No. 722,848. PATENTED MAR. 17, 1903.

J. KAISER.

AERIAL APPARATUS.

APPLICATION FILED NOV. 15, 1901.

NO MODEL. 3 SHEETS—SHEET 1.

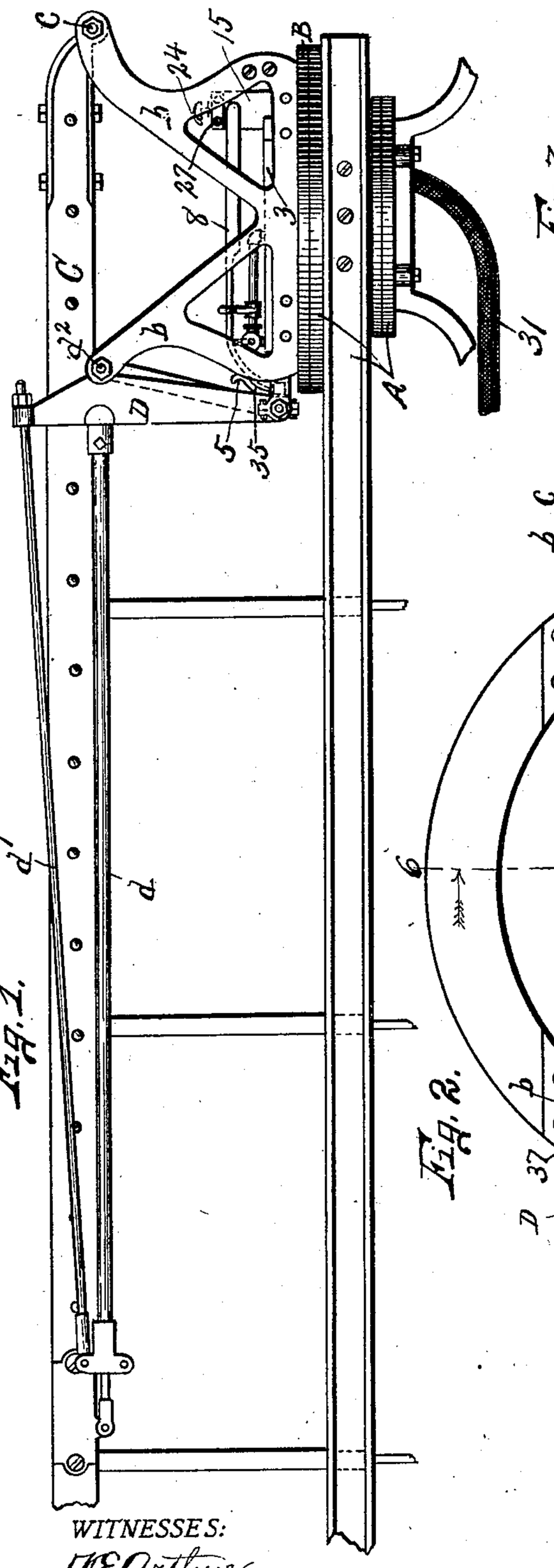

Fig. 1.

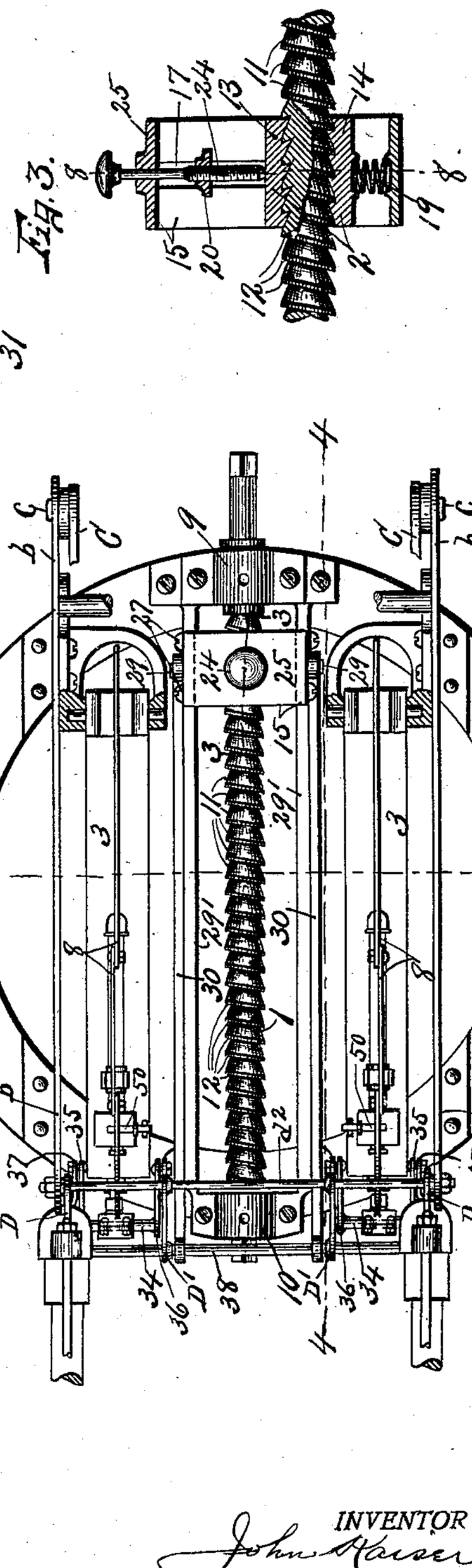

Fig. 2.

