(No Model.) 2 Sheets—Sheet 1.

C. I. HALL.

ELEVATOR FOR BUILDINGS.

No. 519,114. Patented May 1, 1894.

Fig. 1.

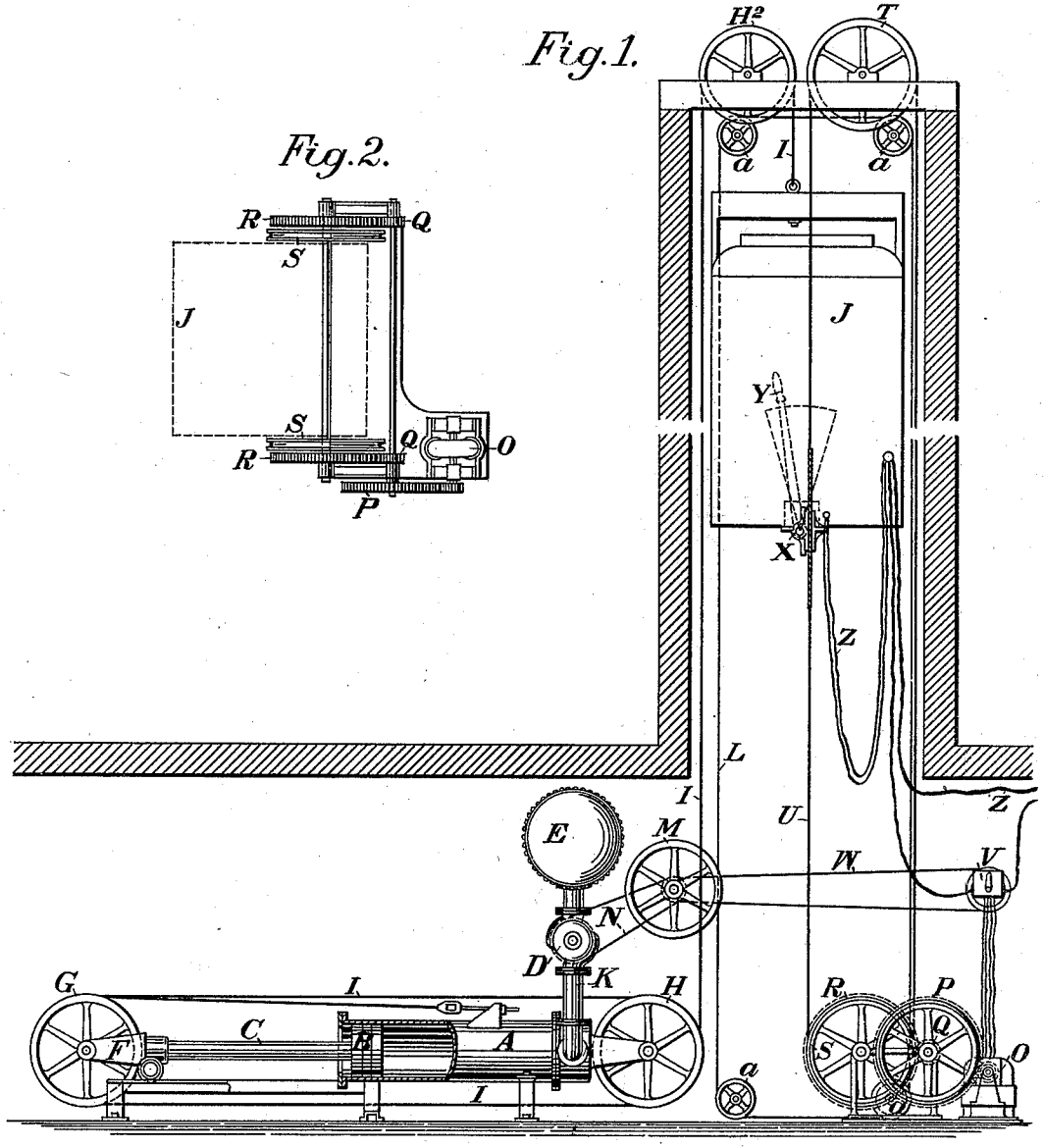

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

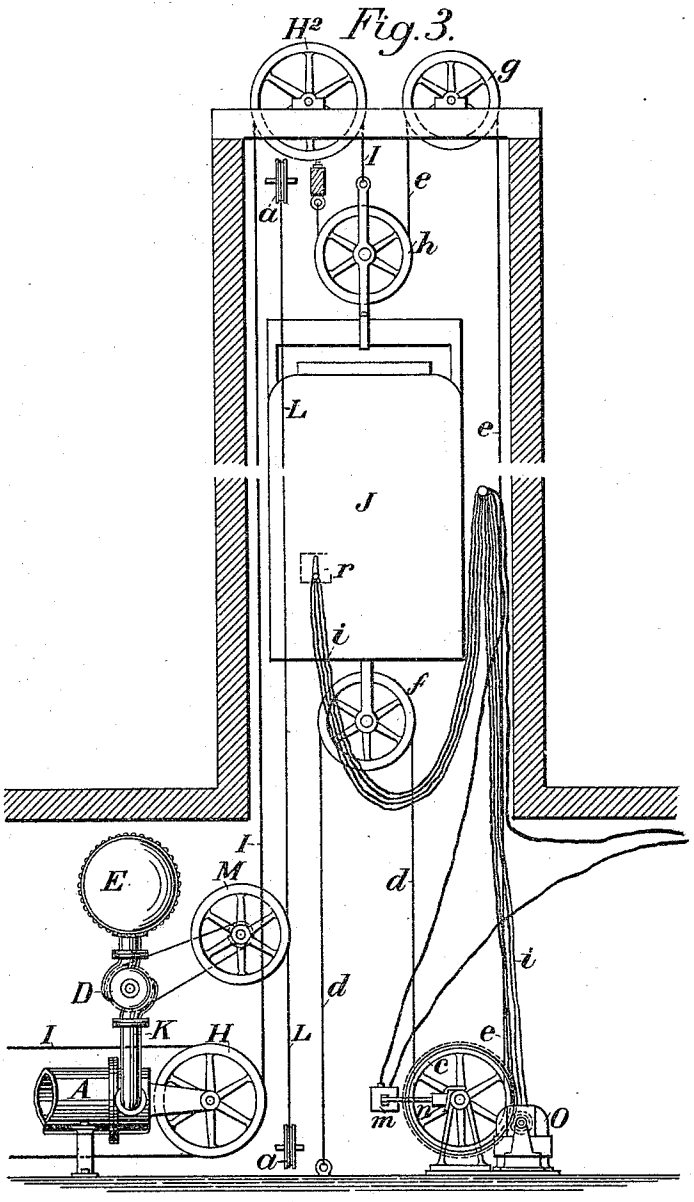
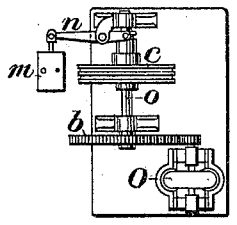


Fig 4



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ELEVATOR FOR BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 519,114, dated May 1, 1894.

Application filed May 15, 1893. Serial No. 474,222. (No model.)

To all whom it may concern:

Be it known that I, COFRAN I. HALL, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Elevators for Buildings; and I hereby declare the following specification and the drawings therewith to be a full, true, and exact description of my invention and the manner of applying and using the same.

My invention relates to the motive machinery for elevators employed in raising and lowering passengers and goods in buildings, and to that class of elevators known as hydraulic, or including the functions thereof.

The object of my invention is to utilize the force exerted by the weight of the cage and its load when descending, to store up power that will be given out again when the cage is raised, and yet retain, for safety and ease of controlling, all the principal features of a hydraulic elevator. Also by distributing the variable auxiliary power over both the up and down movement of the cage, reducing the capacity of any kind of motive power required by distributing its work in both raising and lowering; also to a great extent reduce the total amount of power required to operate an elevator. Also under certain conditions to be able to operate the cage of a hydraulic elevator both up and down without any expenditure of power other than that given off by the weight of the descending loads thereon. As an elevator is seldom required to lift a full load, I arrange the static pressure and the auxiliary power so that the two will be equal to lifting the full load, that is, the maximum load and friction of the machinery is theoretically divided into two equal parts. The force that each will exert is governed by the average loads raised and lowered.

It is well known that in all hydraulic elevators at present in use it takes the same amount of power to elevate the cage, whether it be empty, or loaded to its fullest capacity, and that none of the power generated by the load in descending is utilized. In my invention such loss is almost wholly avoided. The hydraulic power applied is uniform, and seldom exceeds what is required to raise service loads on the cage.

The manner of operating will now be explained by referring to the drawings.

