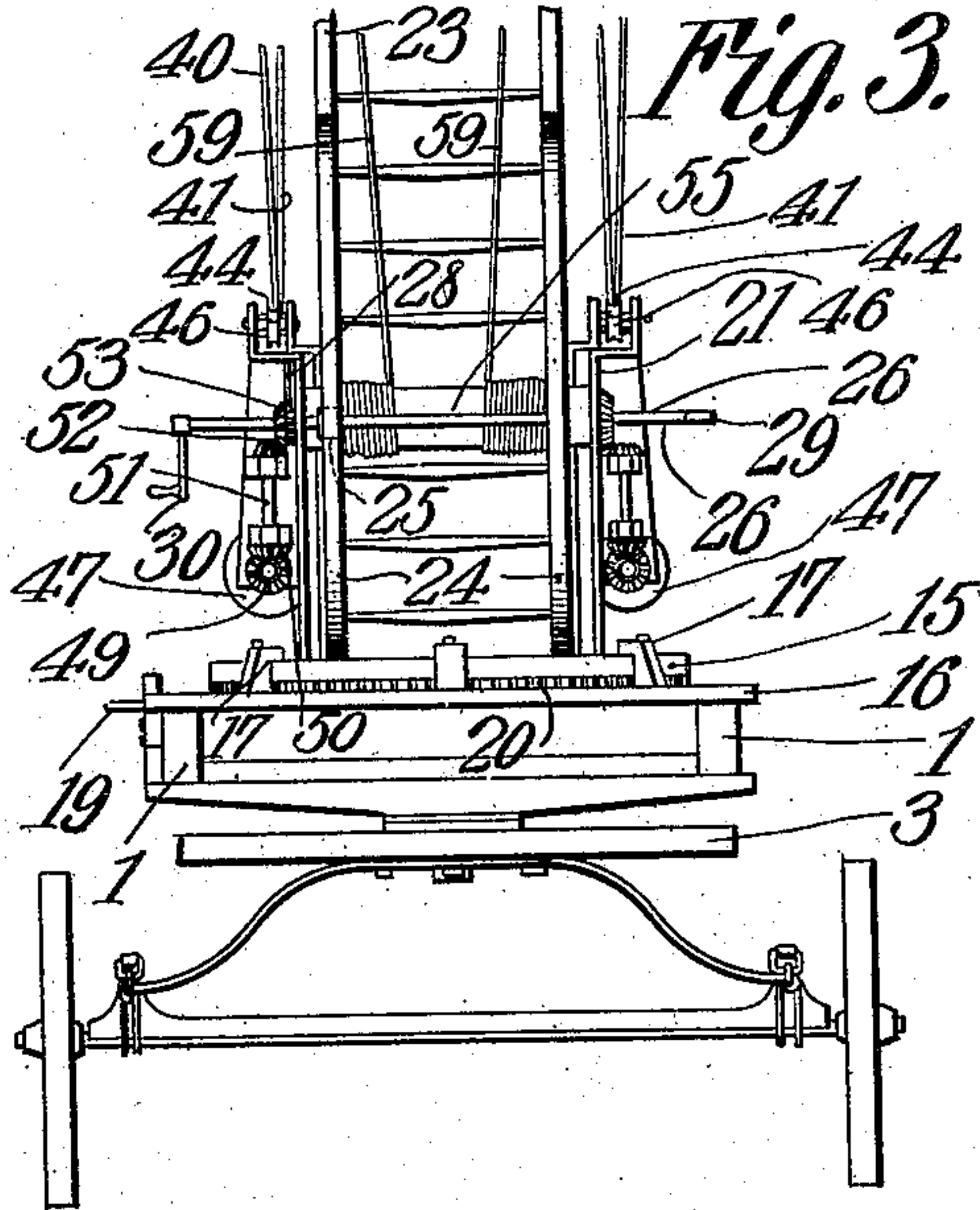