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 4.

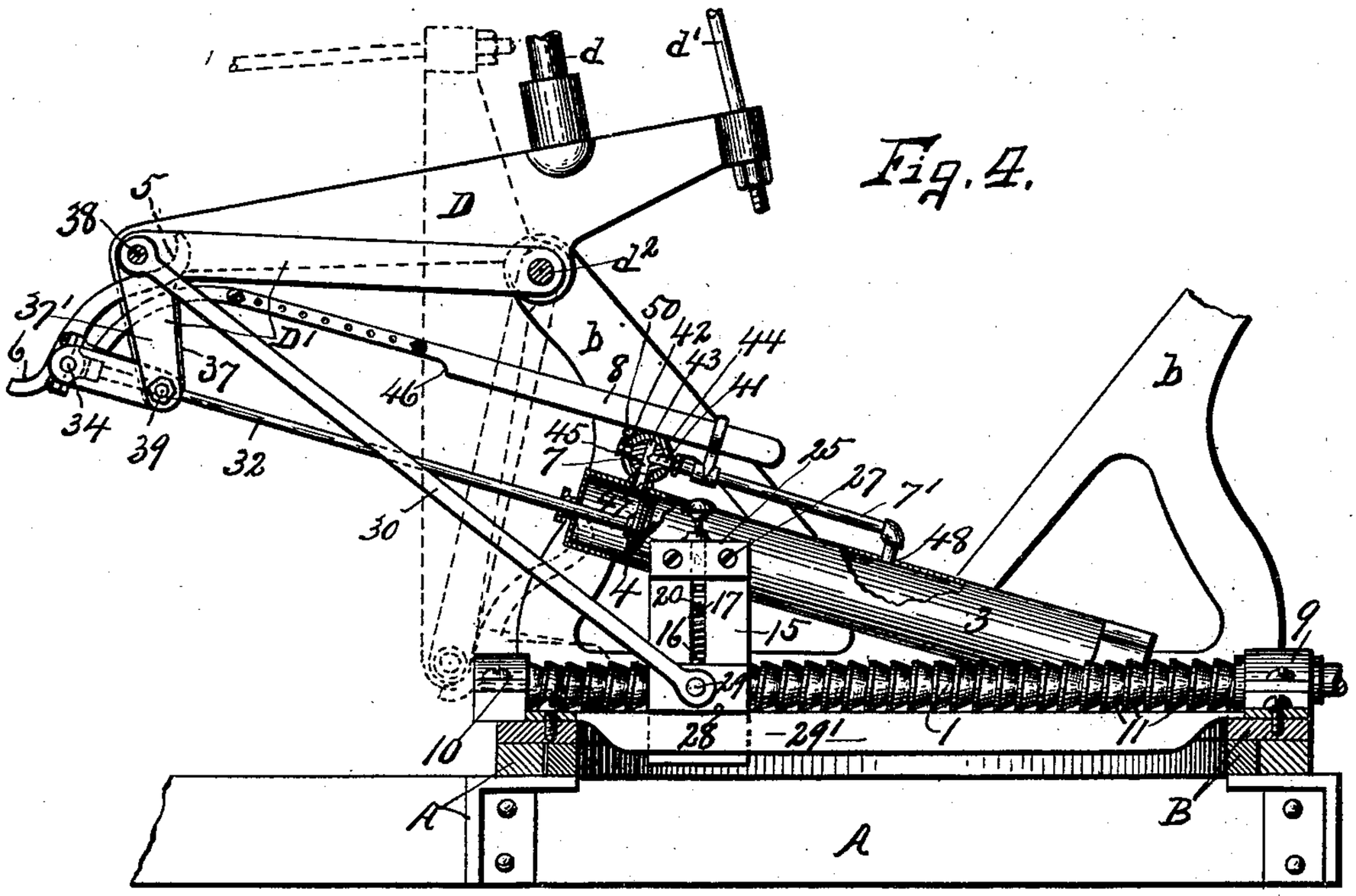
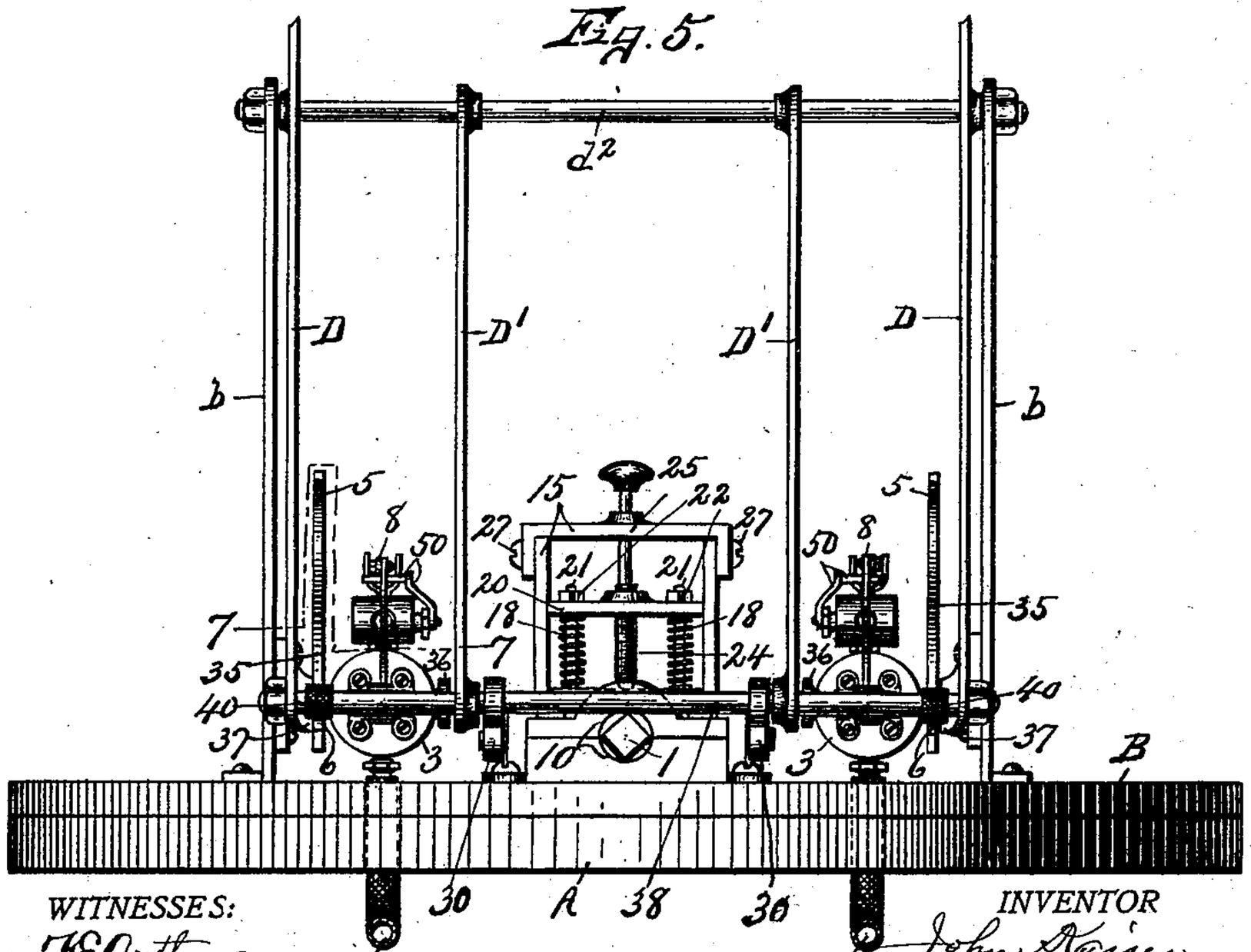


