No. 619,105. Patented Feb. 7, 1899.

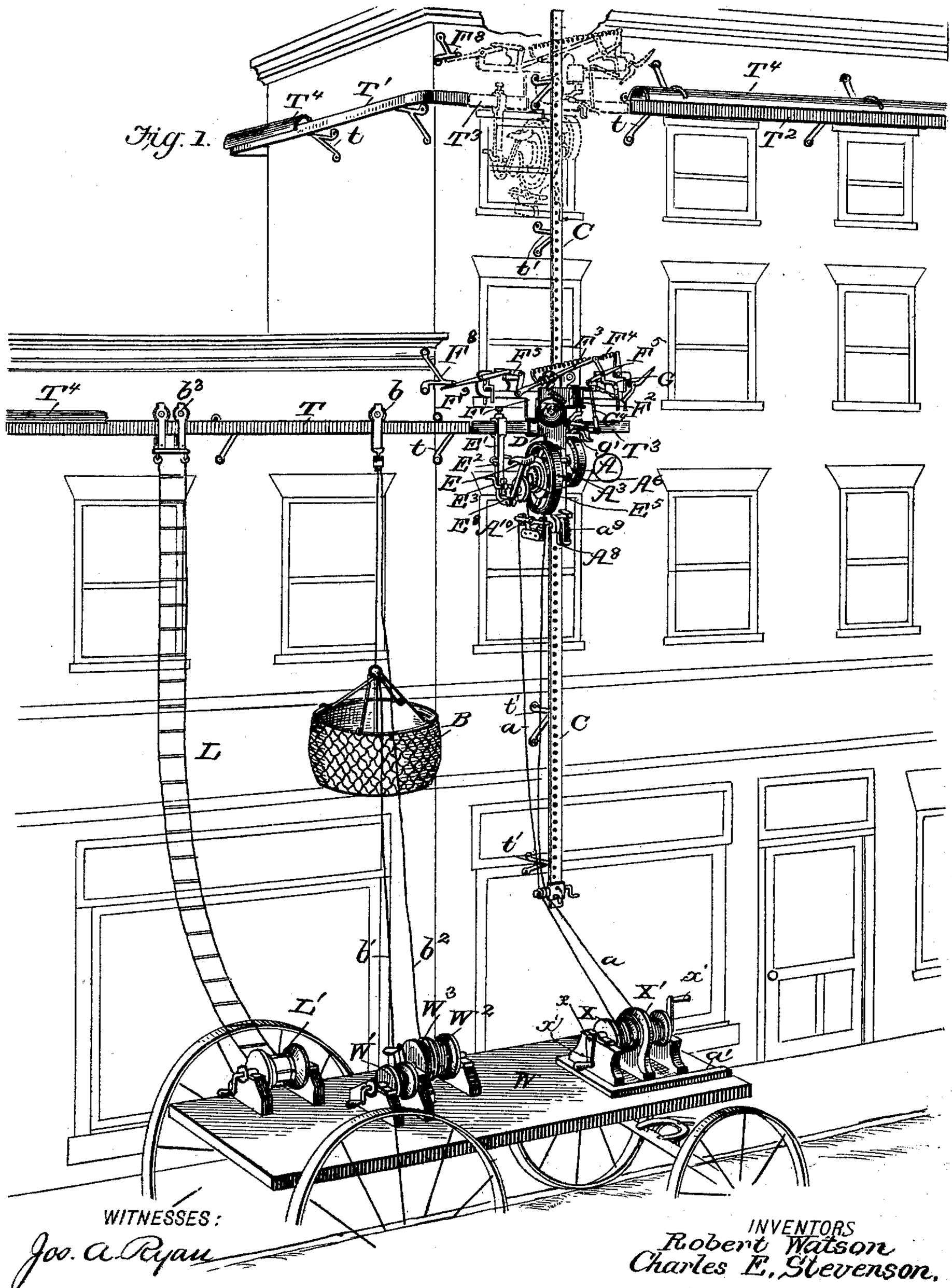
R. WATSON & C. E. STEVENSON.

FIRE ESCAPE.

(Application filed Sept. 6, 1898.)

(No Model.) 6 Sheets—Sheet 1.

Fig. 1.



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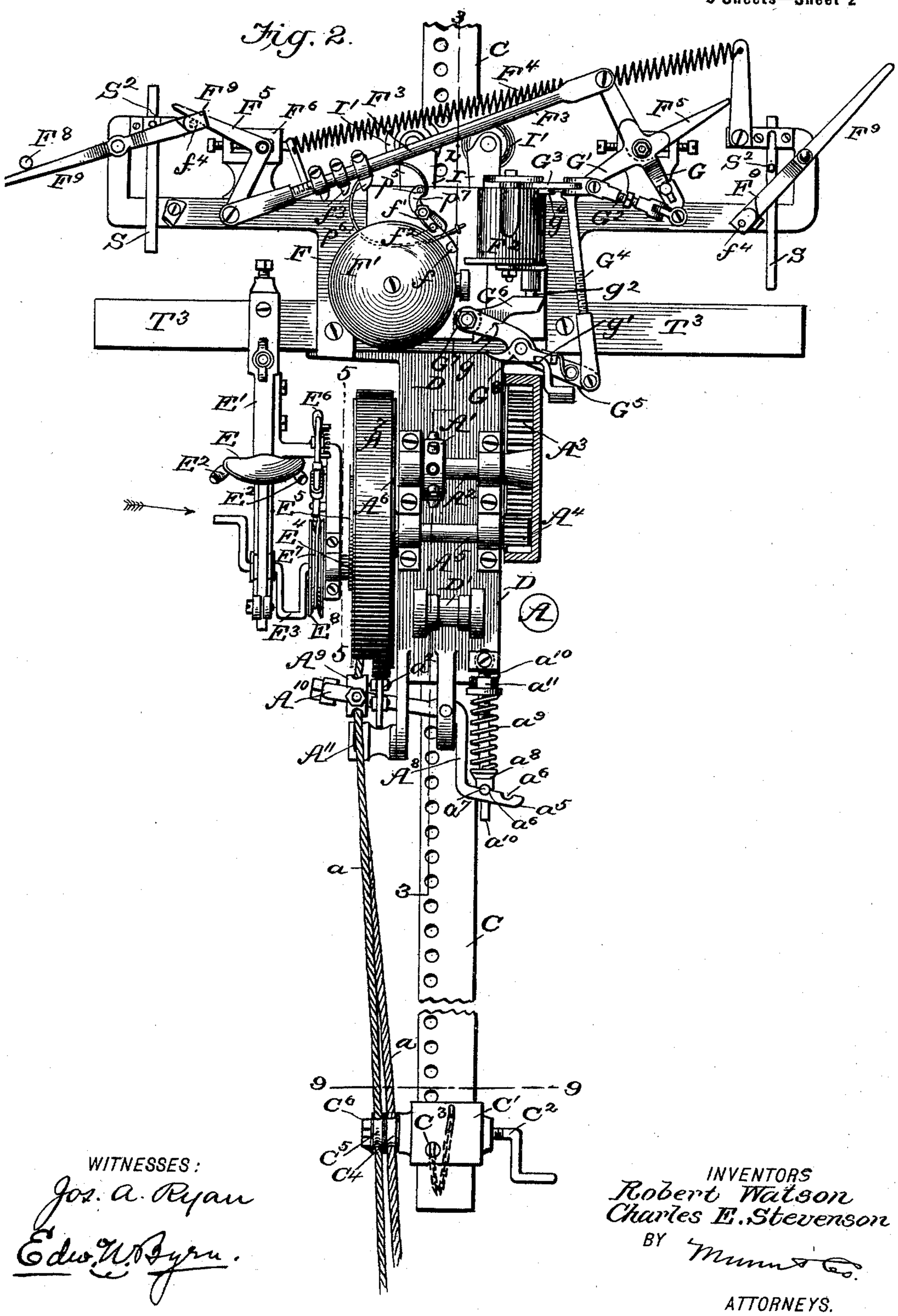
6 Sheets—Sheet 2

Fig. 2.



