May 22, 1956 W. GÜTTINGER ET AL 2,746,567

BRAKING DEVICES FOR ELEVATORS

Filed Oct. 30, 1952

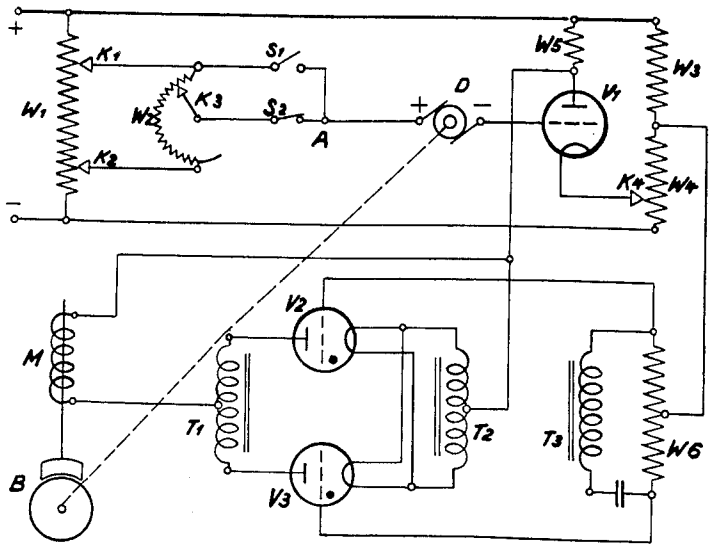


Fig. 1

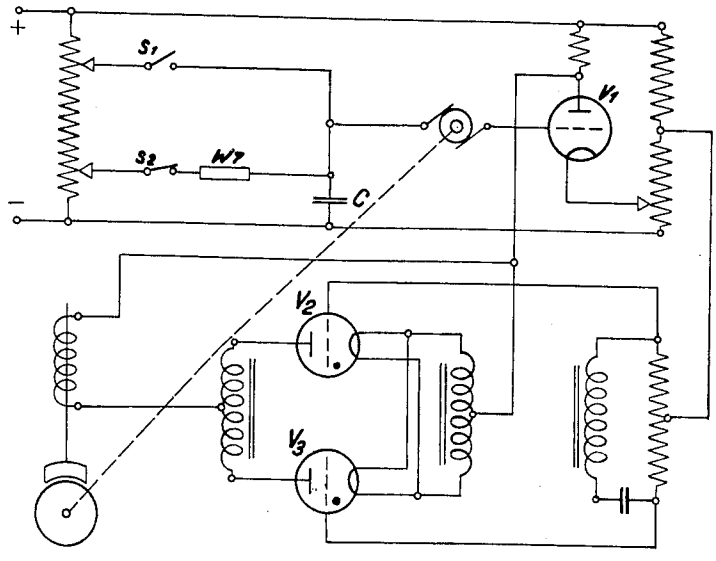


Fig. 2

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United States Patent Office 2,746,567
Patented May 22, 1956

2,746,567

BRAKING DEVICES FOR ELEVATORS

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Application October 30, 1952, Serial No. 317,752

10 Claims. (Cl. 187—29)

In view of the fact that the stopping of elevators running at a comparatively high speed has to be accurate, they have to be provided with finely adjustable stopping devices. Such devices usually are constructed in such a way that before the story level is reached, a lower running speed comes into operation. This low running speed may be attained by the insertion of a second motor, a multi-speed motor, a cascade motor, or a Leonard connected motor. Any one of these arrangements greatly increases the purchase price of the elevator. The object of the present invention is to provide a speed control device by means of which deceleration can be attained that is just as effective as the deceleration obtainable by the above mentioned devices, but the purchase price of which is substantially lower.

The speed control according to the invention comprises an electromechanical brake, a brake release coil, an electronic amplifier, a tachometer-generator and a source of voltage, wherein the tachometer-generator is connected between the source of voltage and the input to the amplifier.

The desired deceleration can be obtained by supplying the current of the brake release coil through an electronic tube, the grid voltage of which is made dependent either upon the position of the elevator cab or upon its speed.

Instead of controlling the brake release coil by the control device, the brake pressure may be kept constant at a predetermined value and the torque of the motor may be varied during braking.

The position of the elevator cab can be determined by mounting a potentiometer on the elevator cab and connecting it to a constant voltage, the potentiometer being tapped in such a manner that the tapped voltage corresponds to the position of the cab. The nearer the cab comes to a floor level the smaller becomes the tapped voltage. The speed of the elevator is indicated by the tachometer-generator. The voltage of the tachometer-generator is compared with the tapped voltage of the potentiometer. Any existing difference is amplified by the amplifier and fed to a thyratron rectifier, whereby the current delivered to the brake release coil is increased or decreased so that the speed of the elevator corresponds again with the speed it should have at that particular position.

The desired deceleration may also be obtained by controlling the grid voltage of an electronic tube inserted in the circuit of the brake either by a voltage dependent on time or by a voltage dependent on speed.

A voltage dependent on time may, for instance, be derived from a discharging capacitor, while a voltage dependent on speed is derived from a tachometer-generator.

The accompanying drawing diagrammatically illustrates two speed control arrangements according to the invention.

Figure 1 is a circuit for obtaining deceleration dependent on speed, and

Figure 2 illustrates a circuit for obtaining deceleration dependent on time.