Fig. 5.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 6.

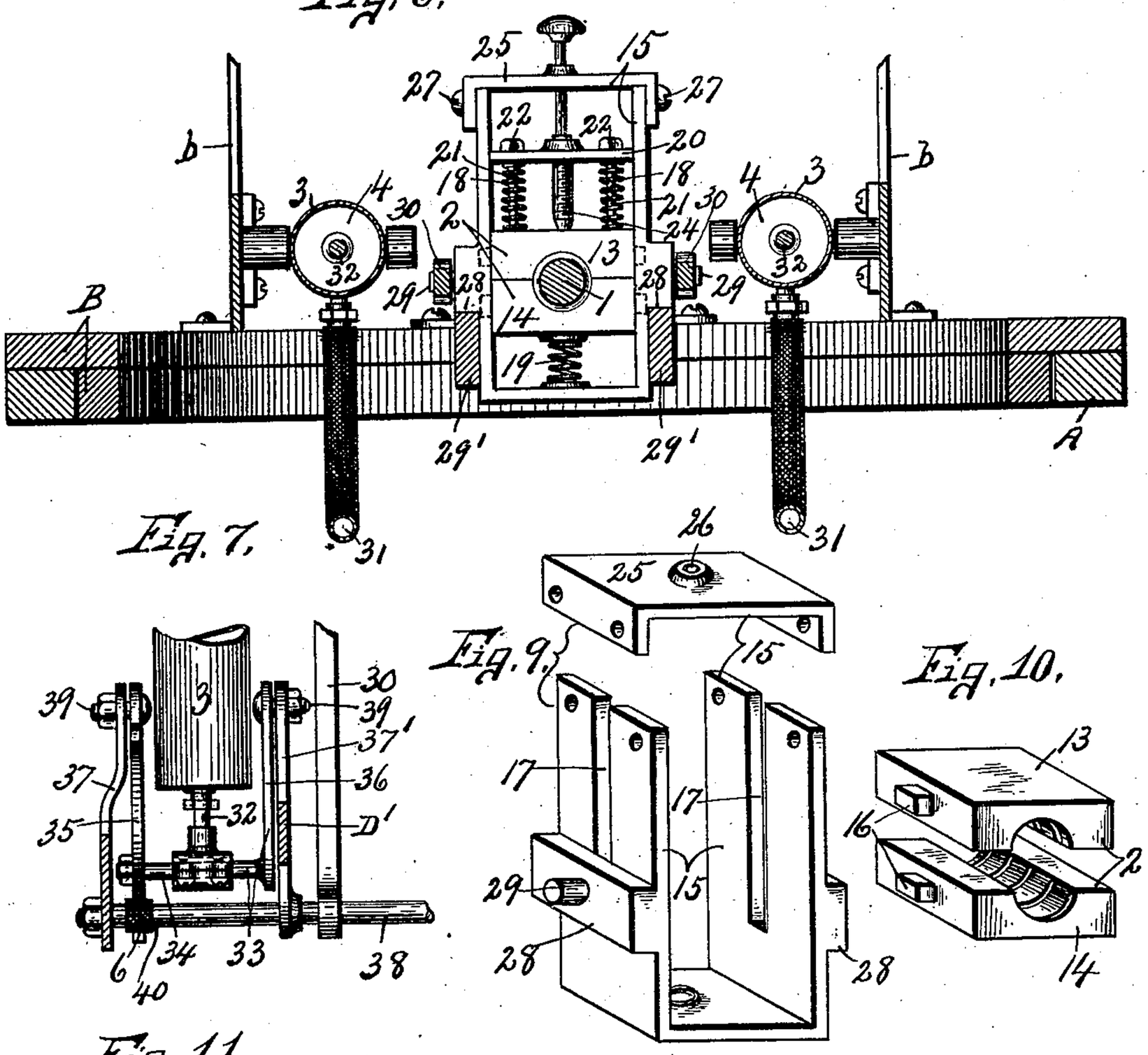


Fig. 7.

Fig. 9.

Fig. 10.

Fig. 11.

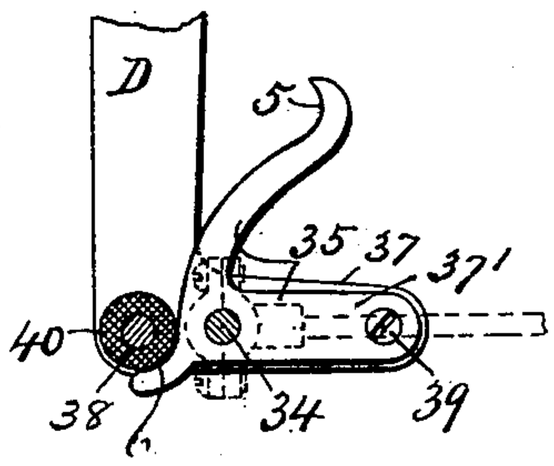


Fig. 18.

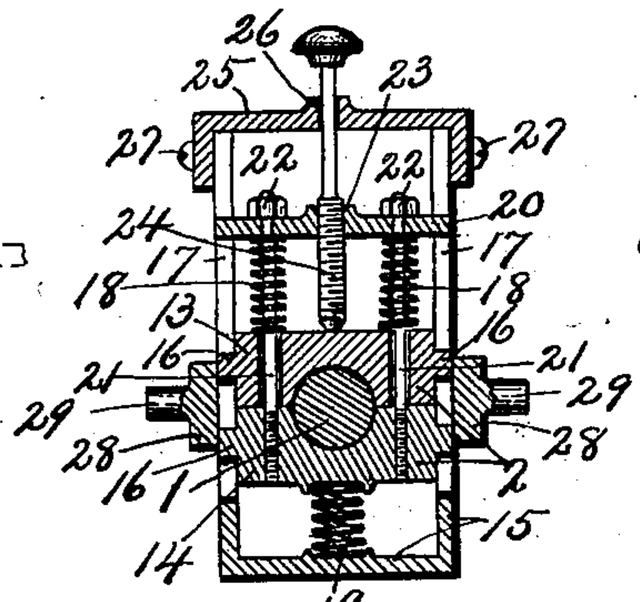
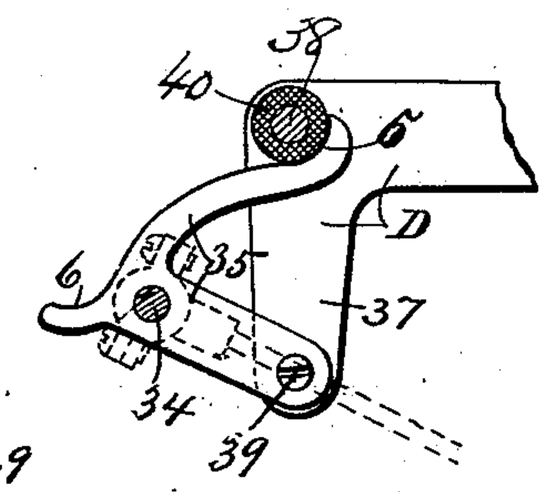


Fig. 12.



