No. 680,353. Patented Aug. 13, 1901.

W. A. PENTECOST.

ELEVATOR MECHANISM.

(Application filed Mar. 6, 1901.)

(No Model.) 2 Sheets—Sheet 1.

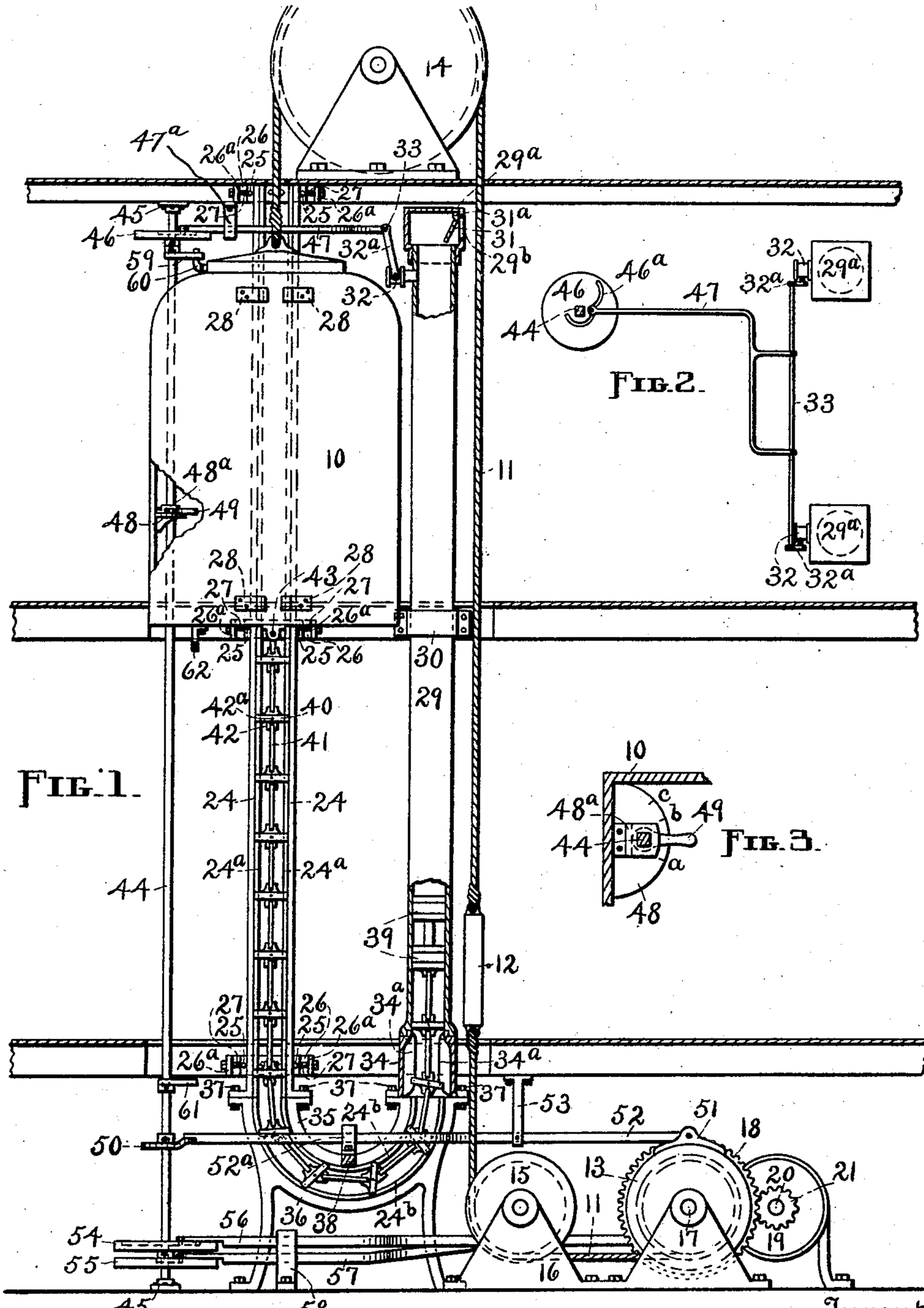

FIG. 1.

