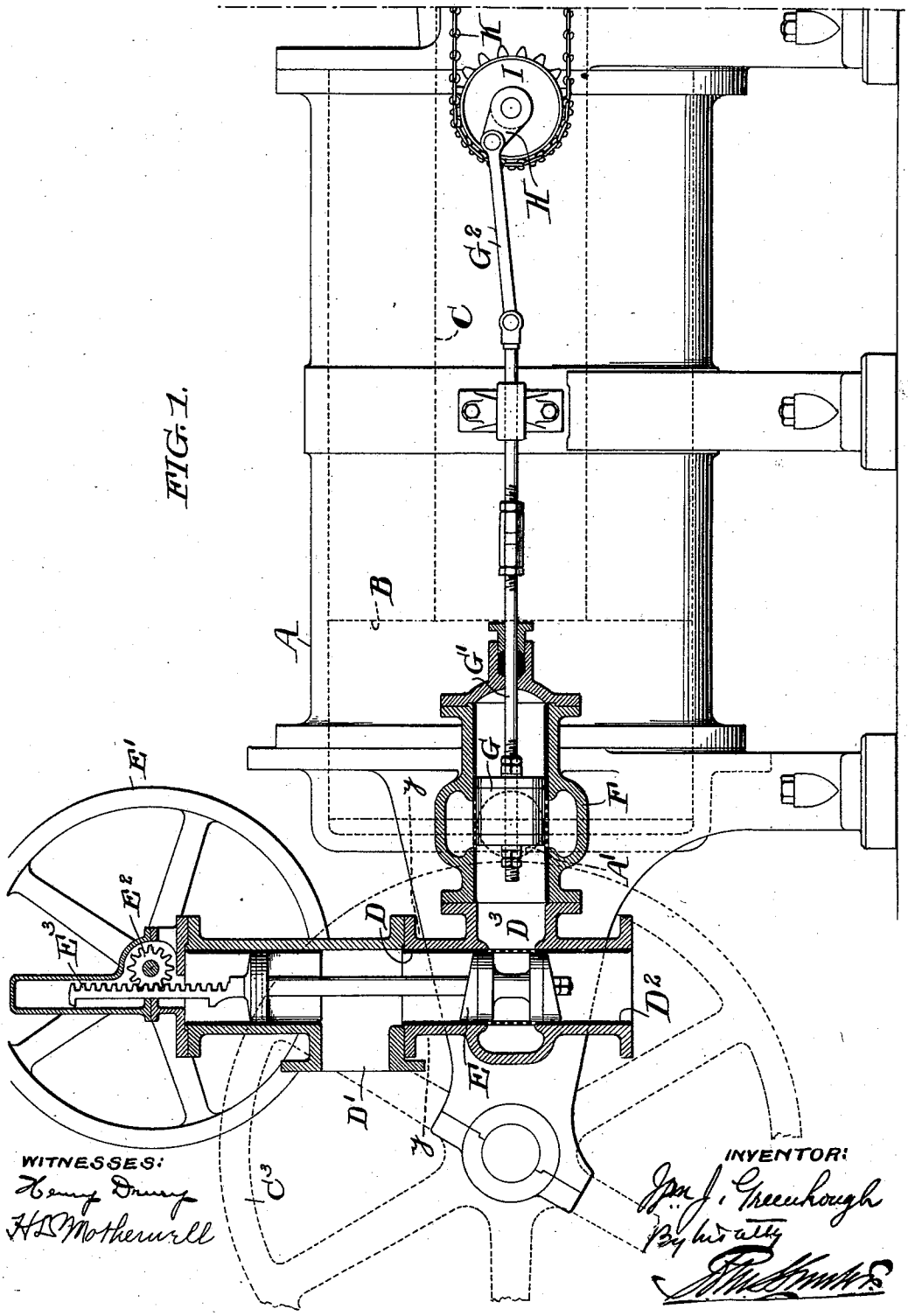
(No Model.) 3 Sheets—Sheet 1.

W. J. GREENHOUGH.

ELEVATOR APPARATUS.

No. 536,142. Patented Mar. 19, 1895.

FIG. 1.



WITNESSES:
Henry Drury
H. S. Mothersill

INVENTOR:
Wm. J. Greenhough
By his atty
Thos. G. Orwig & Co.

