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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889.

Fig. 1.

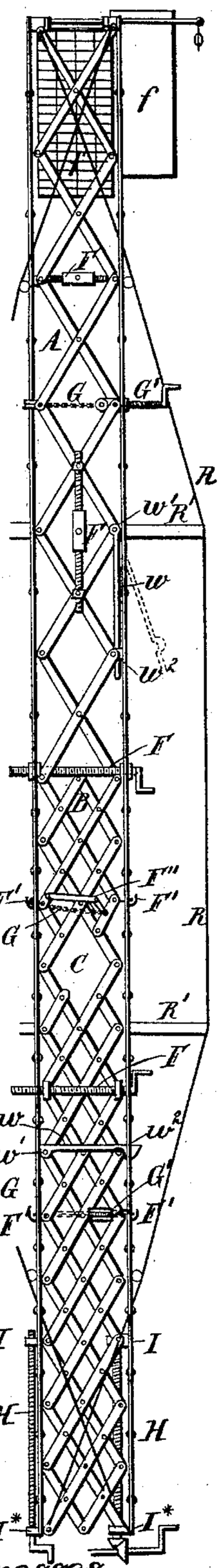


Fig. 7.

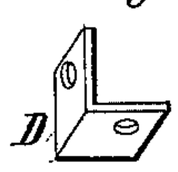


Fig. 15.

Fig. 8.

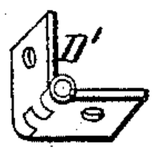


Fig. 2.

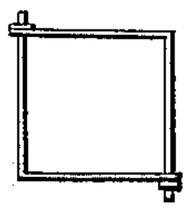


Fig. 5.

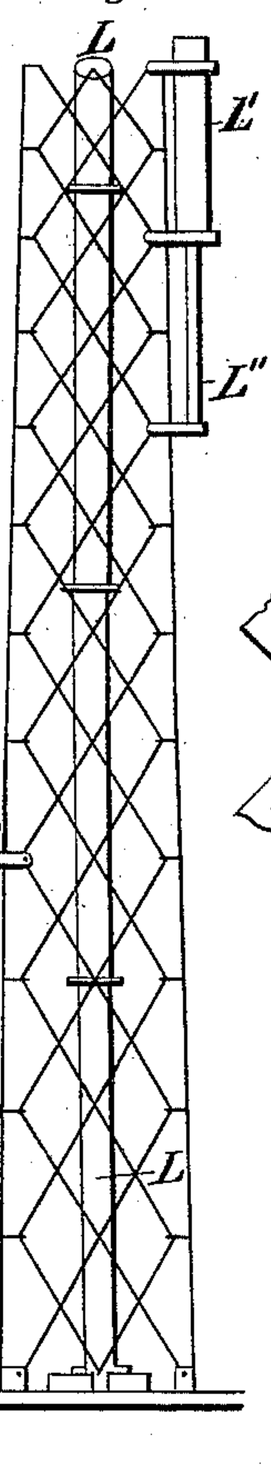


Fig. 14.

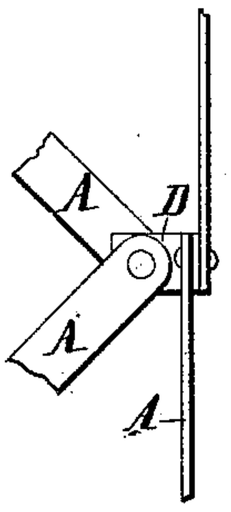
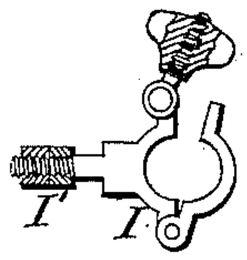


Fig. 6.



Witnesses.
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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889.

Fig. 18.

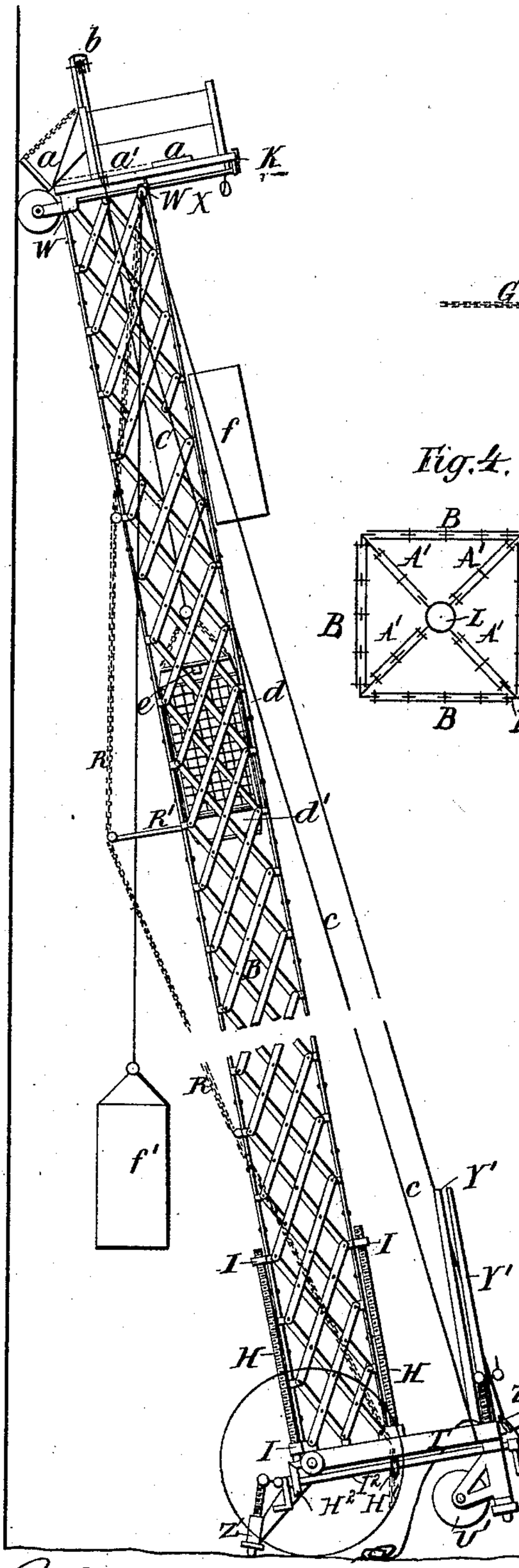

Fig. 3.

