3 Sheets—Sheet 1.

N. S. BOYNTON.

Firemen's Ladder.

No. 197,324. **Patented Nov. 20, 1877.**

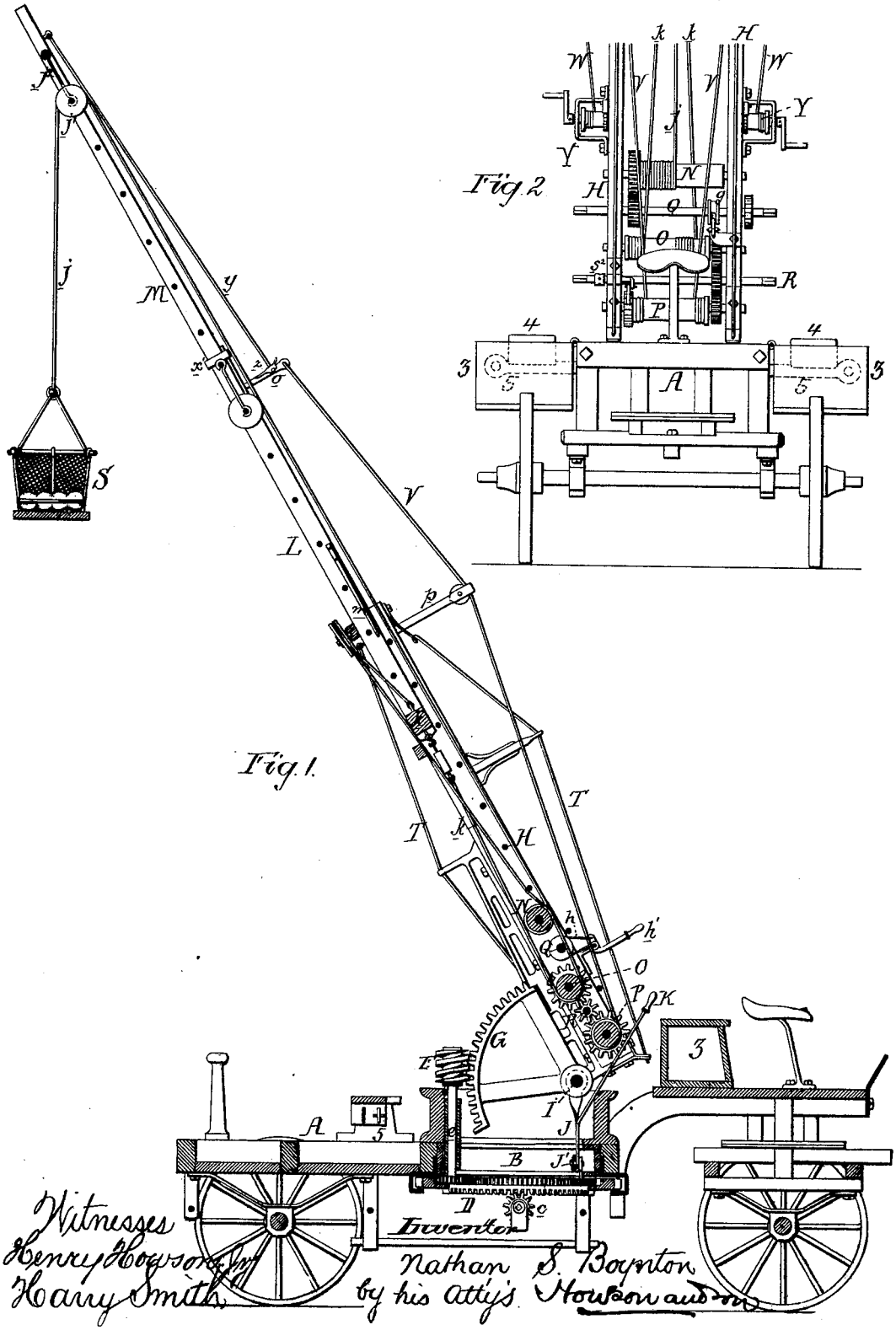

Fig. 1.

