Aug. 30, 1932. C. I. HALL 1,874,513

TRAFFIC SIGNAL CONTROLLER

Filed June 18, 1929 2 Sheets-Sheet 1

Fig. 1.

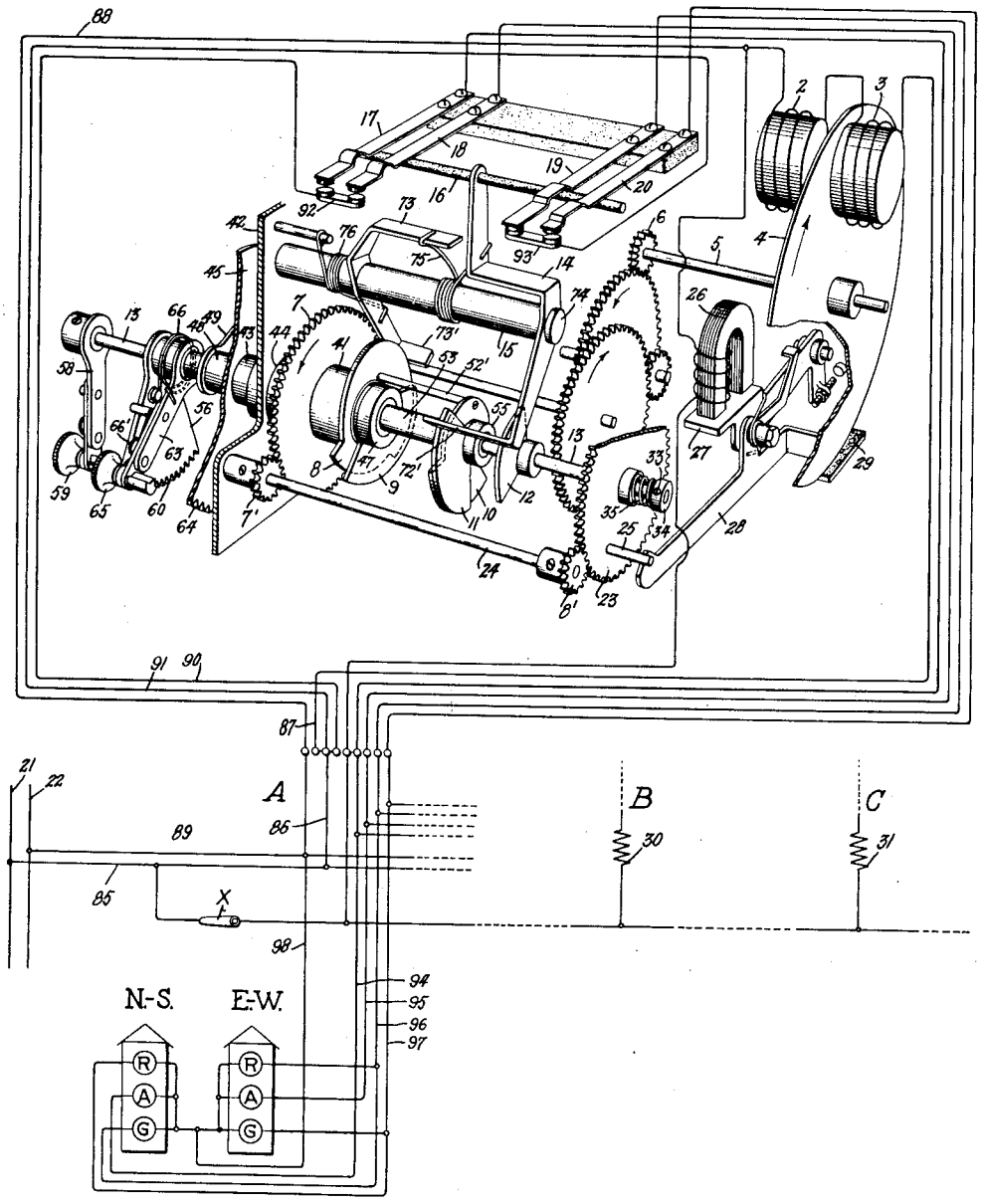

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Fig. 5.