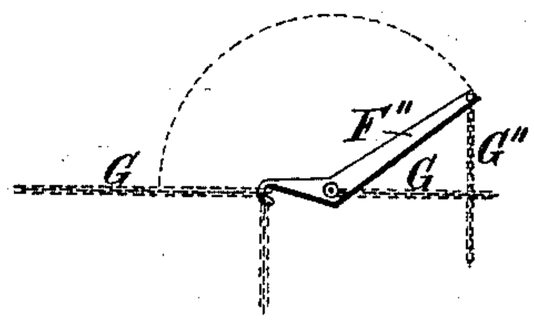

Fig. 4.

Fig. 25

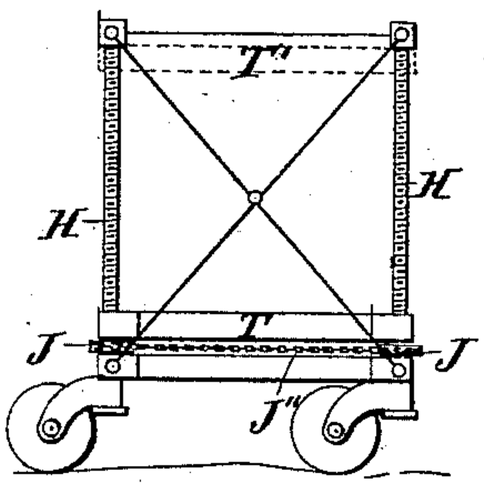

Fig. 24.

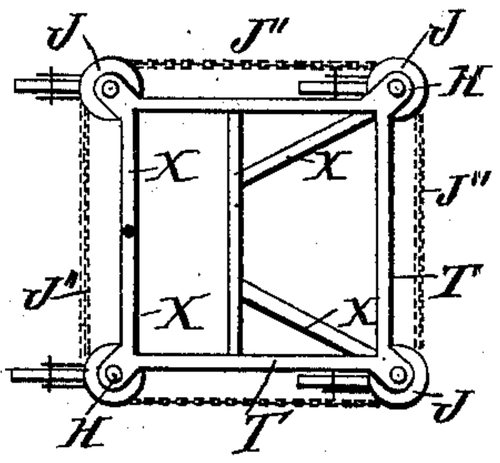

Fig. 23.

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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889.

Fig. 11.

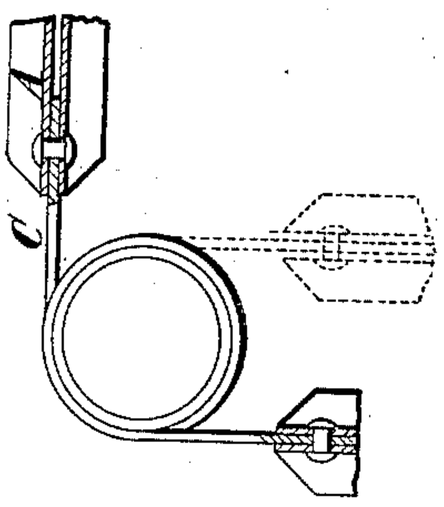


Fig. 16.

Fig. 17.

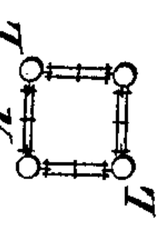


Fig. 10.

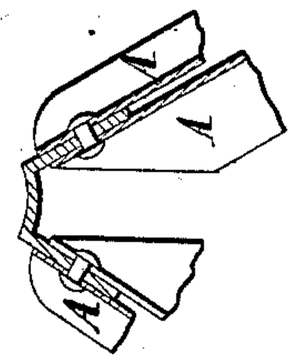


Fig. 13.

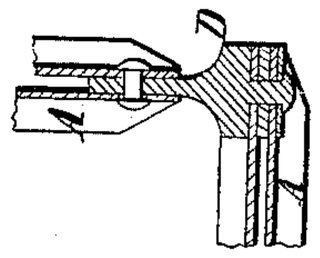


Fig. 9.

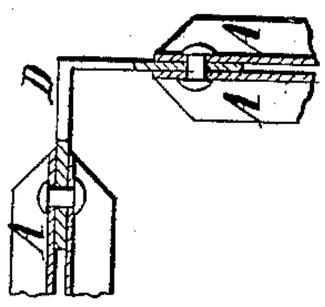
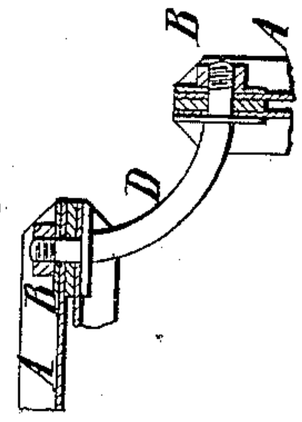


Fig. 12.



Witnesses.

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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889.

Fig. 15a.