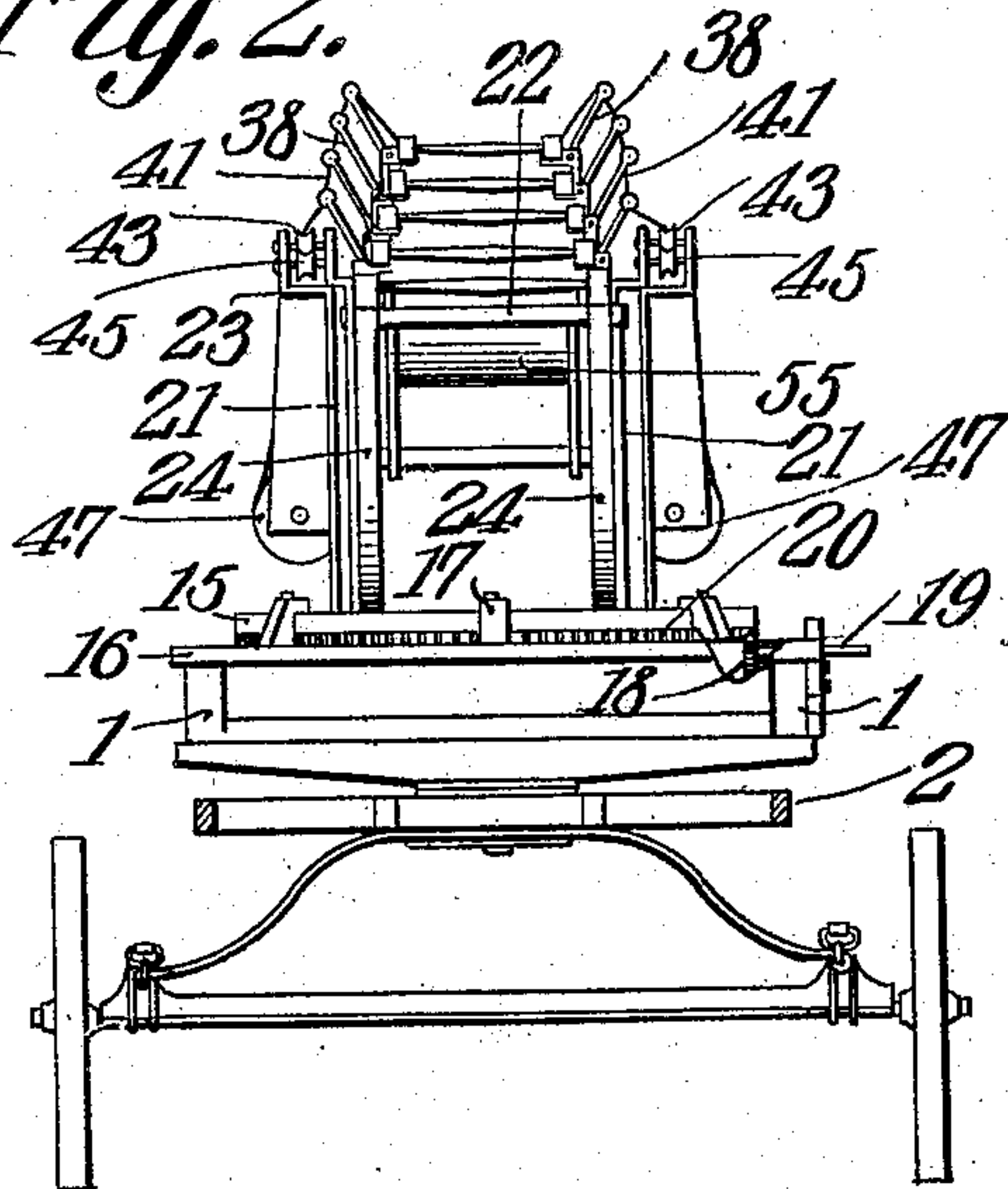


