(No Model.) 2 Sheets—Sheet 1.

J. E. GILLESPIE.

EXTENSION LADDER.

No. 456,651. Patented July 28, 1891.

Fig. 1.

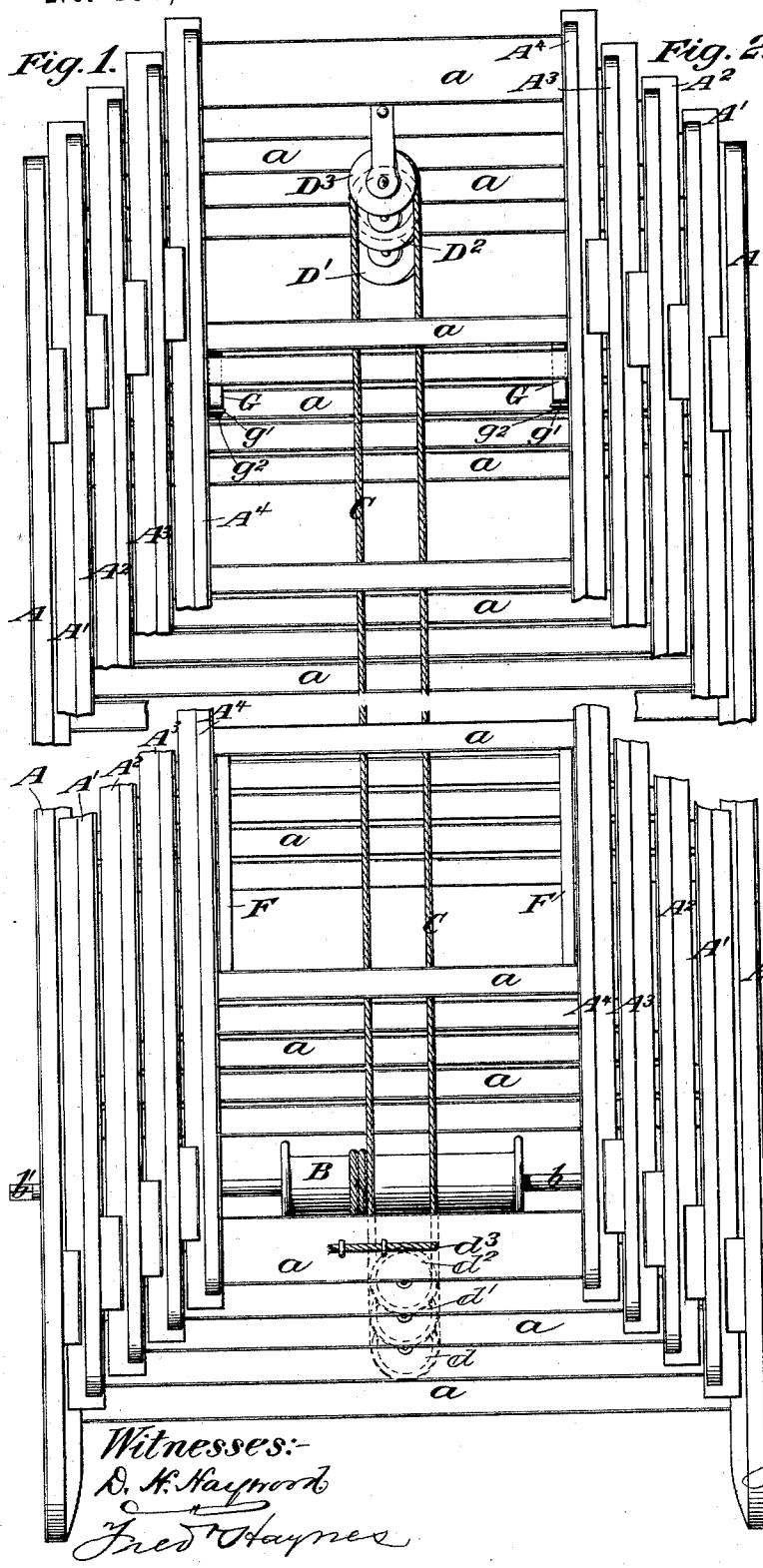
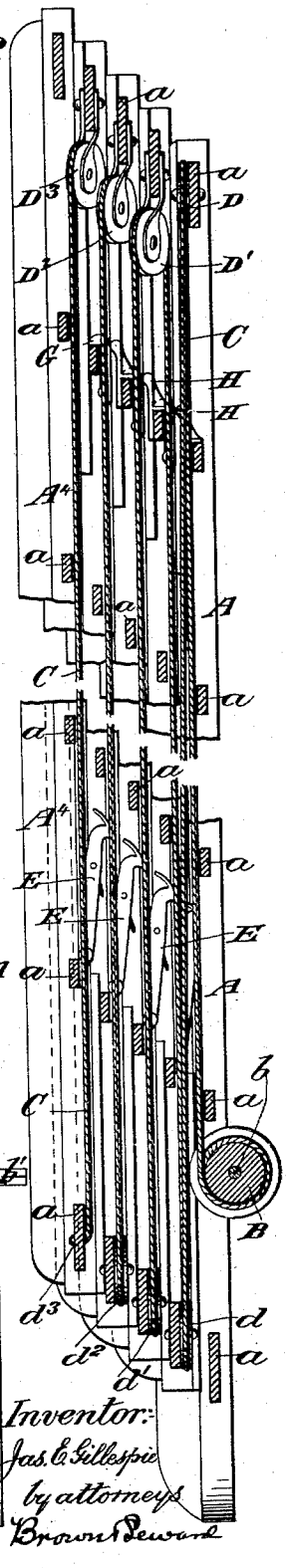