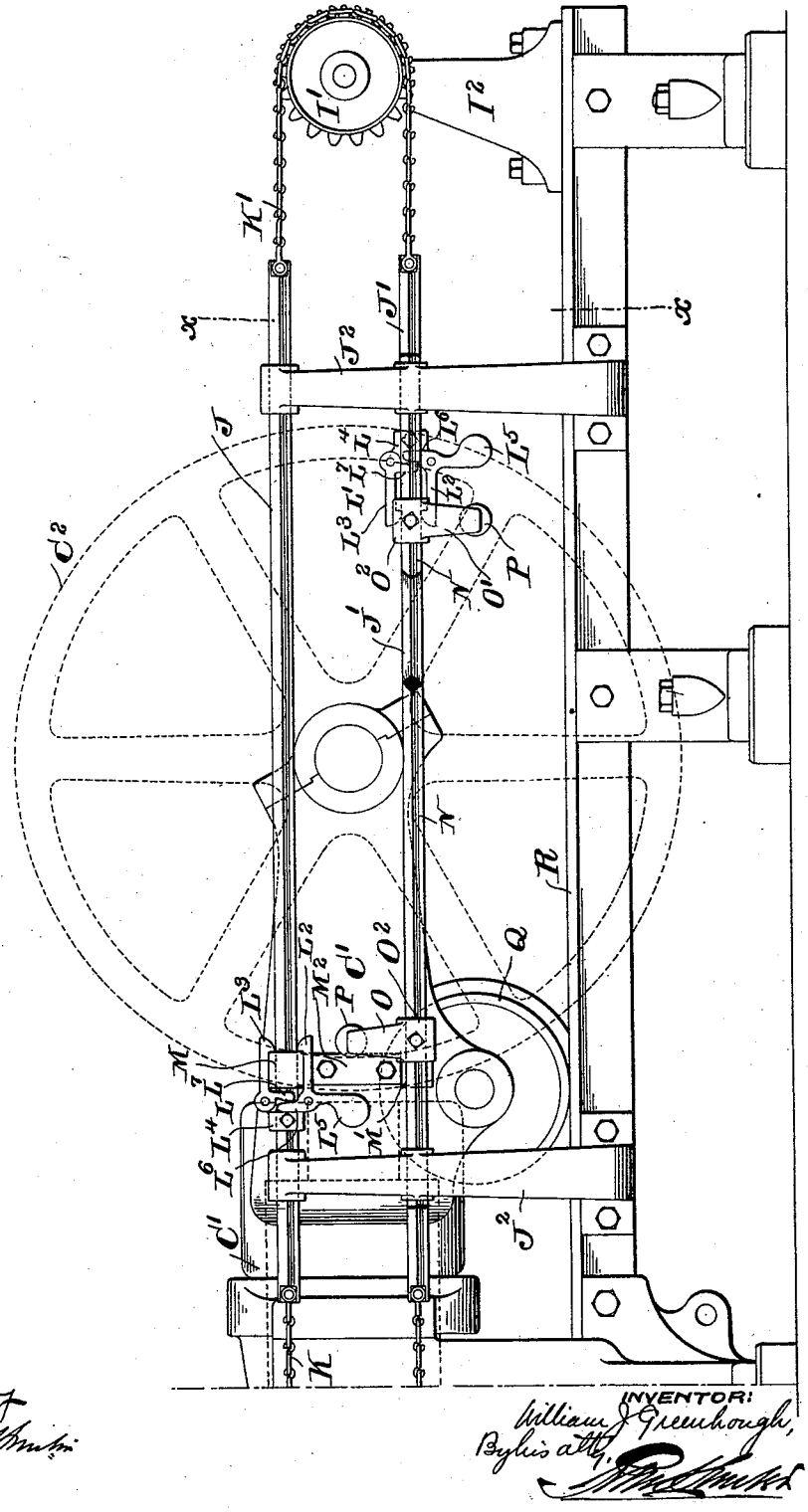
(No Model.) 3 Sheets—Sheet 2.

W. J. GREENHOUGH.

ELEVATOR APPARATUS.

No. 536,142. Patented Mar. 19, 1895.

FIG. 2.



WITNESSES:

Harry Drury

INVENTOR:

William J. Greenhough,

By his att'y,

(No Model.) 3 Sheets—Sheet 3.

W. J. GREENHOUGH.

ELEVATOR APPARATUS.

No. 536,142. Patented Mar. 19, 1895.

FIG. 4.