Fig. 2.

Witnesses
Henry Howson Jr.
Harry Smith.

Inventor
Nathan S. Boynton
by his Att'ys Howson and Sons

3 Sheets—Sheet 2.

N. S. BOYNTON.

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Fig. 3.

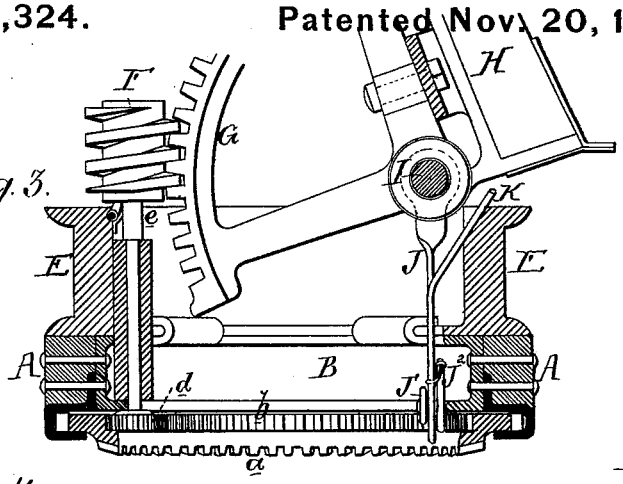


Fig. 4

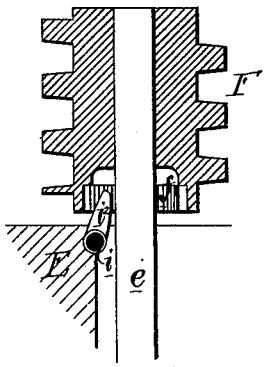


Fig. 4½

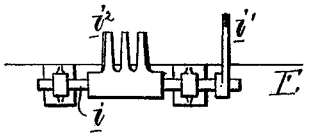
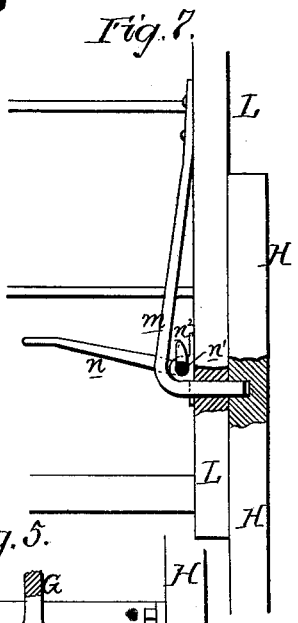


Fig. 7.



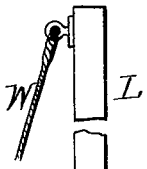
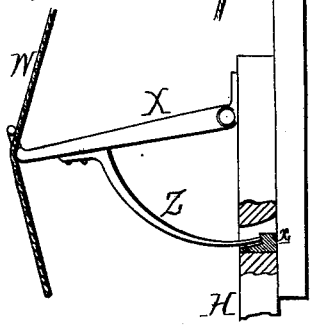


Fig. 10



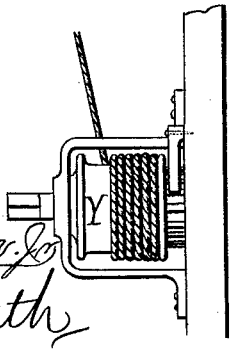
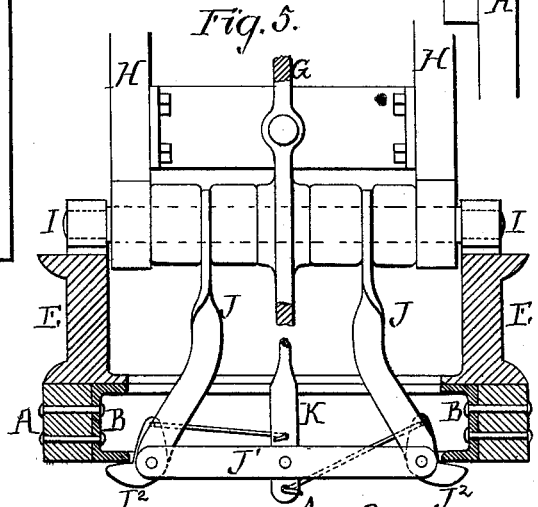


Fig. 5.



