

3 Sheets—Sheet 1.

No. 527,942.

Fig. 7.

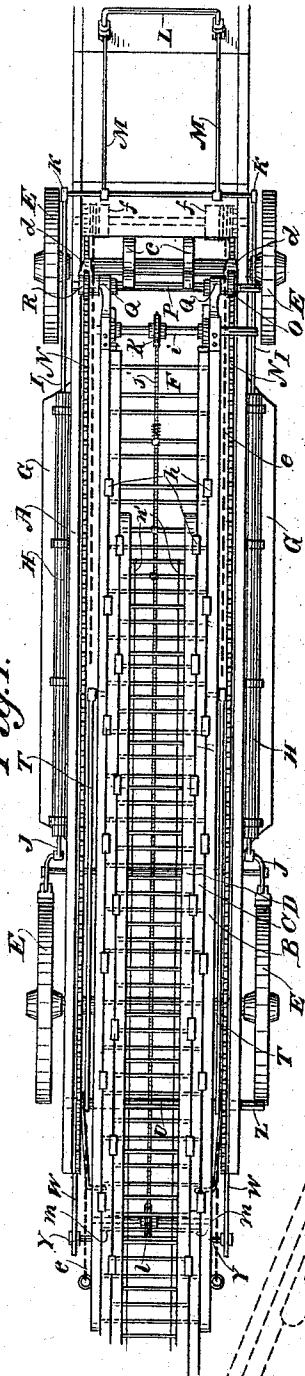
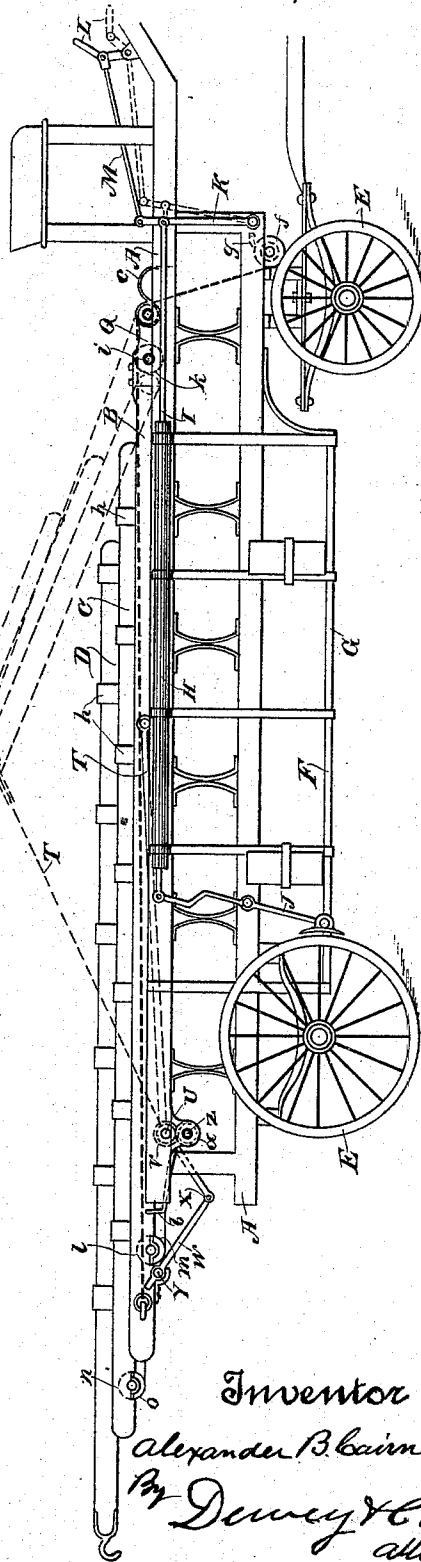


Fig. 2.