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(No Model.) 6 Sheets—Sheet 3.

Fig. 3.

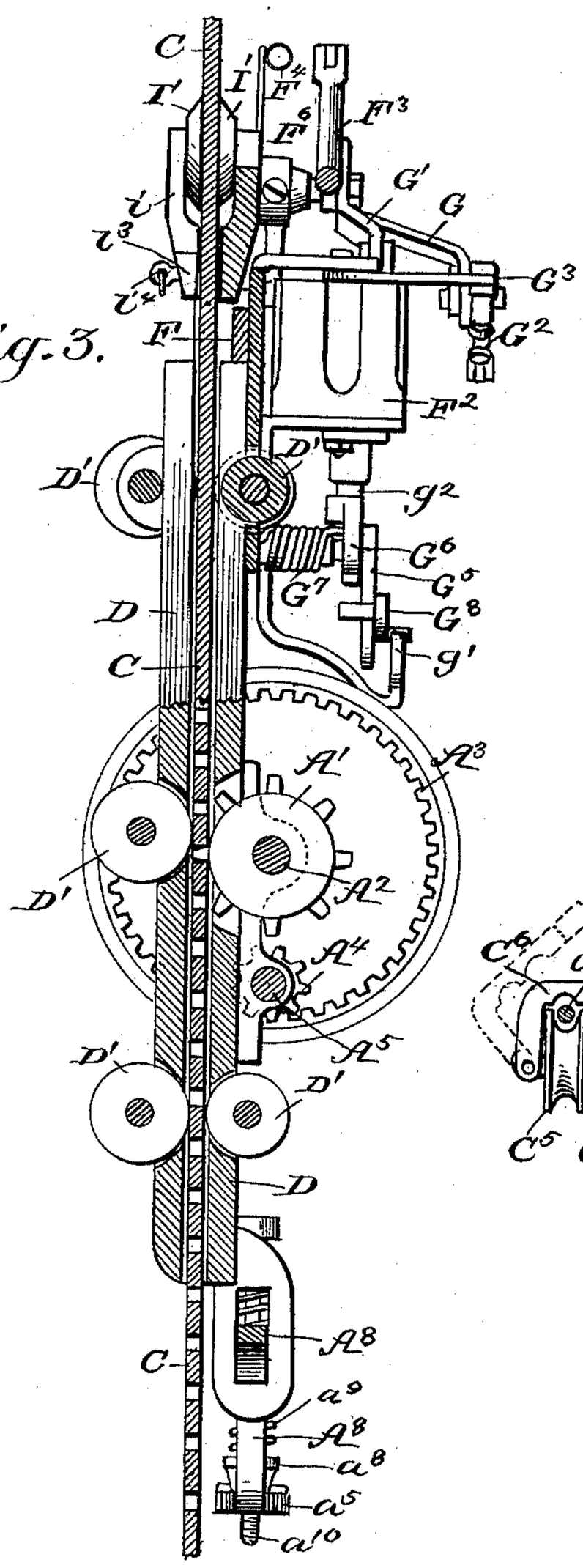
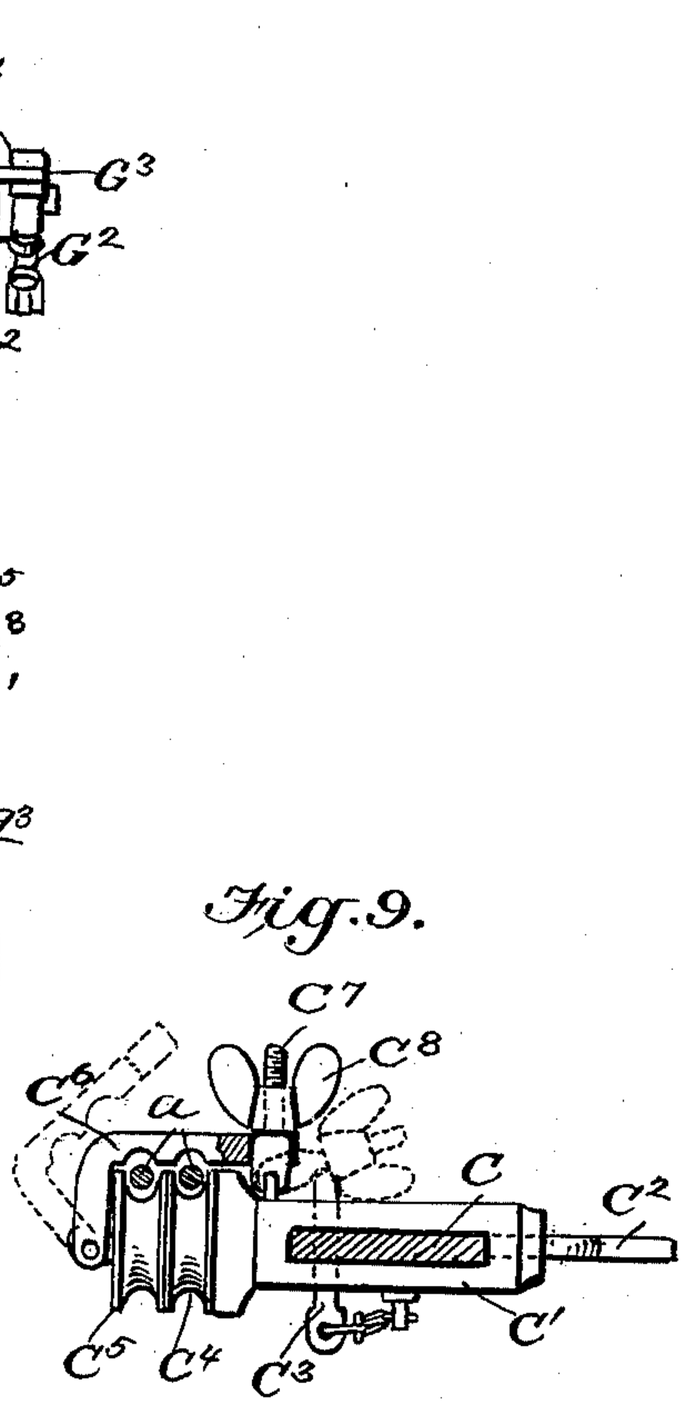


Fig. 9.



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(No Model.) 6 Sheets—Sheet 4.

Fig. 4.