Figure 1 is an elevation showing an elevator arranged according to my invention, operated by hydraulic apparatus supplemented by an electric motor to provide auxiliary power. Fig. 2 is a plan view of the motor and its gearing. Fig. 3 is another view of the same elevator, also arranged with an electric motor to supply auxiliary power, but differently connected and operated. Fig. 4 is a plan view of the electric motor and connected gearing, shown in Fig. 3.

Similar letters of reference indicate corresponding parts throughout the drawings.

Referring first to Figs. 1 and 2, A is a hydraulic cylinder, having a piston B, piston rod C, and a valve D, which opens and closes communication between the cylinder A and a receiver E.

Attached to the piston rod C is a crosshead F, on which are mounted movable sheaves G, corresponding to the fixed sheaves H, around which passes a rope I with a sufficient number of sheaves and wraps to produce the desired relative movement between the piston B and the cage J. This rope I passes from the sheave H over an idle one H^2, and is attached to the cage frame, as shown in Fig. 1, in the usual manner of such gearing. The receiver E in this case is a closed tank, partially filled with water or other inelastic fluid, and a pressure obtained by air compressed into the remaining space, or the vessel may be an open tank set high enough to get the required pressure directly by the weight of the water, or its static head, such pressure being sufficient to raise a certain predetermined load. As the pressure in the receiver E falls, either by expansion of the air therein or lowering of the head, this variation is compensated by the rope I passing over the pulley H^2, removing that much weight from the cage, or resistance to the piston B.

The receiver E is connected by a pipe K with the hydraulic cylinder A, connection being controlled by the valve D, and the cord L, which passes around the grooved wheel M, idle pulleys *a a a a*, and through the cage J so as to be reached and operated by an attendant in the cage. These elements constitute the hydraulic part of the machine, which op-

erates in the following manner: The pressure in the receiver E is maintained at a point that will raise the cage J with an assumed load thereon. To ascend, the attendant pulls the cord L, which turns the wheel, and this in turn moves the stop valve D by means of a chain N, opening communication from the receiver E to the cylinder A, forcing outward the piston B, and raising the cage J, by means of the gearing already described. In this operation, if the load on the cage J is less than the predetermined one, as before explained, no additional power will be required to ascend. When the cage is to descend, if the downward load exceeds the predetermined one, and the friction of the machinery, the descending weight forces back the piston B, and returns the water in the cylinder A to the receiver E, so that with certain service loads, in which the weights lowered exceed those raised, by so much as the frictional resistance of the machinery, no power whatever, other than the descending loads is expended in the operating. As however these circumstances are only exceptional, it becomes necessary to supplement the hydraulic apparatus with some other source of power that may act on either the upward or downward movements of the cage, supplying force as required by the varying loads, when such loads are more or less than the predetermined one. This auxiliary power I supply preferably by an electric motor, when current is available, but this power can be derived from any convenient source. In the present case I have shown an electric motor O, connected to the wheel P, and this wheel by a pinion Q to the wheel R, so as to reduce the motion and increase the power of the electric motor O, as will be understood. On the same shaft with the wheel R is a grooved pulley S, around which and over the pulley T at the top, passes a rope U, so this rope is set in motion by the motor O, and is driven thereby right or left as a reversing switch V may determine. This switch V is connected by means of a rope or chain W with the wheel M, so that the switch is reversed with the valve D, and consequently the rope U always moves coincidently with the cage J, so as to be available in supplying auxiliary power when required in ascending or descending. The connection between the cage J and the rope U, is formed by means of a clamping grip X, operated by a lever Y, that closes the jaws of the grip X on the rope U so the cage and rope will move together. The electric motor O is so connected and arranged, as to operate only when required, or when the grip X is applied to the conducting wires Z, being so arranged that the electric circuit is closed by moving the lever Y and closing the grip X. In this manner it will be seen that the actual operating power is that of the motor O, called into use when the loads raised exceed the predetermined one or the force provided for by the cylinder A, and in descending when the load is less than the predetermined, and not enough to force back the fluid from the cylinder A to the receiver E, the electric motor being called into use whenever required, and performing only the actual duty for service loads, varying as specified.