Witnesses,
J. Source
H. F. Aschbeck

Inventor,
Alexander B. Cairnes
By *Demey & Co.*
attys

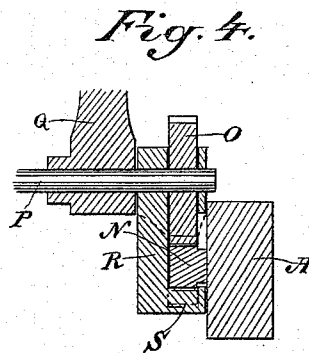
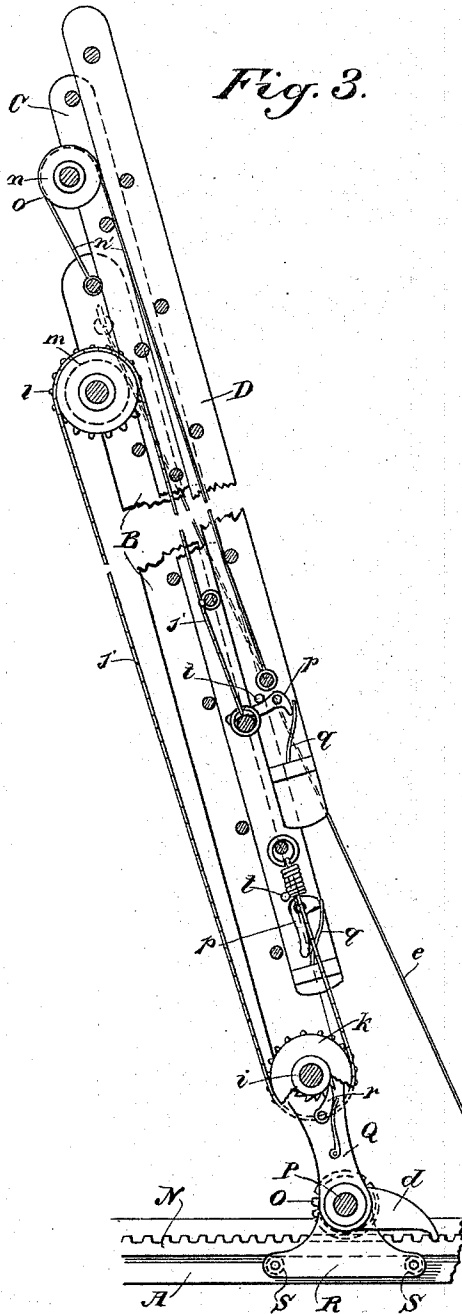
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3 Sheets—Sheet 2

A. B. CAIRNES.
EXTENSION FIRE LADDER AND TRUCK.

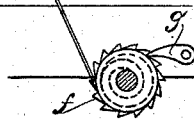
No. 527,942.

Patented Oct. 23, 1894.



Witnesses,
J. F. Aschbeck

Inventor,
Alexander B. Cairnes
By *Dewey & Co.*



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(No Model.)