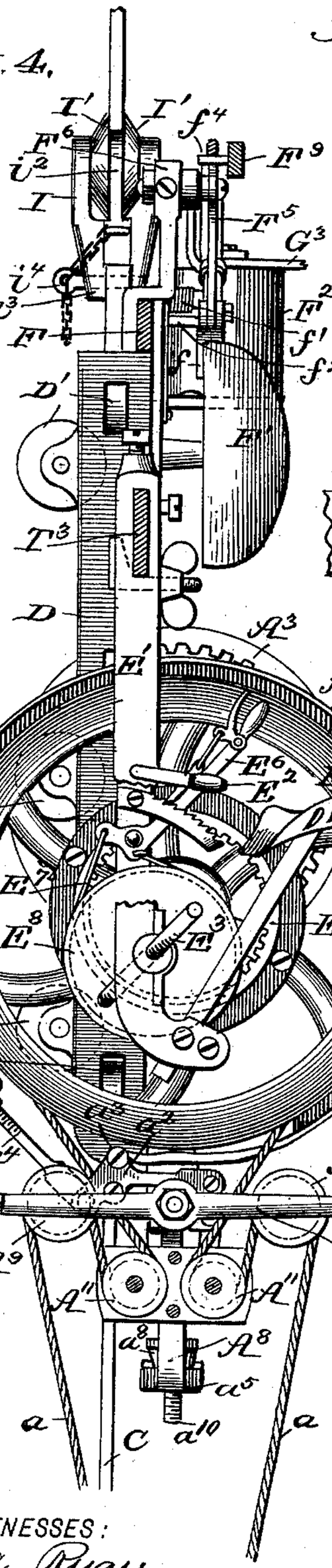

Fig. 6.

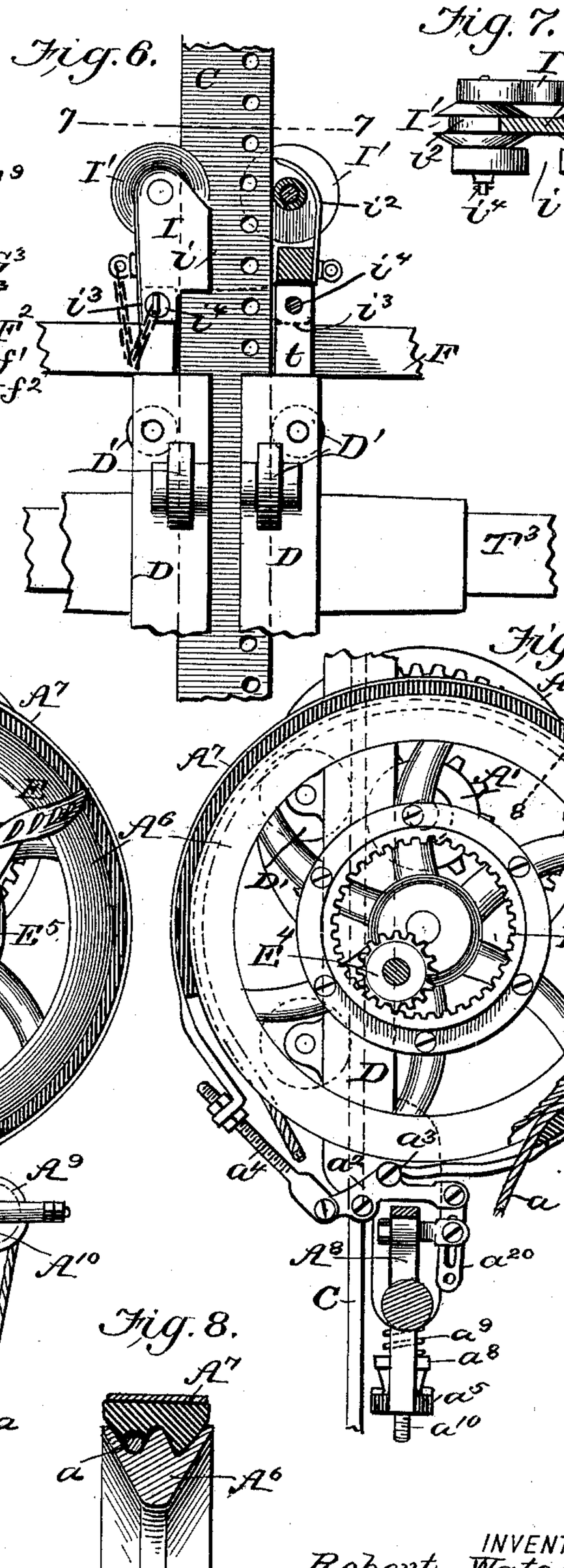

Fig. 7.

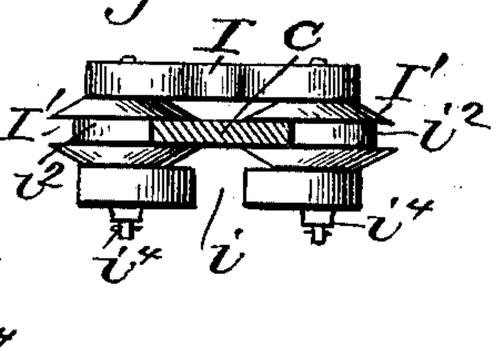

Fig. 5.

Fig. 8.

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(No Model.) 6 Sheets—Sheet 5.

Fig. 10.

