No. 892,980.

PATENTED JULY 14, 1908.

W. J. COOPER.

LADDER.

APPLICATION FILED MAR. 18, 1907.

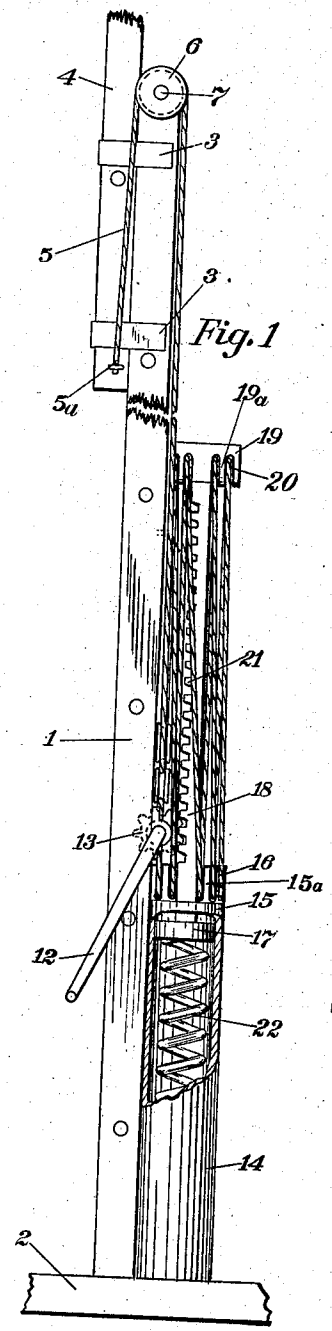



Fig. 1

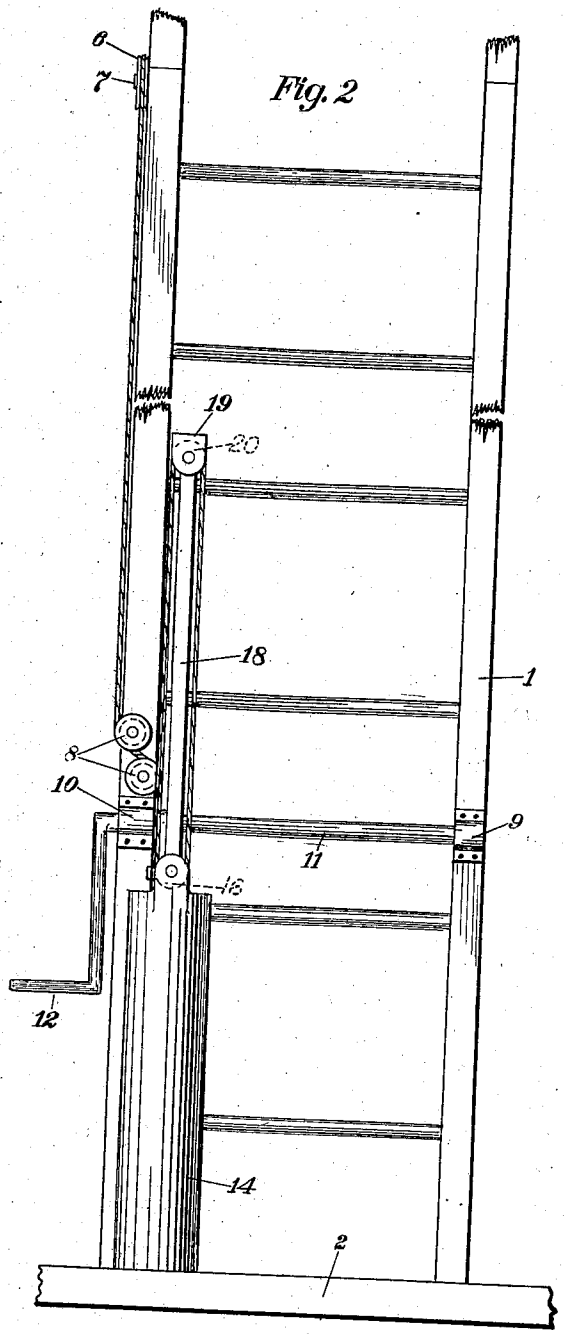



Fig. 2

WITNESSES:

R. Rogers

R. Meiklejohn

Walter J. Cooper INVENTOR.

BY

Geo. W. Reynolds

ATTORNEY.

# UNITED STATES PATENT OFFICE.

WALTER J. COOPER, OF CLEVELAND, OHIO, ASSIGNOR TO THE SEAGRAVE COMPANY, OF COLUMBUS, OHIO, A CORPORATION.

## LADDER.

No. 892,980. Specification of Letters Patent. Patented July 14, 1908.

Application filed March 18, 1907. Serial No. 363,108.

*To all whom it may concern:*

Be it known that I, WALTER J. COOPER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Ladders, of which the following is a specification.

My invention relates to improvements in the mechanism for raising and lowering the extension member of an extension ladder, and consists especially in providing a comparatively simple and inexpensive device having a piston rod with a cable connected thereto passing over pulleys and secured to the extension member at one end and to the head of a cylinder at the other end, said cylinder containing counterbalancing means for the weight of the extension member.