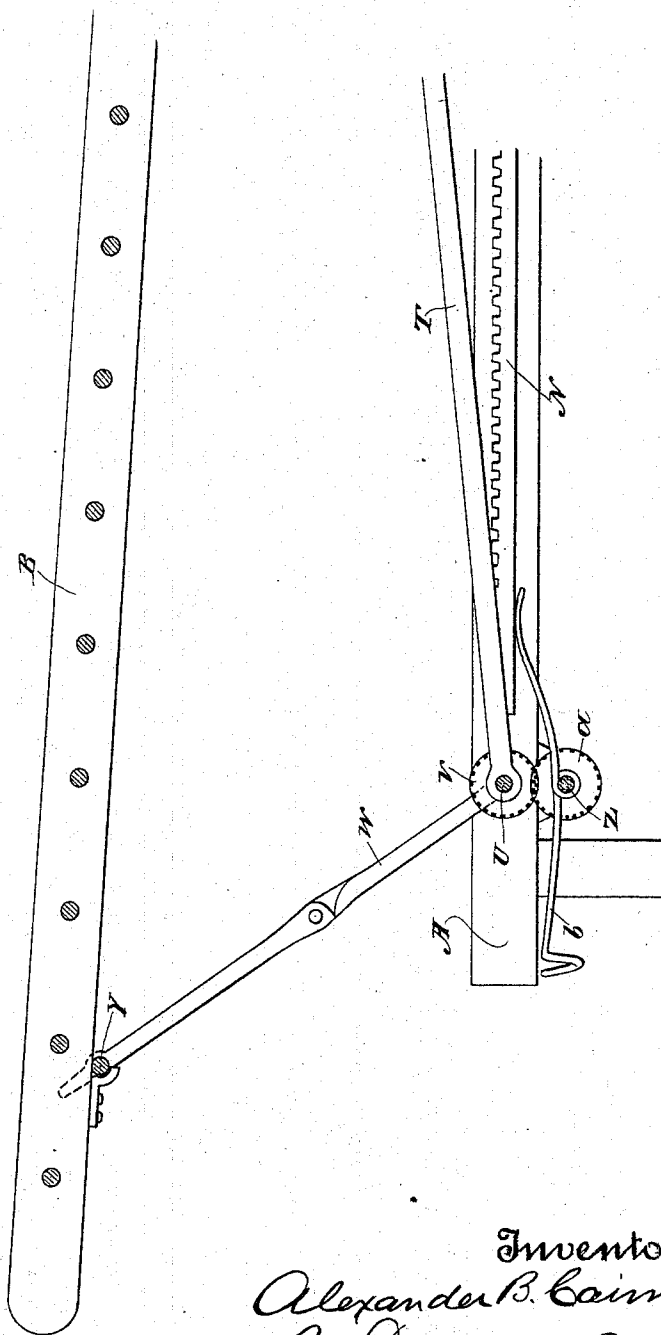
3 Sheets—Sheet 3.

A. B. CAIRNES.
EXTENSION FIRE LADDER AND TRUCK.

No. 527,942.

Patented Oct. 23, 1894.

Fig. 5.



Witnesses,
J. H. House
J. F. Aschbeck

Inventor,
Alexander B. Cairnes
By Dewey & Co
att

UNITED STATES PATENT OFFICE.

ALEXANDER B. CAIRNES, OF SAN DIEGO, CALIFORNIA.

EXTENSION FIRE-LADDER AND TRUCK.

SPECIFICATION forming part of Letters Patent No. 527,942, dated October 23, 1894.

Application filed February 27, 1894. Serial No. 501,665. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER B. CAIRNES, a citizen of the United States, residing at San Diego, county of San Diego, State of California, have invented an Improvement in Extension Fire-Ladders and Trucks; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in extension ladders and the trucks upon which they are conveyed, such as are usually employed by fire departments; and it consists in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a horizontal plan view showing the ladders closed. Fig. 2 is a side elevation of the same with the ladders shown partially raised in dotted lines. Fig. 3 is an enlarged view showing a vertical section through the ladders and a part of the rack elevating mechanism, and other parts. Fig. 4 is a sectional view showing the shaft part of one of the ladder ends connected therewith, and the rack and pinion and traveling guide mechanism. Fig. 5 is a view showing the means for first lifting the rear ends of the ladders from their support.

The object of my invention is to provide a ladder which is capable of being raised to any desired angle between the horizontal and perpendicular, and which may be extended to any distance practicable for the number and length of ladders connected together, a truck upon which said ladders are mounted, with a mechanism whereby they are raised and extended, and an attachment for carrying a quantity of hose in addition to the extra ladders, without raising the frame of the vehicle so high as to make it top heavy.

A is the frame of my apparatus, made of sufficient length to properly support the ladders B, C and D, which are carried and operated thereon. This frame is mounted upon wheels E, the front wheels swiveling under the frame so that they may be turned to a position at right angles or more, for the purpose of turning the truck and backing it up to the curb or other point where it is desired, and moving it in the least possible space for its length.

