Feb. 12, 1935.

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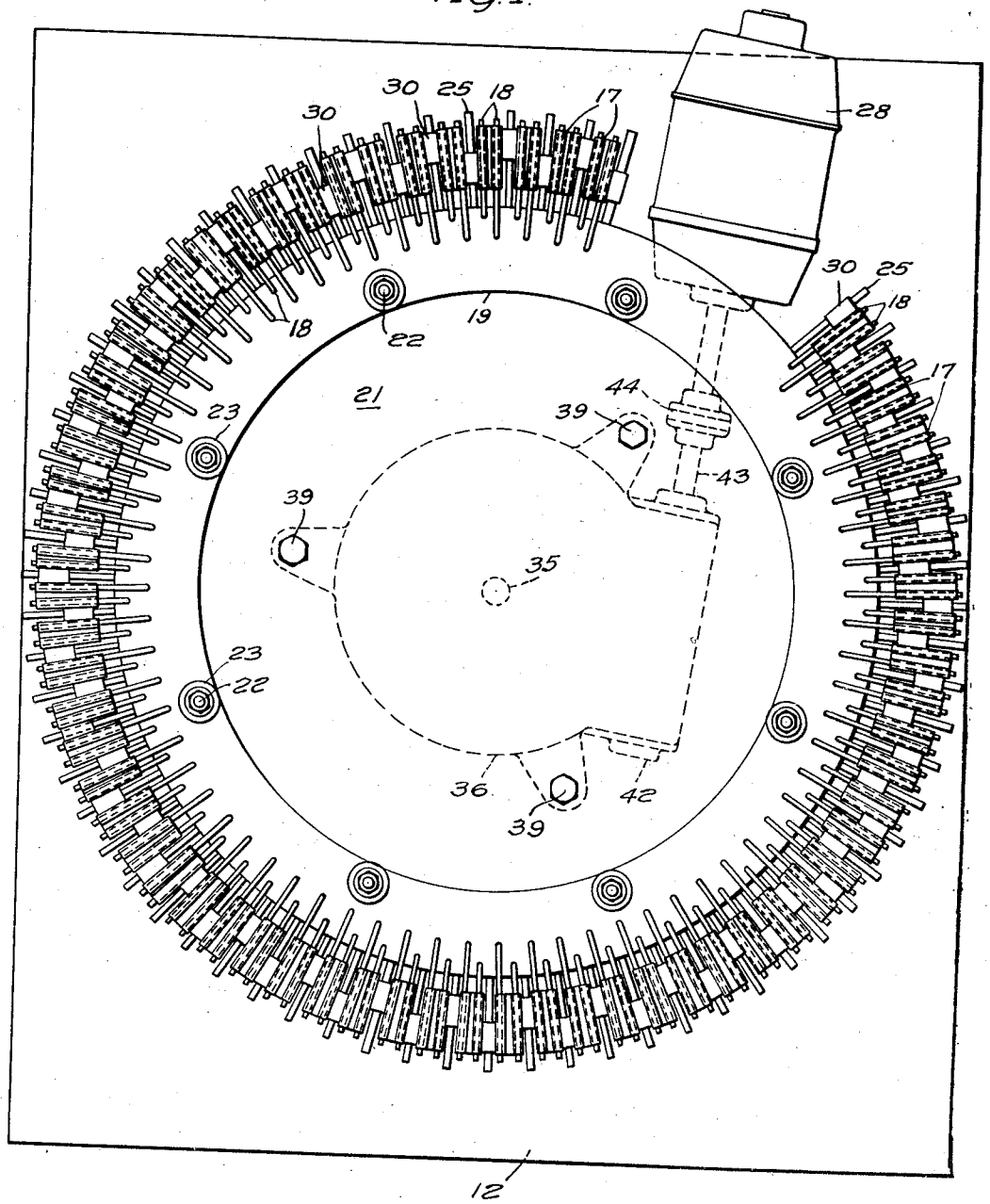
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CONTROL APPARATUS

Filed April 22, 1933

3 Sheets-Sheet 1

Fig. 1.