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

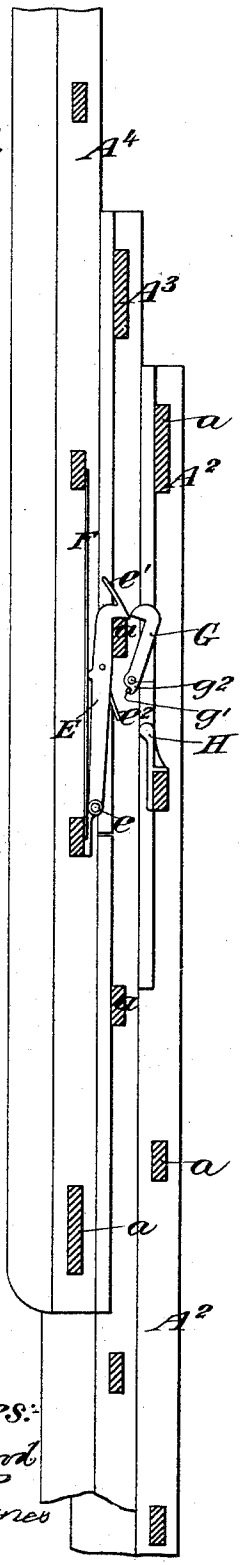
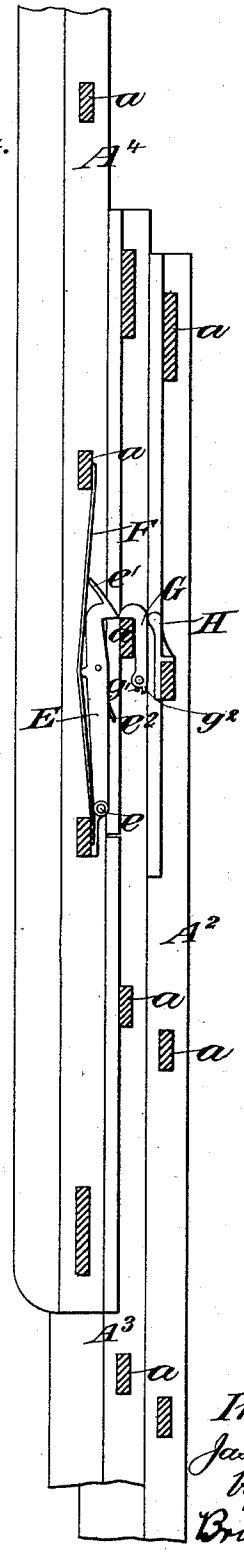


Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES E. GILLESPIE, OF NEW YORK, N. Y.