Witnesses
Henry Howson Jr.
Harry Smith

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by his Attorneys
Howson & Howson

3 Sheets—Sheet 3.

N. S. BOYNTON.

Firemen's Ladder.

No. 197,324. Patented Nov. 20, 1877.

Fig. 6.

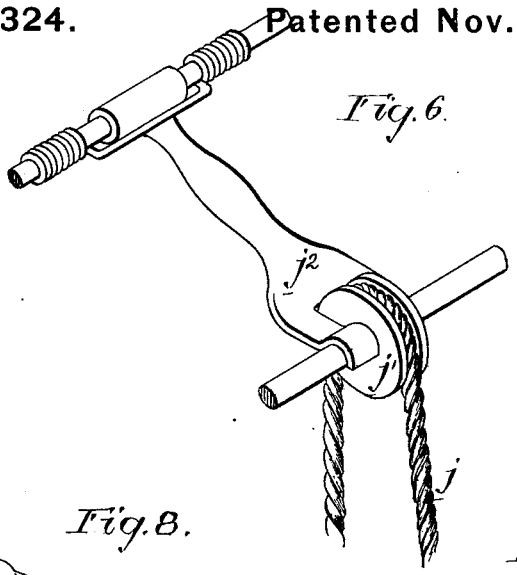


Fig. 8.

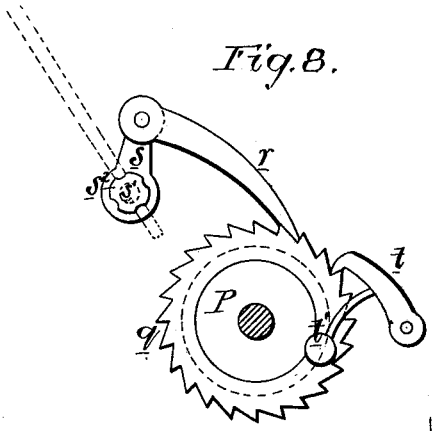


Fig. 9.

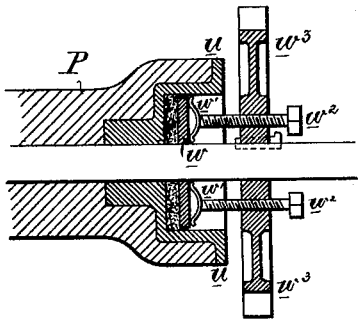
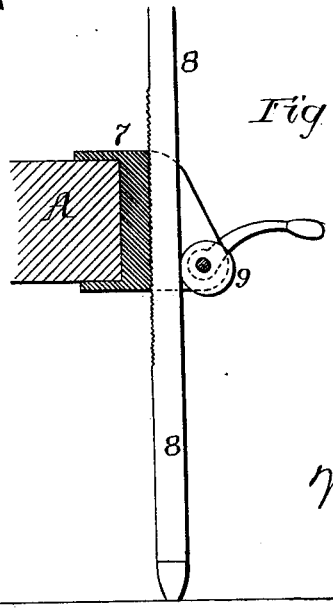


Fig 11



Witnesses
Henry Howson Jr.
Harry Smith

Inventor
Nathan S. Boynton
by his Attorneys
Howson & Son

UNITED STATES PATENT OFFICE.

NATHAN S. BOYNTON, OF PORT HURON, MICHIGAN, ASSIGNOR TO HIMSELF, WILLIAM L. BANCROFT, AND JAMES GOULDEN, OF SAME PLACE.

IMPROVEMENT IN FIREMEN'S LADDERS.