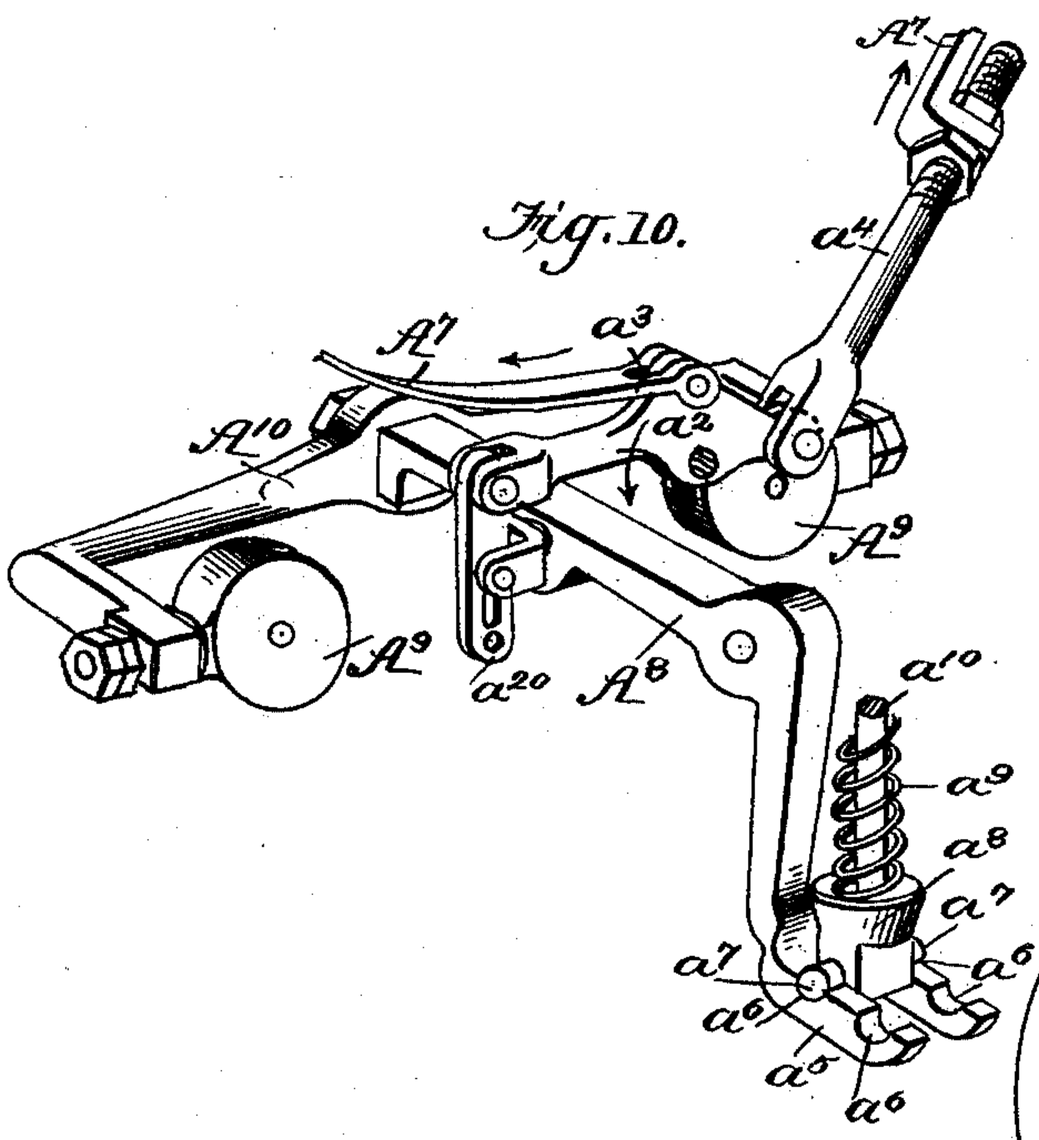


Fig. 11.

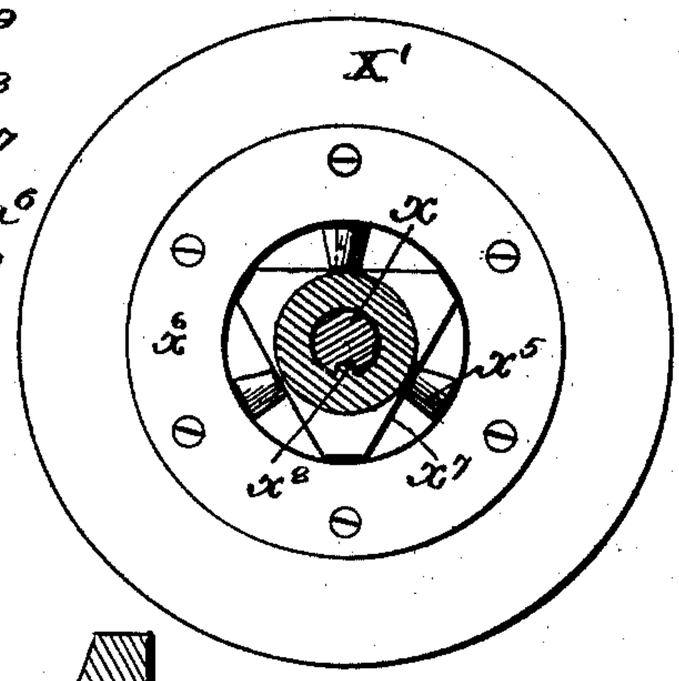
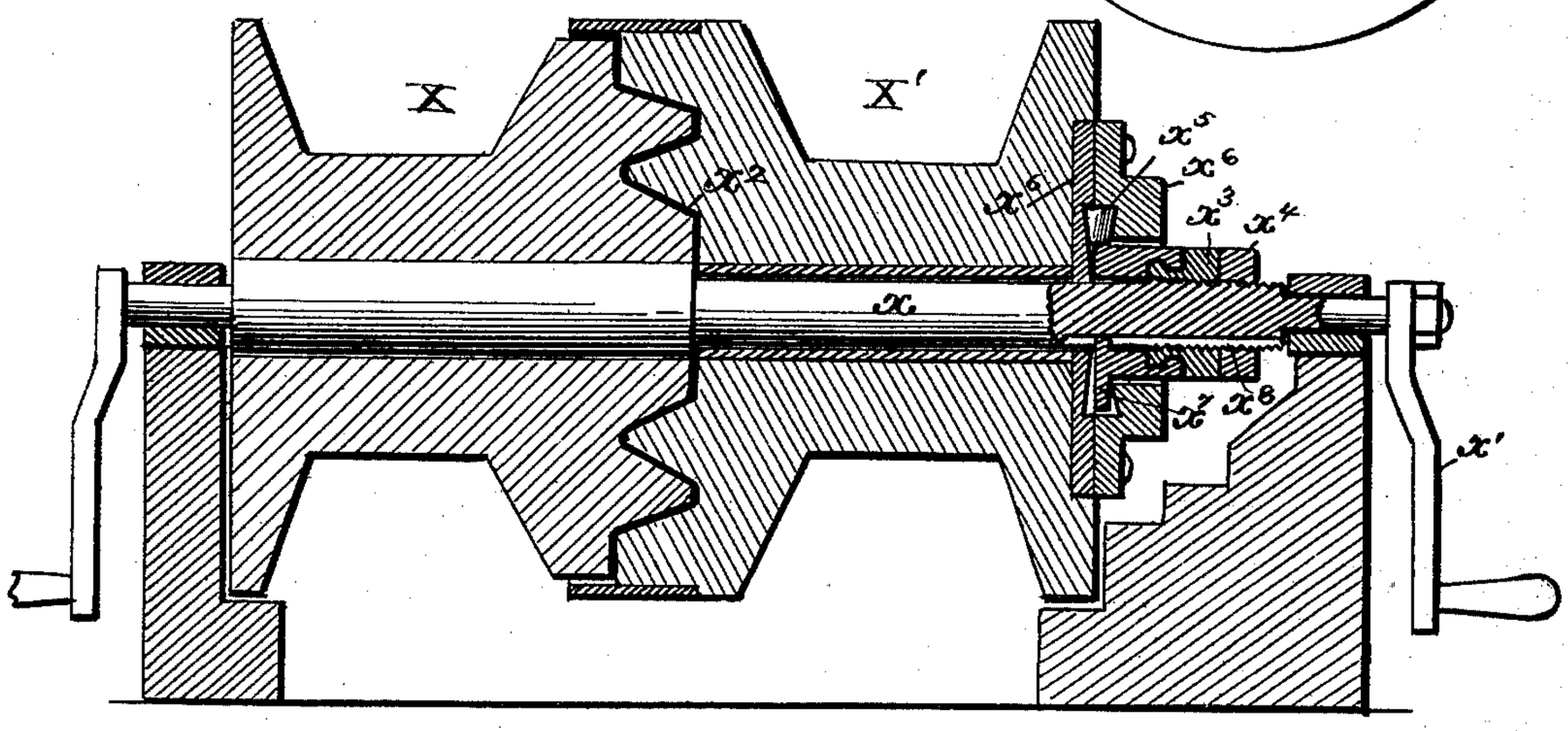


Fig. 12.



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(Application filed Sept. 6, 1898.)

