Oct. 1, 1940. M. RENAUD 2,216,501

DEVICE FOR REGULATING THE SPEED OF ELECTRIC MOTORS

Filed Sept. 13, 1938

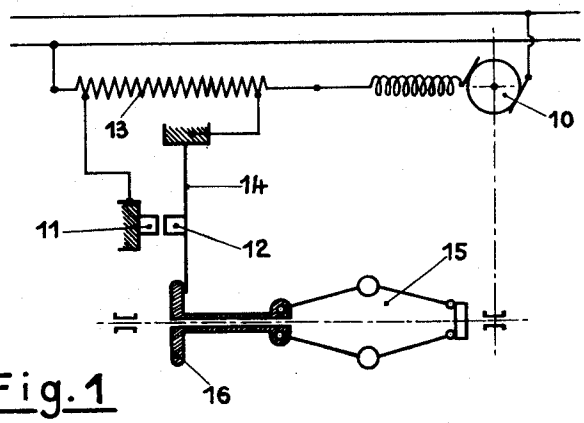


Fig. 1

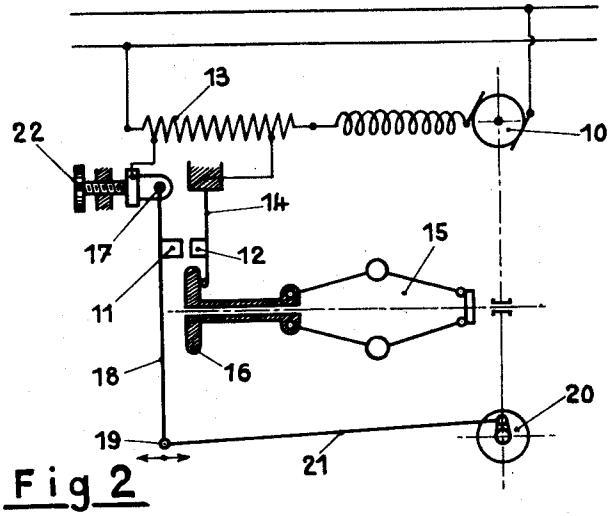


Fig 2

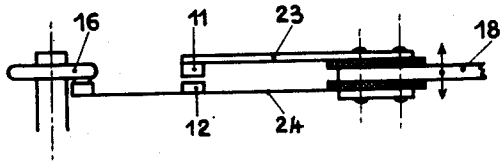


Fig. 3

INVENTOR

MARC RENAUD,

BY Volkaupter & Groff

ATTORNEYS

Patented Oct. 1, 1940 2,216,501

UNITED STATES PATENT OFFICE

2,216,501

DEVICE FOR REGULATING THE SPEED OF ELECTRIC MOTORS

Marc Renaud, Sainte-Croix, Switzerland, assignor to Paillard et Cie, S. A., Sainte-Croix, Switzerland, a corporation of Switzerland

Application September 13, 1938, Serial No. 229,765
In Germany September 16, 1937

4 Claims. (Cl. 200—80)

In order to regulate the rotary speed of electric motors, for example for maintaining it constant, it is well known to switch in or out a resistance, included in a suitable circuit of the motor, for example in the main circuit or in the energizing circuit, by means of pivotally mounted contacts actuated by a centrifugal governor when exceeding a predetermined speed of rotation and to again short circuit this or to switch it in when a suitable reduction in speed occurs. Devices of this character are however associated with the considerable disadvantage that the speed of rotation of the motor is not kept strictly constant but continuously fluctuates between two values which correspond to the positions of the centrifugal governor when the resistance is switched in or short circuited. They are therefore not capable of being used for special purposes, especially in the sound film industry.

The present invention has for its object to eliminate the above mentioned disadvantages in that the oscillations of the regulating contacts are not produced by fluctuations of the speed but by a positive method by which the sequence of opening and closing of the contacts takes place sufficiently rapidly so that the speed of the motor approximates more closely a strict constancy.