It further comprises a rack formed on the piston rod, and a pinion engaging therewith to elevate and lower the same; all together providing a device whereby the extension member is quickly raised and lowered and its weight is effectually counterbalanced to facilitate movement thereof in elevating the ladder.

To accomplish these ends I provide the parts and the combination of parts heretofore mentioned and hereinafter more specifically described.

In the drawings, Figure 1 is a side view of the fixed ladder member and the extension member carried thereby and the operating means partly in section; Fig. 2 is a front view of the ladder having my improvement attached thereto.

Referring to the drawings which are hereby expressly made a part of this specification and in which the same numerals indicate like parts throughout, 1 is the fixed ladder member mounted at its lower end upon the base 2 and carrying the guides 3 in which the extension member 4 is adapted to slide vertically, the latter having secured near the lower end 5ª thereof the cable 5 which passes over the pulley 6 journaled at 7 near the upper end of the fixed ladder member; journaled at a lower point on the fixed member are the guide rollers 8 over which the cable is conducted to the hoisting means. Journaled in the fixed member at the points 9 and 10 is a shaft 11, provided at one end with a crank 12 and carrying the pinion 13. Mounted on the base 2 and secured to the fixed ladder member is a cylinder 14 having at its upper end a head 15 carrying means 15ª for journaling the pulleys 16, while arranged within said cylinder is a piston 17 adapted to travel vertically therein and having the rod 18, the latter being provided at its upper end with the head 19 in which are means 19ª for journaling the pulleys 20; the cable 5 is conducted over these pulleys around and around and is fixed at one end to the head 15 of the cylinder, and as before stated is secured at its other end near the lower end of the extension member. The piston rod 18 is provided on one face with the rack teeth 21, with which the pinion 13 is adapted to engage, and as the crank 12 is moved in one direction the piston will be raised and when moved in the opposite direction the piston will be lowered, the effect being to raise and lower the extension member of the ladder through the arrangement of pulleys and guide rollers described. Housed within the cylinder beneath the piston 17 is the spring member 22 adapted to counterbalance the weight of the extension member, whereby it renders effective aid in elevating the same, and cushions the descent thereof.

As shown in Fig. 1, the piston is at the point of its greatest upward movement, and the extension member of the ladder is also at its most elevated point; now if the crank be rotated towards the left the piston rod or plunger will be lowered against the spring and as the pulleys carried by the piston rod approach the fixed pulleys on the cylinder head the cable will slacken and the extension member will descend by its own weight. The extension member being at its lowermost position, if the crank shaft be rotated towards the right, (see Fig. 1) the upward travel of the piston will widen the interval between the two sets of pulleys 16 and 20, the cable will consequently be more and more drawn into this interval, the effect of which will be to tighten the same and to exert an upward pull upon the extension member at 5ª. The upward movement of the extension member is greatly assisted and accelerated by the effect of the compressed spring 22, which, expanding against the piston 17 will, at the beginning of the upward movement, give great assistance in the raising of the extension member, at the instant when such assistance is most needed. It is obvious that the lifting will continue throughout the entire upward movement of the ex-

tension section, if the spring has been made stiff enough.

It will be noted that the cylinder is mounted upon the same base as the fixed ladder member, is adjacent thereto and preferably secured thereto, that the plunger or piston rod carrying the rack is adapted to travel upwardly and downwardly adjacent a side rail of the fixed ladder member, and that the cable is passed upwardly and downwardly over the pulleys and thence over guide rollers on the fixed ladder member and finally secured near the lower end of the extension member, the whole arrangement of parts being very compact and simple in its construction and operation.

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

1. A ladder comprising a lower member and a relatively movable extension member, a cylinder fixed with relation to the lower member, a piston arranged in said cylinder for reciprocation and having its rod provided with a series of rack teeth, a pinion adapted to mesh with said rack to actuate said piston, means connecting the piston and extension member whereby the latter may be projected and spring means arranged in said cylinder to assist in the elevation of said extension member.

2. A ladder comprising a lower member and a relatively movable extension member, a cylinder fixed with relation to the lower member, a piston arranged in said cylinder for reciprocation and having its rod provided with a series of rack teeth, a rotatable operating shaft, a pinion thereon adapted to mesh with said rack and operable for retracting the piston, a spring within said cylinder placed under compression by the retraction of said piston, and a connection between said piston and said extension member for controlling the movement of the latter.

3. A ladder comprising a lower member and a relatively movable extension member, a cylinder fixed with relation to the lower member, a piston arranged for movement therein and having its rod provided with a series of rack teeth, pulleys journaled at the outer end of said rod, pulleys journaled in the head of said cylinder, guide rollers mounted on said lower member, a rotatable shaft carrying a pinion adapted to engage with said rack teeth for reciprocating the piston, a flexible traction element secured to the extension member and carried over said guide rollers and pulleys, and adapted to transmit the motion of said piston to said extension member to project the same, and spring means in said cylinder for assisting in the elevation of said extension member and for cushioning the same when retracted.

In testimony whereof I affix my signature in the presence of two witnesses.

WALTER J. COOPER.

Witnesses:
HENRY R. MAURER,
ALANSON B. TREAT.