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UNITED STATES PATENT OFFICE.

JOHN KAISER, OF SENECA FALLS, NEW YORK.

AERIAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 722,848, dated March 17, 1903.

Application filed November 15, 1901. Serial No. 82,379. (No model.)

To all whom it may concern:

Be it known that I, JOHN KAISER, of Seneca Falls, in the county of Seneca, in the State of New York, have invented new and useful Improvements in Aerial Apparatus, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to improvements in aerial apparatus, having more particular reference to hook-and-ladder trucks or apparatus in which a ladder, water-tower, fire-escape, or other device is elevated from substantially a horizontal position; and it consists in certain improvements upon the device shown and described in my former patent, No. 645,645.

The object of this invention is to provide simple and practical means whereby an aerial apparatus may be automatically and more speedily elevated from a substantially horizontal position to any desired angle without any or at least very little manual exertion on the part of the attendant.

Another object is to so construct and arrange the parts of the lifting mechanism that the ladder or other aerial device will be automatically locked in its elevated position.

A further object is to provide means for limiting the upward and return movement of the apparatus, and a still further object is to provide means coöperating with the piston for producing a cushion of compressed air in the piston-chamber in advance of the outwardly-moving piston when in the act of elevating an aerial device to the limit of its upward movement.

To this end the invention consists in the combination, construction, and arrangement of the parts of an aerial apparatus and its lifting mechanism, as hereinafter fully described, and pointed out in the claims.

Referring to the drawings, Figure 1 is a side elevation of a portion of a truck and ladder, showing the application of the various features of my invention attached thereto, the ladder being shown in its normal or horizontal position. Fig. 2 is an enlarged top plan view, partly in section, of the right-hand end of the mechanism seen in Fig. 1. Figs. 3 and 4 are sectional views taken, respectively, on lines 3 3 and 4 4, Fig. 2, the lifting mechanism being shown in its operative position in Fig. 4 for elevating the ladder. Fig. 5 is an end elevation of the parts seen in Fig. 2. Figs. 6, 7, and 8 are sectional views taken on lines 6 6, Fig. 2, 7 7, Fig. 5, and 8 8, Fig. 3. Fig. 9 is a perspective view of the parts of the sliding head or nut supporting frame. Fig. 10 is a perspective view of the nut-sections or threaded jaws. Figs. 11 and 12 are detail views showing the operation of the stops upon the rock-arm when the ladder is in its extreme horizontal and elevated positions.

Similar reference characters indicate corresponding parts in all the views.

In the drawings I have shown a portion of a hook-and-ladder apparatus, in which—

A represents the frame of the truck; B, a turn-table or revolving carriage mounted upon one end of the truck and provided with upright standards *b*.

C is a ladder pivotally connected at one end at *c* to the front standards *b*, and D is a rock-arm pivotally connected to the rear standards *b* and provided with connecting rods or bars *d* and *d'*, the rod or bar *d* being formed of sections adapted to telescope or slide one upon the other, one of the sections being secured to the rock-arm D, and the other section is pivotally connected to the intermediate portion of the ladder C. The rod or bar *d'* is also connected at one end to the rock-arm D, and its other end is connected to the outer end of the section of the bar *d* which is secured to the rock-arm D.

My invention consists, broadly, first, in providing manually-operated means, as a screw 1 and nut 2, for rocking the arm D, and thereby raising and lowering the ladder C; second, in providing pneumatic means, as cylinders 3 and pistons 4, movable in said cylinders and having their piston-rods connected to the rock-arm D, also for the purpose of elevating the ladder C, the pneumatic and manually operated lifting mechanisms being adapted to operate jointly or independently of each other. A third feature of my invention consists in providing suitable stop members 5 and 6 for limiting the upward-and-downward movement of the rock-arm D, and a fourth feature of invention consists in providing suitable mechanism controlled by the piston

or one of the parts actuated thereby for introducing compressed air into the cylinder in advance of the outwardly-moving piston for forming an air-cushion, and consists, as seen in Figs. 4 and 5, of a valve 7 and an operating member 8.

The screw 1 and nut 2 are of special construction for permitting the nut to be moved in one direction along the screw independently of the rotation of the screw and at the same time to automatically interlock with each other to hold the aerial device in its elevated position.