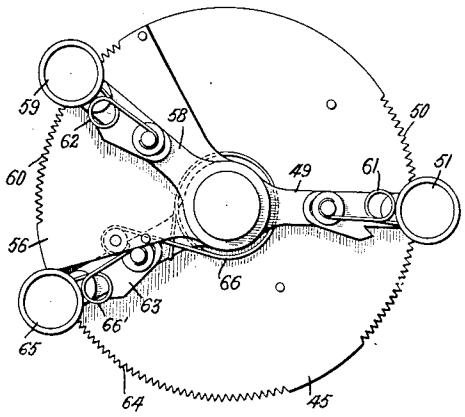


Fig. 4.

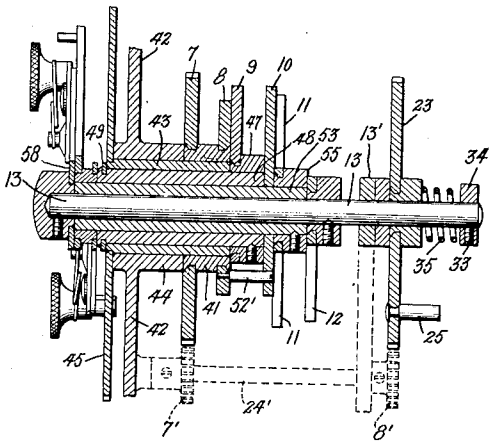


Fig. 6.

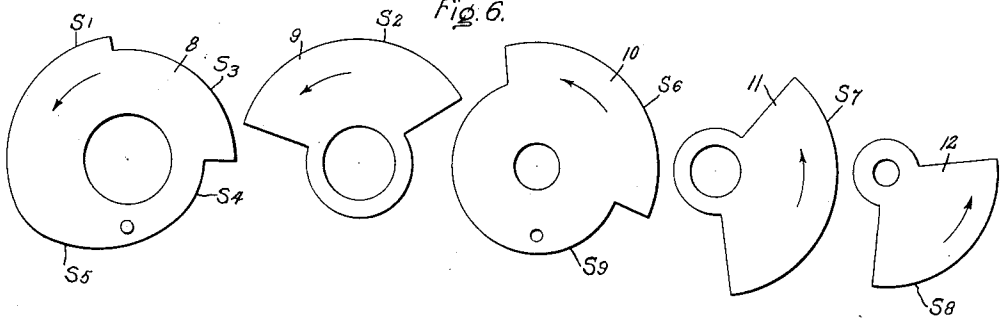


Fig. 2.

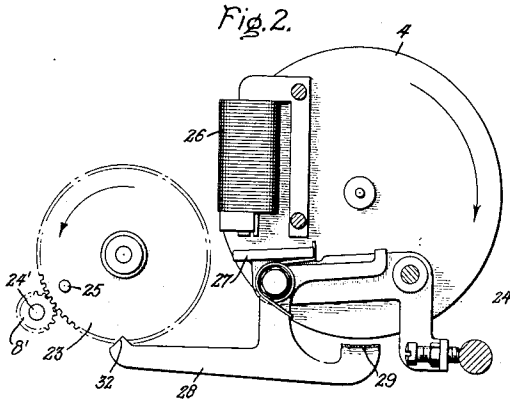
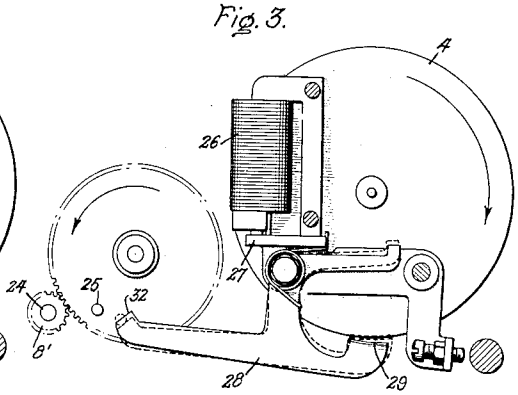


Fig. 3.