The lower part of the frame A serves to

carry the extra ladders which are usually pushed in from the rear and lie between the top and bottom parts of the frame. Below this is a platform F which extends between the rear and front axles at a suitable height from the ground and which serves to carry a quantity of loose hose which is piled in upon the platform, so that it may be used by the crew of the apparatus by connecting with a hydrant in case they arrive before the engines or other parts of the fire apparatus, as is frequently the case. Upon each side of this platform are foot-boards G upon which the men connected with the apparatus can stand, holding themselves in place by side rails H. I make these side rails of hollow tubes, and the brake rods I extend through these tubes from the brake-levers J at the rear, to the levers K which are fulcrumed upon each side of the front part of the frame, the cross-bar which unites them extending above the frame, and just below the seat is a foot-yoke L fulcrumed upon the foot-board as shown and connected by links M with the cross-bar of the levers K. By this connection the device for operating the brake lever is brought directly in front of the driver, and when he presses upon the foot-lever L and forces it toward the front, the brakes are applied. This lever L is so fulcrumed that as it is pushed down upon the foot-board, the leverage becomes greater after the manner of a knee lever, by reason of the links M coming more nearly in line with the lever arms themselves.

By extending the brake lever rods through the side hand rails H, they are entirely out of the way, and enable me to make a convenient connection for the brakes, without interfering with the men who rise on each side.

Along the inside of the top rail of the frame A, on each side, is secured a straight toothed rack N. These are adapted to be engaged by pinions O upon the shaft P. This shaft extends through the lower ends of the metal sockets Q which are forked at their upper ends and strongly bolted to the foot of the lower ladder, forming extensions therefor, and having holes made through them transversely through which the shaft P turns as described.

In order to retain the lower ends of the ladder in place and the pinions in engagement with the racks, I have shown L-shaped blocks

R, through the upper ends of which the shaft P turns loosely. The lower ends of these blocks have anti-friction rollers S pivoted to them and extending beneath the rack bars, so that while the pinions O engage the teeth on the upper sides of the rack bars, these rollers travel upon the lower sides and thus prevent the lower ends of the ladder, the shaft P, and the pinions from lifting, by reason of any weight that may extend beyond the fulcrum point about which the ladders are raised.

T T are fulcrum rods, the lower ends of which are fulcrumed upon a shaft U at the rear end of the frame A. The opposite ends of the rods T are fulcrumed upon the sides of the lower ladder as shown. Upon this shaft U are fixed the pinions V, and also the levers W which are jointed at X so that they may fold upon themselves. The outer ends of the outer portion of the levers are united by a cross bar Y.

Beneath the shaft U is another shaft Z carrying pinions *a* which engage the pinions V. This lower shaft extends out upon either side beyond the frame and has an appliance by which to turn it which, in the present case, is in the form of a wheel with arms or spokes, and a short tubular shaft which may be slipped upon the end of the shaft Z so as to engage a pin thereon when it is necessary to turn the shaft, and which may be removed when the apparatus is not being operated. By turning this wheel and the shaft, the pinions V and the shaft U may be turned, and the jointed lever arms thus raised and extended. These lever arms lie beneath the outer ends of the ladder, when the ladders are lying horizontally upon the truck, and as the fulcrum rods T are also in a horizontal position in line with the ladders at that time, it will be manifest that the ladders can not be raised by the rack and pinion mechanism, until they have first been elevated by other means so that the fulcrum levers and the ladder to which they are connected form an angle with each other. The ladders are thus raised to form this angle by means of the jointed lever arms W and the pinion mechanism just described, which acts to raise and extend the levers and with them raise the outer ends of the ladders sufficiently to enable the other part of the mechanism to act upon them. Springs *b* are fixed to support the lower joint of these jointed arms and they may be made of sufficient strength to materially assist in raising the outer ends of the ladders when the shafts and pinions are turned for that purpose, and to ease the ladders down.

When the ladders are being let down, the rear ends of the socket pieces Q come into contact with bent springs *c* which are fixed near the front of the truck and have curved pieces upon them against which the ends of Q are received, and as the ladders are let down into their horizontal position these springs C are compressed and exercise a pressure against

the lower ends of the ladders to ease them down, and to keep the joints close while they are being let down.