FIG. 2.

FIG. 3.

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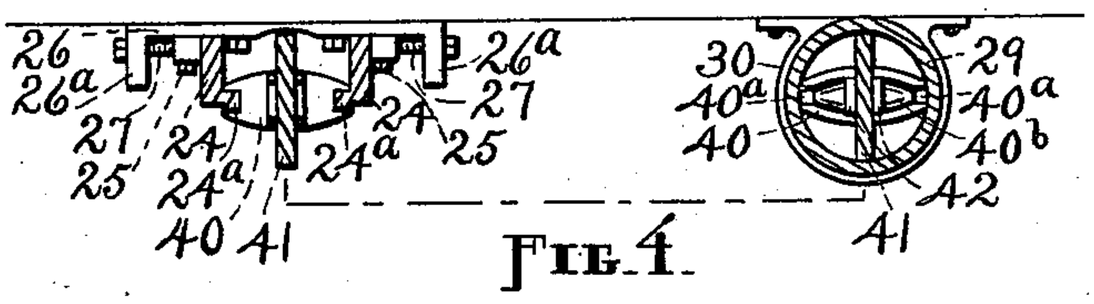


FIG. 4.

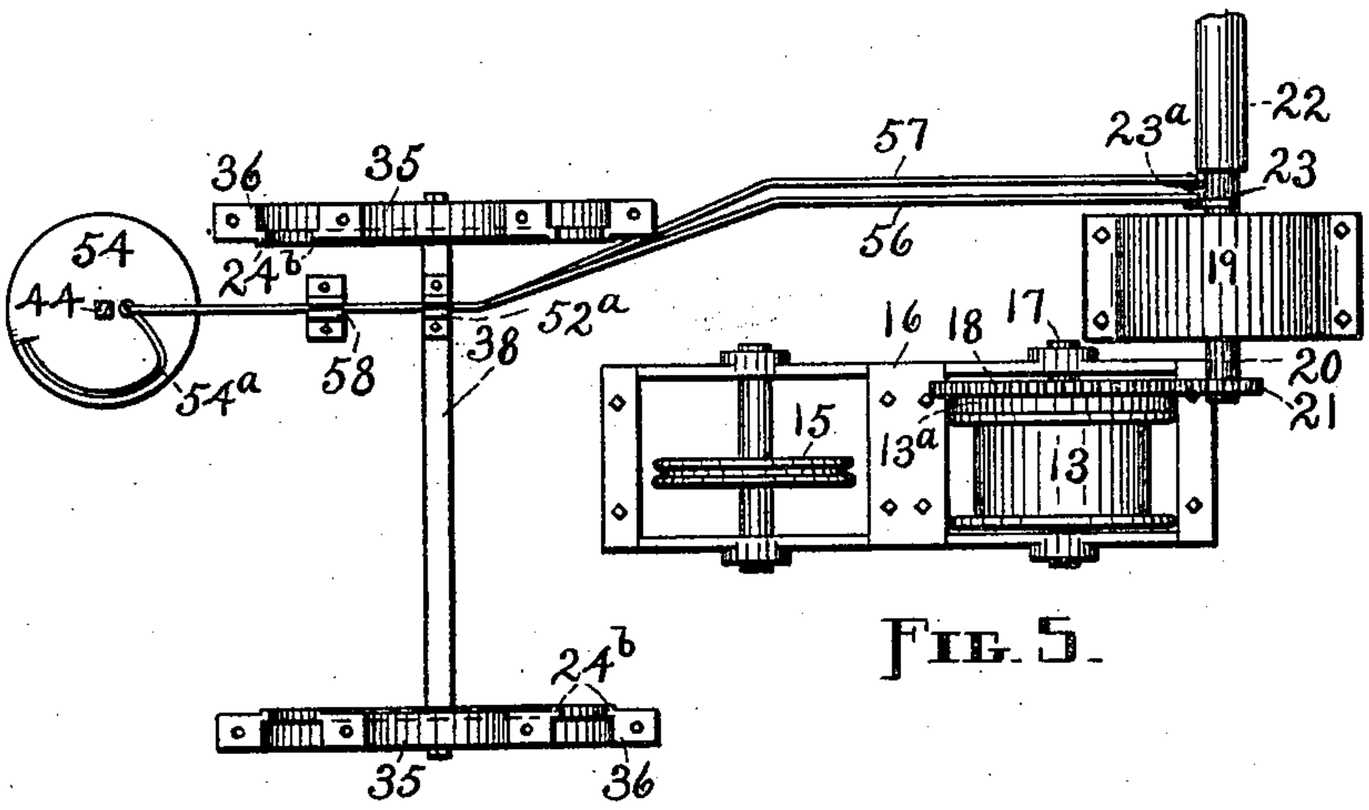


FIG. 5.

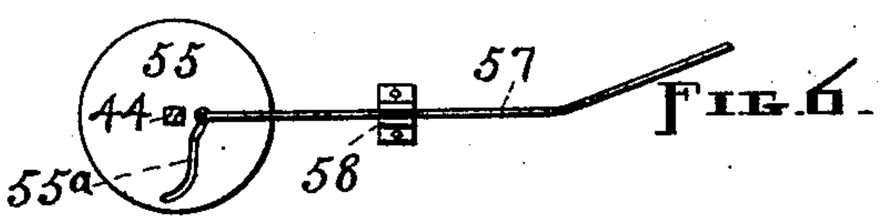


FIG. 6.

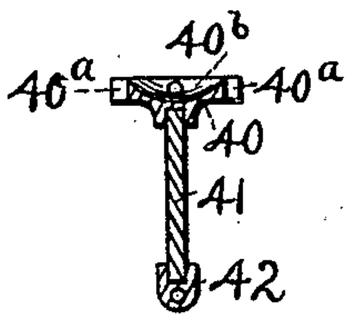


FIG. 7.

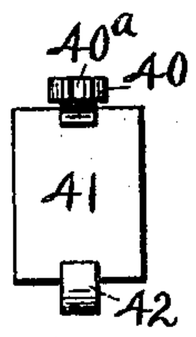
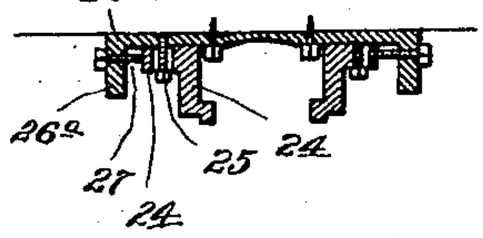


FIG. 8.

Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELEVATOR MECHANISM.

SPECIFICATION forming part of Letters Patent No. 680,353, dated August 13, 1901.

Application filed March 6, 1901. Serial No. 50,006. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. PENTECOST, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented new and useful Mechanism for Elevators, of which the following is a specification.

My invention relates to improvements in elevator mechanism in which flexible supports are employed, the free terminals of the same operating in air-tubes, whereby the safe and easy descent of the elevator-car is insured, and said improvements further consist of suitable devices for operating or controlling the motive power, air-valves, &c., all as hereinafter fully described, and especially pointed out in the claims.