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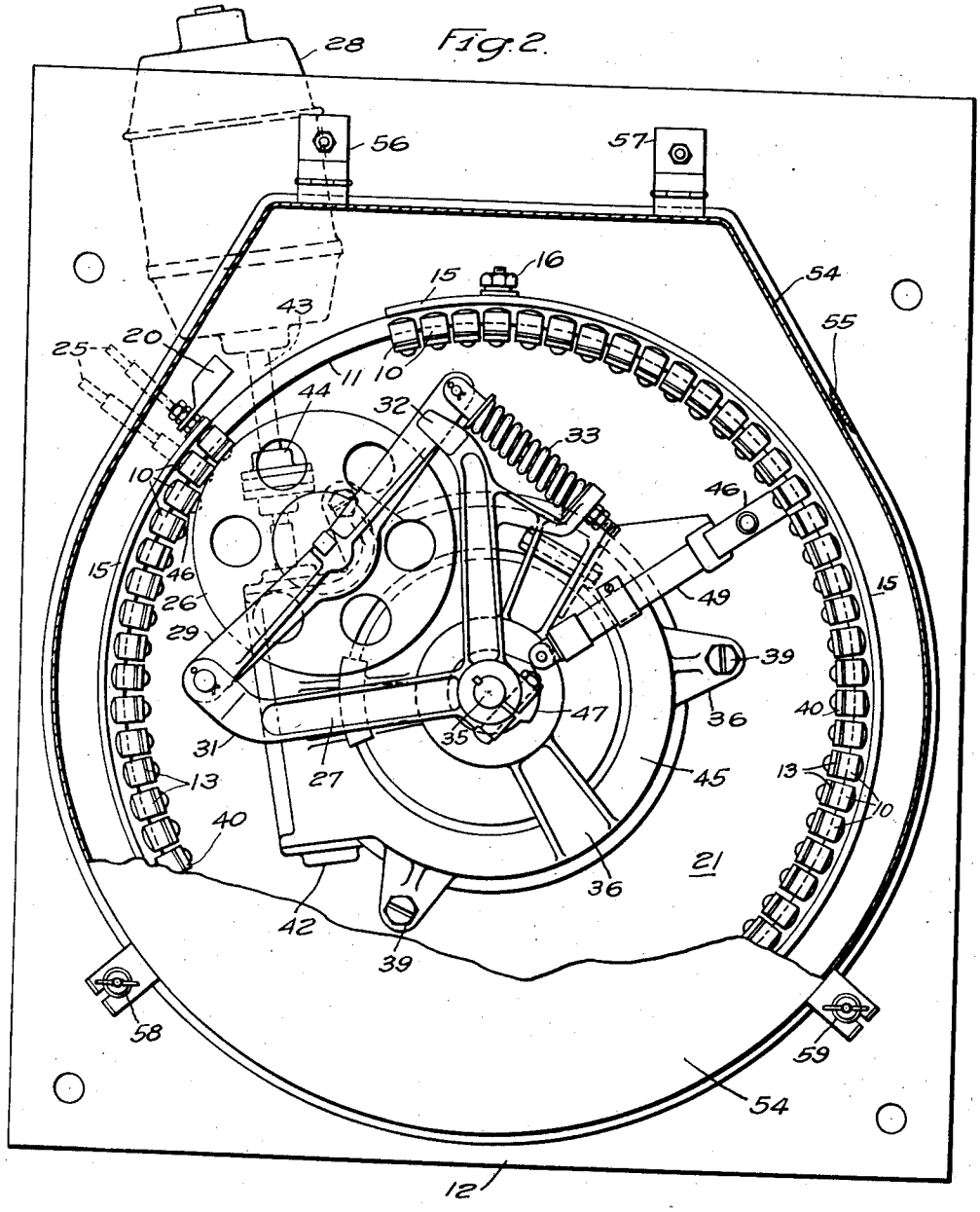
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CONTROL APPARATUS

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Fig. 2.