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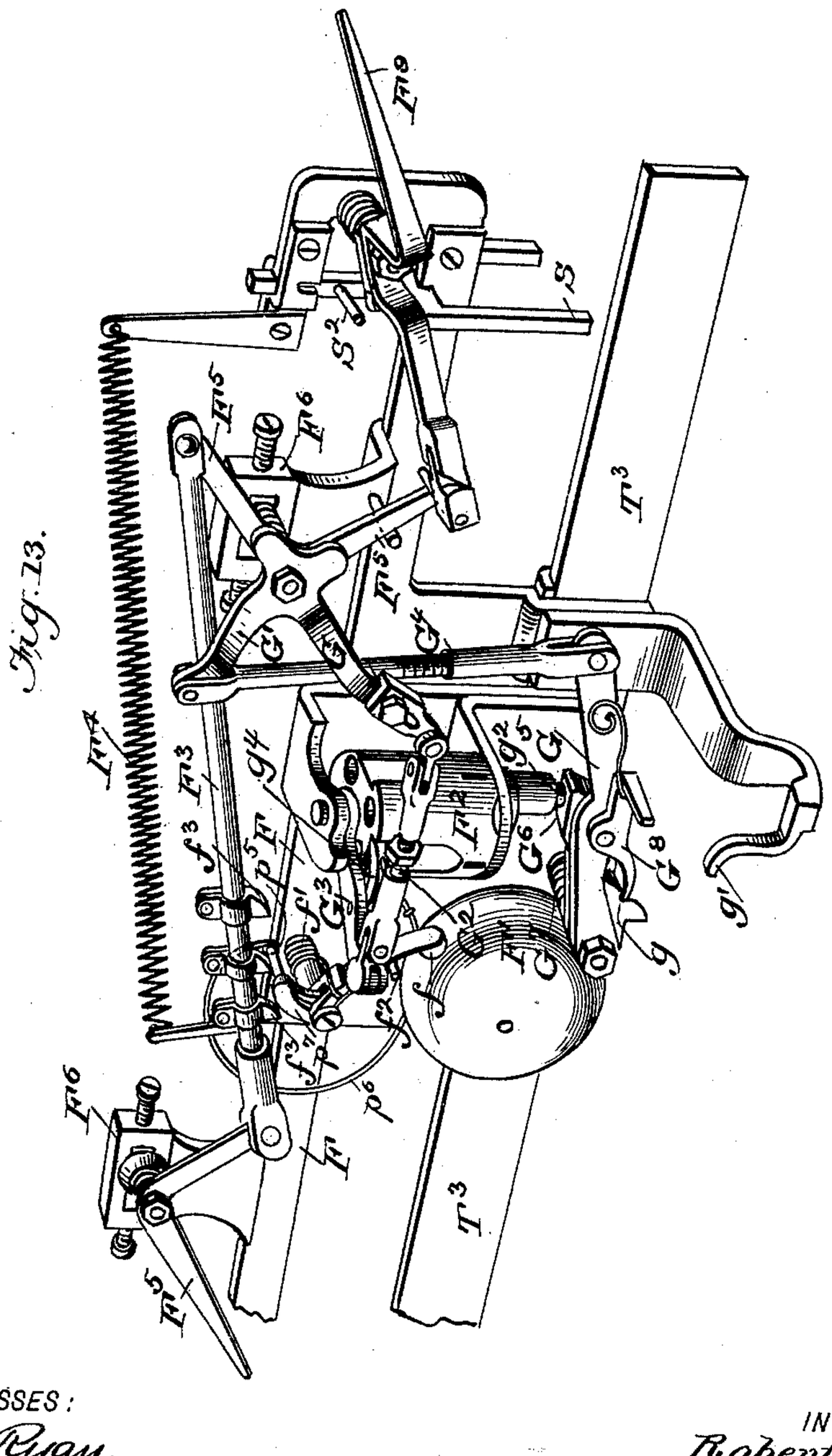
Fig. 13.



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UNITED STATES PATENT OFFICE.

ROBERT WATSON AND CHARLES E. STEVENSON, OF NANAIMO, CANADA.

FIRE-ESCAPE.

SPECIFICATION forming part of Letters Patent No. 619,105, dated February 7, 1899.

Application filed September 6, 1898. Serial No. 690,311. (No model.)

To all whom it may concern:

Be it known that we, ROBERT WATSON and CHARLES E. STEVENSON, of Nanaimo, British Columbia, Canada, have invented a new and useful Improvement in Fire-Escapes, of which the following is a specification.

Our invention relates to fire-escapes of that class in which a trolley-rail is fixed and supported near the top of a building in horizontal position and is arranged to coöperate with a trolley hung thereupon and carrying a basket, a line of hose, or other receptacle, which may be raised and lowered and shifted sidewise on the trolley-rails to come in front of any window.

Our invention consists, chiefly, in a detachable section for said trolley-rail, which may be raised and lowered and adjusted to alinement with one or more fixed trolley-rails arranged at different levels, said adjustable section being provided with a special brake mechanism and means for raising and lowering it and regulating its ascent or descent either from below or by a person carried thereon, the said detachable section of trolley-rail and its attached and coöperating parts being a part of the paraphernalia of the fire department and being carried on a wagon to the scene of action in case of fire.

Our invention consists in many other details of construction and combinations of parts, which will be first fully described with reference to the drawings and then pointed out in the claims.

Figure 1 is a perspective view of the apparatus applied to a building and in position for working. Fig. 2 is an enlarged front view of the portable climbing or elevating apparatus. Fig. 3 is a vertical longitudinal section of the same on line 3 3 of Fig. 2. Fig. 4 is a side view, partly in section, looking in the direction of the arrow in Fig. 2. Fig. 5 is a sectional view on line 5 5 of Fig. 2, looking in the same direction as Fig. 4. Fig. 6 is a sectional detail of the ice-cutter on the upper part of the climbing apparatus. Fig. 7 is a cross-section on line 7 7 of Fig. 6. Fig. 8 is a cross-section through the periphery of the brake-wheel. Fig. 9 is a cross-section on line 9 9 of Fig. 2, showing the cable-guide. Fig. 10 is a detail in perspective of a part of the brake mechanism. Fig. 11 is an end view of the roller-bearings of the double-drum windlass. Fig. 12 is a longitudinal section of said double-drum windlass. Fig. 13 is a perspective view of the signaling devices at the top of the climbing apparatus.

Referring to Fig. 1, which shows a perspective view of our fire-escape applied to adjoining buildings of different height with the portable apparatus of the fire department connected for use, we will first describe the general plan of our apparatus and explain its detailed construction and operation afterward.

In the drawings, T T′ T^2 represent metal-bar sections of trolley-rails about one-half inch thick and three inches wide. These are firmly secured to the buildings to be protected in elevated position near the corner or top. These rails are set with their width in a vertical plane and are securely and permanently secured to the building by means of offsetting brackets *t*. The rail T is adjusted to a two-story building, the rail T^2 to a three-story building, and T′ shows how it may be extended around a corner.

C is an elevator-bar by which a detachable section of trolley-rail T^3 is raised from the ground to alinement with the trolley-rail T or T′ or T^2 and by which a basket B, suspended from a trolley *b*, may be elevated from the ground on said section T^3 and then slid off from the detachable rail-section T^3 onto the fixed trolley-rails T T′ T^2 and brought to position before any one of the windows.