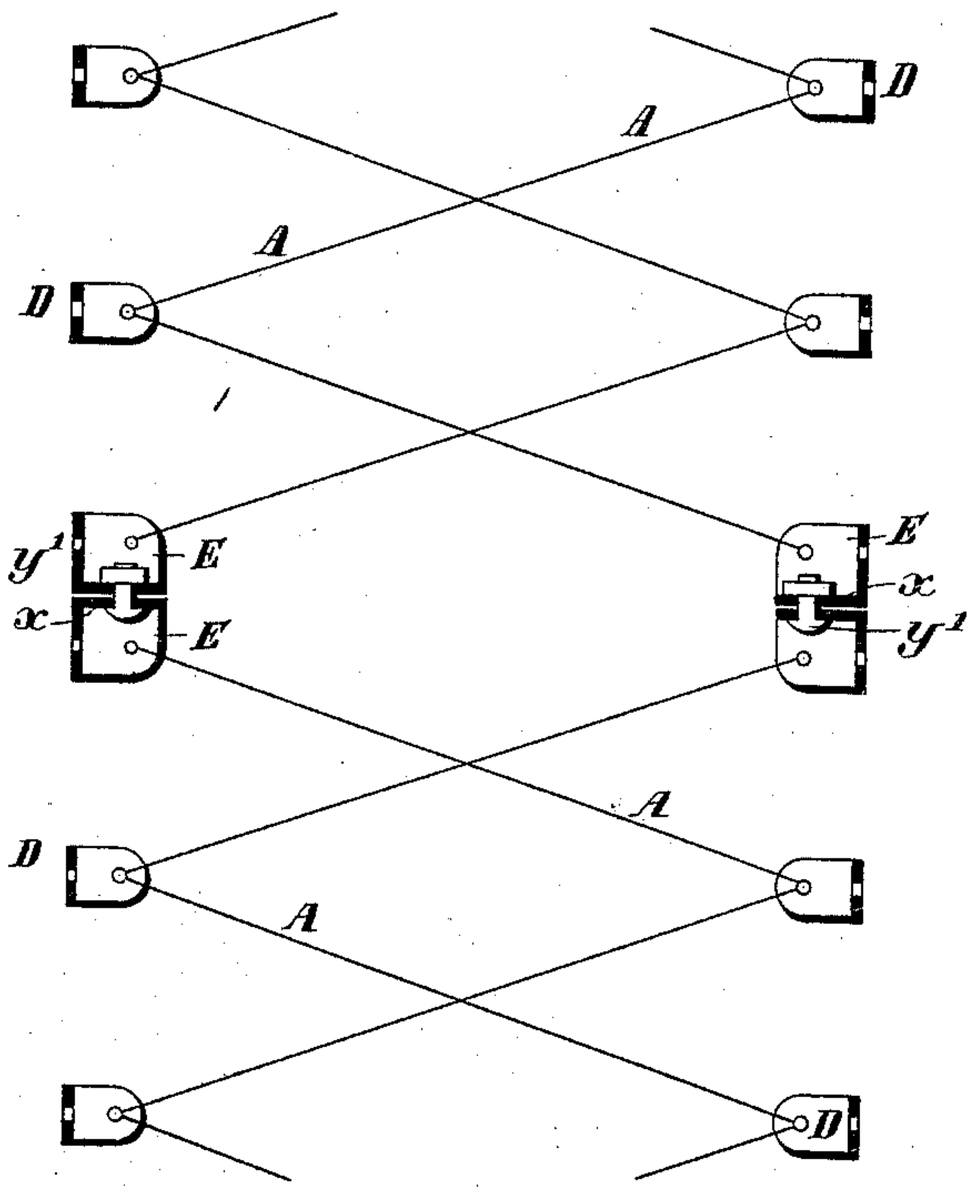
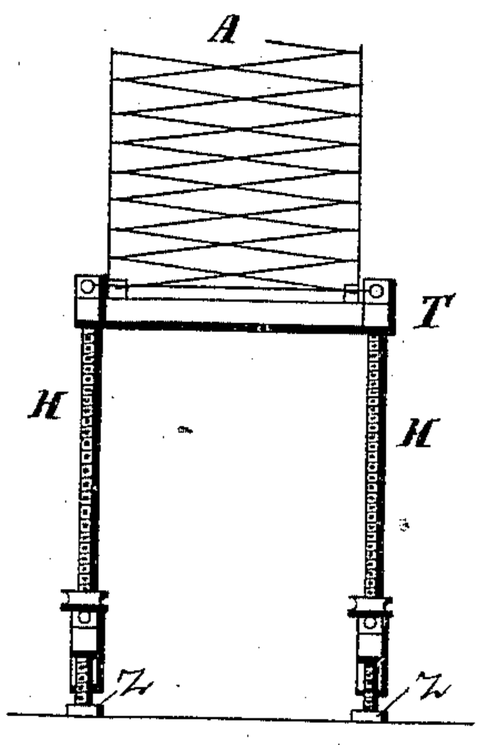


Fig. 25a.



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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889

Fig. 19.

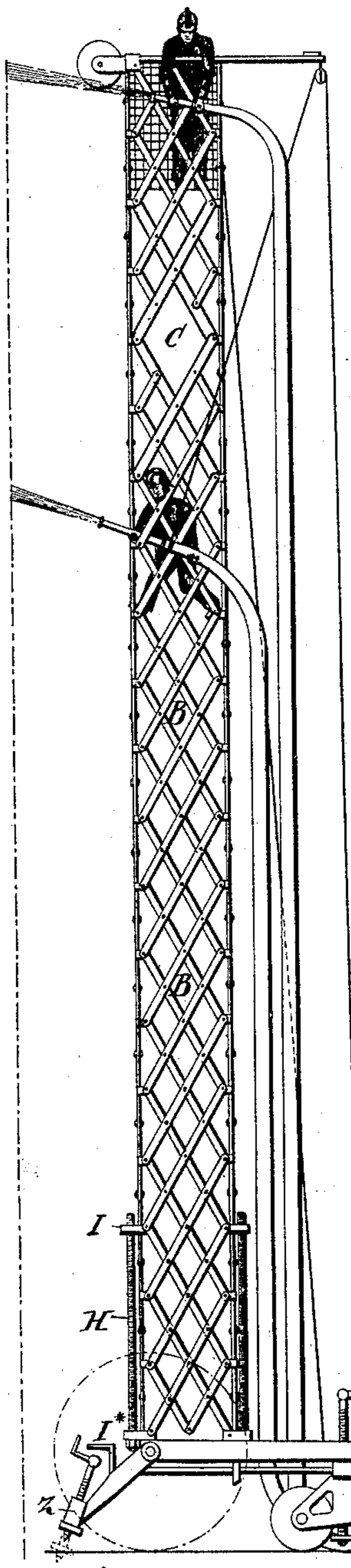


Fig. 28.

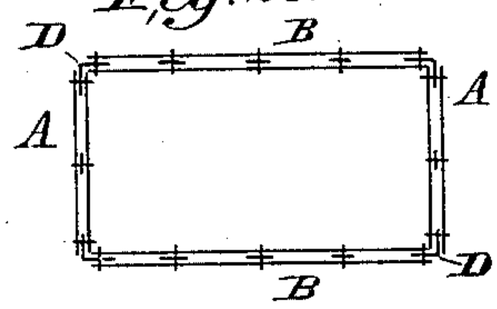


Fig. 27.

Fig. 29.