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CONTROL APPARATUS

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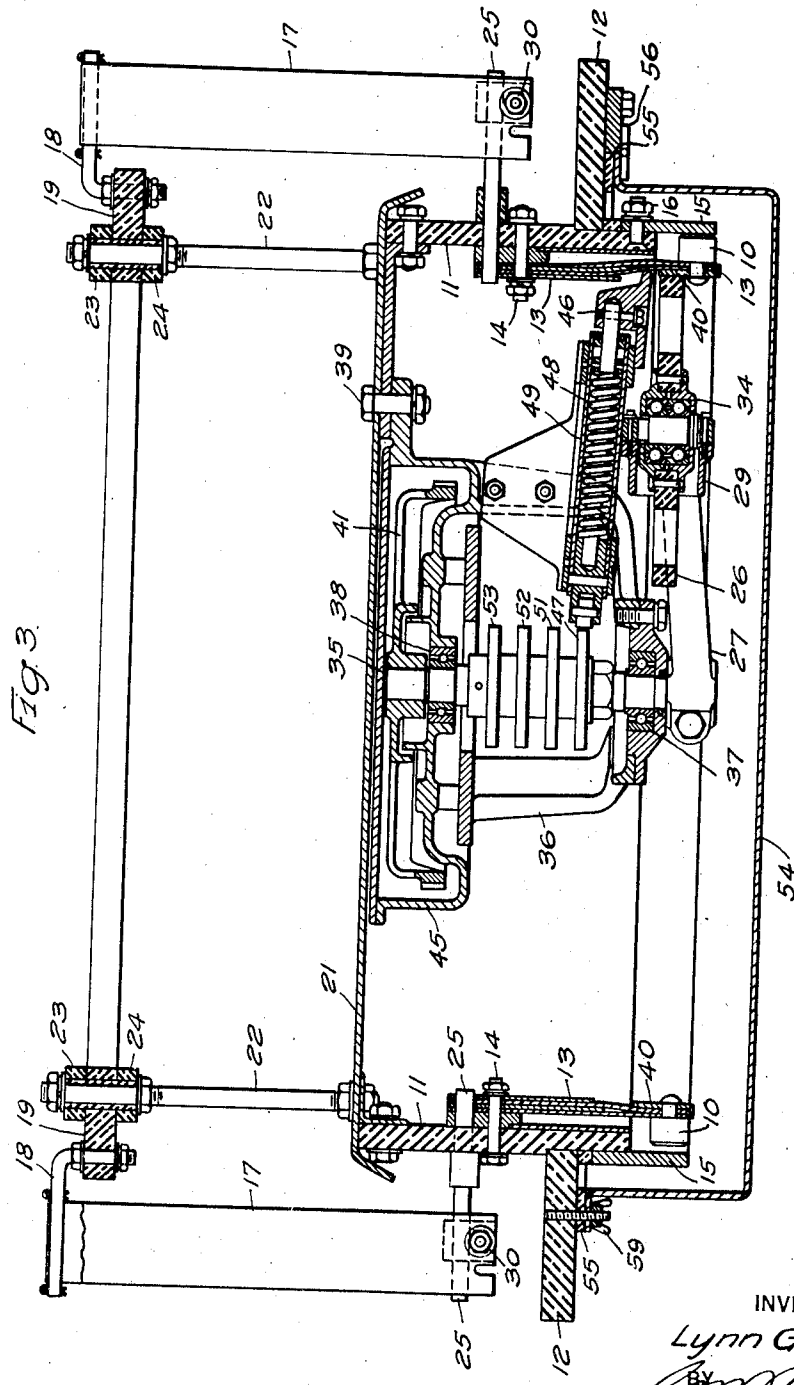


FIG 3.

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UNITED STATES PATENT OFFICE

1,991,229

CONTROL APPARATUS

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Application April 22, 1933, Serial No. 667,367

13 Claims. (Cl. 201—48)

My invention relates, generally, to control apparatus and more particularly to apparatus for controlling the acceleration of street cars, trolley buses and the like.

In accordance with the teachings of the prior art, the acceleration of electrically-propelled vehicles has been controlled by connecting resistors in series with the propelling motors of the vehicles to control the current supplied the motors. The resistors are shunted from the motor circuits step-by-step either by means of drum controllers having sliding contact members or by means of unit switches which are operated either electrically or by air pressure. Drum controllers are fairly satisfactory when the motor current is small and a relatively few steps of acceleration are required, but they are not capable of controlling high values of current and the drums become excessive in size if a large number of steps are provided. Unit switches have been developed which have high interrupting capacities and, at present, switches of this type are utilized on practically all street cars to control the acceleration.

However, when a large number of steps of resistance are provided, in order to increase the smoothness of acceleration, the unit switches require a large amount of space and greatly increase the weight and cost of the control equipment. In order for the street car to successfully compete with other modes of transportation, it is necessary to increase the rate of acceleration and the smoothness of control, and at the same time decrease the cost of operation.