Specification forming part of Letters Patent No. **197,324**, dated November 20, 1877; application filed September 3, 1877.

To all whom it may concern:

Be it known that I, NATHAN S. BOYNTON, of Port Huron, St. Clair county, Michigan, have invented certain Improvements in Firemen's Ladders, of which the following is a specification:

The object of my invention is to so construct an extension-ladder as to attain the following results: First, ease and rapidity of manipulation, both as regards raising the ladder and maneuvering the same when raised; second, great rigidity when extended; and, third, compactness when not in use.

This object I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1, Sheet 1, is a transverse section of my improved extension-ladder; Fig. 2, a front view of a portion of the same; and Figs. 3 to 11, Sheets 2 and 3, enlarged detached views illustrating different features of the apparatus.

A represents a strongly-built truck, mounted upon wheels, and having a circular opening, to which is firmly bolted an annular ring, B, flanged internally at top and bottom.

In guides below this ring turns an annular ring, D, having bevel-teeth *a* and a rack, *b*. Into the bevel-teeth gear the teeth of bevel-pinions *c c* at opposite sides of the truck, the shafts of these wheels being adapted to fixed bearings on the said truck, and being turned either by hand, through the medium of cranks, or by means of chain or other gearing from the driving-shafts of small engines secured to the sides of the truck.

Into the teeth of the rack *b* gears a pinion, *d*, secured to the lower end of an upright shaft, *e*, the latter turning in a bearing secured to the inner side of a hollow frame, E, which rests upon and is guided by the upper flange of the annular ring B, thus forming a turn-table, as shown in Fig. 3.

The shaft *e* carries at its upper end a worm, F, the thread of which engages with the teeth of a segment, G, pivoted upon a transverse shaft, I, to which the lower end of the ladder is also pivoted, and which has its bearings in boxes secured to the opposite sides of the turn-table E.

The segment G is loose upon the shaft I, but is firmly bolted to a transverse frame-work which is secured to the lower end of the ladder H. By this means all twisting strain is removed from the shaft I, the latter merely serving as a pivoting-shaft.

The lower portion of the worm F (see Fig. 4) is tubular, and in the interior of this tubular portion is formed a rack, *f*, while to a shaft, *i*, adapted to bearings secured to the turn-table E, and provided with an operating lever, i^1, is secured a sleeve carrying a number of teeth, i^2, which are adapted to the spaces between the teeth of the rack *f*.

When the shaft *i* is in the position shown in Fig. 4, the teeth i^2 are out of gear with the rack *f*, the shaft *e* is free to turn, and the movement of the ring D causes the operation of the segment E and consequent raising of the ladder H; but when the teeth i^2 are in gear with the rack *f* the shaft *e* is locked to the turn-table E, and any movement of the ring D is communicated to said turn-table.

It will thus be seen that both the raising and turning of the ladder are effected by means of a single operating ring.

Hung to the shaft I, by means of two bars, J J, is a horizontal bar, J^1, to each end of which is pivoted a bell-crank lever, J^2, the short arms of these levers extending beneath the lower flange of the ring B, or beneath the body of the truck, while their long arms are connected to a lever, K, on opposite sides of the fulcrum of the same, so that after turning the turn-table to any desired position it may, by operating said lever, be firmly clamped to the body of the truck, and held immovably in position while the ladders are being raised or when otherwise required. (See Fig. 5.)

The strain exerted against the shaft I and turn-table E, when the ladder is raised, is thus transferred from said shaft and turn-table to the body of the truck, and the danger of fracturing the shaft or tearing the turn-table loose from the truck is thus effectually obviated.

The complete ladder consists, in the present instance, of three parts—the main ladder H, a sliding ladder, L, adapted to the same, and a fly-ladder, M, arranged for attachment to the upper end of the sliding ladder L.

The lower portion of the main ladder H carries three windlasses, N, O, and P, and two operating shafts, Q and R, the former operating the windlass N, and the latter, through the medium of suitable gearing, operating the shafts of both windlasses O and P. (See Fig. 2.)