When the ladders have been raised by the jointed lever at the rear so that they stand at a slight obtuse angle with the fulcrum rods T, a wheel or other device is applied to the end of the shaft P, and this shaft is rotated so as to cause the pinions O to travel along the rack bar N.

The ladders are prevented from returning along the rack bar by pawls *d* which are fulcrumed upon the shaft P and drop into the teeth of the rack as the foot of the ladder moves toward the rear of the truck.

As the foot of the ladder moves toward the rear, the outer end is correspondingly raised by reason of the fulcrum rods T about which it is turned, and as the base of the ladder approaches the base of the fulcrum rods, the angle between the two is constantly raised and rendered more acute until the ladder is in any desired position.

If it is necessary to enter the first or second story window of a building the truck is backed up to the curb, the ladder is raised until the proper angle is reached and the upper ladders are then extended as will be hereinafter described, until they reach the window or desired point, and the same result is accomplished for any floors above which are within reach of the full length of the ladder by raising the ladders to a greater angle and then extending the upper parts until they reach the desired point. This construction also allows the ladders to be raised inside the line of the telegraph wires, which are usually extended above the edge of the sidewalk. By reason of this construction, the ladders are very firmly supported, having the whole length of the truck body to resist the weight and strain upon them, and the apparatus is very steady because the ladders are raised and lowered in a plane lengthwise of the truck. In addition to this I employ guy ropes *e* which are preferably made of steel wire rope, the upper ends being attached at the top of the lower ladder and the opposite ends are coiled upon drums *f* journaled near the front end of the truck frame. These drums contain coil springs which yield while the ladder is being raised and allow the ropes to uncoil and accommodate themselves to any position of the ladder. Pawls *g* are adapted to engage the teeth of the ratchets which are connected with the drums, and retain them at the proper point so that when the ladder has been raised to a nearly perpendicular position, and its foot is very near to the bottom of the fulcrum rods T, these guy ropes serve to support and steady the ladder and relieve the narrow base of the strain which would otherwise be brought upon it.

The ladder section C slides upon the section B, moving in guides *h* which are fixed upon the ladder, and curve over the upper edges of the ladder C. The ladder D in the

same manner slides within the side rails of the ladder C and is similarly guided.

The lower ladder has a shaft *i* extending through the upper part of the socket piece Q, and this has a chain sprocket wheel fixed to it around which passes a chain *j*. One end of this chain is secured to the lower round of the ladder C, with an interposed tension, equalizing spring, and extends thence down around the sprocket wheel *k*, thence up behind the ladders, and over a sprocket wheel *l* upon a shaft which extends across the upper end of the ladder B and thence down between the rounds of the ladder B and those of the ladder C, being attached to one of the lower rounds of the ladder C. Upon the ends of the shaft which carries the sprocket wheel *l* are loose rollers *m* upon which the sides of the ladder C travel and which relieve the friction as it is caused to slide upward upon the ladder B. When the shaft carrying the sprocket wheel *k* is turned up by a wheel or crank upon the outer end, it acts upon the chain and raises the ladder C, causing it to slide along the ladder B. At the same time the ladder D is caused to slide upon the ladder C in the same manner by steel wires, ropes or chains *n'*, one end of which is connected with the ladder D near its lower end. This rope or chain passes over a pulley *n* which is journaled at the upper end of the ladder C. It passes thence down and connects with the upper round of the ladder B, so that as the ladder C slides upon a ladder B and increases the distance of the pulley *n* from its upper end, the pulley pulls upon that part of the wire rope which is attached to the ladder D, and thus lifts the latter simultaneously with the upward movement of the ladder C. The ladder D travels over anti-friction rollers *o* which are journaled upon the shaft at the upper end of the ladder C.