A form of construction of the subject of the invention is shown diagrammatically by way of example in the accompanying drawing, wherein:

Fig. 1 shows a circuit diagram of a non-controlled device.

Fig. 2 shows the device according to the invention.

Fig. 3 shows a detail of modification. In order to show clearly the difference between the known devices and that according to the invention, one of the former will be described briefly with reference to Fig. 1. The current may be continuous or alternating.

In the circuit of the main motor 10 is provided a resistance 13, which can be included in the circuit or short circuited by means of a switch consisting of the parts 11 and 12.

The contact member 11 is stationary whilst the contact member 12 is mounted on a resilient arm 14, which normally tends to bring the contact members into contact with one another. The arm 14 is extended beyond the contact member 12 and its end is located in the path of a disc 16 actuated by a centrifugal governor 15. The method of operation of this device is as follows:

The disc 16 of the centrifugal governor 15 is so adjusted that at a predetermined speed of the motor 10 the contact members 11 and 12 are spaced from one another so that the motor circuit passes through the resistance 13. Consequently the motor will run more slowly until the centrifugal governor 15 in consequence of its lower speed of rotation again permits of contact between the contact members 11, 12. The disadvantage of this device is that the to and fro movement of the contact members 11 and 12 naturally only takes place slowly and the contact members themselves are considerably strained by the opening sparks which occur for a comparatively long period of time. The device only comes into action in two predetermined positions of the contact members 11, 12, that is to say in a "closed" and in an "open" position. These positions are determined by the length of the opening spark. These two positions correspond with two different speeds of rotation of the motor, of which the speed is thus not constant but fluctuates about the mean value with an oscillation frequency which depends upon the inertia of the masses in question as also with an amplitude which depends on the length of the opening spark between the contacts 11 and 12.

Even when a spark protection is provided the above mentioned disadvantages still obtain.

The device according to the invention which will be described with reference to Fig. 2 differs from the known devices in that the contact member 11 is no longer stationary, but is secured to an arm 18, which is hinged at 17. This arm is connected at 19 to a crank rod 21 actuated by a crank 20. The hinge 17 is also adjustable by means of an adjusting device as for example a set screw 22. Both the crank 20 and the centrifugal governor 15 are driven by the motor 10.

This device operates as follows:

When the motor 10 rotates, the disc 16 of the centrifugal governor 15 is set according to the selected speed of rotation. At the same time the crank 20 produces a regular to and fro movement of the arm 18, carrying the contact member 11 so that this normally comes into contact with the contact member 12 at each revolution of the crank and consequently short circuits the resistance 13. Very rapidly succeeding uniform impulses are thus superposed on the motor current. As the contact member 12 is secured to the resilient arm 14, this latter bears alternately against the disc 16 of the centrifugal governor and on the contact member 11. In the case of the least displacement of the disc 16, the duration of contact between the contact members 11 and 12 is varied and thus the motor is influenced correspondingly.

By the set screw 22, the relative position of the contact members 11, 12 can be varied and thus the speed of rotation of the motor can be adjusted as desired.

As the magnitudes of the oscillations of the contact member 11 are sufficient within a magnitude of the order of minus 0.5 mm. there oc-

curs a sharp interruption of the spark produced between the contact members.

From the above description it will be seen that the disc 16 of the centrifugal governor 15, on condition that the crank 20 rotates at a sufficient speed of rotation, assumes a practically invariable position for a predetermined speed, which corresponds with the position in which the necessary ratio between the closing and opening periods of the circuit through the contact members 11 and 12 takes place. This ratio between the opening and closing periods, which determines the speed of rotation of the motor, is a definite one for every position of the disc 16 so that even on a slight movement of the disc a regulation of the current takes place, contrary to what is the case in the known device first described wherein the disc 16 must first traverse a path corresponding to the temporary spacing between the two contact members, before a regulation of the current can in fact occur. As the sequence of the interruptions is very rapid, fluctuations in the speed of rotation can no longer be absolute. The motor thus rotates at a practically absolutely constant speed of rotation.