As seen in the drawings, and particularly in Figs. 2, 3, and 4, the screw 1 is journaled at its front and rear ends in suitable bearings 9 and 10, mounted upon the revoluble carriage B, and its intermediate portion is threaded to engage the nut 2, the forward end faces 11 of said threads being substantially conical for permitting the nut 2 to move rearwardly freely and with but little resistance when it is desired to elevate the ladder C by means of compressed air acting upon the piston 4. The rear end faces 12 of said threads are usually abrupt and preferably incline inwardly and forwardly for the purpose of more positively interlocking with the threads of the nut, or rather with the sections of the nut, for holding said nut and the rock-arm D, connected thereto, from return movement when the ladder is elevated to the desired position. In order to permit this sliding movement of the nut lengthwise of the screw, as in the act of raising the ladder by compressed air acting upon the piston 4, the nut is preferably formed in sections 13 and 14, each of which is threaded on its inner surface to engage the screw and are yieldingly mounted in a sliding head 15, being provided with lugs or projections 16, which are guided in vertical slots 17 in the opposite walls of the head or frame 15. These sections are yieldingly held in engagement with the screw 1 by suitable springs 18 and 19, the springs 18 being interposed between a suitable bar or plate 20 and the upper face of the section 13, and the spring 19 is interposed between the lower wall of the head 15 and the lower surface of the jaw or section 14. The lower jaw 14 and the plate 20 are connected to each other by tie-rods 21, having their lower ends preferably threaded and engaged with threaded apertures in the sections 14, and the upper ends are passed through apertures in the plates 20 and provided with suitable adjusting-nuts 22, which are adapted to draw said jaw and plate 20 together and serve also to adjust the tension of the springs 18, which preferably encircle the tie-rods 21. The jaw 13 is free to move vertically against the action of the springs 18, being provided with apertures which receive the tie-rods 21 and serve to additionally guide the jaw 13 in its vertical movement and to relieve the strain upon the lugs or projections 16. It is sometimes desired to lock these jaws firmly together to form a substantially integral nut, and I therefore provide the plate 20 with a central threaded aperture 23, which receives an adjusting-screw 24, the upper end of which is provided with a suitable handpiece by which the screw is rotated into engagement with the upper face of the jaw 13, it being evident that owing to the fact that the plate 20 and lower jaw 14 are locked to each other by the tie-rods 21 as soon as the adjusting-screw 24 engages the upper face of the upper jaw 13 to force the same downwardly the lower jaw is simultaneously drawn upwardly, thus forming a substantially solid nut.

The construction and arrangement of the clamping-jaws and adjusting-screws just described permit the nut and screw to be employed to raise and lower the aerial device independently of the pneumatic means previously mentioned.

The frame 15 is preferably open at both ends to receive the screw 1 and is provided with a removable upper wall 25, having an aperture 26, which receives the stem of the adjusting-screw 24 and guides the same in its vertical movement. The vertical slots or guideways 17 in the opposite walls of the sliding head or frame 15 preferably extend to the upper ends of said side walls for permitting the insertion or removal of the jaws 13 and 14 and plate 20, the upper removable wall serving to close the open ends of the slots or guideways 17 and is held in position by suitable fastening means, as screws 27. This sliding head or frame 15 is provided with lateral projections 28, having trunnions 29, the projections 28 being adapted to rest upon suitable tracks or rails 29′, also supported upon the revolving carriage B, and the trunnions 29 are arranged to receive corresponding ends of links 30, which are connected in the manner hereinafter described to rock the arm D for raising and lowering the ladder by means of the screw 1 and nut 2.

The pneumatic means for raising and lowering the ladder C consists of the cylinders 3, means for conducting compressed air to one end of the cylinders, and a piston 4, adapted to be actuated by the compressed air and connected to operate the rock-arm D.

Any desired means (not illustrated) may be employed for compressing and storing the compressed air which is conducted to the cylinders 3 by suitable conduits 31, the passage of air through said conduits and to the cylinders being controlled by any well-known valve or equivalent device. (Not necessary to herein illustrate or describe.)

The connection between the piston 4 and the rocking lever D consists of the piston-rod 32 and a yoke 33, Fig. 4, said yoke being provided with a wrist-pin 34 and rearwardly-extending links 35 and 36. The outer end of the piston-rod 32 is journaled on the wrist-pin 34, and the rear ends of the links 35 are pivoted to arms 37, projecting laterally from the rock-arms D and preferably formed inte-

gral therewith. The rear ends of the links or arms 36 of the yoke 33 are pivoted to additional rock-arms D′, which are similar in construction to the arm D, being pivotally mounted at one end upon the pivotal shaft or pin d^2 of the arm D. These rock-arms D and D′ are preferably arranged in pairs, one on each side of the corresponding cylinder 3, and it is evident from the foregoing description that as the piston is forced outwardly by means of the compressed air admitted to the cylinder 3 the arms D and D′ are rocked upon the shaft d^2, and thereby elevates the ladder C. As previously stated, the arm D′ is similar to the arm D, being mounted upon the same pivotal pin or shaft d^2 and provided with a lateral extension or arm 37′, formed integral therewith, and the shaft d^2 forms a support common to each pair of arms D and D′. The lower ends of the arms D and D′ of each pair are connected by a rod or bar 38, to which the outer ends of the links 30 are secured, thereby connecting the sliding head 15 to the rock-arms D and D′.

The arms 35 and 36 of the yoke 33 are, as previously stated, pivoted at 39 to the rock-arms D and D′, the axes of said pivotal connection being substantially coincident, and the arm 35 of each yoke is provided with suitable stop-shoulders 5 and 6, the shoulder 5 being arranged to engage the bar or rod 38, or rather a buffer 40, provided thereon, as the ladder is elevated for limiting its upward movement, and the shoulder 6 is arranged to engage said rod or bar 38 or the buffer 40 thereon when the ladder is returned to its normal position for limiting its downward movement and holding the same in substantially a horizontal position.