In order to prevent accident by reason of any breakage of the lifting chains or ropes which would allow the ladders to slip down by gravitation, I have shown pawls *p* fulcrumed upon the sides of the ladders and normally kept in a position which prevents them from engaging by springs *q*. When the ladders are being elevated, the pawls are turned so that these springs act in such a manner as to hold the points of the pawls in line with the rounds of the ladder next below. The backs of the pawls rest against stop pins *t* fixed in the sides of the ladders so that if a ladder should be let down, the end of the pawl would rest upon the round of the ladder below and that would arrest it at that point, the stop pins being strong enough to resist the pressure upon the back of the pawl. When the ladder is to be depressed, these pawls are first turned parallel with the sides of the ladder and out of line of the rounds of the next ladder, and this allows the ladders to be depressed by turning the shaft and sprocket wheel *k* in the opposite direction from that which raises the ladders.

This shaft is retained in position while the ladders are being raised by pawls *r* which engage ratchet wheels fixed upon the shaft *z*, and when the ladders are to be depressed these pawls are turned back out of engagement so as to allow the shaft and sprocket wheel to be turned backward, the ladders to move down until the ladders are all closed up. The ladders are then let down to lie upon the truck by turning the holding pawls *d* of their pinions *O* back, and allowing the pinions to be rotated backward along the rack bars *N* when the ladders will gradually approach the horizontal position, the guy ropes being wound up by the spring-actuated drums *f* so as not to become foul, and as the ladders approach the position near where they will rest upon the jointed arms at the rear, the pinion shaft *P* comes in contact with the springs *c* which are thus compressed and assist to let the ladders down more gently until they rest upon the upper bar of the jointed levers *W*. The ladders are then let down the remainder of the distance by turning the shaft which carries the jointed levers so as to fold the levers down and allow the ladders to come to their support upon the top of the truck frame, the springs *b* at the rear receiving the levers as they fold down, and assisting to ease the ladders down. By this construction I am enabled to make the truck very low while allowing sufficient room for extra ladders and a large quantity of hose, and the mechanism by which the ladders are raised and extended is so low upon the frame, that the apparatus does not become top heavy and in danger of upsetting as is the case with many devices of this sort on account of the high position of the mechanism by which they are operated. It also enables me to construct it much lighter and make it easier to handle.

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

1. A frame mounted upon wheels having rack bars extending longitudinally upon the top, a ladder having pinions journaled at its foot adapted to engage the rack bar, a means for rotating the pinions to cause them to advance along the rack bar, fulcrum rods connected at one end to the ladder at a point intermediate between the pinions and the opposite end, and having the other ends connected with the rear end of the frame whereby the movement of the foot of the ladder along the rack bar acts to raise its outer end about the fulcrum rods as described.

2. A frame having toothed rack bars extending along its top, a ladder having a pinion shaft extending through its lower end, pinions fixed thereon engaging the rack bars, a means for rotating the shaft so that the pinions advance along the rack bars, fulcrum rods connected with the frame at the rear end and having their opposite ends connected with the sides of the ladder, whereby

the outer end of the ladder is raised by the movement of the lower end toward the rear of the frame, pawls adapted to engage the rack whereby the foot of the ladder is prevented from returning as described.

3. In an extension fire ladder, a frame mounted upon wheels having toothed rack bars extending along the sides at the top, a ladder having a shaft extending across its foot with pinions fixed upon the shaft adapted to travel upon the rack bars, fulcrum rods having their rear ends attached to the rear of the frame and their opposite ends connected with the sides of the ladder, whereby the outer end of the latter is raised as the foot is caused to approach the rear of the frame, pawls engaging the rack bar to prevent the return of the foot of the ladder, and anti-frictional locking blocks connected with the pinion shaft and extending beneath the rack bars, whereby the pinions are held in mesh with the rack bars, and the lower end of the ladder prevented from being lifted by the weight outside of its fulcrum points as herein described.

4. In an extension fire ladder, a frame mounted upon wheels having rack bars extending along its sides, a ladder having a shaft extending across its lower end with pinions adapted to engage and travel upon the rack bars, and a means for rotating said pinions and retaining the foot of the ladder at any point in its advance, fulcrum rods having one end connected with the rear of the frame, and the other end with the sides of the ladder whereby the ladder is raised to any desired angle by causing its foot to approach the rear of the supporting frame, a ladder slidable in guides upon the main ladder, sprocket wheels mounted upon shafts at opposite ends of the main ladder, a chain passing around said sprocket wheels and having its ends connected with the second ladder whereby the latter is caused to advance within its guides upon the first ladder, substantially as described.