The windlass N carries a rope, *j*, which passes around a pulley, j^1, at the top of the fly-ladder M, and is attached at the end to a basket, S. The operating shaft Q has a disk, *g*, to the periphery of which is adapted a friction-band, *h*, controlled by a lever, *h'*, by operating which the descent of the basket can be regulated at pleasure.

The rope *j* is prevented from slipping off the pulley j^1 by means of a spring-bar, j^2, hung at the upper end to a suitable shaft, and forked at the lower end, so as to embrace the said pulley. (See Fig. 5.)

Around the windlass O is wound a rope, *k*, the opposite ends of which are connected to a cross-bar, *k'*, at the lower end of the sliding ladder L, so that by turning the windlass in one direction the ladder will be extended, while by turning it in the opposite direction the ladder will be drawn inward.

The sliding ladder L is maintained in position when extended by spring-bolts *m* carried by the poles of the ladder, and adapted to openings in the poles of the ladder H. These bolts can be withdrawn from the openings in the ladder H, however, by operating levers *n*, Fig. 7, attached to shafts n^1, carrying arms n^2, the operation of the levers being effected, preferably, by cords or ropes leading to the foot of the ladder H.

The ladder H is braced and stiffened by tie-rods T at each side, and the rigidity of the sliding ladder L when extended is insured by two sets of bracing ropes, V and W, preferably of wire.

The ropes V are each secured at one end to a post, *o*, at the upper end of the ladder L, and, after passing over an anti-friction roller at the end of a post, *p*, on the main ladder H, pass to the windlass P, to which their opposite ends are secured.

Thus, as the windlass O is winding up the rope for extending the ladder L, the windlass P gradually unwinds the stay ropes V, as the ladder ascends.

In order, however, that these stay-ropes may be tightened after the ladder L is extended, the windlass P is loose on its operating shaft, but is clutched thereto by a friction device described hereinafter; and at one end of the windlass is a ratchet, *q*, (see Fig. 8,) with the teeth of which engages a pawl, *r*, carried by an arm, *s*, on a shaft, s^1, adapted to a bearing on the frame of the ladder, and provided at its outer end with a disk, s^2, having openings into which can be inserted the end of a suitable operating bar.

Back motion of the windlass is prevented by means of a hinged pawl, *t*, provided with a bent arm carrying a weight, *t'*, which serves to keep the said pawl constantly against the teeth of the ratchet.

The friction device by which the windlass P is secured to its shaft is shown in Fig. 9, and consists of a recessed plate, *u*, secured to the end of the windlass, and having a trued face, against which is forced a disk, *v*, of leather or other suitable material, by means of a plate, *w*, to which pressure is applied by means of springs w^1 acted on by set-screws w^2, passing through the pinion w^3, which imparts motion to the windlass-shaft.

The stay-ropes W are secured at their upper ends directly to the upper ends of the poles of the ladder L, and lead from thence down through elongated eyes formed in the bent ends of bars X, secured to the ladder H, to winches Y, the shafts of which have their bearings in the poles of said ladder H. These winches are provided with pawls and ratchets, so that the stays W, as well as the stays V, can be tightened after the ladder L is extended. (See Fig. 10.)

The bars X are hinged to the poles of the ladder H, and are provided with curved spring-arms Z, which pass through openings in the said poles, and are held in position when extended by means of lugs *x* on plates secured within recesses in the poles of the ladder H, Fig. 10.

Upon releasing the arms from the control of the lugs, however, the bars X may be folded in against the sides of the ladder H, so as to occupy but little room when the ladder is not in use, the elongated eyes in the bent ends of the bars X preventing the bending or kinking of the rope by this change of position.

The poles of the fly-ladder M are slotted at the lower ends so as to embrace the upper rungs of the ladder L, the poles of the latter being provided with metal bands *x'*, which embrace the poles of the ladder M, and serve to insure a firm connection between the two ladders.