In Fig. 3 is shown a detail of a modification in which the oscillating arm 18 carries suitably insulated two contact members 11 and 12 of which the first is secured to a rigid support 23 and the second to a blade spring 24 which normally holds the two contact members in contact with one another. The blade spring is extended beyond the contact member 12 and its end projects into the path of the movable disc 16 of the centrifugal governor.

At each oscillation of the arm 18 the contact members are separated from one another when the end of the blade spring 24 meets the disc 16 and the duration of this separation depends on the relative position between the pivot of the arm 18 and the disc 16.

Various modifications may be made in the arrangement shown diagrammatically in Fig. 2. For example spark bringing devices may be provided. As the contact members 11 and 12 may be sufficiently far apart at each oscillation these devices may act more effectively.

The crank 20 may also be replaced by a cam disc or an eccentric.

The to and fro movement of the contacts may also be produced for example by inclining the disc 16 of the centrifugal governor on its shaft or also by a suitably shaped cam disc.

The movement of the oscillating arm 18 may also be produced by any suitable auxiliary motor.

The centrifugal governor may be static or astatic and of any suitable construction.

The closing of the contact may naturally act on the motor in various ways, for example by short circuiting a portion of a shunt resistance in the case of shunt wound motors or by short circuiting an additional winding and so forth.

This device is capable of being used in a suitable circuit for any type of electric motor.

The contact closing may be used in every case where a periodic closing of the circuit for regulating a condition magnitude is possible (for example regulation of the speed, regulation of the voltage or current of a current generator).

I claim:

1. Regulating means for a movable element comprising a switch having a pair of cooperating contacts, means for imparting to at least one of said contacts, during movement of said element, oscillations of a fixed amplitude to open and close said contacts, a yieldable mounting for the other of said contacts, and means operable in response to variations in the movement of said element to adjust the position of said yieldably mounted contact relative to said first mentioned contact to vary the duration of the periods of opening and closing of said contacts resulting from the fixed-amplitude oscillations of said first mentioned contact.

2. Regulating means for a movable element comprising a switch having a pair of cooperating contacts, a pivoted oscillatory member carrying one of said contacts, means for imparting to said member and to the contact carried thereby, during movement of said element, oscillations of a fixed amplitude to open and close said contacts, a yieldable mounting for the other of said contacts, means operable in response to variations in the movement of said element to adjust the position of said yieldably mounted contact relative to said first mentioned contact to vary the duration of the periods of opening and closing of said contacts resulting from the fixed-amplitude oscillations of said member and said first mentioned contact, and means for adjusting the location of the pivot of said member to vary the duration of the periods of opening and closing of said contacts resulting from the fixed-amplitude oscillations of said member and said first mentioned contact.

3. Regulating means for a movable element comprising a switch having a pair of cooperating contacts, means for imparting to one of said contacts, during movement of said element, oscillations of a fixed amplitude within fixed limits corresponding to the amplitude of the oscillations, yieldable means mounting the other of said contacts for movement toward and away from said first mentioned contact, and means operable in response to variations in the movement of said element and cooperating with said yieldable mounting means to adjust the position of said second mentioned contact relative to said first mentioned contact to vary the duration of the periods of opening and closing of said contacts resulting from the fixed-amplitude oscillations of said first mentioned contact.

4. Regulating means for a movable element comprising a switch having a pair of cooperating contacts, an oscillatory member by which both of said contacts are carried for oscillation therewith, one of said contacts being fixed to said member, yieldable means mounting the other of said contacts on said member for movement toward and away from said first mentioned contact, means for imparting to said member and to said first mentioned contact, during movement of said element, oscillations of a fixed amplitude, and means operable in response to variations in the movement of said element to limit oscillatory movement of said second mentioned contact with said first mentioned contact in one direction to cause said contacts to open and close in response to oscillations of said member and said contacts and to vary the duration of the periods of opening and closing of the contacts resulting from the fixed-amplitude oscillations of said member and the contact fixed thereto.

MARC RENAUD.