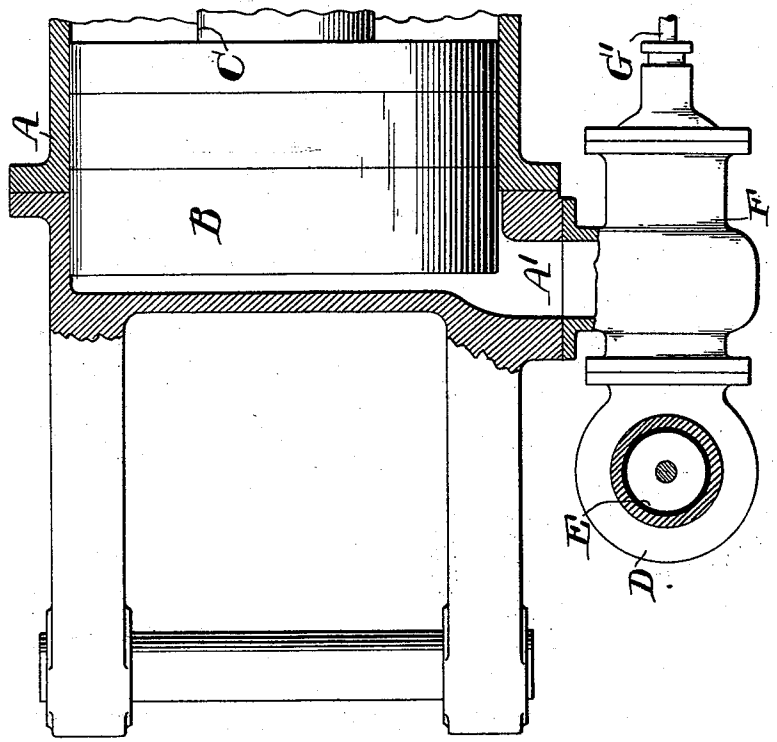
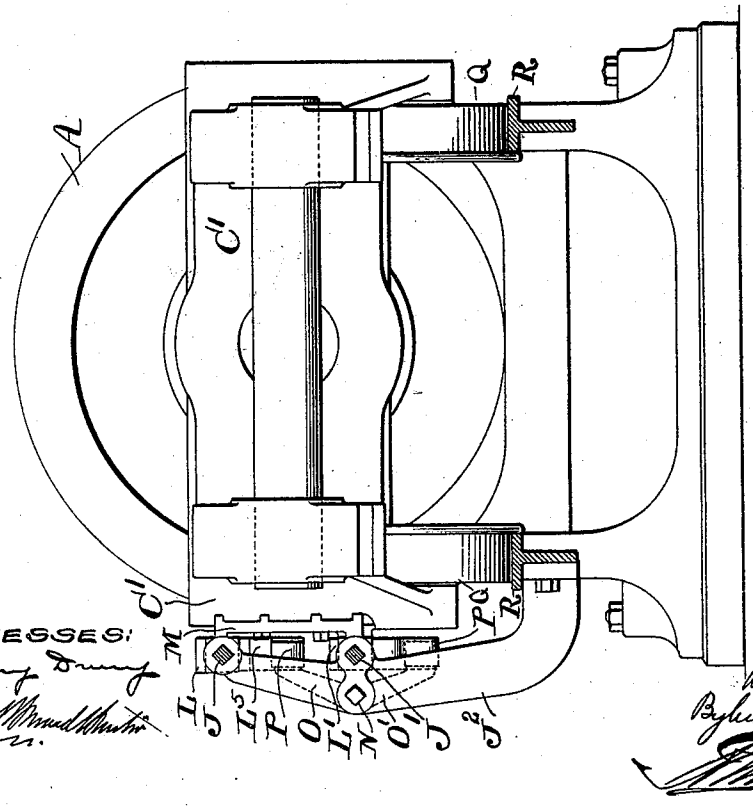


FIG. 3.



WITNESSES:

Henry Druery

INVENTOR:

William J. Greenhough

By his atty

UNITED STATES PATENT OFFICE.

WILLIAM JOHN GREENHOUGH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE MORSE, WILLIAMS & COMPANY, OF SAME PLACE.

ELEVATOR APPARATUS.

SPECIFICATION forming part of Letters Patent No. 536,142, dated March 19, 1895.

Application filed June 20, 1894. Serial No. 515,143. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM JOHN GREENHOUGH, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Elevator Apparatus, of which the following is a specification.