Referring to Figure 1, the resistance W_1 is connected to a constant direct current voltage. The resistance itself acts as a voltage divider. During movement of the elevator cab, the switch S_1 is closed and switch S_2 open, and during the stopping period switch S_2 is closed and switch S_1 is open. D is a tachometer-generator, the voltage of which is proportional to the elevator speed. V_1 is a tube with normal amplifying connections, that is to say, the anode current is a function of the grid voltage and when the latter varies a variable voltage is produced through the resistance W_5. The gas filled tubes V_2 and V_3, the transformers T_1, T_2, T_3, and the resistance W_6 represent the usual thyratron connection, which requires no explanation. A voltage divider, consisting of the resistances W_3 and W_4, determines the working point of the thyratron tubes V_2 and V_3, and the tapping K_4 determines the working point of the amplifying tube.

The voltage at the output of the thyratron tubes V_2 and V_3 is applied to the release coil M of the brake B. In this way, the braking pressure of the brake B becomes a function of the grid potential of the tube V_1. This grid potential is determined, on the one hand, by the potential at the point A and, on the other hand, by the voltage of the tachometer-generator D. During operation of the elevator, the potential at point A is determined by the tapping K_1 on the resistance W_1. This tapping is so adjusted that when the elevator speed is a maximum the potential of the grid of the tube V_1 is sufficiently high to cause the brake to be completely released.

During the braking period, the potential at the point A is dependent on the position of the contact K_3, which, in its turn, is dependent on the distance of the elevator cab from the story or hall floor level. The voltage of the tachometer-generator D must correspond at any instant to the voltage tapped at W_2, a change in the current flowing through the brake release coil being produced by the voltage difference at the grid of the control valve V_1. This change is always in such a direction that the brake pressure is increased or reduced according as to whether the elevator speed is too fast or too slow at the particular moment.

During the braking period, the driving motor, which may be constructed as a slipring motor, may remain connected to the supply with a large rotor resistance.

When the contact K_3 reaches the far end of the resistance W_2, the position of the contact K_2 on the resistance W_1 determines the speed of the elevator. The elevator now moves at a low speed up to within a short distance of the hall floor level at which point the driving motor is disconnected, manually or automatically and the current flowing through the brake release coil is interrupted.

Referring to the circuit diagram shown in Figure 2, the grid of the tube V_1 is connected during the deceleration period to a voltage constituted by the difference between a voltage dependent on time and one dependent on speed.

The voltage depending on speed is indicated by a tachometer-generator, as in the case of Figure 1, whilst the voltage dependent on time is determined by a capacitor C discharging through a resistance W_7.

Instead of the resistance W_7, other electrical elements may be used, such as pentodes, etc., in order to obtain a discharge curve of the capacitor C the shape of which as a function of time is different.

During the running of the elevator, the switch S_1 is closed so that the capacitor C can be charged. In order to stop the elevator, the switch S_1 is opened and the switch S_2 is closed. All other functions are as in the case of Figure 1.

Instead of the amplifier consisting of an electronic tube,

use may be made of magnetic amplifiers or of amplifying dynamos or generators.

What we claim is:

1. In an elevator decelerating device, the combination of an electromagnetic brake, an electric amplifier, a tachometer-generator and a source of voltage, the tachometer-generator being electrically connected between the source of voltage and the input to said amplifier and being driven at a speed proportional to the elevator speed, whereby the difference in voltage between said source of voltage and the output of the tachometer-generator controls the application and release of the electromagnetic brake.

2. Device according to claim 1 in which the source of voltage consists in a resistance traversed by an electrical current and having a sliding contact which is movable to tap proportionally less voltage as the braking distance decreases.

3. Device according to claim 1 in which the source of voltage consists of a potentiometer to which a supply of constant voltage is connected, the movement of the sliding contact of such potentiometer being effected to tap proportionally less voltage as the braking distance decreases.

4. Device according to claim 1 in which the source of voltage is an electric capacitor.

5. Device according to claim 1, in which the source of voltage is an electric capacitor which is connected in an electric circuit so as to be charged during the non-decelerating operation of the elevator, such circuit including a resistance connected to the capacitor, and through which the capacitor is discharged during the deceleration period.

6. Device according to claim 1 in which the amplifier consists of a thermionic vacuum tube.

7. In an elevator decelerating device, the combination of an electromagnetic brake, a magnetic amplifier, a tachometer-generator and a source of voltage, the tachometer-generator being electrically connected between the source of voltage and the input to said amplifier and being driven at a speed proportional to the elevator speed, whereby the difference in voltage between said source of voltage and the output of the tachometer-generator controls the application and release of the electromagnetic brake.

8. Device according to claim 1 in which the electric amplifier is a dynamo.

9. In an elevator decelerating device, the combination of a driving motor for the elevator cab, an electromagnetic brake, an electric amplifier, a tachometer-generator and a source of voltage, the tachometer-generator being electrically connected between the source of voltage and the input to said amplifier and being driven at a speed proportional to the elevator speed, said driving motor having a large rotor resistance inserted in the circuit during the deceleration period, whereby the difference in voltage between said source of voltage and the output of the tachometer-generator controls the application and release of the electromagnetic brake.

10. Device according to claim 1 in which means are provided for maintaining the elevator cab at a low speed, after braking down from a relatively high speed, such low speed being maintained up to shortly before the cab levels off at a stop.

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