The means by which the detachable section T^3 and basket B, with its trolley *b*, are raised to the level of the fixed trolley-tracks we have designated in Figs. 1 and 2 by the letter A and will refer to hereinafter as the "climbing devices." On account of the small scale in Fig. 1 it will not be practical to describe the detail construction in this figure; but its special construction and operation will be described in connection with enlarged detail views hereinafter. It will suffice to say with reference to Fig. 1 that the apparatus A, with rail-section T^3 and the basket B and trolley *b*, is designed to be within the control of the fire department, kept at a station, and brought to the scene of the fire and there made to coöperate with the trolley-rails T T′ T^2, which are permanently fixed on all buildings which are to be protected by our system. The ap-

paratus A, with rail-section T^3, and the basket B, with trolley *b*, are to be transported upon a specially-arranged wagon W, which also carries windlasses for raising and lowering the apparatus A and the basket B. For raising and lowering the basket B two windlass-drums W′ W^2, with brake W^3, are used in connection with ropes or wire cables *b′* b^2, which are wound upon the windlasses W′ W^2 below and pass over a sheave in the trolley *b* above. For operating the elevating mechanism A a rope or wire cable *a* is employed, whose lower ends are wound upon separate windlass-drums X X′, that are transported upon the wagon by having their base slide into undercut guideways *a′ a′* on the wagon, but which when in use are preferably removed from the wagon and are placed nearer the building.

The elevator-bar C is a permanent fixture against the building, being fixed thereto by brackets *t′* in a vertical position and extending from a point near the ground to a position above the roof, being for this purpose preferably carried straight up through an opening in the cornice. This elevator-bar is perforated with a row of sprocket holes or cogs forming tooth-seats to be engaged by a sprocket-wheel on the apparatus A, which sprocket-wheel when turned causes the entire apparatus A, with the trolley-rail section and the basket and trolley, to climb up or down said elevator-rod.

T^4 is a curved cover constructed somewhat in the shape of an inverted gutter, which extends over and along all the trolley-rails T T′ T^2 for the purpose of housing and protecting the same against accumulation of ice and snow, which would, if allowed to accumulate along the upper edge of these rails, prevent the basket-trolley *b* from moving along the same.

We will now proceed to describe the climbing apparatus A, by which the detachable section T^3 of the trolley-track is raised and lowered on the elevator-bar C, referring more especially to Figs. 2, 3, 4, 5, and 10. This elevator-bar, it will be remembered, is perforated with a longitudinal row of holes, and these holes receive the teeth of a sprocket-wheel A′, Figs. 2 and 3, on a shaft A^2, journaled in a main frame D. This shaft A^2 has on its opposite end a gear-wheel A^3, with an internal gear meshing with a pinion A^4 on another shaft A^5 parallel to A^2 and just below it, and which shaft A^5 has rigidly fixed to its other end a combined operating and brake wheel A^6, Figs. 2 and 4. When this wheel A^6 is rotated, the sprocket A′ is turned, and it is made to rise on the elevator-bar C with its attached parts, as shown in dotted lines, Fig. 1. To turn this operating-wheel A^6, we provide mechanism by which it may be effected from the street below or from a person on the apparatus A and at the same time provide an automatic regulating-brake. For operation from below the wheel A^6 has a grooved periphery, Figs. 8 and 5, and around it is wrapped the cable *a*, one end of which goes to the drum X and the other end to the drum X′ of the elevating-windlass, as in Fig. 1. By winding up one of these windlasses and allowing the other to unwind the cable *a* is moved in one direction and the apparatus A is raised, and by moving the drums in the opposite direction the apparatus A is lowered.

To guide the cable *a* as it passes along up the building beside the elevator-bar C, we provide a detachable cable-guide C′, Figs. 2 and 9. This consists of a tubular plate having a T-shaped channel through it of the size to admit the elevator-bar C through it and having on one edge a crank-screw C^2 and in front a locking-bolt C^3, which passes into a hole in the plate and through one of the holes in the elevator-bar, by which means it is tightly but detachably fastened to the lower end of said bar. At one side of the plate there are two sheaves C^4 C^5 to receive the two runs of the cable, and these sheaves have a housing C^6, that is hinged to the axis of the sheaves and at its other end is forked and adapted to receive an articulated screw-stem C^7 and a butterfly-nut C^8, by which it is clamped down in position and yet may be released and thrown back at will, as in dotted lines, Fig. 9, to permit the cable to be inserted or removed. The object of this cable-guide is to prevent the cable from being entangled in electric-light, telephone, or telegraph wires and to bring the cable down straight and allow it to then extend out horizontally to the windlass on the wagon and to allow also the cable to be placed laterally within its guides. As the cable *a* passes from the guide below to the wheel A^6 above, it operates an automatic brake, which constitutes an important feature of our invention and which we describe as follows, referring to Figs. 2, 4, 5, and 10.

A^7 is a strap encompassing the grooved wheel A^6. The outer band of this strap is of metal and the inner lining is of wood or rubber (see Fig. 8) or any other material which is suitable to take the wear and may be removed and replaced when needed. The opposite ends of the brake-strap A^7 are secured (see Figs. 5 and 10) to a lever a^2, one end of said strap being jointed at a^3 and the other end being connected through a screw-stem a^4, which has adjusting-nuts, by which the tension of the strap may be tightened when necessary. The lever a^2 is fulcrumed at a point between the two connections of the strap, and when this lever is moved in one direction it loosens the grip of the strap on the wheel A^6 and when moved in the opposite direction it constricts or tightens said strap on the wheel. The outer end of lever a^2 is connected by a link a^{20} to an elbow-lever A^8, Figs. 2 and 10, fulcrumed in slotted projections from the main frame D and having at its lower end a bifurcated foot or stirrup a^5, with two seats a^6 a^6 for the trunnion-like projections a^7 of a block a^8, which presses upwardly against a

spiral spring a^9 on a swinging stem a^{10}, pivoted at its upper end to the main frame D and having a screw-threaded portion engaged by a nut a^{11}, which forms the upper bearing for said spring. By adjusting the nut the tension of the spring may be varied, and by shifting the trunnions a^7 of block a^8 from one to the other of the seats a^6 the leverage of the pressure of said spring on the lever A^8 may be varied. The tendency of the spring is to throw the right-hand end, Fig. 2, of lever A^8 down and the end, Fig. 5, connecting with strap-lever a^2 up, which latter movement tightens the strap around the brake-wheel. To release the strap contemporaneously with the rotation of said wheel by the cable a, both runs of said cable are passed in the form of loops around pulleys A^9 in a T-shaped head A^{10}, Fig. 10, of the elbow-lever A^8, and thence pass around fixed pulleys A^{11} A^{11}, Fig. 4, in a stationary head attached to the lower end of the main frame D. Now when there is no tension on the cable it will be seen that the spiral spring secures the constant and automatic application of the brake-strap. When, however, the combined brake and operating wheel is to be turned to raise or lower the apparatus A, as effected through the drums X X′ of the windlass, as soon as tension is applied to the cable a the first effect is to pull down the pulleys A^9 A^9, Figs. 4 and 10, in the T-head of lever A^8, and by deflecting the latter against its spring so turns the small strap-lever a^2 (see arrows in Fig. 10) as to relax the strap and simultaneously turn the wheel, which operates the driving-gear and raises or lowers the apparatus A. As soon, however, as the tension on the cable is relaxed either by design or by the accidental breaking or burning of the same the brake is instantly and automatically applied again through the spring.