The means for forming a cushion of compressed air within the cylinder 3 in advance of the outwardly-removable piston 4 consists of the rotary valve 7, an arm 8, and a conduit 7′, having one end connected to the intermediate portion of the piston-chamber and its other end communicating with the valve-chamber. This valve-chamber is provided with an inlet-opening 41 and an outlet-opening 42, and the valve 7 is provided with suitable passages 43, 44, and 45, Fig. 4, the passages 43 and 45 being normally registered with the inlet and outlet openings 41 and 42 when the ladder is in its normal or horizontal position. The arm 8 is provided with a shoulder 46, which is so arranged relatively to the point of connection between the conduit 7′ and the piston-chamber as to rock the valve 7 to the position seen in Fig. 4, in which the passages 44 and 45 are registered with the inlet-passage 41 and a passage 47 in the cylinder 3 in proximity to its outer end after the piston 4 has passed the inlet-opening 48 of the conduit 7′ in its outward movement, the valve 7 being provided with an arm 50, projecting into the path of the shoulder 46. This valve-operating member 8 is preferably formed of sections, the one provided with the shoulder 46 being adjustable longitudinally upon the other section for varying the time of operating the valve 7 to admit the compressed air from the rear of the piston to a point in advance of the piston relative to the movement of said piston.

It is apparent from the foregoing description that when the valve is rocked by the shoulder 46 to register the passages 44 and 45, respectively, with the inlet-passages 41 and 47 the escape of the air through the outlet-opening 42 is cut off and that during the outward movement of the piston previous to the operation of the valve the passages 43 and 45 are registered with the inlet and outlet openings 41 and 42 and forms a suitable vent for the air in advance of the outwardly-moving piston.

In the operation of my invention, assuming that the ladder is in its normal horizontal position and it is desired to elevate the same quickly, the adjusting-screw 24 being in such position as to permit a free vertical movement of the jaws or nut-sections 13 and 14, the compressed air is then admitted to one of the cylinders from suitable storage-reservoirs, (not shown,) which compressed air forces the pistons outwardly, and thereby raises the free end of the ladder to any desired angle controlled by a suitable valve in the air-supply conduits. This movement of the piston acting upon the rock-arm D draws the head and yielding jaws 13 and 14 along the screw 1, the conical or inclined faces 11 of the screw facilitating this outward sliding movement of the jaws or nut-sections. When the ladder has been raised to the desired position, the springs 18 and 19 act instantly to force the jaws 13 and 14 in position for holding the ladder in its raised position, and the abrupt faces 12 of the screw form a positive lock for preventing any retrograde movement of the jaws and ladder connected thereto. Should the ladder be elevated to the limit of its upward movement, the buffers engage the stops 5 and prevent the movement of the ladder beyond a vertical movement. During the outward movement of the piston to the inlet-opening 48 of the conduit 7′ the passages 43 and 45 of the valve 7 are registered, respectively, with the inlet and outlet openings 41 and 42 of the valve-chamber to relieve the air-pressure in advance of the piston, and when the piston passes the inlet 48 or any predetermined time thereafter regulated by the adjustment of the arm 8 the shoulder 46 rocks the valve 7 to register the passages 44 and 45 with the passages 41 and 47 to cut off the vent and to admit compressed air from the rear to a point in advance of the piston. In returning the ladder to its normal position the compressed air is shut off wholly or partially, and the screw 1 is then rotated by any suitable hand-piece attached thereto to lower the ladder which automatically returns the piston and other parts connected thereto to their normal positions. When it is desired to raise and

lower the ladder by means of the screw 1, the adjusting-screw 24 is adjusted to engage the nut-section 13, which locks both nut-sections from any yielding movement, and the screw is then rotated in reverse directions in the usual manner.

The operation of my invention will now be readily understood upon reference to the foregoing description and the accompanying drawings, and it will be noted that some change may be made in many details without departing from the spirit of this invention.

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

1. The combination with an aerial apparatus and its support, a rotary screw, and a jaw connected to the aerial apparatus and having independent movement lengthwise and into and out of engagement with the screw for permitting the apparatus to be raised and lowered by or independently of the screw.

2. A lifting device for aerial apparatus comprising a support, a rotary screw, a sliding head connected to the apparatus and movable lengthwise of the screw independently thereof, and means mounted on the head and movable into and out of engagement with the screw for the purpose described.

3. A lifting device for aerial apparatus comprising a support, a rotary screw, a sliding head connected to the apparatus and movable lengthwise of the screw independently thereof, and a threaded jaw carried by the head and movable into and out of engagement with the screw for the purpose specified.

4. The combination with an aerial apparatus and a support carrying a rotary screw and parallel ways, of a sliding head guided on the ways and connected to the apparatus for the purpose described, and clamping-jaws carried by the head and movable into and out of engagement with the screw.

