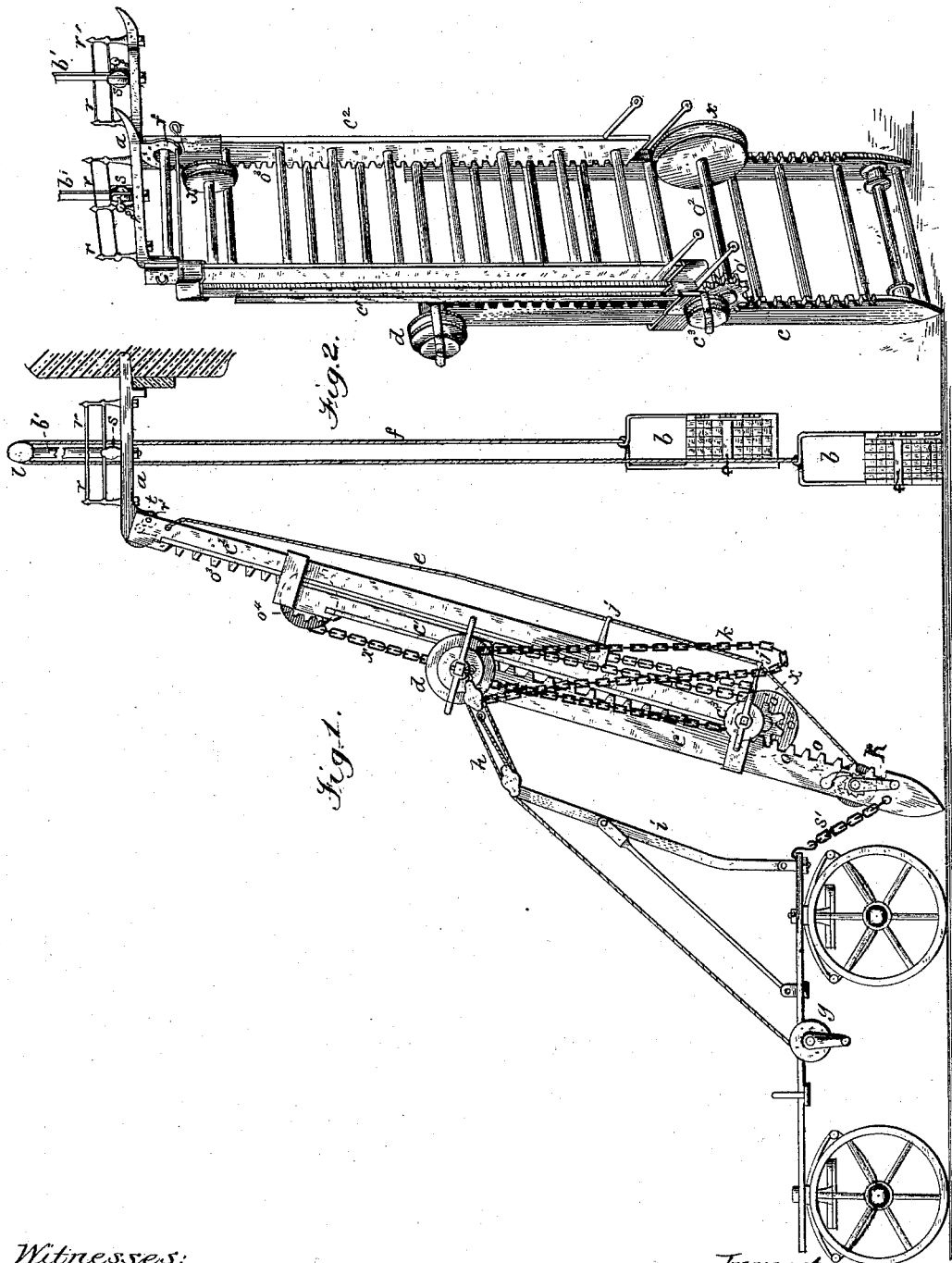


B. CAVANAGH.  
Fire-Escape Ladder.

No. 218,929.

Patented Aug. 26, 1879.



Witnesses;  
T. Walter Fowler,  
Nat. E. Oliphant

Inventor,  
Bartholemew Cavanagh,  
per Cha. H. Fowler,  
Attorney.