My invention relates to elevator apparatus, and consists of certain improvements which are fully set forth in the following specification and are shown in the accompanying drawings.

My particular invention relates to stop valve mechanism for automatically operating a stop valve at a certain point in the ascent or descent of the car or cage, to close the port to the main cylinder and thereby automatically arrest the rapid movement of the elevator car or cage, and avoid the sudden and dangerous jar which would occur if the attendant did not properly or reasonably operate the usual control valve, or if the control valve or its operating devices were out of order.

It is the object of my invention to provide automatic limit stop devices of improved construction and more positive action and to avoid jolting or jarring of the car or cage when the limit stop devices operate, so as to bring the car or cage to a gradual stop.

It is also an object of my invention to enable the devices to be easily adjusted so that the speed of stoppage at the limits may be adjusted, and if desired the limits of operation may be increased or diminished.

Referring now to the accompanying drawings for more particularly describing my invention: Figure 1 is a side elevation of a portion of the lifting devices of an elevator apparatus with the valve chambers in vertical section. Fig. 2 is a side elevation of a continuation of the lifting device of Fig. 1. Fig. 3 is a transverse sectional view on the line *x*—*x* of Fig. 2 looking to the left; and Fig. 4 is a horizontal sectional view on the line *y*—*y* of Fig. 1.

A is the main cylinder.

B is the piston working in the cylinder A.

C is the piston rod carrying on its end the frame C′ in which are journaled the usual movable sheaves C^2.

C^3 are the usual stationary sheaves.

Q are the guiding wheels carried by the frame C and running on tracks R.

D is the control valve cylinder having the inlet and outlet ports D′, D^2, respectively, and the port D^3, which communicates with the cylinder.

E is the usual control valve which is operated from the traveling car through the usual control cable or cables.

E′ is the wheel or lever which is operated by the control cable or cables and moves the valve E through the pinion E^2 and rack E^3.

So far as the parts have been described they are of well known construction and form no part of the present invention.

Between the port D^3 of the control valve chamber and the port A′ of the cylinder A is a valve chamber F in which is located a stop valve G by which the passage through the chamber F may be opened or closed.

G′ is the valve rod of the valve G and projects through the rear of the chamber. The rear end of the valve rod G′ is connected through a pitman G^2 with a crank H connected with a sprocket wheel I so as to move with it. The sprocket wheel I is journaled on a suitable stud carried by the main cylinder or by a stationary frame. I′ is a second sprocket wheel journaled in a suitable standard I^2 in the rear of the cylinder.

J, J′, are two sliding rods guided in suitable brackets J^2, and connected together at their ends by chains K, K′ which pass about the sprocket wheels I, I′ respectively. It is apparent that the movement of either rod in either direction will, through these chains K, K′, turn the sprocket wheels I, I′. The chains K, K′ and rods J, J′ thus constitute endless bands or chains.

L, L′ are clutches carried by the rods J, J′ respectively and moving with them. These clutches are respectively adapted to receive clutch engaging parts, here shown as blocks or heads M, M′ carried by a frame M^2 secured to and moving with the frame C′. The clutches L, L′ are simultaneously and oppositely moving engaging pieces adapted, when operated, to impart motion to the stop valve through the power transmitting connections; and the frame M^2 with the heads M, M′ is a device carried by the piston actuated frame

for moving the simultaneously and oppositely moving engaging pieces.

The clutches L, L′ and blocks or heads M, M′ constitute locking devices for automatically locking the rods J, J′ to the moving head C′, and thereby imparting movement to the wheel I and crank H and operating the stop valve. The special form of these locking devices is not material. I have shown my preferred construction in which I employ clutches each composed of two dogs L^2, L^3, pivoted to a collar L^4 adjustably carried on the rod, the dog L^2 being provided with a counterweighted extension L^5 and also with a nose piece or trigger L^6, and the dog L^3 with a toe piece L^7 adapted to be acted upon by the nose piece or trigger L^6 of the dog L^2. The weighted extension L^5 normally holds the dogs in the position shown in Fig. 2. It is apparent that by throwing the weighted extension to the rear the dogs L^2, L^3 will be opened, the trigger L^6 acting on the toe L^7 to lift the dog L^3.

The blocks or heads M, M′, may slide upon the guide rods J, J′ respectively.

N is a stationary rod or bar carried by the brackets J^2 and extending adjacent to the bar or rod J′.