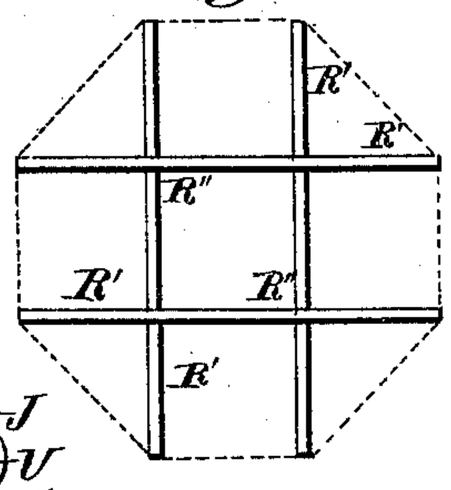
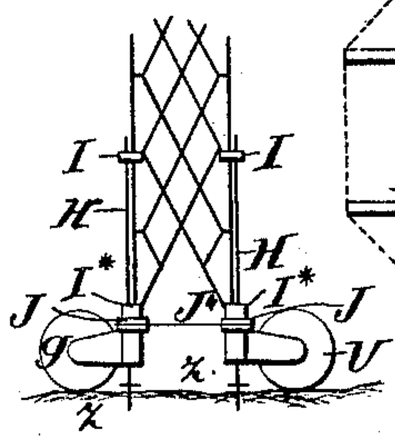


Fig. 26.



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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

No. 415,667. Patented Nov. 19, 1889.

Fig. 22.

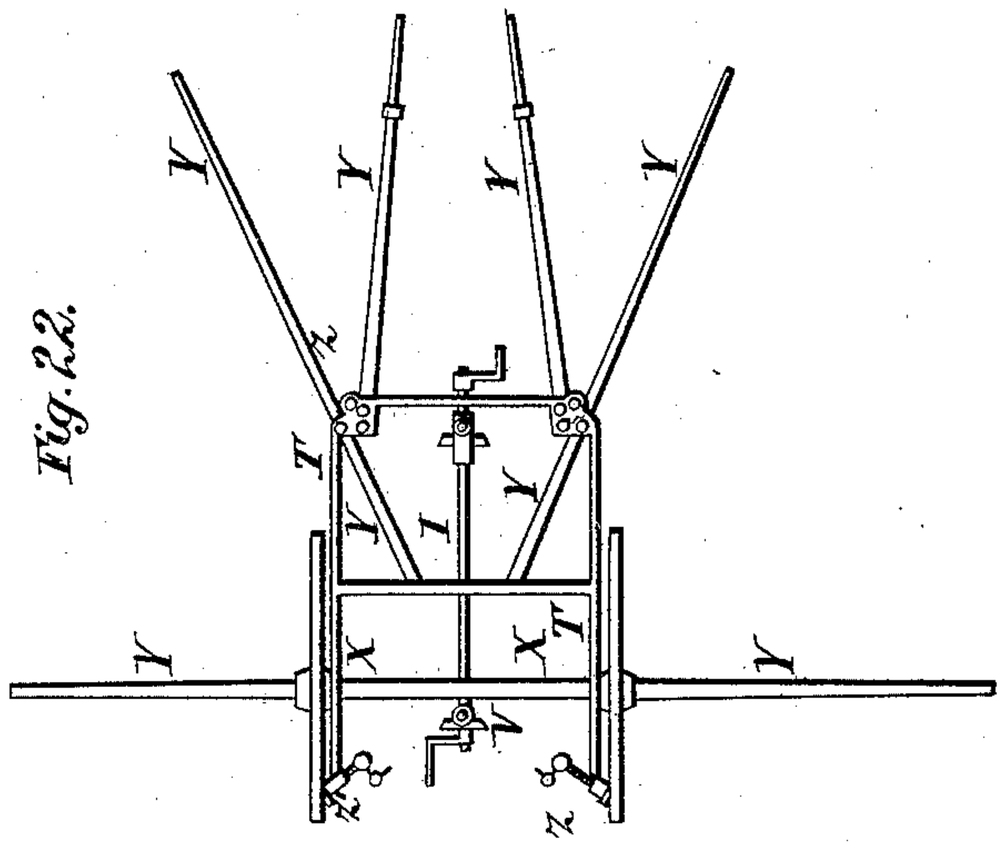


Fig. 21.

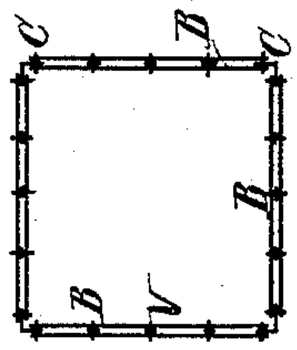
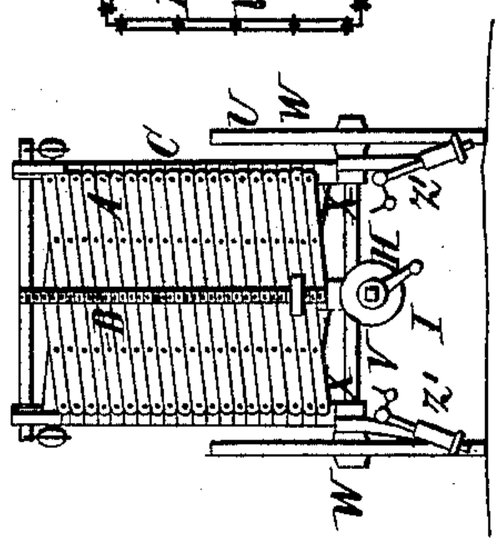


Fig. 20.



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G. EDWARDS.

EXPANDING APPARATUS FOR FIRE ESCAPES.