# UNITED STATES PATENT OFFICE.

BARTHOLEMEW CAVANAGH, OF SUSQUEHANNA DEPOT, PENNSYLVANIA.

## IMPROVEMENT IN FIRE-ESCAPE LADDERS.

Specification forming part of Letters Patent No. **218,929**, dated August 26, 1879; application filed October 2, 1878.

*To all whom it may concern:*

Be it known that I, BARTHOLEMEW CAVANAGH, of Susquehanna Depot, in the county of Susquehanna and State of Pennsylvania, have invented an Improved Portable Extensible Truss Fire-Escape Ladder, of which the following is a specification.

The invention or improvement relates to apparatus for the rescue of persons and property from the upper stories of burning buildings.

In the drawings furnished, Figure 1 is a side elevation of carriage and fire-escape ladder in position for operation, and Fig. 2 is a perspective rear elevation of the latter.

Referring to Fig. 1, the ladder  $c$   $c^1$   $c^2$  is shown in three sections. (More than three sections may be employed.) These sections are free to move longitudinally in relation to each other, the middle section being placed back of the first or lower section, and the upper section back of the middle section.

The middle section,  $c^1$ , is made just narrow enough to slide within the side rails of the lower section, and the upper section,  $c^2$ , narrow enough to slide within the side rails of the middle section.

The side rails of the lower section,  $c$ , are furnished with a rack,  $o$ , on their back edges, into which mesh pinions  $o^1$  on shaft  $o^2$ , revolving in suitable bearings attached to the lower end of the second section,  $c^1$ .

The side rails of the upper section are furnished with a rack,  $o^3$ , on their front edges, into which mesh pinions  $o^4$  on shaft revolving in suitable bearings attached to the upper end of the second section. The three sections are united by suitable clasps and guides on the sides of the side rails.

In addition to the pinions  $o^1$   $o^4$  (of equal diameter) on the shafts described, there is also on each a chain-wheel,  $x$ , keyed fast near the left-hand side rail, and an endless-chain belt connects the two shafts together. Thus it will be seen that if the lower shaft be made to revolve the upper shaft will also revolve, by reason of the chain-wheels and chain-belt connection; and as the pinions on the lower shaft mesh into the racks of the lower section, and the pinions of the upper shaft mesh into the racks of the upper section, (both shafts being

on middle section,) it follows that as these shafts revolve, both the middle and upper sections are simultaneously extended or contracted, according to the direction in which the shafts are made to revolve.

At the upper end and on the outside of the lower section of the ladder, on the right-hand side, on a fixed stud for that purpose, revolves the upper or power block of differential chain-pulley  $d$ , the moving block  $c^3$  of same being keyed fast upon the projecting end of the shaft, attached in bearings at the lower end of the middle section of the ladder.  $k$  is a chain connecting the pulleys  $d$   $c^3$ .

The first or lower section of the ladder is attached to the rear end rail of the carriage or truck by stay-chains  $s'$ , of such length and so placed as to allow the foot of the ladder to reach the ground, but without the chain becoming slack in so doing.

Hinged to the top of the upper section of the ladder is platform or landing  $a$ , which is held rigidly in a horizontal position, when the ladder is in place for service, by a movable rod passed through suitable holes in cheeks  $r'$  of the hinges, and remote from the pivots thereof. This platform has a hand-rail,  $r$ , on either side, hinged to the bifurcated projections  $s$ . Attached to the platform, and meeting overhead at a point immediately over the center of a trap-door in the platform  $a$ , is a bail,  $b'$ , which supports pulley-block  $l$ , through which rope  $f$  is rove, to which baskets  $b$   $b$  are attached, to ply as required between the platform and the ground.

The furcated projections  $s$  attached to the upper face of the hinged platform  $a$  are perforated at their upper ends to receive pins passing through said perforations and similar ones made in the lower ends of the bail, so as to hold the bail rigidly in a vertical position when in operation. When not in use the bail is turned down on the platform.

Attached to the upper ends of the side rails of the upper section of the ladder are wire cables  $e$ . These cables pass over pulleys in the free ends of struts  $j$   $j$ , placed at the lower ends of the upper and middle sections, to the winch or windlass  $K$ , having ratchet-wheel and pawl to prevent backward motion, working in suitable bearings in the side rails of the lower

section of the ladder, and suitably near to the ground for convenient working. By this device I give to the ladder the character of a true mechanical truss, the cable forming the lower and the ladder the upper chord thereof.