The objects of my improvement are, first, to furnish an elevator with a safety appliance which is absolutely sure and positive in the performance of its work, while serving also as a cushion or yielding support for said elevator in its descent, a movement which is thereby accomplished in a steady, gradual, and even manner; second, to provide means for varying the motive power in accordance with the load; third, to produce elevator mechanism having the advantages possessed by the ordinary plunger-elevator without resorting to the expensive and often difficult expedient of driving a hole into the ground for the plunger; fourth, to equip the elevator with easily-operating, quick-acting, and simple contrivances for controlling the connecting mechanism, and thus operating the elevator itself, and, fifth, to supply the demand for an economical elevator both in first cost and cost of operating and for one which may, with its appurtenances, be confined in a comparatively small space or area. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side and general view of my invention taken between the flexible supports, the disposition of the parts being such as would appear when the car is in its highest position and at rest; Fig. 2, a plan view of the air-valve-operating device; Fig. 3, an enlarged plan view of the operating-lever and table therefor; Fig. 4, an enlarged cross-section through one of the flexible supports, showing its appearance when engaging the tracks and when in the air-tube, said tracks and tube being relatively located; Fig. 5, a top view of the flexible-support guides and of the motive-power members; Fig. 6, a top view of a portion of the second motor-valve-operating lever and cam; Fig. 7, an enlarged vertical section through one of the flexible-support links; Fig. 8, a side view of the same; and Fig. 9 an enlarged view showing bolts 25 passing through elongated openings in the tracks.

Similar figures and letters refer to similar parts throughout the several views.

In Fig. 1 three floors are shown, the first two being properly cut away to allow for the passage of the elevator-car 10. The motive power is preferably located below the first floor in the basement, as is customary. Although as shown the travel of the car 10 is limited to one story—that is, from the first to the second floor and return—it will be understood that an extension and duplication of certain of the members about to be described is all that is required to adapt the elevator for use in buildings having any number of stories, and of course the car and the vertical parts above the first floor must be made longer or shorter to adapt them for a building of greater or less height between stories. The flexible supports may make half-turns, so that the straight portions stand vertically, as shown, or they may make only quarter-turns, with the straight portions standing at right angles to each other, in which last event the air-tubes must extend horizontally instead of vertically, or any other desirable direction may be given said supports to adapt them to the space available for the purpose. A steam-engine, electric, water, gas, or other motor or any other suitable power-machine may be employed for elevating the car.

The mechanism is described as follows: The wire cables or ropes 11 11 have their adjacent ends made fast to the counterweight 12, and their opposite ends secured, respectively, to the top of the car 10 and the winding-drum 13, the large sheave 14 and the small sheave 15 being introduced to support and guide said ropes. The sheave 14 is supported above the top floor, in which holes are made to permit of the passage of the upper rope

11. The sheave 15 is carried by the bed 16, into which the drum-shaft 17 is journaled, and said sheave is so placed relative to the sheave 14 as to keep the counterweight 12 and attached portions of the ropes 11 in a vertical position. The winding-drum 13 is fast on the shaft 17, as is the gear 18, and said drum is provided with the brake-flange 13ª. A motor is represented at 19, having the shaft 20 and the pinion 21 fast thereon in mesh with the gear 18. A pipe 22 leads from the motor 19 to the source of power-supply, (not shown,) and the stem 23, extending from said pipe, and the stem 23ª, extending from a similar pipe below the first, control the internal cut-offs or valves by which the water or other initial force is admitted to and shut off from said motor. When the stem 23 is thrown to the right, enough initial force is admitted to the motor 19 to cause it to raise the car 10 through the medium of the intervening members with a certain limited load, and when the stem 23ª is thrown to the right in addition more of said initial force is admitted and a greater load can be lifted. More than two stems may be provided for a like number of valves, and in this way it is possible to graduate the power by the load more nearly than when two only are furnished; but in any event a great saving in power results, since it is necessary to use only about the amount actually required to do the work, while ordinarily as much is expended in raising an empty car as one loaded to its fullest capacity.