From the foregoing description it will be seen that the entire apparatus A may be raised and lowered from below by the firemen. To raise and lower the apparatus A by means of a person ascending thereon, we provide (see Figs. 2, 4, and 5) a seat E with treadle mechanism for rotating wheel A^6. The seat E is mounted beside wheel A^6 upon a hanger-bar E′, Figs. 2 and 4, detachably secured by slot and set-screw to the trolley-rail section T^3. Steady-handles E^2 E^2 are provided for the hands and a double crank-axle E^3 affords operating-pedals for the feet. This crank-axle is hung in bearings in the two branches at the lower end of the hanger and has on its end next to wheel A^6 a rigid pinion E^4, Fig. 5, that meshes with an internal gear E^5, affixed to the side of the main operating and brake wheel A^6, so that when the crank-axle is rotated by the feet of a person occupying the seat E the wheel A^6 is rotated and the apparatus A is made to climb up the elevator-bars C, as before described. To control the movement, the operator in seat E is provided with a strap-brake close at hand, consisting of a hand-lever E^6, a strap E^7, and a grooved wheel E^8, fixed to the crank-axle. This hand-lever is made to apply or remove the strap-brake and is itself locked to its adjustment by an ordinary detent and curved ratchet-bar.

To guide the main frame D on the elevator-bar C as it rises and falls thereon and to reduce friction, rollers D′ D′, Figs. 3 and 6, are arranged on the face and side edges of the frame D and are made to bear against the bar C as they travel up and down thereon.

When the apparatus A has been raised by the firemen from below, so that the trolley-rail section T^3 is on a level with one of the fixed rails T T′ T^2, (see Fig. 1,) it will be seen that it will be very difficult to ascertain through the smoke, noise, and confusion and the distance of the rails T T′ T^2 from the ground just when the movable rail-section T^3 is on exact alinement with the stationary rails, and it is obvious that if said section T^3 were not in exact alinement and it were attempted to run off the trolley b and the suspended basket from the section T^3 on which it was hoisted while rails were not in alinement the trolley would get hung or might run off altogether and cause the basket to be precipitated to the ground. To prevent this, we have devised a set of signals which automatically indicate such exact alinement. One of these signals is a bell and the other is a cartridge-exploding device, which latter when the noise is very great or the building very high would come into requisition when the bell might not be heard from below. We will now describe this feature of our apparatus.

On the top of the movable section T^3 of the trolley-rail, Figs. 2 and 13, there is mounted a metal frame F, bearing a gong-bell F′ and a revolving cartridge-cylinder F^2, similar to that found in a pistol. Beside the bell is a hammer f, which is pressed toward the bell by a spiral spring f' and rests normally against a stop-pin f^2.

F^3 is an operating-rod bearing one or more lugs f^3, which when moved in one direction causes its lugs f^3 to bear against a pin p^5 and deflect the hammer f and upon passing the same allows the hammer to fly back from its spring and strike the bell. The operating-rod F^3 is strained in the opposite direction to its striking movement by a spiral spring F^4. For effecting the striking movement of the rod F^3 there is duplicated at each end of the same a similar device, one or the other of which comes into play, depending upon whether the apparatus is to coöperate with a trolley-rail on the left of it or one on the right of it, the position of which varies with different buildings. As these devices have the same construction and mode of operation, it will be sufficient to describe one of them.

F^5, Figs. 2 and 13, is an elbow-lever, one arm of which is jointed to the signal-operating rod and the other arm of which is operated upon

by a tappet-lever F^9. The fulcrum of the elbow-lever is a stud mounted in a slotted head F^6 adjustably by means of set-screws.

F^9 is the tappet-lever, which is fulcrumed upon a stud projecting laterally from the frame F. This tappet-lever has at one end a stud or pin f^4, Fig. 2, that is adapted to bear against one arm of the elbow-lever F^5 when deflected and after passing the same allows the elbow-lever and operating-rod F^3 to fly back from the action of spring F^4. To cause this tappet-lever F^9 to be thus deflected, it projects outwardly from the apparatus A and is made to come in contact with a rigid arm F^8, (see Figs. 1 and 2,) fixed to the side of the building just above the trolley-rail, so that the tappet-lever comes in contact with the same and causes the signal to be sounded just at the instant that the movable rail-section T^3 reaches a position exactly in alinement with the stationary rail-section on the building, the rigid arm F^8 being so placed in the building as to permit this to take place at the right time. After the advance movement of the rod F^3 has carried the lugs f^3 past the pin p^5 of the bell-hammer the lugs on the backward movement must get past the pin p^5 again, and for this purpose the pin p^5 is carried in an articulated piece p^7 of the hammer and is also connected to the end of a curved spring p^6, that allows the piece p^7, with pin p^5, to yield in backward direction as the lugs f^3 return.

At each end of the movable trolley-rail section T^3 there is a stop S to prevent the suspended trolley carried upon the rail T^3 from accidentally running off. This stop is simply a forked slide mounted to reciprocate vertically on the frame F. At the time of alinement of trolley-rail section T^3 with those on the building the tappet-levers F^9 bear against pins S^2 on these stops and lift them out of the way, so that the trolley can be run off T^3 and onto T, T′, or T^2.

We will now describe the cartridge-exploding signal, which is operated at the same time with and through the bell-operating devices.

The right-hand one of the elbow-levers F^5, Figs. 2 and 13, is made with two sets of arms, or four altogether, two of them corresponding to the elbow-lever F^5 on the other side, and two additional ones, G G′, which are made to operate the cartridge-exploding devices. G is connected through an adjustable link-bar G^2 with a swinging arm G^3, hung about the axis of the pistol-cylinder F^2 and having a pawl g^4, that engages notches in the periphery of the pistol-cylinder and gives it a step-by-step revolution corresponding to the action of a revolver to bring a fresh chamber into range of the exploding-hammer. The arm G′ is jointed to an adjustable rod G^4, which at its lower end is jointed to an arm G^5, pivoted at one end to a stud on the framework and carrying a hammer G^6, that is strained upwardly toward the pistol-cylinder by a spiral spring G^7 on the axial stud. A trigger G^8 is also pivoted to the arm G^5, and one end of it is arranged to engage a notch g on the hammer and draw back the hammer with the arm whenever the arm G^5 is deflected downwardly. When, however, the arm G^5 descends far enough to bring the trigger G^8 in contact with a stationary projection g' on the framework below, the trigger is deflected by contact therewith, its tooth or dog is thrown out of the hammer-notch, and the hammer, responding to the influence of its spring, advances to and strikes against a firing-pin g^2 in a guide at the bottom part of the cylinder, which firing-pin being in line with the cartridge explodes the same and sounds a signal which is sufficiently loud and distinct to be heard above the uproar and confusion of the crowd and the noise of the engines.