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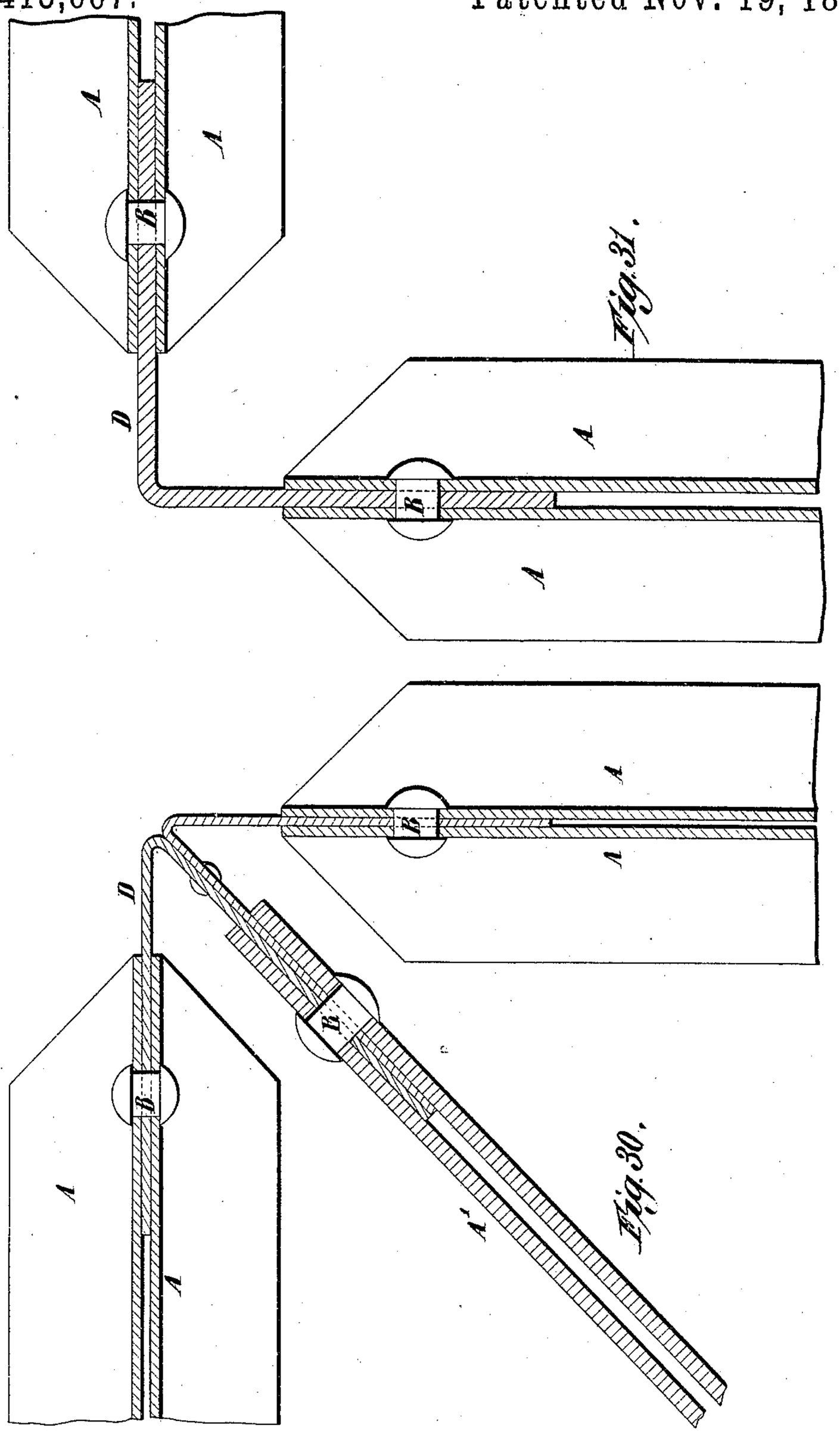

Fig. 31.

Fig. 30.

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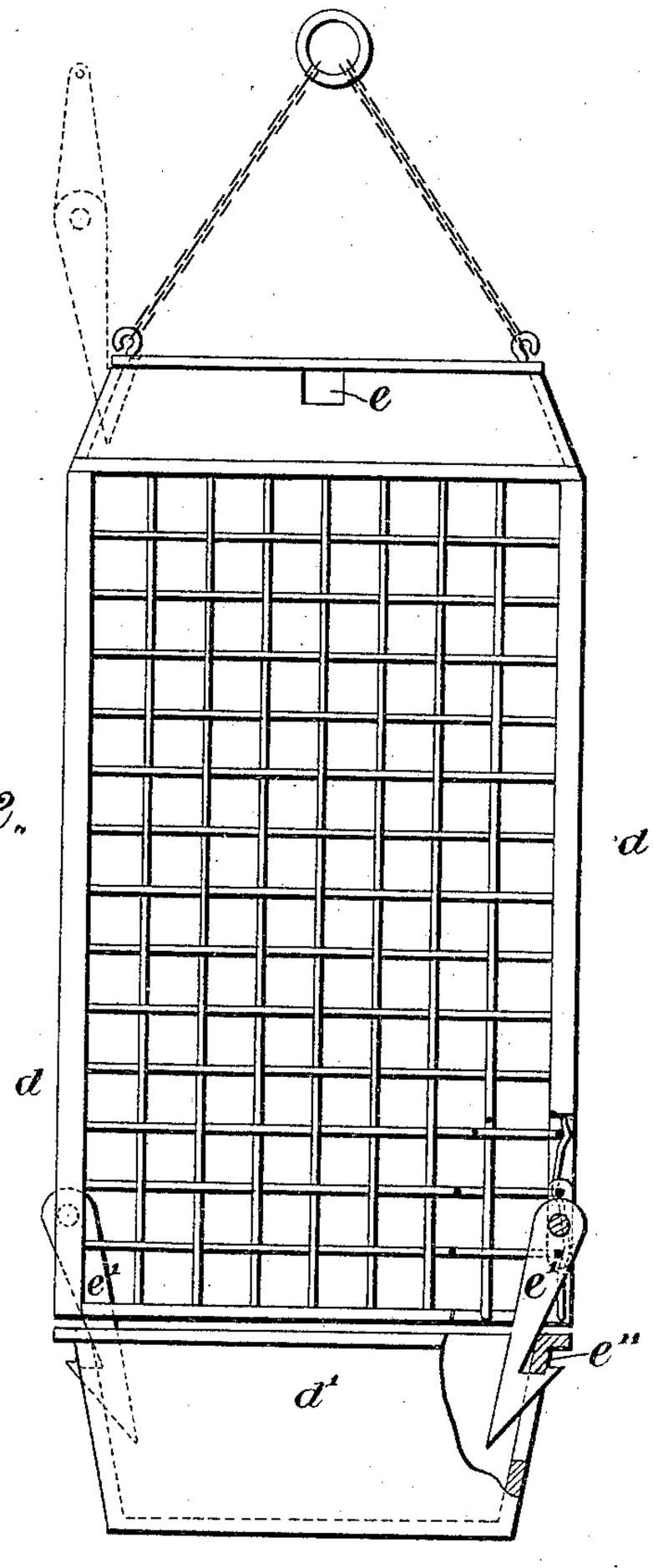

Fig. 32.

Witnesses
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UNITED STATES PATENT OFFICE.

GEORGE EDWARDS, OF THORNTON HEATH, ENGLAND.