5. The combination with a support and an aerial apparatus mounted thereon, of a rotary screw, a sliding head movable lengthwise of the screw and connected to the apparatus for moving the same, and jaws carried by the head and movable into and out of engagement with the screw.

6. The combination with a support and an aerial apparatus mounted thereon, of a rotary screw, a sliding head movable lengthwise and independently of the screw and provided with an opening receiving the screw, said head being connected to the apparatus for transmitting motion thereto, and a jaw carried by the head and movable into and out of engagement with the screw for the purpose specified.

7. The combination with a support and an aerial apparatus mounted thereon, of a rotary screw, a sliding head movable lengthwise and independently of the screw and provided with an opening receiving the screw, said head being connected to the apparatus for transmitting motion thereto, and opposite threaded jaws carried by the head and movable into and out of engagement with the opposite faces of the screw for the purpose described.

8. A lifting device for aerial apparatus comprising a support, a rotary screw, and a sliding head connected to the apparatus and movable lengthwise of the screw independently thereof, a movable threaded jaw carried by the head, and means also carried by the head for forcing said jaw into and out of engagement with the screw.

9. The combination with an aerial apparatus and a support carrying a rotary screw and parallel ways, of a sliding head guided on the ways and connected to the apparatus for the purpose described, clamping-jaws carried by the head, and means for simultaneously forcing the jaws into engagement with the screw.

10. The combination with a rock-arm to elevate an aerial apparatus, a screw, a sectional nut engaging the screw, and means connecting the nut to the rock-arm for the purpose set forth.

11. In combination with an aerial apparatus supported at one end, a rock-arm connected to raise and lower the other end, and a screw having a sectional nut connected to rock the arm for the purpose described.

12. An aerial apparatus supported at one end, a screw, a sectional nut for the screw having one of its sections movable relatively to the other, and means connecting the nut to the free end of the apparatus to raise and lower the same as the screw is rotated.

13. An aerial apparatus supported at one end in combination with a rock-arm connected to raise and lower the apparatus, a screw, a sliding head having yielding threaded jaws engaged with the screw, said head being connected to actuate the rock-arm.

14. An aerial apparatus supported at one end, a screw having a nut composed of sections one being movable relatively to the other, and a head actuated lengthwise of the screw by the nut and connected to raise and lower the other end of the apparatus.

15. In combination with an aerial apparatus a lifting mechanism comprising a screw and a sectional nut, the screw having corresponding faces of its thread inclined and terminating in abrupt shoulders.

16. In combination with an aerial apparatus a lifting mechanism comprising a screw and a sectional nut, the screw-thread being undercut at one end for the purpose set forth.

17. In combination with an aerial apparatus a lifting mechanism for aerial apparatus comprising a frame carrying a nut consisting of separable jaws, and a screw having its threads inclined at one end and abrupt at the other end to permit the nut to be moved endwise in one direction and to prevent its movement in the other direction without rotating the screw.

18. In combination with an aerial apparatus supported at one end, a rock-arm connect-

ed to raise and lower the apparatus, a sliding frame connected to the rock-arm, a nut consisting of separable jaws mounted on the frame, and a screw engaged with the nut for the purpose described.

19. In combination with an aerial apparatus supported at one end, a rock-arm connected to raise and lower the apparatus, a sliding frame connected to the rock-arm, a nut consisting of separable jaws mounted on the frame, and a screw engaged with the nut, and means to lock the jaws in operative position to form a substantially solid nut.

20. The combination with an aerial apparatus and its support, a cylinder having one end adapted to receive compressed air, a piston in the cylinder actuated outwardly by the compressed air, and means controlled by the piston for admitting compressed air in the cylinder in advance of the outwardly-moving piston for the purpose described.

21. The combination with an aerial apparatus and its support, a cylinder having one end adapted to receive compressed air, a piston in the cylinder actuated outwardly by the compressed air, a conduit connecting the intermediate portion of the piston-chamber with the outer end of the cylinder for admitting air to the piston-chamber in advance of the outwardly-moving piston, a valve in said conduit for controlling the inlet of compressed air into said cylinder in advance of the piston, and means actuated by the piston for opening said valve after the piston passes the intermediate connection of the conduit with the cylinder during the outward stroke of the piston.

22. The combination with an aerial apparatus and its support, a cylinder having one end adapted to receive compressed air, a piston in the cylinder actuated outwardly by the compressed air, a conduit connecting the intermediate portion of the piston-chamber with the other end of the cylinder for admitting air to the piston-chamber in advance of the outwardly-moving piston, a valve in said conduit for controlling the inlet of compressed air into said cylinder in advance of the piston, said valve being provided with a vent normally communicating with the atmosphere and with the conduit and free end of the piston-chamber, and means actuated by the piston for moving said valve as the piston is moved outwardly, whereby the vent-openings are registered respectively with the conduit and the outer end opening of the piston-chamber for the purpose described.

In witness whereof I have hereunto set my hand this 3d day of September, 1901.

JOHN KAISER.

Witnesses:
H. E. CHASE,
HOWARD P. DENISON.