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UNITED STATES PATENT OFFICE

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TRAFFIC SIGNAL CONTROLLER

Application filed June 18, 1929. Serial No. 371,871.

My invention relates to traffic signal controllers. More particularly it relates to controllers of the type in which the signals are operated through the medium of a motor. The invention is especially adapted for use in connection with traffic signaling systems in which a set of signals is provided at each street intersection, in which a separate controller is provided with each set of signals, in which the controllers are maintained in synchronism and the different sets of signals are operated in a definite relation. For example, the "Go" signals along a given street may be caused to operate simultaneously or they may be caused to operate progressively.

In traffic signaling systems where the motors are operated in synchronism, from time to time the motors temporarily fall out of step, sometimes due to one cause and sometimes due to another, producing an improper relationship between the controllers. Therefore, it becomes necessary to send some one out to reset the controllers in synchronism. This resetting operation has to be done at each controller. It is an object of my invention to provide means for accomplishing the resetting operation from a central point and thus avoid the necessity of having to send some one to each device to reset the motors manually.

It is an object of the invention to accomplish the resetting operation by the provision of electro-magnetic means at each motor, all of said electro-magnetic means being controlled from a central point.

It is an object of the invention to provide the electromagnetic means with a brake device for stalling the motors as they arrive at a predetermined position so as to bring the cams into the desired relation and to then release them simultaneously in order that they may start in synchronism. It is also an object to provide other features which will be understood from the accompanying specification and claims, reference being had to the accompanying drawings, in which Fig. 1 represents more or less diagrammatically in perspective a system having the features of the invention. In this figure three intersections A, B, C, are represented. At intersection A the signals are shown together with the control motor and circuits. The brake device of this motor is shown in detail, the brake device being under the control of an electromagnet. In this same figure the two other intersections B and C are represented each by a coil through the medium of which the corresponding brake device is actuated to stop the corresponding motor. Neither the brake device nor the motor is shown at intersections B or C. In Fig. 2 one of the brake devices and the electromagnet controlling it are shown in side elevation, the electromagnet being represented as deenergized and consequently the brake is shown disengaged from the disk of the motor. In Fig. 3 the same brake device is shown with the electromagnet energized. The solid line position of the brake is that corresponding to the position of the brake before the control mechanism which is operated by the motor has reached the point at which the motor should be stalled. The dotted lines represent the position of the brake when it has been applied to the motor disk. Fig. 4 shows the signal control mechanism which is operated by the motor comprising gears, cams and dials. In this figure the mechanism is shown in elevation and in section. Fig. 5 shows the same section of the device in front view, the control dials being shown more clearly in this figure than in Fig. 4. Fig. 6 shows a so-called exploded view of the signal controller cams of Figs. 1 and 4, in a given relative position, which relative position may be varied by the dials, Fig. 5.

Referring to Fig. 1, in the lower left-hand corner a set of signals associated with the signal controller, shown in the upper part of the same figure, is indicated. These signals are usually located in a housing having four faces, two corresponding to the north and south positions of the compass and the other two corresponding to the east and west positions of the compass. For the sake of simplicity only two of the four faces are shown, one representing the north and south signals and the other the east and west signals, marked N—S and E—W, respectively.

The features of the invention may be ap-

plied to a signal controller of any suitable design, such for example as that shown and described in my copending application, Serial No. 339,349, filed February 12, 1929.