EXPANDING APPARATUS FOR FIRE-ESCAPES.

SPECIFICATION forming part of Letters Patent No. 415,667, dated November 19, 1889.

Application filed June 14, 1888. Serial No. 277,058. (No model.) Patented in England December 21, 1885, No. 15,699, and June 11, 1887, No. 8,398.

To all whom it may concern:

Be it known that I, GEORGE EDWARDS, civil engineer, a subject of the Queen of Great Britain, and a resident of Thornton Heath, England, have invented new and useful Improvements in Expanding Apparatus Useful for Fire-Escapes, Scaffolding, Ladders, Observatories, Piers, Ponton and other Bridges, and the like, (for which I have obtained patents in Great Britain, No. 15,699, dated December 21, 1885, and No. 8,398, dated June 11, 1887,) of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to improvements in expanding and contracting apparatus made by combining a number of lattices or lazy-tongs in such a manner that the said apparatus will, both when expanded and contracted, have great rigidity. It also relates to devices for use in connection therewith to adapt the same for various purposes. These combined lattices and lazy-tongs are expanded, contracted, and retained by means of screws, ropes, chains, pneumatic or hydraulic apparatus, struts, sprags, levers, and other suitable means, separately or combined. They may be mounted on their own wheels, or on carriages, trestles, or platforms, with or without wheels, or may be used without such appendages.

Expanding and contracting apparatus as heretofore constructed of lattices or lazy-tongs are not rigid, and are consequently useless for the purposes herein mentioned. My invention, however, comprises a system of combining two or more lattices or lazy-tongs by uniting them at suitable angles by means of corner-plates or angle-pieces, hinges or eye-bolts, so arranged that while they retain the lattices fast to each other they allow them to expand and contract uniformly, whether the apparatus be parallel or taper.

My invention also comprises improved methods of and apparatus for expanding, contracting, or raising and lowering and sustaining the apparatus, and machinery for rendering the apparatus useful for the purposes herein mentioned. Two or more lattices thus united, forming in cross-section the letters L, V, T, H, a cross, a triangle, a square, a hexagon, or any suitable form, become rigid and capable of resisting lateral stresses and bearing weight to, at, or from a considerable height or distance, and such a combination of lattices or lazy-tongs is herein generally called a "tower," whether used in a vertical, inclined, or horizontal position.

Although my invention is applicable to towers of various shapes in cross-section, I will herein describe more particularly a square tower.

In the following description the term "lattice" is generally used to signify my expanding and contracting lattice or lazy-tongs provided with several slats extending parallel to and overlapping one another; "vertical," to signify vertical, or thereabout; "horizontal," to signify horizontal, or thereabout; "corner-plate," to signify any of my improved connectors for joining lattices together; "ropes," to signify ropes, chains, cords, bands, belts, or rods; "river," to signify any water.

In the accompanying drawings, Figure 1 is a side elevation of a composite expanding and contracting tower composed of lazy-tongs and lattices, showing various forms of expanders, stiffeners, and stays or trusses, hereinafter described. Fig. 2 is a plan of a gland-strap stiffener. Fig. 3 is a view, drawn to an enlarged scale, of a chain-tightener with lever-hook. Fig. 4 is a plan, and Fig. 5 a side elevation, of a tower with pneumatic or hydraulic tubular expanders and telescopic-screw expanders. Fig. 6 is a view of a hinged swivel-nut and collar or clip, hereinafter described. Figs. 7 and 8 are perspective views, and Figs. 9, 10, 11, and 12, horizontal sections illustrating various forms of my improved corner-plates or connectors, hereinafter described. Fig. 13 is a horizontal section showing an eyebolt connector, hereinafter described. Fig. 14 is a side elevation showing how the lattices are connected or united by the said corner-plates or connectors. Fig. 15 is a horizontal section showing a terminal corner-plate or connector, hereinafter described. Fig. 15ª is a diagram illustrating the manner of connecting two sections of an expanding and contracting structure by means

of the webbed corner-plates E. These corner-plates are attached by rivets or otherwise to the corners of the adjacent ends of the two sections and are rigidly united by bolts and nuts, as at y' in the drawings. When two corner-plates E are thus connected, they act like one long corner-plate and compel the two sections to expand and contract uniformly and simultaneously. Fig. 16 shows in transverse section three different forms of lattice bars or slats. Fig. 17 shows in plan a square tower with hydraulic or pneumatic expanders at the corners thereof. Fig. 18 is a side elevation of an improved tower bearing against an edifice, showing, also, a cage, a platform, expanding-screws, tilting and leveling legs, and a truss for stiffening the said tower. Fig. 19 is a side elevation of an improved tower fitted as a fireman's ladder. Fig. 20 is a rear elevation of the said tower, showing the same contracted or collapsed. Fig. 21 is a plan of the said tower. Fig. 22 is a plan of the carriage for the said tower, showing, also, parts of the gearing for expanding and contracting it. Fig. 23 is a detail view of a safety-hook for the said cage. Fig. 24 is a plan, and Fig. 25 a side elevation, of a trestle-carriage, hereinafter described, for supporting a tower for scaffolding and the like. Fig. 25ª shows an end elevation of the carriage shown in Figs. 24 and 25. When the frame T is raised and the chains J'' are removed, there is a clear passage through the said carriage, as shown. Fig. 26 is a side elevation showing part of a tower which is designed to be expanded by means of chain-gearing and screws. Fig. 27 is a side elevation of several towers combined in the form of a pyramid. Fig. 28 is a plan of an oblong tower. Fig. 29 is a detail view showing truss-stretchers, hereinafter referred to. Figs. 30 and 31 are enlarged detail sectional views of portions of the tower. Fig. 32 is an enlarged elevation of the cage.

The slats or strips A, forming the lattices or lazy-tongs may be made wholly of wood, or of wood partly, or wholly covered or combined with metal, or of other suitable material, and they may be of any convenient form. I prefer, however, generally, to make them of steel of either of the shapes shown in Fig. 13. The bar or slat A in this figure is, as will be seen, trough-shaped in transverse section. A' A'' show metal and wood combined. The two parts A'' may be galvanized together and the wood or other blocking and filling (if required) put in subsequently.

My expanding and contracting lattices or lazy-tongs are made by bolting, riveting, or otherwise suitably joining together any required number of these slats or bars A.