5. In an extension fire ladder, a frame mounted upon wheels having rack bars extending along its sides, a ladder having a shaft extending across its lower end with pinions adapted to engage and travel upon the rack bars, and a means for rotating said pinions and retaining the foot of the ladder at any point in its advance, fulcrum rods having one end connected with the rear of the frame, and the other end with the sides of the ladder whereby the ladder is raised to any desired angle by causing its foot to approach the rear of the supporting frame, a ladder slidable in guides upon the main ladder, sprocket wheels mounted upon shafts at opposite ends of the main ladder, a chain passing around said sprocket wheels and having its ends connected with the second ladder whereby the latter is caused to advance within its guides upon the first ladder, a second rope or chain passing around a pulley

turning upon the shaft at the upper end of the second ladder, said rope having one of its ends attached to the top of the first ladder and the other end to the bottom of the third ladder whereby the latter is caused to advance between its guides upon the second ladder while the second ladder is advancing upon the first, substantially as described.

6. In an extension fire ladder, a frame mounted upon wheels and having toothed rack bars extending along its sides, a ladder having its lower end guided to move parallel with, and pinions adapted to engage the rack bars whereby the rotation of the pinions will advance the foot of the ladder toward the rear, fulcrum rods having the lower ends attached at the rear of the frame, and the opposite ends pivoted to the sides of the ladder, so that the advancing of the foot of the ladder toward the rear will raise the outer end, another ladder slidable in guides upon the first ladder and sprocket wheels and chain whereby it is moved and stop pawls fulcrumed to the foot of each movable ladder projecting so as to engage the rounds of the ladder below, whereby the ladders are prevented from slipping down in case of breakage, as described.

7. In an extension fire ladder, a frame mounted upon wheels and rack bars extending along the upper part of the frame, a ladder having a pinion shaft extending through its foot, and pinions secured thereto adapted to travel along the rack bar and fulcrum rods having the lower ends connected with the rear end of the frame and the opposite ends pivoted to the sides of the ladder, a mechanism for partially raising the outer end of the ladder from a horizontal position so that the fulcrum levers are brought into position to act, consisting of jointed levers hinged to the rear of the frame, shafts having pinions and a mechanism whereby they are rotated and the levers extended so as to raise the outer ends of the ladder above the horizontal position as herein described.

8. An extension fire ladder consisting of a frame mounted upon wheels having rack bars extending along the upper part a ladder and fulcrum rods connected as shown, a pinion shaft and pinions whereby the foot of the ladder is advanced along the rack bar in either direction, and the springs *c* against which the lower end of the ladder is received as it is being let down for the purpose of relieving the strain as it drops into the horizontal position as herein described.

9. An extension fire ladder consisting of a portable frame support, having rack bars extending along the upper part a ladder and fulcrum rods connected as shown, a pinion shaft and pinions whereby the foot of the ladder is advanced along the rack bar and guy ropes connected with the top of the ladder at one end, and having the opposite ends coiled upon yielding spring-actuated drums with holding pawls, as herein described.

10. A portable extension ladder, a wheeled
frame upon which the ladder is carried, with
mechanism for raising and depressing the
ladder, a supplemental hose platform beneath
5 with foot-boards extending outwardly at the
sides, a brake mechanism acting upon the
rear wheels and foot levers within reach of
the driver, rods extending along the sides of
the frame and connecting the foot and brake
10 levers and tubular inclosing hand rails

through which the rods pass, fixed along the
upper sides of the frame above the foot
boards as described.

In witness whereof I have hereunto set my
hand.

ALEXANDER B. CAIRNES.

Witnesses:

S. H. NOURSE,
H. P. ASCHECK.