Fig. 4.

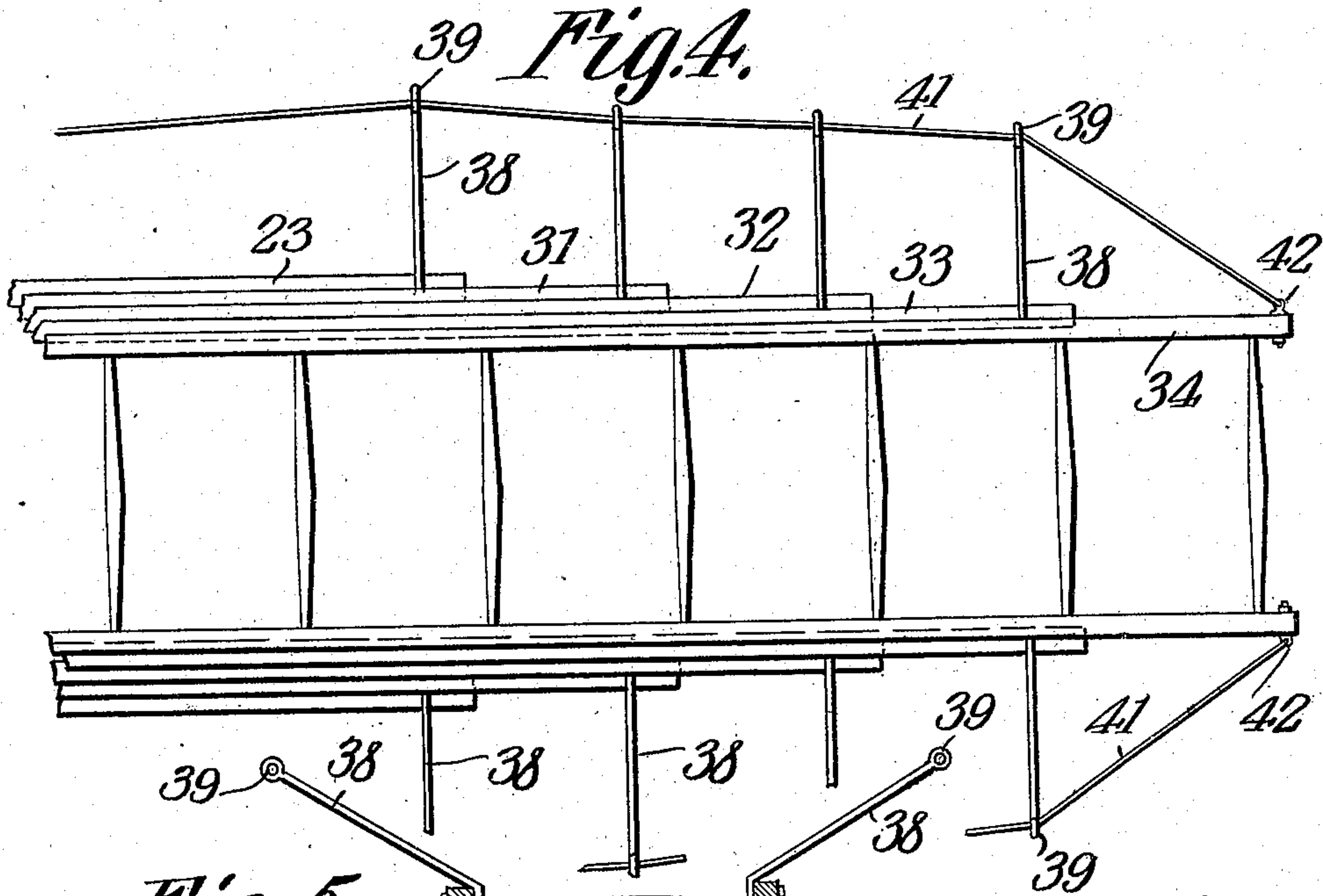


Fig. 5.

Witnesses
Ed. Stewart
Robert D. Lawson.

Inventor

Alonzo F. Cralle.

By

C. A. Snow & Co.
Attorneys

UNITED STATES PATENT OFFICE.