O, O′ are trips carried by the bar N and located respectively adjacent to the clutches L, L′, on the rods or bars J, J′, in position to act upon the extensions L^5 thereof. These trips are located slightly in advance of the clutches so as to permit the clutches to move to some extent before they are actuated. The trips O, O′ may be adjustably supported on the rod N as by the collars O^2, and may be provided with rollers P upon their operative ends as shown.

I shall now describe the operation of the apparatus.

The elevator cage is operated by the movement of the piston C in the usual manner; and the movements are controlled by the operation of the control valve E. The stop valve G normally occupies a position which will leave the inlet A′ to the cylinder A slightly open, just enough to admit sufficient water to start a gradual movement of the piston B when the control valve is opened. Supposing the parts to be in the positions indicated in Figs. 1 and 2 with the elevator lowered, the control valve closed and the block or head M held by the clutch L; when the control valve is opened to admit fluid to the chamber F, the slight amount which passes through the partially opened valve G will enter the cylinder A and move the piston B with a gradual movement. As the piston moves, the head or frame C′ is correspondingly moved, and as the clutch L is locked to the head M, which is carried by the frame C′, the rod J to which the clutch L is secured will be similarly moved. This movement of the rod J will turn the sprocket wheel I through the chain K, and thus, through the crank H, pitman G^2 and rod G′, will operate the valve G, opening it and permitting the water to flow freely into the cylinder A. At this moment the trip O strikes the extension L^5 of the clutch and opens it releasing the head M and permitting the frame C′ to move without further movement of the rod J and the stop valve. The elevator car may then ascend at full speed under the control of the control valve E. As the limit of upward movement is reached the frame C′ has been moved to the rear until the block or head M′ secured thereto strikes the clutch L′ and is engaged by it. As the head or block M′ strikes the clutch L′ it moves it and the rod J′ back. This movement of the rod J′ turns the sprocket wheel I, and, through the crank H and its connections, restores the valve G to to its approximately closed position. The rapid movement of the elevator or car will thus be arrested and the car will be quietly stopped. The valve G will not ordinarily be entirely closed, but if through any cause the control valve should not be operated properly to actually stop the cage after the limit is reached, the movement of the piston and head C′ beyond the limit will be sufficient to move the valve G far enough to positively close the stop valve. The apparatus thus acts as a safety device to positively stop the car after the proper limit of movement has been passed. In descending the operations are exactly reversed. When the control valve is operated to permit the water to be discharged from the cylinder, the water will at first gradually pass through the slightly opened valve G and permit a slight movement to the piston B under the weight of the descending cage. As the frame C′ moves back the clutch L′ being locked to the head M′ is carried with it and thus the rods J, J′ are moved and the valve G is opened as has been described. The trip O then opens the clutch L′ and the frame C′ travels back until the limit of downward movement is approached when the frame M strikes the clutch L and moves it back, thus closing the valve G and arresting the rapid descent of the cage. At the same time the clutch L engages the head M and the parts are again in the position shown in Figs. 1 and 2. As the closing of the stop valve to arrest the rapid ascent or descent of the elevator car is accomplished by the movement imparted to the chain through the clutches and heads, it is apparent that a quick and positive action is obtained, and as the valve is only approximately closed under normal conditions, the sudden jar, that would result from a quick full closing of the valve, is avoided. The said movement of the elevator is thus automatically arrested and changed into a slow movement at the limits of ascent and descent and all sudden jolting is avoided.

The advantage of employing the endless chain construction is that the stop valve is moved in the same direction at the limit of the movement of the frame C′ either backward or forward.

By employing the crank H to impart the

movements to the stop valve G, I am able to obtain a gradually increasing speed in opening the valve, and a gradually decreasing speed in closing it, and the effect of this is to produce a gradually decreasing speed in the stopping of the cage and gradually increasing speed in starting it, from the limit.

It is especially desirable in apparatus of this character that there should be provision for suitable adjustment. To adjust the rapidity of the operation of the stop valve, I prefer to make the crank H adjustable. For this purpose I prefer to employ a sectional rod G′ with the sections united by an adjusting joint T, so that by adjusting the joint T to extend or shorten the rod G′ the crank H may be moved to the right or left to increase or diminish its throw and thus vary the speed of the movement of the valve G to adjust the length of the movement of piston before the operation of the stop valve. I prefer to make the clutches L, L′, adjustable longitudinally upon the rods J, J′ as by the set collars shown. The stops O, O′ may also be made adjustable in a similar manner upon the rod N.