The angle-irons forming the tracks 24 24 are secured in place, two each side of the car 10, by the bolts 25, which pass through elongated openings in said tracks into the plates 26, which latter are bolted to the wall or floor-timbers. The set-screws 27 are threaded into openings in the plate projections 26ª and bear against the tracks 24, which are thereby rendered adjustable. This adjustment is accomplished by loosening the bolts 25 and turning the screws 27 until the tracks assume the required position, when said bolts are again tightened. The tracks may be fixed permanently in place by any suitable means; but I prefer this or some other method of adjustment in order to facilitate the work of putting in my appliances and especially to be able to counteract or rectify any displacement caused by the settling of the building. The guide-irons 28 on the sides of the car 10 engage the track-flanges 24ª and prevent any lateral motion on the part of the car.

The tracks 24 project some little distance from the wall or timbers, as will be seen in Fig. 4, and to the right of them is the air-tube 29, held in an upright position by the strap 30, fastened to the wall or a floor-timber. The centers of the engaging edges or flanges 24ª of the tracks 24 and of the tube 29 are on a line parallel with the timbers to which they are fastened. Since there are two pairs of tracks—one pair each side of the car—there must also be two air-tubes 29, for the reasons presently to be given. At the top of each tube 29 is the cap 29ª, provided with the opening 29ᵇ and the clapper 31, pivoted at 31ª to said cap and adapted to open and close said opening. An air-valve 32 projects from each tube 29 below the cap 29ª and has the upwardly-extending stem 32ª for operating the same. The two stems 32ª are pivotally connected to the rod 33. The base of each tube 29 rests upon the annular box 34, which is provided with the internal flanges 34ª 34ª.

Beneath each pair of tracks 24 and box 34 is a semicircular guide consisting of the upper segment 35 and the lower segment 36, the latter having legs adapted to be bolted to the floor. The bases of the tracks and boxes and the tops of the segments are contiguous and have lips to receive the bolts 37, by which the upper and lower members are rigidly held together. Each of the segments is provided with the engaging flange 24ᵇ, which is a continuation of the abutting track-flange 24ª. The beam 38 extends between the upper segments 35, to which it is bolted for the purpose of steadying them. A flexible support operates between each pair of tracks and the connected segments and extends through the connected box into the connected tube.

The flexible support is made up of a series of links strung together or pivotally connected one with another, terminating with the piston 39 in the tube 29. The aforesaid links may be made in various forms, so long as the requisite amount of movement between them is provided for. The link shown in the drawings consists of the head 40, the body 41, and the lug 42. The head 40 is adapted to operate between the tracks 24 and the segments 35 and 36 and has the slots 40ª 40ª in opposite ends to register with the flanges 24ª, 24ᵇ, and 34ª. The body 41 stands at right angles to the head 40, to which it is rigidly attached, is as wide as the head is long, and serves to center the link when in the tube 29 and retain the slots 40ª in line with the box-flanges 34, which guide said link into engagement with the segment-flanges 24ᵇ. The lug 42 is rigidly attached to the body 41 and designed to fit into the head 40 of the next link, to which it is pivoted at 42ª. The head 40 is hollowed out at 40ᵇ to permit the lug 42 to rock freely therein, thus providing for a sidewise motion of the body 41 when two or more links arrive at the semicircular guide. It will now be seen that the flexible support constructed as described can move freely through the segmental guide in either direction; but the column of air above the piston 39 will retard the upward movement of the links in the tube 29 in the manner hereinafter explained. The first link, which may be said to be at the top of the flexible support regardless of its actual elevation, is pivoted at 43 to the bottom of the car 10, and the last or bottom link is attached to the piston 39.

The operating-rod 44, preferably square,

extends from the bearing 45 on the basement-floor upward through the car 10 to a similar bearing 45 on the under side of the top-floor timbers. The cam 46 is secured to the rod 44 near the top and operates the air-valve stems 32^a through the medium of the bar 47 and the rod 33. The bar 47 has a projection at one end to engage the cam-groove 46^a and is bent forward and forked at the opposite end or terminal to provide a firmer connection for the rod 33. The bar 47 is held against lateral movement by the guide 47^a, depending from the top-floor timbers. When the cam 46 is turned far enough to the left, the valve 32 is opened and when turned to the right said valve is closed, the groove 46^a being concentric with the rod 44 after the closing-point is reached, so that further movement to the right does not affect the valve-operating bar 47.