ALONZO F. CRALLE, OF ABERDEEN, SOUTH DAKOTA.

EXTENSIBLE LADDER.

No. 923,815.

Specification of Letters Patent.

Patented June 8, 1909.

Application filed April 2, 1908. Serial No. 424,802.

To all whom it may concern:

Be it known that I, ALONZO F. CRALLE, a citizen of the United States, residing at Aberdeen, in the county of Brown and State of South Dakota, have invented a new and useful Extensible Ladder, of which the following is a specification.

This invention relates to extensible ladders for use by firemen, the same being of that character mounted upon portable trucks.

The object of the invention is to provide a ladder consisting of a number of slidably connected sections, mechanism being provided whereby the complete or partial extension of the ladder can be quickly effected by causing each ladder during the extending movement, to shift longitudinally relatively to the adjoining ladder, the shifting movement of all the ladders occurring simultaneously and not successively as heretofore.

Another object is to provide the ladder with trusses or braces and mechanism whereby the same can be paid out or drawn in during the extension or retraction respectively of the ladder.

A further object is to provide a ladder which can be adjusted to any desired angle relative to the horizontal and locked in such position, after which it can be swung so as to extend in any desired direction relative to the sides of the truck on which the ladder is mounted.

Another object is to provide an extensible ladder which is compact, durable, and efficient, can be readily transported and the parts of which can not readily get out of order.

With these and other objects in view the invention consists of certain novel features of construction and combinations of parts which will be hereinafter more fully described and pointed out in the claim.

In the accompanying drawings is shown the preferred form of the invention.

In said drawings: Figure 1 is a side elevation of the ladder and showing the parts in their normal positions. Fig. 2 is a front elevation of the ladder and its truck, the parts being shown in positions indicated in Fig. 1. Fig. 3 is a rear elevation of the truck and of the lower portion of the ladder when extended and raised. Fig. 4 is a plan view of the end portion of the folded ladder. Fig. 5 is a transverse section through one of the ladders and showing the relative positions of the truss arms. Fig. 6 is a diagrammatical view showing the flexible connections between the

ladder sections and the truck whereby simultaneous shifting of the sections is effected. Fig. 7 is a transverse section through one side of two adjoining ladder sections and showing the means employed for holding them against lateral displacement. Fig. 8 is a section through one side of the rear portions of two adjoining ladder sections and showing one of the upper guides of the ladder. Fig. 9 is an enlarged section on line A—B, Fig. 1 and showing a portion of the mechanism at one side of the machine. Fig. 10 is a detail view showing the gearing for actuating the toothed segment and the winding drums of the apparatus.

Referring to the figures by characters of reference, 1 designates the base of the ladder, the same being mounted upon front and rear trucks 2 and 3 respectively, each of which is wheel supported and is mounted to rotate relative to the base. A tongue 4 extends from the truck 2 so that the draft animals can be conveniently harnessed thereto while the rear truck 3 is provided with suitable means whereby it can be turned manually for the purpose of assisting in steering the vehicle. This mechanism may consist of a large gear 5 secured to the truck 3 and concentric with its pivot, said gear meshing with a smaller gear 6 secured to a shaft 7 carrying a beveled gear 8. This beveled gear may be engaged by a beveled gear 9 on the end of a steering shaft 10, which extends upward through a platform 11 on base 1 and has a steering wheel 12 located directly in front of the seat 13 which is provided for the steersman. A supporting frame 14 is arranged upon the base 1 adjacent its rear end and constitutes the rear support for the ladder when it is folded and in its normal position.

Mounted on the base preferably near the front thereof is a turntable 15 which is held firmly upon a top plate or track 16 by means of retaining lugs 17 which extend upward and lap the turntable. It is of course to be understood that any suitable devices may be utilized for reducing friction between the turntable and the adjoining parts of the device so that said turntable can be operated with little effort. The rotation of the turntable may be effected in any desired manner as by mounting a cog 18 upon a shaft 19 extending from one side of the base, said cog meshing with a circular gear 20 formed upon or secured to the turntable 15. The shaft 19 may be provided with an angular outer end

for engagement by a crank so that by rotating said shaft the turntable can be partly or entirely revolved.