Hinged to the side rails of the carriage or truck, admitting of vertical vibration only, are cranes *i*, having braces with furcated heads, attached by bolts, on which said braces vibrate, and which braces, when in use, are seated in furcated upright posts, and firmly held in position by movable pins passing through suitable holes in said braces and furcated ends of said upright posts. These cranes support tackle-blocks and falls *h*, which have their fixed working-points about the upper ends of said cranes, the moving pulley-block being hooked at pleasure to suitable point of the lower section of the ladder, while the free ends of the falls pass downward to winch *g*, working in suitable bearings attached to side rails of carriage or truck.

The mode of operation is as follows: The carriage being in position where it is desired to erect the ladder, platform *a* is adjusted in place by raising the free end till the holes through the cheeks of the hinges allow the movable rod to be inserted. Cranes *i* are raised, and lower ends of braces thereof pinned in furcated upright posts.

The moving blocks of tackle-blocks and falls *h* being already attached to the lower section of ladder, and the free ends of falls already in place on the barrel of the winch *g*, the cranks of said winch are turned, causing the ladder to rise, and as it rises the stay-chains by which it is attached to the carriage keep the foot in position, and when the ladder is thus raised to an angle slightly inclining toward the building the winch *g* is arrested from further motion.

Cable *e* being free to pay out, the ladder is extended as required by operating the differential chain-pulley *d*, which, imparting the required motion to the lower shaft, and, through the endless chain-belt *g*, to the upper shaft, causes the middle and upper sections of the ladder to be simultaneously extended.

Guy-ropes, usual in the erection of all very long ladders, being attached to mine, are used to keep it clear from projecting signs or prominences and depressions of architecture, and to assist in placing the supporting ends or horns of platform *a* upon the desired window-sill or other point.

The ladder being now extended and in required position, cable *e* is brought up taut by operating winch *k*, and so held by ratchet-wheel *m* and pawl *p*.

Rope *f* being always in position in pulley-block *l*, and attached to baskets *b b*, the length of rope to be used is the only adjustment it needs, and that is quickly accomplished by a clamp on one of the baskets.

As I designed to use rope *f* not only for the purpose of lowering persons and property from upper stories of buildings on fire, but also for the speedy hauling of lines of hose up the ladder, any automatic arrangement was dispensed with in favor of free lines of rope, easily attached to or detached from the lower part of baskets *b b*, and entirely within the control of firemen detailed for that special service.

I do not claim any improvement in the carriage, nor in the method employed to raise the ladder from and lower it to the carriage.

I do not claim the extension-ladder; but I believe the application of the differential chain-pulley, through which to apply the power to extend or contract the ladder, as well as the simultaneously extending or contracting the upper sections of the ladder, and therefore the method employed for that purpose, to be both new and useful.

I do not lay claim to any improvement in the use of the baskets attached to ropes and operated as above set forth; but I believe my device of a platform at the head of the ladder to be new and useful. Therefore,

What I do claim as new, and desire to secure by Letters Patent, is—

1. The combination of the differential chain-pulley *d* and chain-pulley *c*<sup>3</sup> with the sections *c c*<sup>1</sup> *c*<sup>2</sup>, provided with the racks *o n* *o*<sup>3</sup>, pinions *o*<sup>1</sup> *o*<sup>4</sup>, and chain-pulleys *x x*, journaled in the central section, whereby the sections are extended and retracted, substantially as described.

2. The combination of the differential chain-pulley *d* and chain-pulley *c*<sup>3</sup> with the sections *c c*<sup>1</sup> *c*<sup>2</sup>, provided with racks, pinions *o*<sup>1</sup> *o*<sup>4</sup>, and chain-pulleys *x x*, journaled in the central section, struts *j j*, wire cable *e*, windlass *K*, ratchet-wheel *m*, and pawl *p*, substantially as described, and for the purpose set forth.

3. The hinged platform *a*, provided with a trap-door, perforated cheeks *r*<sup>1</sup>, rod *t*, hand-rail *r*, furcated arms *s s*, and swinging bail *b*<sup>1</sup>, having pulley *l*, substantially as described, and for the purpose set forth.

BARTHOLEMEW CAVANAGH.

Witnesses:

ARTHUR T. BACK,  
NICHOLAS IRVING.