Within the car 10 is the table 48, secured to the front thereof at one side of the door. The operating-lever 49 rests upon the table 48 and is connected with the rod 44, which passes through said table and the lip 48^a, the latter being secured to the table and projecting over said lever to hold it in place when the car descends. These parts are arranged to slip freely along the rod 44. The table 48 has three indicator-marks on it, one on one side of the lever 49 when normally disposed and two on the other side. These marks may be designated as *a*, *b*, and *c*. The lever when normally disposed stands at right angles to the front of the car.

The cam 50, fast on the rod 44 below the first floor, operates the brake-shoe 51, which is adapted to engage and release the brake-flange 13^a. This cam operates the shoe 51 by means of the lever 52, one end of which bears on said cam and the other end has said shoe pivoted thereto, while said lever is pivoted intermediate of its ends to the bracket 53, depending from the first floor. When the elevated part of the cam 50 is beneath the lever 52, the latter forces the shoe 51 against the flange 13^a with sufficient force to hold the drum 13 and prevent the car 10 from descending. By turning the cam in either direction the elevated part thereof passes from beneath the lever 52, the contiguous end of which consequently moves downward and the opposite end upward, carrying with it the shoe 51 away from the flange 13^a, thereby releasing the drum and car. The preponderance of weight is at the cam terminal of the lever 52. Hence the latter by its own weight raises the shoe. Springs or counterweights can be used in this connection, if desired. The bar 52 is held against lateral motion by the guide 52^a, affixed to the top of the beam 38.

The cams 54 and 55 are tight on the rod 44 below the cam 50 and support the free ends of the bars 56 and 57, respectively. The opposite ends of the bars 56 and 57 are pivotally connected with the motor valve-stems 23 and 23^a, respectively. The bar 56 has a projection to engage the cam-groove 54^a, and the bar 57 has a projection to engage the cam-groove 55^a. When the lever 49 is turned from its normal position to the indicator-mark *b*, the cam 54 actuates the bar 56 and the stem 23, thus admitting to the motor a part of the force which it is capable of utilizing; but the bar 57 is not disturbed, since its projection has remained in that part of the groove 55^a that is concentric with the rod 44. When the lever 49 is moved from *b* to *c*, however, the bar 57 is actuated and the motor receives the balance of the force which was held back by the other valve or its equivalent. During this last movement of the rod 44 the bar 56 is not disturbed, because its projection is in the part of the groove 54^a that is concentric with said rod. By turning the lever 49 from *c* to the normal position the bars 57 and 56 are actuated in turn to shut off the power from the motor. The upwardly-projecting guide 58, through which the bars 56 and 57 pass, prevents lateral movement of the same. Said guide is bolted to the basement-floor.

The general operation of my invention, assuming that the parts are at rest, as shown in Fig. 1, is as follows: Turn the operating-lever 49 from its normal position to the mark *a*, thereby releasing the brake from the drum 13 and opening the air-valves 32, as previously explained. The car 10 now descends steadily and easily, but only so fast as the air in each tube 29 escapes through the open valve 32 and permits the piston 39 to rise, the clapper 31 being closed at this time over the opening 29^b by the internal pressure. Now by turning the lever 49 from *a* to the normal position again the air-valves 32 are closed, the brake is applied to the drum, and the descending car is checked and stopped without jar or shock. To start the car upward, shift the lever 49 from its last position to *b*, which movement first actuates the stem 23 to start the motor, and then releases the brake-shoe, the movements of the cams 50 and 54 being so timed that the car is brought under the influence of the motor before being released by the brake. If additional power is required, shift the lever 49 from *b* to *c*, thus admitting a full supply of initial force to the motor. The ropes 11 carry the car up until the power is shut off and the brake applied by returning the operating-lever to its normal position once more. The upward movement of the car draws up the attached ends of the flexible supports and the pistons travel downward in the air-tubes, the clappers swinging open to admit air into said tubes. The counterweight 12 simply serves to balance the car 10 in a measure, thereby lessening the strain on the motor. In case either of the ropes 11 should break or other accident occur while the car is ascending or at rest the flexible supports are quickly checked by the confined air in the tubes 29, which is compressed by the rising pistons, and said car comes to a