Mounted upon the turntable 15 are preferably two parallel upstanding frames 21 and connecting the upper portions of these frames at the centers thereof is a pivot shaft 22 on which is mounted the lower ladder section 23 which, when in normal position, rests adjacent its rear end upon the supporting frame 14. Two semi-circular racks 24 are fastened to the sides of this ladder section 23 and are concentric with shaft 22 and each of these racks is engaged by a gear 25, said gears being mounted on a shaft 26 journaled in the frames 21. A ratchet wheel 27 is secured to shaft 26 and is normally engaged by a pawl 28 and a head 29 is formed at each end of the shaft 26. These heads are designed to be engaged by cranks 30 so that shaft 26 can be rotated manually for the purpose of actuating the racks 24 and thus swinging the ladder section 23 upwardly with shaft 22 as a center. It will of course be apparent that pawl 28 and ratchet 27 will operate to lock the ladder at any desired inclination. It is to be understood that a pawl and ratchet may be located adjacent each end of shaft 26 if desired.

The ladder may be formed of any desired number of sections, and in the drawings five of these sections have been disclosed. The lower section 23 is pivotally mounted between the frames 21 as heretofore described while the other sections 31, 32, 33 and 34 are placed one upon the other, as clearly indicated in Figs. 1 and 6. These last mentioned ladder sections are slidably mounted upon one another and in order that lateral displacement of the sections relative to one another may be prevented each ladder section, with the exception of the section 23, is provided at its lower end with an angular extension 35 which is bolted to each side thereof and laps the outer face of the adjoining ladder and then extends thereunder as shown at 36. Each extension is designed to slide upon the ladder engaged thereby and as a result the end portions of the ladders are positively held against displacement although capable of moving longitudinally relative to one another. The upper ends of all of the sections with the exception of the top section 34 are also provided with combined guiding and retaining means consisting of angular extensions 37 which are fastened to said ladder sections and slidably engage the sections thereabove so as to prevent their lateral displacement relative to one another, although allowing independent longitudinal movement of the sections. Each ladder section, except the section 34, has outwardly diverging truss arms 38 connected to the sides thereof at their upper ends and the outer ends of these arms are provided with eyes 39

for the reception of bracing cables 40 and 41. The cables 40 extend loosely through the eyes of the downwardly extending arms of the ladder sections while the cables 41 extend loosely through the eyes of the upwardly extending arms 38. One set of cables extends along each side of the ladder sections and all of the cables are fastened in any preferred manner to the upper end of the ladder section 34, as indicated at 42. The cables 41 and 42 at each side of the ladder extend forwardly over sheaves 43 and 44 mounted upon one of the frames 21 and are then extended in opposite directions and over sheaves 45 and 46 from which they are carried downward and are secured to opposite end portions of a drum 47. This drum is secured to a shaft 48 which is journaled in the frame 21 and has a gear 49 thereon meshing with a gear 50 on a shaft 51. This shaft is journaled in suitable bearings on frame 21 and has a gear 52 meshing with a beveled gear 53 which is keyed or otherwise fastened to a shaft 54 extending transversely of the machine and journaled upon the two frames 21. It is of course to be understood that two drums 47 are provided, one being used for the cables 40 and 41 at each side of the ladder and each of these drums is provided with its own set of gears and shafts such as hereinbefore described, the mechanisms of both drums being actuated from the shaft 54.