One feature of my invention consists in making the expanding and contracting apparatus of lattices, each slat or bar of which is connected or jointed to more than three slats or bars—that is to say, each slat or bar has more than three holes to receive joint-pins, so that the leverage is reduced, and the slats or bars can therefore be made lighter than when ordinary lazy-tongs are employed. These lattices form much better ladders than the ordinary lazy-tongs, the steps not being so high when the apparatus is expanded.

My improved expanding apparatus is made by combining two or more of such lattices or lazy-tongs at any suitable angle to each other and uniting them at the edges or corners of the structure in such a manner that while the lattices or lazy-tongs are free to expand and contract they are firmly held or retained at the proper angle to each other.

In apparatus of this kind as heretofore constructed lattices are not used, but ordinary lazy-tongs only, and these are usually secured at the center to frames placed within the structure, the said lazy-tongs not being connected at the corners, except through the said frames. In other cases two lazy-tongs are united parallel with each other by means of bars, like the rounds or rungs of a ladder. The said apparatus is therefore deficient in respect of rigidity, and has to be made of great weight. Moreover, the said frames and rungs do not expand and contract, and expanders must be applied at all sides of the apparatus and operated simultaneously. In my improved apparatus the lattices or lazy-tongs, or both combined, are united at the edges and become so uniformly connected that they can be expanded by a screw at one corner or side, and can be held expanded and rigid by a strut at one corner or side, if desired.

When two lattices are joined together by means of my improved corner-plates or connectors and rivets or bolts at an angle—thus L—they become rigid and not easily deflected when expanded, providing some part of the lattice be locked or prevented from moving upon the rivets or bolts. When three lattices are joined—thus U, or thus △—they become still more rigid and are useful for some purposes; but for general purposes I prefer to use four lattices or lazy-tongs connected, as shown in Figs. 4, 17, 21, or 28, the meshes of which form ladders both inside and outside of the tower, if required.

The composite expanding and contracting tower shown in Fig. 1 has its upper portion composed of four lazy-tongs, as at A, and its lower portion of four lattices, as at B, so as to obtain increased strength and rigidity in the lower part of the tower. This object I sometimes effect by making the slats of varying strength from top to bottom without augmenting its weight. The slats or bars at the lower part of a tower to be used vertically should be stronger that those at the upper part thereof.

Another feature of my said invention consists in forming man-holes C, Figs. 1, 18, and 19, in lattices whose meshes are not large enough to permit a man to pass through

them. These man-holes may, if desired, be made in the corners of a tower, and should be surrounded with stronger slats.

Figs. 7, 8, 9, 10, 11, 12, and 13 show rigid and hinged corner-plates or connectors D D′ for connecting or uniting the sides of a tower. These corner-plates are connected to the slats by rivets or bolts, as shown, so that the lattices or lazy-tongs are free to expand and contract. The eyebolt connector, Fig. 13, serves for connecting the edge of one lattice to the side of another lattice, (as, for instance, when they are joined in the form of a T,) as well as for joining lattices to a central tube, as shown in Fig. 6.

In Fig. 15, E is a terminal or webbed corner-plate or connector for connecting or joining towers or lengths or sections of towers together. These connectors are secured by rivets or bolts or otherwise to the ends of the towers or lengths and facilitate the junction of two towers or parts of towers by means of suitable bolts passed through the holes y in the webs x of the said connectors.

My said invention comprises various improved devices or apparatus for expanding and stiffening or sustaining the towers.

R R are ropes used as trusses for stiffening and strengthening towers when used in either a vertical or a horizontal position. R′ R′ are struts or stretchers of the truss. These trusses may be used on one or more sides of the tower, and the stretchers R′ are sometimes made to cross each other and form a girdle to embrace and retain the tower within the space R″ R″, Fig. 29, the said stretchers being fastened together by any suitable means. These stretchers may be attached to the tower before it is expanded, and will move toward the center as the expansion of the tower takes place. Provision is sometimes made for the automatic tightening and securing of the said stretchers around the tower when the latter is raised to the desired height.

F is a screw-link tightener, which may be either vertical or horizontal. One of these tighteners may, if desired, be used on each side of the tower.

F′ F′ are supports or guides for a chain or rope girdle G, with or without rollers, as required. A screw G′ is sometimes provided for tightening this girdle.

In Fig. 27 I have shown a chain girdle, as G^2, cords tied around the tower at G^3, and a leather strap buckled round the tower at G^4 for stiffening the tower.

In Figs. 1 and 3, F″ is a lever coupling-hook for joining and tightening chain and rope girdles, stiffeners, and trusses. By moving the lever F″, as indicated by the dotted line in Fig. 3, the chain G is tightened and may be kept so by means of the chain G″ or other suitable means.

In Fig. 1, w is a latch-stiffener arranged to lock automatically. This latch may be arranged vertically or horizontally. It is pivoted at w' and adapted to engage with a pin or stud at w^2.

H H′ are the screws for expanding the towers, which screws are usually rotated by means of a windlass or winch, with or without intermediate gearing. These screws and the tightening-screws F are held in improved clips I, Fig. 6, which are secured to the tower by rivets or nuts I′. The improved clip consists of a hinged nut or collar, by means of which the screws H H′ or F, Figs. 1, 5, 18, 19, 26, and 27, may be easily attached to and detached from their nuts and bearings I I*. These bearings and nuts are sometimes, however, made in one piece, or in two parts bolted together, like an ordinary plumber-block.

In some instances I provide for expanding the rear side of the tower more rapidly than the front thereof, so that it will be inclined toward a building in a cambered shape, by making the joints of the lattices or lazy-tongs on one side of shorter distance from each other than those on the other side; or I arrange the screws at the back only of the ladder and secure the front by means of a chain truss or otherwise; or I employ screws of different pitch, so that when the screws are operated the ladder will be inclined, as above described. In a similar manner I can make a cambered bridge.

In Figs. 4 and 5 are shown telescopic screw and tubular expanders.

H H′ show a telescopic screw. This screw may have any desired number of lengths or sections.

L is a telescopic tube, which may be placed in the center of the tower, as shown, and is guided at the top or other suitable parts with levers A′, arranged to expand and contract with the tower; or the tubes may be placed at or near one or more corners or sides of the tower.