The minor details of construction shown may be varied without departing from the invention.

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

1. In an elevator apparatus, the combination with the main cylinder, and the hoisting piston and frame, of a stop valve for controlling the port to the main cylinder, a crank, connections between the crank and stop valve, a movable clutch adjacent to the frame, power transmitting connections between the crank and clutch, a clutch engaging part carried with the movable piston frame, and a trip arranged to operate the clutch and release the clutch engaging part after a given movement.

2. In an elevator apparatus, the combination with the main cylinder, and the hoisting piston and frame, of a stop valve for controlling the port to the main cylinder, a crank, adjustable connections between the crank and stop valve, a movable clutch adjacent to the frame, power transmitting connections between the crank and clutch, a clutch engaging part carried with the movable piston frame, and a trip arranged to operate the clutch and release the clutch engaging part after a given movement.

3. In an elevator apparatus, the combination with the main cylinder and the piston and piston operated frame, of a stop valve for controlling the port to the main cylinder, an endless chain or band independent of the piston operated frame, power transmitting connections between the endless chain or band and the stop valve, and intermittently acting clutch devices between the movable piston operated frame and the endless chain or band, whereby at certain intervals in the movement of the piston operated frame the endless band is clutched and actuated, thereby actuating the stop valve.

4. In an elevator apparatus, the combination with the main cylinder and the piston and piston operated frame, of a stop valve for controlling the movement of the motor fluid in the cylinder, mechanism for operating the stop valve, two engaging pieces, oppositely acting connections between said engaging pieces and the valve operating mechanism so as to impart relatively opposite movements to the valve operating mechanism when said two engaging pieces are moved in the same direction, and a device controlled by the movement of the piston operated frame successively engaging the two engaging pieces in each full reciprocation, whereby the stop valve may move in opposite directions in each full reciprocation of the piston to first open and then close the stop valve.

5. In an elevator apparatus, the combination with the main cylinder and the piston and piston operated frame, of a stop valve for controlling the port to the main cylinder, a band or chain, power transmitting connections between the movable band or chain and the stop valve clutch mechanism between the piston operated frame and the movable band or chain adapted at certain intervals to connect the band or chain with the piston operated frame and thereby cause the band to move and operate the stop valve, and a trip arranged in the path of the clutch mechanism to unclutch it and release the band or chain.

6. In an elevator apparatus, the combination with the main cylinder and the piston and the piston operated frame, of a stop valve adapted to control the port to the main cylinder, a movable band or chain, power transmitting connections between the movable band or chain and the stop valve, a clutch carried by the band or chain, a clutch engaging part carried with the movable piston operated frame and adapted at certain intervals to engage the clutch and move the band or chain and thereby operate the stop valve, and a trip located on the path of the clutch to unclutch it after a given movement.

7. In an elevator apparatus, the combination with the main cylinder and the piston and the piston operated frame, a stop valve adapted to control the port to the main cylinder, a movable band or chain embracing a bar J′, a clutch L′ carried by the bar J′ with the freedom of longitudinal adjustment thereon, a clutch engaging part carried with the movable piston actuated frame adapted at certain intervals to engage the clutch and move the band or chain, a trip to release the clutch after a given movement, and power transmitting connections between the band or chain and stop valve.

8. In an elevator apparatus, the devices for automatically operating a stop valve of the main cylinder, consisting of movable endless chain or band embracing bars J, J′, clutches carried by the bars J, J′, a clutch engaging

part moving with the piston of the main cylinder and adapted to engage either of the clutches carried by the bars J, J', and thereby move the chain or band, trips for releasing the clutches after a given movement, and power transmitting connections between the chain or band and the stop valve.

9. In an elevator apparatus the combination with the main cylinder and the piston and piston operated frame, of the stop valve for controlling the movement of the motor fluid in the main cylinder, an endless chain or band, power transmitting mechanism between the chain or band and the stop valve, a clutch device carried by the endless chain or band on one side thereof, a second clutch device carried by the endless chain or band on the other side thereof, and a device controlled by the movement of the piston operated frame to alternately engage first one and then the other clutch device in each full reciprocation of the piston in either direction, whereby the stop valve will be fully opened at the commencement of the movement of the piston and will be closed at the end of the movement.

In testimony of which invention I have hereunto set my hand.

WILLIAM JOHN GREENHOUGH.

Witnesses:
ERNEST HOWARD HUNTER,
C. H. NEWCOMB.