An object of my invention, generally stated, is to provide acceleration-control apparatus which shall be light in weight, simple and efficient in operation and which may be readily and economically manufactured and installed.

A more specific object of my invention is to provide for shunting a plurality of resistor sections in sequential relation without utilizing sliding contact members.

Another object of my invention is to provide acceleration-control apparatus which shall be extremely compact and which will occupy a minimum amount of space.

A still further object of my invention is to provide resistor-shunting apparatus in which the resistor elements are connected directly to contact members which shunt the respective resistor elements, thereby making cable connections unnecessary.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

According to one embodiment of my invention, an accelerator or controller is provided in which a plurality of spring-mounted contact members are successively pressed against a circular bus-bar by means of a spring-loaded roller. As each contact member is pressed against the bus-bar, a small step of resistance is shunted from an electrical circuit, thereby increasing the current in the circuit. The actuating roller is carried on a rotating arm which may be driven either by a reversible pilot motor or by an air engine. The speed of the pilot motor may be varied to permit the selection of several different rates of acceleration as desired by the operator to suit operating conditions. The resistor sections are assembled on the outside and above the accelerator frame and are connected directly to the contact members, thereby making separate cable connections between the control apparatus and the resistors unnecessary.

For a fuller understanding of the nature and scope of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top plan view of control apparatus constructed in accordance with my invention;

Fig. 2 is a bottom plan view of the apparatus, and

Fig. 3 is an enlarged view, partially in section and partially in elevation of the apparatus shown in Figs. 1 and 2.

Referring to the drawings, and particularly to Figs. 2 and 3, the accelerator illustrated comprises a plurality of contact members 10 which are resiliently mounted on the inside of a ring 11 composed of insulating material. The ring 11 is mounted in a panel 12 which may be supported in a car body (not shown) in any suitable manner.

As shown, the contact members 10 are carried by leaf springs 13 which are secured to the ring 11 by bolts 14. The contact members 10 are so disposed that they may be pressed outwardly to engage a circular bus-bar 15 mounted on the outside of the ring 11 and secured thereto by screw bolts 16. The bus-bar 15 may be composed of copper, or other material suitable for conducting electric current, and, as shown, the bar extends below the bottom of the ring 11 to permit the contact members 10 to be pressed into engagement therewith in a manner to be more fully described hereinafter. A cable connection 20 is provided for connecting the bus-bar in an electrical circuit.

As shown, a plurality of resistor elements 17 are mounted outside and above the ring 11. The resistor elements 17 are supported by L-shaped arms 18 which are secured in a ring 19 composed of insulating material. The ring 19 is mounted above a circular metal plate 21 which covers the ring 11, by means of extension bolts 22, the lower ends of which are secured to the plate 21.

Insulating bushings 23 and 24 are placed between the ring 19 and the bolts 22, as shown, to

insure that the resistor elements 17 will be properly insulated from the bolts 22 and the cover plate 21. If it is desired to provide more resistor elements than can be mounted around the outside of the ring 19, as shown, additional resistors may be readily mounted inside of the ring in the space above the plate 21. All of the resistor elements 17 may be connected in series if desired, or they may be divided into two or more groups, the elements in each group being connected in series.

In order that the resistor may be shunted step-by-step, each section or element of the resistor is connected to one of the contact members 10 by means of a stud 25, which extends through the ring 11, and is connected to the upper end of the spring 13 which carries the contact member 10. The resistor sections are connected to the studs 25 by means of clamps 30. When each contact member is pressed against the circular bus bar 15, as will be described hereinafter, the section of the resistor connected to that contact member is shunted from the electrical circuit in which the resistor is connected.

A roller 26, which is of sufficient circumference to engage two of the contact members 10 at the same time and may be composed of a suitable insulating material, is provided for pressing the contact members into engagement with the copper ring 15. The roller 26 is carried by a bifurcated rotating arm 27, driven by a motor 28 and is mounted on a cross-arm 29, one end of which is pivotally connected to one fork 31 of the bifurcated arm 27. The other end of the cross arm 29 is slidably mounted in the other fork 32 of the arm 27 and the roller 26 is forced outwardly by a spring 33. The roller 26 is mounted on the cross arm 29 by means of a ball bearing 34, thereby reducing friction.