When several screw-expanders are used on different sides of the tower, they are sometimes geared together, as shown in Figs. 18, 19, 20, and 22, where two screws act on opposite lattices by means of two sets of wheel-gearing H′ H^2. The gearing H′ slides on and is rotated by the square or feathered shaft I^2. In like manner four screws may be geared together at the four sides or corners of the tower. I sometimes use an endless chain J″, Figs. 24, 25, and 26, which, passing round or about chain-wheels J, will rotate the screws simultaneously. In the modification shown in Fig. 26 four screws H are placed at the corners and rotated by pulling the chain J″, or by turning one of the said screws. The slack chain should be taken up by a tightening-pulley or other suitable means.

The tower shown in Fig. 18 is provided at the top with a platform K, upon which a fireman or other person can stand, and which supports the pulleys for the different sets of tackle.

d, Fig. 18, is a cage arranged to be raised

and lowered inside the tower from below by means of a cord *c*, which passes over a pulley suspended at *b*, for the purpose of lowering persons or goods from burning buildings, or for similar purposes. The platform K is provided with a trap-door *a* and trap *a'* for passage to the cage or to the interior of the tower. The said cage is made with holes *e*, or with notches or shoulders, so that when raised to the top it may be caught and held by hooks *e'*, Fig. 23, attached to the platform K. Similar hooks are provided for securing the bottom part *d'* of the cage to the body thereof while permitting its disengagement therefrom when required, so that on arriving at the base of the tower the body of the cage may be unhooked and drawn from about its occupant or its contents. The notch *e''* in the said hook prevents the disengagement of the cage from the hooks, except when, if the cage is at the top, the rope *c* is tight enough to hold it up, and if the cage is at the bottom the rope *c* is slack enough for the cage to rest with its weight on the base; and in some cases the carriage T, Fig. 22, is made with an aperture for the cage to pass through to the ground. Cages may, if desired, be hung on or lowered with cord and pulley outside the tower, as shown at *f f'* in Figs. 1 and 18.

The tower shown in Figs. 18, 19, 20, and 22 is mounted on a skeleton carriage T, to one side of which the tower is attached at V. The corners of the tower are attached to bearings W, Fig. 20, which slide or roll upon the axle and support X as the tower is expanded or contracted by means of the windlasses, gearing, and screws. Sometimes the tower is fastened to the base or top, so as to contract toward the center instead of toward the side V, Fig. 22, being guided by bearings, as at W, Fig. 20, which slide in guides, or by guide-studs which slide in grooves.

Y Y are levers fitting in holes, with suitable catches arranged in the framing and hollow axles, Figs. 18 and 22, to serve as shafts and for steadying the tower. When out of use, these levers may be placed vertically, as shown at Y', Fig. 18.

Z Z, Figs. 18, 20, 22, and 27, are screw or ratchet legs with points and disks for steadying and plumbing the tower. The legs Z' supersede scotches when the apparatus is tilted.

When my improved apparatus is to be used where a foot-path or other passage must be left clear, I sometimes mount it on a trestle-carriage, Figs. 24, 25, and 25ª.

T is a frame to which the tower is fastened at V or otherwise in the center. This frame T, which forms the base of the tower, (not shown,) is raised to T' by means of four screws H, rotated by pulling the chain J'', or in any other convenient manner. The said chain can then be removed, thus leaving a clear passage through the carriage beneath the frame T and the tower thereon.

Fig. 28 shows in plan how two lazy-tongs A and two lattices B may be united by means of my improved corner-plates at D to form a tower which is oblong in transverse section. This form of tower is mostly useful for bridges and for ladders whose width must be limited.

My improved expanding apparatus, adapted for use in vertical, leaning, or inclined and horizontal positions, is obviously useful as a fire-escape, fireman's ladder, salvage-ladder, ladder for pruning or lopping trees, for gathering fruit, and for general purposes, as a military and general observatory, signaling-station, surveyor's, photographer's, artist's, or signal-station, as a scaffolding, post, girder, ponton or other bridge, bridge-pier, landing, or embarking-stage, life and other boat launching apparatus, expanding substitute for swing-bridges, boating or fishing pier, and also for many other purposes.

The size, proportions, strength, and material of the various parts of these apparatuses may be varied to suit special or general uses.

When two or more lengths of tower are intended to be joined together, the ends may be joined by bolting them together through the ordinary holes of slats and corner-plates, and I sometimes provide the ends intended to be joined with webbed corner-plates, as above described. This arrangement serves for fastening together two lengths of a square tower with four bolts only.

The towers may be pulled open while horizontal and used as ladders without other appendages than those for locking and stiffening them.

Guy-ropes, chains, wires, and rods may be used, when required, to steady, remove, and adjust the apparatus.

What I claim is—

1. In an expanding and contracting structure of the character hereinbefore described, trough-shaped or channeled slats or lattice-bars, substantially as and for the purpose specified.

2. In an expanding and contracting structure of the character hereinbefore described, webbed corner-plates or terminal connectors E, for coupling or connecting lengths or sections of the said structure, substantially as and for the purposes set forth.

3. In an expanding and contracting structure of the character hereinbefore described, a lattice formed with man-holes C, surrounded by slats or bars of increased strength as compared with those forming the other parts of the lattice, substantially as and for the purposes set forth.

4. In an expanding and contracting structure of rectangular form, and composed of lazy-tongs united at their corners or edges by means of angle-plates, the combination, with a screw H for expanding said structure, of the bearing I* and the nut I, substantially as and for the purpose described.

5. The combination, with an expanding and contracting structure of the character hereinbefore described, composed of lazy-tongs having their corners connected by angle-

plates, of rope or chain trusses or struts, substantially as and for the purposes set forth.

6. In combination with an expanding and contracting structure of the character hereinbefore described, a skeleton carriage provided with steadying and tilting bars and with leveling and tilting legs and feet, substantially as and for the purposes set forth.

7. In combination with an expanding and contracting structure of the character hereinbefore described, a skeleton carriage provided with a movable frame, and means, substantially as described, for raising said frame and holding it up, so as to leave a clear passage through said carriage, for the purpose specified.

8. In combination with an expanding and contracting structure of the character hereinbefore described, a cage, basket, or box *d*, arranged to be raised and lowered within the same, and provided with a detachable or removable bottom *d'*, secured thereto by safety-hooks *e'*, and a similar safety-hook pivoted to the structure to hold up the said cage, basket, or box, all substantially as and for the purposes set forth.

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

GEORGE EDWARDS.

Witnesses:
DAVID YOUNG,
ARTHUR TRACY.