In Fig. 3, I have shown another manner of supplying the auxiliary power by means of an electric motor, the result being the same but with a different method of connecting to the cage J. The hydraulic elements being the same as in Fig. 1, no further explanation of these will be required. The motor O is placed as before, with a pinion gearing into the wheel *b*. Mounted loosely on the axis *g* of this wheel is a grooved drum *c*, on which are wound, right and left, the ropes *d* and *e*. The rope *d* passes around sheaves *f*, and the rope *e* around sheaves *g* and *h*, so that the cage J may move freely up or down, the ropes *d* and *e* winding and unwinding on the drum *c* accordingly, that turns loosely on the shaft *g*, so this auxiliary gearing offers no resistance except slight friction of the drum *c*, so long as the cage J is operated by the hydraulic apparatus.

When the electric motor O is called into use, it is set in motion by a rheostat *r*, operated by the attendant in cage J. This connects the circuit through the wires *i i* for right or left motion of the motor O as the cage may be ascending or descending. At the same time the electric circuit being thus closed, acts on a solenoid *m*, which moves the lever *n* and engages a clutch *o*, so the grooved drum *c* is driven by the motor O and the power applied to the cage J by means of the ropes *d* or *e* to assist in raising or lowering the cage. It is obvious that such gearing can be modified in various ways without departing from my invention. I have accordingly shown two methods of connecting and controlling the auxiliary power when an electric motor is employed for that purpose.

Having thus explained my invention and methods of constructing and applying the same, what I claim is—

1. In an elevator a main driving apparatus, in combination with a car or platform to be operated thereby, a separate and independent auxiliary motor, a connection between the auxiliary motor and the car and a grip device on the car for engaging said connection so that the power of the auxiliary motor may be temporarily applied to act upon the car in ascending or descending, substantially as described.

2. In an elevator, the combination with the car or platform, of a main apparatus for operating the same, a separate and independent auxiliary motor, suitable gearing connecting with the latter, and a cable actuated by said gearing and running through the car, to which it may be connected or disconnected so that the power of the motor may be temporarily applied to assist the main apparatus, substantially as specified.

3. In an elevator, the combination with the

car or carriage, of a hydraulic apparatus for operating the same, consisting essentially of a cylinder, a piston therein, cable connections between the piston and the car and a receiver or vessel containing fluid under pressure which is supplied to the cylinder and a separate and independent auxiliary motor, a cable running therefrom to the car and a gripper on the car for temporarily engaging the said cable so that the auxiliary motor may apply its power to assist the hydraulic apparatus whenever required, substantially as described.

4. In an elevator, the combination with the car or cage, of a hydraulic apparatus for operating the same, a separate and independent auxiliary motor, suitable gearing operated thereby, a cable actuated by said gearing and running through the car and a gripping mechanism on the car for engaging said cable when required so that the power of the auxiliary motor may be applied to assist the hydraulic apparatus in ascending or descending, substantially as described.

5. In an elevator, the combination with the car or cage, of a hydraulic apparatus for operating the same, a separate and independent auxiliary electric motor, gearing driven by said motor, a cable running through the car and actuated by said gearing, electric connections between the car and the motor, a gripper on the car for engaging the auxiliary cable and circuit closing devices on the car whereby the motor is controlled, substantially as specified.

6. In an elevator, the combination with the car or cage, of a hydraulic apparatus for operating the same, consisting essentially of a cylinder, a piston therein, a cable operated by the piston and connected to the car, a fluid receiver containing fluid under pressure which is supplied to the cylinder, and a valve for controlling said supply, and a separate and independent auxiliary motor which actuates a cable running through the car, means extending from said car to the auxiliary motor for stopping and starting the latter and a gripping device on the car for engaging the auxiliary cable and simultaneously therewith starting the auxiliary motor so that the power of the latter may be applied to assist the hydraulic apparatus when required, substantially as specified.

7. In an elevator, the combination of a main driving apparatus, a car or platform to be operated thereby, an auxiliary electric motor, a cable connection between said motor and the car, devices on the car for temporarily engaging said cable and circuit closing devices likewise on the car whereby the electric motor may be controlled, substantially as specified.

8. In an elevator, the combination with the car or carriage, of a hydraulic apparatus for operating the same, consisting essentially of a cylinder, a piston therein, cable connections between the piston and the car and a reservoir or vessel containing fluid under pressure which is supplied to the cylinder, a separate and independent auxiliary electric motor, gearing driven by said motor, a cable running through the car and actuated by said gearing, electric connections between the car and the motor, a gripper on the car for engaging the auxiliary cable and circuit closing devices on the car whereby the motor is controlled, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

COFRAN I. HALL.

Witnesses:
JAMES L. KING,
WALTER W. KEMPSTON.