The rotating arm 27 is secured to the lower end of a vertical shaft 35, which is supported in a casting member 36 by two ball or roller bearings 37 and 38. The casting member 36 is secured to the bottom side of the plate 21 by three bolts 39. The shaft 35 is rotated by a gear wheel 41 driven by an enclosed worm drive 42 which is connected to the shaft 43 of the motor 28 by means of a flexible coupling 44. The gear wheel 41 is also enclosed in a metal casing 45 to provide for proper lubrication of the driving mechanism.

It will be seen that the contact members 10 are successively pressed into engagement with the circular bar 15 as the roller 26 is actuated around the circular row of contact members. As previously explained, each contact member 10 is connected to a section of the resistor 17. Therefore the bus-bar 15 and the resistor 17 may be so connected in an electrical circuit that the resistor elements 17 will be shunted from the circuit step-by-step when the roller 26 is driven in one direction around the circular row of contact members, thereby decreasing the amount of resistance in the electrical circuit. When the roller 26 is driven in the opposite direction, the amount of resistance connected in the circuit is increased. The operation of the motor 28 may be controlled to stop the roller 26 at any desired position and the rate of travel of the roller may be varied by varying the speed of the motor 28. In this manner the rate of acceleration of the propelling motors of a street car, or other electric vehicle may be readily controlled.

It will be observed that the contact members 10 are provided with a spherical or rounded surface for making contact with the circular bus-bar 15. In order that a definite rubbing action shall take place between the contact member 10 and the bar 15, as the contact member engages and disengages the bar, to keep the contacting surfaces clean, a non-flexible plate 40 is mounted on each of the contact members 10, the flexible spring leaves 13 being interposed between the plate 40 and the contact member.

As shown in Fig. 3, the plate 40 extends upwardly a sufficient distance to permit the roller 26 to engage the plate above the contact member. It will thus be seen that the springs 13 are deflected, when the roller 26 engages the plate 40, in a manner to produce a slight movement, in a vertical direction, between the contact member and the bus bar.

Referring particularly to Fig. 2, it will be observed that the roller 26 first engages one corner of the plate 40 on each of the contact members as the roller is driven around the circular row of contact members. The leaf springs 13, which support the contact members, are, therefore, twisted a slight amount as the contact member is actuated toward the bus bar, thereby producing a slight movement, in a horizontal direction, between the contact member and the bus bar. In this manner, a definite rubbing action is caused to take place between the contact members and the bus bar, thereby maintaining the contacting surfaces clean and free of oxidized matter, which prolongs the life of the contact members.

In order that certain of the contact members 10 may be actuated into engagement with the bus-bar 15 independently of the roller 26, a plunger arm 46 is disposed to be actuated by a cam 47 on the shaft 35. The plunger arm 46 is normally retracted by a spring 48, disposed in a housing 49 which is secured to the casting member 36. When the end of the plunger rod is engaged by the cam 47, the plunger 46, which is disposed opposite one of the contact supporting springs 13, engages the spring to press one of the contact members 10 against the bus-bar 15.

It will be understood that the cam 47 may be so shaped and positioned on the shaft 35, that the contact member actuated by the plunger 46 may be retained in engagement with the bus bar 15 during any desired period of time. Additional cams 51, 52 and 53 are provided on the shaft 35, which may be utilized to operate limit switches (not shown) for controlling the operation of the motor 28, also other plungers, similar to the one shown, may be provided if desired.

A metal cover 54 is mounted underneath the panel 12 for enclosing the contact members 10, the roller 26 and its operating mechanism. A felt washer 55 is interposed between the cover 54 and the panel 12 to exclude dirt and moisture from the mechanism. The cover is mounted on the panel by means of hinges 56 and 57 and is retained closed by wing-nuts 58 and 59. It may be readily lowered to permit inspection of the apparatus by removing the nuts 58 and 59 and permitting the cover to swing about its hinges 56 and 57. It will thus be seen that all moving parts of the apparatus and also the resistor shunting contact members are completely enclosed and protected from dirt and moisture.

From the foregoing description it will be apparent that I have provided control apparatus particularly adapted for controlling the acceleration of the propelling motors of electric vehicles, although it is not limited to controlling motors of this type. Since a large number of resistor steps are provided, the smooth acceleration necessary for the comfort of the passengers in the vehicle

is obtained. The apparatus herein described is light in weight and compact, thereby occupying a small amount of space in a vehicle.