In order to insure the ascent of the apparatus A, it is necessary at times during the winter season to clear the elevator-bar C of adhering ice. For this purpose there is detachably fastened to the apparatus A at the top an ice-cutter. (Shown in detail in Figs. 4, 6, and 7.) This consists of a metal frame I, having a channel through the same large enough to receive the elevator-bar and having a slot or opening i at the middle of its back part opening into the channel to allow passage over the supporting-brackets t' of the elevator-bar. On each side of the channel in the frame I there is arranged on suitable axes double disk-shaped cutters I′ I′. The two disks of each pair hug closely to opposite sides of the elevator-bar C and cut the ice off of the front and back sides of the same, while a curved chisel or plow-bit i^2, fixed between the two disks of each cutter, plane the ice off the edges of said bar. This ice-cutter has at its lower four corners perforated lugs i^3 and two bolts or pins i^4, which when passed through the perforated lugs and also through corresponding lugs i^4 on the top of the main frame of apparatus A connect the ice-cutter to the latter, so that as said apparatus rises the ice-cutter clears the elevator-bar of all adhering ice and leaves the bar clean for the apparatus A to climb thereon.

With reference to the principal feature of our invention we would state that the combined brake and operating wheel with cable a is the most important. This is not only capable of use independently of the signal devices above it, but it may be used for climbing tall chimneys, steeples, &c., and all analogous uses, its peculiar construction and arrangement causing it to be effectively operated in either direction by the rope with a perfect and automatic brake action.

In connection with our apparatus as thus described any number of trolleys b may be used, one for the basket and one or more others for raising lines of hose, &c., to the top of the trolley. We may also use a trolley b^3 to support a flexible ladder L, which is wound upon a drum L′, Fig. 1, and is to be carried

on the fireman's wagon with the other apparatus.

The basket B is preferably made of woven wire lined with fireproof material, such as asbestos-board, and it also has, preferably, a cover made of the same material to protect its occupants from the flames.

Instead of making the elevator-bar C with perforations to be engaged by a sprocket-wheel it is obvious that it may have rack-teeth to engage a toothed gear-wheel.

The cable-winding drums X X′ (shown in Fig. 11) are rotated by a shaft x and cranks x' x'. They may be forced together, so that their corrugated friction-faces x^2 come together and rotate as one, or they may be loosened to rotate independently. To loosen them, the nuts x^3 x^4 are screwed back on the threaded portion of the shaft x and a swiveling collar x^7 with rollers x^5 is drawn back over a spline x^8, and the rollers x^5, playing in a box x^6 x^6, rigid with drum X′, pull the latter away from X.

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

1. A combined brake and gear operating mechanism, consisting of a set of gears, a cable-wheel connected with the same and provided with a peripheral strap-brake normally held to the periphery with frictional contact, a cable surrounding the said wheel between its periphery and the strap-brake and two guide sheaves or pulleys for the cable arranged in loops of the cable as it extends from each side of the wheel, a movable device sustaining said sheaves and connected to the strap-brake, said device being arranged to release the brake and operate the cable-wheel with a positive movement in either direction substantially as and for the purpose described.

2. The combination with a cable-operated wheel, a cable, and a strap-brake surrounding the same; of a pair of guide-pulleys arranged in loops of the cable, and a spring-actuated device carrying said pulleys arranged to normally apply the brakes from a tension of the spring and to release the brakes from a tension on the cable in operating the wheel substantially as shown and described.

3. The combination with a cable-operated wheel, a cable, and a strap-brake surrounding the same; of a lever connected to the ends of the strap-brake, a second lever with T-head bearing cable-pulleys connected to the first-named lever, and a spring acting upon the T-headed lever to apply the brakes substantially as and for the purpose described.

4. The combination with a cable-operated wheel, a cable, and a strap-brake surrounding the same; of a lever a^2 jointed to the strap-brake on opposite sides of the fulcrum, the elbow-lever A^8 connected to lever a^2 and having a T-head with pulleys A^9 A^9, the stationary pulleys A^{11} A^{11}, the spiral spring a^9, and the swinging stem a^{10} substantially as and for the purpose described.

5. A climbing device for a fire-escape or analogous purpose, comprising a fixed upright elevator-bar attached to the building and provided with a continuous row of tooth-seats, a main frame guided upon said bar and having a gear-wheel positively engaging the said tooth-seats, a cable-operated wheel for said gear, and a cable extending from said wheel to the ground substantially as and for the purpose described.

6. A climbing device for a fire-escape comprising a fixed upright elevator-bar attached to the building and provided with a continuous row of tooth-seats, a main frame guided upon said bar and having a gear-wheel positively engaging said tooth-seats, a cable-operated wheel for said gear, a cable extending therefrom to the ground, and a cable-guide attached to the lower end of the upright bar substantially as and for the purpose described.

7. The combination with the upright elevator-bar; of a cable-guide C′ consisting of a channeled plate slipping over said bar and provided with a set-screw and a locking-bolt, and having upon one side two sheaves C^4 C^5, a hinged housing C^6 for the same, and an articulated screw C^7 and nut C^8, to permit its lateral insertion and removal of the cable substantially as and for the purpose described.

8. A fire-escape comprising horizontal trolley-rails, brackets for sustaining the same fixed to the upper part of a building, an upright elevator-bar, with tooth-seats therein, a climbing device arranged thereon and provided with a gear-wheel engaging the tooth-seats, means for rotating said gear-wheel, and a movable trolley-rail section carried by said climbing device and arranged to raise a trolley, and suspended attachments, to the level of the fixed trolley-rails, and when in alinement therewith to permit the trolleys to be run off the movable trolley-rail onto the fixed trolley-rails substantially as and for the purpose described.

9. A fire-escape, comprising horizontal trolley-rails fixed to the upper part of a building, an upright elevator-bar, a climbing device arranged thereon, a movable trolley-rail section carried by said climbing device and arranged to raise a trolley to the level of the fixed trolley-rails, and an automatic signaling device to determine when the movable trolley-rail is in alinement with the fixed trolley-rails substantially as and for the purpose described.

10. The combination with the upright elevator-bar with tooth-seats and climbing-gears guided thereon; of an internal gear E^5 connected to the operating-gears, a hanger E′ bearing operator's seat E, the crank-axle E^3 with pinion E^4 engaging gear E^5, and a suitable brake substantially as and for the purpose described.

11. The combination with the upright elevator-bar and the climbing devices thereon; of an ice-cutter for the elevator-bar consist-

ing of a plate or frame with a T-shaped channel through it embracing the bar and giving passage to its supporting-brackets, and two pairs of sharp disk cutters arranged at opposite edges and upon opposite sides of the bar, and chisel cutters or plow-bits arranged between each pair of disk cutters substantially as and for the purpose described.

12. In combination with the fixed trolley-rails on the building, the upright elevator-bar and climbing devices mounted thereon and carrying a movable trolley-rail, an audible-signal device, a stationary arm or abutment on the building, and a signal-operating device adapted to strike the said stationary arm or abutment on the building and be in turn made to sound the signal substantially as and for the purpose described.

13. In a fire-escape of the kind described, the combination with the climbing devices carrying the movable trolley-rail, the stationary trolley-rails, and a fixed arm or abutment on the building; of an automatic cartridge-exploding device mounted on the climbing devices and operating when the trolley-rail sections are in alinement substantially as and for the purpose described.

14. A fire-escape apparatus comprising horizontal trolley-rails and a vertical elevator-bar permanently attached to the building, a climbing device with portable trolley-rail, a trolley with cable basket and windlass, a second windlass, with cable for the climbing device, said climbing device, portable rail, trolley, basket, and windlasses, being transported upon a wagon and adjusted to the fixed fire-escape friction of different buildings substantially as and for the purpose described.

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