EXTENSION-LADDER.

SPECIFICATION forming part of Letters Patent No. 456,651, dated July 28, 1891.

Application filed March 31, 1891. Serial No. 387,129. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. GILLESPIE, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Extension-Ladders, of which the following is a specification.

My invention relates to an improvement in extension-ladders, in which several ladder-sections are so interlocked as to be capable of sliding longitudinally with relation to one another, and in which provision is made for extending the several sections one after another from a point near the base of the primary or ground section.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Figure 1 is a view in front elevation showing the several sections in closed adjustment. Fig. 2 is a view of the same in transverse vertical section. Fig. 3 is a view in transverse vertical section of a portion of three adjacent ladder-sections, showing the locking and tripping mechanism, the locking mechanism being shown in locked adjustment, and Fig. 4 is a similar view showing the locking mechanism tripped.

The primary or ground ladder-section is represented by A, the next succeeding section by A′, and the following sections in order by A^2 A^3 A^4. In the present instance I have shown five sections, including the primary or ground section; but it is obvious that this number might be increased or diminished at pleasure. I have shown each succeeding section embraced between the sides of the next preceding section and secured against displacement to the front or rear by suitable guides of any well-known or approved form, the arrangement being such that each section, beginning with the section A′ or that next following the ground-section, shall be capable of sliding longitudinally with respect to the preceding section a predetermined distance.

My present invention more particularly contemplates improved means for elevating the several sections and for locking and releasing them. A winding-drum B is fixed upon a suitable shaft *b*, mounted in bearings in the sides of the primary or ground section A, and conveniently provided with squared ends *b*′ exterior to the sides of the section A for the attachment thereto of cranks for operating the drum. The rope C, by means of which the sections are extended, is fixed at one end of the drum B and leads thence up the front side of the section A to a pulley D, journaled at the upper end of said section, thence down along the rear of the section A′ to a pulley *d*, mounted at the lower end of said section, thence up along the same side to a pulley D′, mounted at the upper end of the section A′ and set at such an inclination as to present its opposite faces one to the rear and the other to the front of the line of rungs in said section. The rope C in passing over the pulley D′ passes from the rear of the ladder-section A′ to the front of the same, and extends thence downwardly along the rear of the section A^2 to a pulley d' at the lower end of said section, thence upwardly the same side of said section to a pulley D^2, mounted at the upper end of the section A^2 in a manner similar to that in which the pulley D′ is mounted, over the pulley D^2 to the front of the section A^2, thence downwardly along the rear of the section A^3 to the pulley d^2, mounted at the lower end of said section, thence upwardly along the same side to the pulley D^3, mounted in the upper end of the section A^3 in a manner similar to the pulleys D^2 and D′, passing over the pulley D^3 from the rear to the front side of the ladder-section A^3, and thence downwardly to the lower end of the section A^4, where it is attached firmly—as, for example, at d^3.

It will be observed that there is one continuous rope from the drum B to the lower end of the last section. When, therefore, strain is applied upon the rope C by the turning of the drum B, the tendency will be to lift each one of the several sections, and as the one which lifts the easiest will take precedence over all others, it follows that the final section—in the present instance the section represented by A^4—will be first slid along the section A^3 to its limit of extension. When this limit is reached, the effect will be to extend the next succeeding section A^3, carrying