The longitudinal bracing of the fly-ladder M is insured by rods *y*, hinged to the upper ends of the side bars of said ladder, and bent and notched at their lower ends, where they are adapted to openings in the posts *o* of the ladder L, spring-hooks *z* entering the notches in the bent ends of the rods after they are inserted into said openings, thus preventing their accidental withdrawal.

As will be observed in Figs. 1 and 2, the front portion of the truck A is provided with a seat, 3, which is hollow, and is made in two halves, each hinged at its outer edge to the body of the truck, so that it can be swung outward and downward, as shown in Fig. 2, so as to act as a support for one end of a strip, 4, the opposite end of which is supported by a rod, 5, which slides under a seat on the rear portion of the truck. When these strips are in place at each side of the truck a continuous platform around the entire base of the ladder is afforded, so that the various operations connected with the raising, lowering, or maneu-

vering of the ladder can be carried on without crowding.

The two halves of the seat 3 also form receptacles for blankets, tools, or other portable articles required about the truck.

In order to insure against any accidental movement of the truck during the various movements of the ladder, I secure to each side of the truck A a plate, 7, having a serrated face, against which bears the serrated edge of a bar, 8, the lower end of which rests firmly on the ground, while against its rear edge bears an eccentric, 9, hung to a shaft carried by said plate 7. (See Fig. 11.)

Any tendency of the bar 8 to move upward will cause it to wedge tightly between the face of the plate 7 and the edge of the eccentric 9, which will thus effectually resist this upward movement.

If desired, also, each side of the ladder H may be provided with a hinged supporting-pole, the lower ends of which rest upon the ground when said ladder is raised.

The above-described extension-ladder is capable of universal and rapid adjustability, and is, owing to the system of braces and stays employed, exceedingly rigid when extended, yet when not in use occupies but little if any more space than an ordinary hook-and-ladder truck.

I claim as my invention—

1. The combination of the turn-table E, an independent operating ring, D, and a shaft, *e*, capable of being locked to, or moving independently of, said turn-table.

2. The combination of a turn-table, to which is pivoted a ladder, with an operating ring, and with mechanism by which the said ring is caused to either turn the table or raise the ladder, as set forth.

3. The combination of the turn-table E and its shaft *i*, provided with teeth i^2, with the shaft *e* and its worm F, having a rack, *f*, as set forth.

4. The combination of the turn-table E and ring B or body of the truck with levers J^2, carried by said turn-table, and serving to clamp the same to the said ring or body, substantially as described.

5. The combination of the levers J^2 with the bar J^1 suspended from the shaft I, and with an operating lever, K.

6. The combination of the main ladder H, having windlasses O and P, geared together, with the sliding ladder L, operating rope *k*, and stay-ropes V.

7. The combination of the windlass O and operating shaft R with the windlass P, capable of moving independently of its shaft, as set forth.

8. The combination of the windlass P and its ratchet *q* with the shaft s^1, its perforated disk s^2, arm *s*, and pawl *r*, and with the weighted pawl *t*.

9. The combination of the windlass P and its recessed plate *u* and the windlass-shaft and its pinion w^3 with the disk *v*, plate *w*, springs w^1, and set-screws w^2, as set forth.

10. The combination of the ladder L and its stay-ropes W with the ladder H, its bars X, and winches Y, as set forth.

11. The combination of the poles of the ladder H, having recesses provided with lugs *x*, with the bars X, hinged to the said ladder H, and having curved spring-arms Z, as described.

12. The combination of the stay-ropes W with the hinged arms X, having bent ends with elongated eyes for the passage of the rope, as set forth.

13. The combination of the pulley j^1 and the rope *j* with the forked spring-bar j^2 for preventing the displacement of the rope, as set forth.

14. The combination of strips 4 with the seat made in halves hinged to the truck, and with sliding rods 5.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

NATHAN S. BOYNTON.

Witnesses:
HERMANN MOESSNER,
HARRY SMITH.