I do not desire to be restricted to the specific embodiment of my invention herein shown and described, since it is evident that it may be changed and modified without departing from the spirit and scope of my invention as defined in the appended claims.

I claim as my invention:

1. In control apparatus, in combination, a resistor having a plurality of sections, a stationary bus-bar comprising an arc of a circle, a plurality of resiliently mounted contact members disposed to engage the bus-bar to shunt the resistor sections, and means disposed to move concentrically within the bus-bar for pressing the contact members into engagement with the bus-bar.

2. In control apparatus, in combination, a resistor having a plurality of sections, a stationary bus-bar comprising an arc of a circle, a plurality of resiliently mounted contact members disposed to engage the bus-bar to shunt the resistor sections step-by-step, a rotatable member for pressing the contact members into engagement with the bus-bar in successive relation, and means for operating said rotatable member concentrically along the bus-bar.

3. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of resiliently mounted contact members mounted along the circular bus-bar and disposed to engage the bar to shunt the resistor sections, a rotatable member for actuating the contact members into engagement with the bus-bar, and means for operating said rotatable member.

4. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members mounted inside of the circular bus-bar and disposed to be actuated into engagement with the bar to shunt the resistor sections, a rotatable member mounted inside of the contact members and disposed to actuate the contact members into engagement with the bus-bar, and means for operating the rotatable member.

5. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members disposed to engage the bus-bar to shunt the resistor sections, a resiliently mounted roller for pressing the contact members into engagement with the bus-bar, and means for actuating the roller.

6. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members disposed to engage the bus-bar to shunt the resistor sections, a resiliently mounted roller for pressing the contact members into engagement with the bus-bar, a rotatable arm for supporting the roller, and means for driving the rotatable arm.

7. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members disposed to engage the bus-bar to shunt the resistor sections, a resiliently mounted roller for successively pressing the contact members into engagement with the bus-bar, a bifurcated arm for supporting the roller, and means for rotating the arm.

8. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members disposed to engage the bus-bar to shunt the resistor sections, a resiliently mounted roller for pressing the contact members into engagement with the bus-bar, a rotatable arm for supporting the roller, means for driving the rotatable arm, and plunger means for actuating certain of the contact members into engagement with the bus-bar during a predetermined period of time.

9. In control apparatus, in combination, a resistor having a plurality of sections, a circular bus-bar, a plurality of spring mounted contact members disposed to engage the bus-bar to shunt the resistor sections, a resiliently mounted roller for pressing the contact members into engagement with the bus-bar, a rotatable arm for supporting the roller, means for driving the rotatable arm, plunger means for actuating certain of the contact members into engagement with the bus-bar during a predetermined period of time, and cam means for operating said plunger means.

10. In control apparatus, in combination, a plurality of resistor elements, a circular bus-bar, a plurality of contact members disposed to engage the bus-bar to shunt the resistor elements, a spring element for supporting each of said contact members, stud members for connecting the resistor elements to the spring elements, rotatable means for pressing the contact members into engagement with the bus-bar, and means for actuating said rotatable means.

11. In control apparatus, in combination, a plurality of vertically mounted resistor elements disposed in circular arrangement, a circular bus-bar disposed below the resistor elements, a plurality of contact members disposed to be actuated into engagement with the bus-bar to shunt the resistor elements, a spring element for supporting each of said contact members, stud members for connecting the resistor elements to the spring elements, rotatable means for pressing the contact members into engagement with the bus-bar, and means for actuating said rotatable means.

12. In control apparatus, in combination, a circular bus-bar, a plurality of contact members having a rounded surface disposed to engage the bus-bar to establish electrical circuits, a flexible spring element for supporting each of said contact members, a non-flexible plate mounted on each contact member, and rotatable means for actuating the contact members into engagement with the bus bar, said rotatable means being disposed to first engage one corner of the plates on the contact members in a manner to twist the flexible springs a slight amount thereby producing a rubbing action between the contact members and the bus-bar.

13. In control apparatus, in combination, a circular bus-bar, a plurality of contact members having a rounded surface disposed to engage the bus-bar to establish electrical circuits, a flexible spring element for supporting each of said contact members, a plate mounted on each contact member and extending above the contact member, and rotatable means for actuating the contact members into engagement with the bus-bar, said rotatable means being disposed to engage the plates above the center line of the contact members in a manner to produce a rubbing action between the contact members and the bus-bar.

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