Secured on the shaft 54 is a spool 55 and one or more ratchet wheels 56 are also secured to this shaft and each is normally engaged by a pawl 57 whereby rotation of the mechanism in one direction may be prevented. Each end of shaft 54 is preferably provided with a head 58 designed to be engaged by the crank 30. Secured to the spool 55 are two hoisting cables 59 which extend rearwardly and over pulleys 60 on the upper ends of the sides of ladder section 23 and then extend forward and are secured to the lower end of the ladder section 31, as indicated at 61. Another set of cables 62 is fastened to the lower end of the ladder section 23 and extends rearwardly and over pulleys 63 upon the upper end of ladder section 31, said cables then extending forward or downward and being fastened to the ladder section 32, as indicated at 64. Cables 65 are fastened to the lower end of section 31 and extend rearwardly and over pulleys 66 on the upper end of ladder section 32 and then extend forward and are secured to the ladder section 33 near the lower end thereof as shown at 67. Another set of cables 68 is fastened to the lower end of ladder section 32 and extends rearwardly and over pulleys 69 at the upper end of ladder section 33 and are then brought forward and secured to the lower portions of the ladder section 34 as indicated at 70. With this arrangement of cables it will be apparent that when cables

59 are wound on drum 55 they will pull the ladder section 31 longitudinally upon the section 23 and the pulleys 63 on section 31 will push against the cables 62 so as to produce a simultaneously longitudinal movement of the ladder section 32 relative to section 31. The pulleys 66 on section 32 will thus be forced against the cables 65 and cause longitudinal movement of section 33 relative to section 32 and at the same time the pulleys 69 on section 33 will push against the cables 68 and cause the top section 34 to shift longitudinally upon section 33. It will be seen therefore that in the time which would ordinarily be occupied in extending one ladder section all of the ladder sections are pushed outwardly, thus resulting in the rapid extension of the ladder.

Inasmuch as the spool 55 and the drum 47 rotate simultaneously because of the gearing connecting them it will be apparent that while the ladder sections are being extended the bracing cables will be unwound and the ladder as extended will be provided with four of these cables held taut and extending through the diverging truss arms 38.

As heretofore stated the normal positions of the parts have been indicated in Fig. 1. When it is desired to use the ladder a crank is placed in engagement with shaft 26 which, when rotated, will cause the racks 24 to work upon either pivot shaft 22 and swing the collapsed ladder to any desired angle relative to the horizontal, after which shaft 26 can be locked by means of the pawl 28 and ratchet 27. The ladder can then be turned by means of shaft 19 and gears 18 and 20. As soon as adjustment has been effected shaft 54 is rotated so as to wind the cables 59 on spool 55 and unwind the cables 40 and 41 from drums 47. The ladder 28 will therefore be simultaneously shifted longitudinally and the bracing cables will be paid out at such a speed as to remain taut during the shifting of the ladders and thus, in conjunction with arms 38, act as a truss to strengthen the ladder

longitudinally. When the ladder has been extended to the desired length it can be secured by placing pawl 57 in engagement with ratchet 56. To collapse the ladder the pawl 57 is disengaged from ratchet 56 and the rotation of the mechanism is reversed so that the cables 59 will be unwound from spool 55 and the cables 40 and 41 will be wound on drums 47. When the ladder sections have been wholly collapsed they can be swung downward by actuating shaft 26, gears 25 and racks 24. This, of course, is not done until after the turntable has been shifted so that when the sections are lowered they will rest upon the frame 14.

It will be seen that by constructing the ladder in the manner herein described the extension thereof can be speedily accomplished because all of the sections can be shifted for their entire lengths in the time which would ordinarily be required for shifting a single ladder section in a construction wherein a step by step extension of the sections is effected. It is to be understood that means other than cranks may be utilized for rotating the shafts. For example, a suitable motor may be placed upon the base 1 for driving the mechanism.

What is claimed is:

The combination with a frame; of a ladder pivotally mounted upon the frame and consisting of superposed slidably connected sections, means for simultaneously shifting all of the sections longitudinally, diverging arms at each side of each section, separate tension devices extending through the arms at the sides of the sections, and means operated by the extension of the ladder for paying out the tension devices.

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

ALONZO F. CRALLE.

Witnesses:

F. G. HUNTINGTON,
LUCY L. STEELE.