with it, as a matter of course, the section A^4, and so in successive order the several sections will be extended until the section A′, adjacent to the primary or ground section, has been extended, carrying with it the several extended sections A^2 A^3 A^4. As the several sections reach their limit of extension, they are locked in their extended adjustments by means of hooks E, pivotally secured thereto, as at *e*, and held normally by the tension of a spring F in position to hook over one of the rungs *a* of the next section to the rear. The hooks E are provided with inclined or bevel heads *e*′, which carry them freely past the several rungs as the section is being extended. I have here shown the hook as having a substantially flat-faced jaw; but it might be made with more or less curvature to hook over the rung *a*, as, in each instance, at the time of lowering there is sufficient play to lift the section which is hooked slightly relative to the section to which it is hooked, so as to free the hook therefrom. The hook E is located at the lower portion of the section, while the upper portion of the section is provided with a releasing device or trip intended to act upon the hook of the next succeeding section. In the present instance I have shown the releasing or tripping device as consisting of a dog G, pivotally secured to the section and limited in its swinging movement by means of a suitable stop *g*′, fixed to the side of the ladder-section in position to engage a projection g^2 on the end of the dog. The dog G is so located with respect to the particular rung *a*, with which the hook of the next preceding section engages, that when forced toward said rung it will press back the hook E out of engagement with the rung, as clearly shown in Fig. 4, and thereby leave the section to which the hook is attached free to lower.

The dog G is forced into engagement with the hook E by a guide-piece H on the section adjacent to that carrying the dog, so that the lowering of the section carrying the dog will bring the back of the dog G into engagement with the guide H, and hence force it into engagement with the hook E and press the latter back out of engagement with the rung. The hook E is further provided with a swinging arm e^2, pivotally secured thereto intermediate of its ends and limited in its swinging movement, so as to project slightly beyond the face of the shank of the hook E into the plane of the rung of the next succeeding ladder-section. As the section carrying the hook is lowered, the arm e^2 will catch over the several rungs of the adjacent section one after another and because of its limited swinging movement will gradually press the shank of the hook E back against the tension of the spring F sufficiently to prevent the hook from catching over the rung.

As it follows from the construction described that the extreme ladder-section will be first extended, the others following in succession, so it follows that in lowering the several sections that one adjacent to the primary or ground section will be the first to lower, as it carries the weight of all the others, and that each succeeding section from the primary or ground section to the extreme will be lowered in successive order.

By giving the section adjacent to the primary or ground section a vertical play sufficient to carry the swinging arm e^2 on its hook above the rung *a* and then lowering it, each of the subsequent sections may be automatically unlocked or tripped by the engagement of the dog G on the next preceding section with the hook on the section to be tripped, so that there will be no necessity for allowing the succeeding sections after the section A′, or the one next adjacent to the primary or ground section, any more play than just sufficient to release the point of the hook from the rung.

The several sections which I have selected to show the operation of the locking and tripping device in Figs. 3 and 4 are the sections A^4, A^3, and A^2. It is to be understood, of course, that the section A^3, which carries the dog G at its upper portion, also carries at its lower portion a hook similar to the hook E, and so of each succeeding section A^2 and A′, until the primary or ground section is reached, which only requires the dog-operating guide H.

By arranging the sections so that the extreme section is first lifted and then the others in successive order, I am enabled to so distribute the lifting strain that it will be very light at first and will only reach its full tension during the extension of the section next succeeding the primary or ground section, and by making provision for the tripping of the locking-hooks without any considerable play of the several sections one upon another, I am enabled to utilize the full movement of extension of each of the several sections as a part of the total available length of the ladder.

By setting the pulleys at the end of the movable sections oblique to the plane of the section the rope is carried from one side to the other of the section, and at the same time the pulley employed may be large enough to cause the rope to render freely.

What I claim is—

1. An extension-ladder comprising several interlocking sections having limited sliding movements relatively to one another, a continuous operating-rope leading from section to section throughout the series, pulleys set at an oblique angle to the planes of the sections for directing the rope from one side of a ladder-section to the opposite side, and means for applying strain to the rope, substantially as set forth.

2. The combination, with several ladder-sections having sliding movements relatively to one another, of retaining-hooks at the lower portions of the sections and tripping devices at the upper portions of the sections, the tripping device on one section being in position to release the retaining-hook on the adjacent section, substantially as set forth.

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