stop. In case of accident while the car is descending it gradually settles to the bottom, but only so fast as the escaping air from the open air-valves permits. In any case serious results from any cause are obviated, as it is entirely impossible for the car to fall or drop when my safety appliances are applied and properly adjusted. The horizontal arm 59, fixed to the rod 44 below the cam 46, lies in the path of travel of the dog 60, which is attached to the top of the car 10. When the car is ascending, in case the lever 49 is not shifted at the proper time the dog engages the arm 59 and actuates it with the rod 44 to the left, and thereby shuts off the power and applies the brake. The arm 61 is fast on the rod 44 below the first floor and extends into the path of travel of the dog 62, which depends from the bottom of the car. Failure to operate the lever 49 when the car approaches its lowest position leaves the work to be done by the dog 62, which engages the arm 61 and actuates it with the rod 44 to the right, thereby closing the air-valves 32 and setting the brake. These automatic shifting devices are additional preventives of accident, and although devices of this character are common to elevators it is believed that the present construction and arrangement of the coacting parts are new.

The several modifications before alluded to, with others of a minor character, may be made without departing from the nature of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the car, of an air-tube and a piston therein, and a flexible support having one end connected to the car and the opposite end connected to said piston, said support adapted to uphold or sustain the car from below.

2. In combination with flanged tracks for an elevator, a flexible support having slotted members to register with said tracks.

3. The combination, with the car, of an air-tube and a piston therein, a flexible support having one end connected with the car and the opposite end connected to said piston, said support adapted to uphold or sustain the car from below, and flanged tracks to register with slotted members of the support.

4. In combination with tracks for an elevator, a flexible support to run in said tracks, means to prevent lateral movement of the support, an air-tube arranged to receive the free end of said support, and means to guide the support from said tracks into said tube.

5. In combination with tracks for an elevator, an air-tube adjacent to said tracks, a guide extending between the former and the latter, a flexible support adapted to run in said tracks, guide and tube, and means to prevent lateral movement of the support.

6. The combination, in elevator mechanism, of a car, an air-tube having a valve controlled from the car, a piston in said tube, and a flexible support connected with said car and piston and arranged to uphold or sustain the car from below.

7. The combination, in elevator mechanism, of a car, an air-tube having an air-valve, a bar connected with said valve and operated from the car, a cam to actuate said bar, a piston in said tube, and a flexible support connected with said car and piston and arranged to uphold or sustain the car from below.

8. In combination, elevator-tracks having flanges, segmental guide having similar flanges, an air-tube, and a flexible support adapted to engage said flanges and enter said tube, substantially as set forth.

9. In combination, elevator-tracks having flanges, a connected segmental guide having similar flanges, an internally-flanged box connected with said guide, an air-tube attached to said box, and a flexible support adapted to engage the flanged members and enter said tube, substantially as described.

10. A flexible support for elevator mechanism, comprising a plurality of links each consisting essentially of a body, a head and a lug attached to said body, said head set across said body and having slotted ends, and adapted to receive the lug of the next link, which is pivoted thereto, substantially as set forth.

11. The combination, in elevator mechanism, of an air-tube having an air-valve, a flexible support connected with the car and a piston in said tube, a brake-lever, an operating-rod and connections between the same and said air-valve and lever, and automatic means for actuating said rod to stop said car when at the end of its downward travel, substantially as set forth.

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

WILLIAM A. PENTECOST.

Witnesses:
T. A. CUTTER,
F. H. STEVENS.