The signal controller comprises a motor represented by the coils 2 and 3 and by the disk 4 mounted on the shaft 5. On the shaft 5 there is a gear 6 which drives a train of gears, as shown, including the gear 7 through the medium of which the cams 8, 9, 10, 11 and 12 are driven about an axis through the shaft 13, see Figure 4.

It will be seen by referring to Fig. 4 that gear 7 is mounted on a collar 41. On the same collar there is mounted the cam 8. Within the collar 41 there is a tubular bearing 43 to which the collar 41 is secured. This tube passes through bearing 44 formed in the front part 42 of the frame, which tube terminates in the dial 45. Next to the cam 8 is located a cam 9 which is secured to the collar 47, which collar is in turn secured to the tube 48, the latter being located within the tube 43. Beyond the frame 42 and beyond the dial 45 this tube 48 is secured to an index arm or lever 49. This lever is provided with a radially movable dog element 51, which under the control of spring 61 engages the teeth 50 in the peripheral section of the dial 45 and which is provided for convenience with a knob as shown. Therefore, by unlatching the arm 49 from the teeth and rotating it the cam 9 may be adjusted with respect to the cam 8.

Beyond the cam 9 there is located the third cam 10, which is loosely mounted on the hollow tube element 53. It will be seen from the drawing that cams 8 and 10 are locked together by means of the bolt 52'. Consequently, when the gear 7 is rotated both cams 8 and 10 must rotate with it. Just beyond the cam 10 there is placed the fourth cam 11, which latter is secured to the collar 55, which collar is in turn secured to the tube 53. This tube terminates at the left in a dial segment 56. Within the tube 53 is located the shaft 13 to which there is secured on one end the cam 12 and on the other end an index arm or lever 58. This lever is provided with a dog 59 similar to dog 51. Dog 59 normally engages the teeth 60 on the periphery of the segment 56 due to the tension of the coiled spring 62. Between the segment 56 and the lever 49 there is loosely mounted another index arm or lever 63, which latter is provided also with a dog 65, similar to dogs 51 and 59, and which is normally held in engagement with the teeth 64 on the periphery of the dial by means of the coiled spring 66'. The dial segment 56 and the arm 63 are connected by a coiled spring 66, one end of which latter is secured to the segment and the other end of which is secured to the arm 63, tending to draw the segment 56 against the arm 63. The object of this spring is to enable the arm 58 to be set or adjusted at any instant regardless of the position of the cams which, at intervals during a cycle of operation lock the segment 56 against rotation. However, at any other time the spring 66 will draw the segment into a new position determined by the arm 63.

With the mechanism described, when the gear 7 is rotated by the motor the whole mechanism shown in Fig. 4 rotates about the bearing 44, inasmuch as all of the elements are interlocked by means of the levers 49, 58 and 63 and their corresponding dogs. However, the cam 9 is adjustable with respect to the cam 8 through the medium of the lever 49. Similarly, the cam 12 is adjustable with respect to both the cams 11 and 10 through the medium of lever 58. Furthermore, cams 11 and 12 are adjustable simultaneously with respect to cam 10 through the medium of the lever 63 inasmuch as the lever 58 locks the cams 11 and 12 together.

In Fig. 6 I have shown the cams 8, 9, 10, 11 and 12 in one relation of adjustment with respect to each other along the axis of the shaft 13.

Through the medium of these cams the arm 14 is oscillated back and forth about the shaft 15. This arm is provided on its end with a rod 16 of insulating material, through the medium of which the springs 17, 18, 19 and 20 are operated, these springs being connected in circuit with the signals N—S and E—W, as indicated. For example, in one possible arrangement the spring 20 may control the "Go" signal east and west and the "Stop" signal north and south, while the spring 19 may control the "Go" signal north and south and the "Stop" signals east and west. On the other hand, the springs 17 and 18 may control the amber signals both north and south and east and west. In this figure the conductors 21 and 22 are intended to represent any suitable source of current supply, such as an alternating current generator.

It will be seen that the arm 14 is under the control of the arm 73, both of which arms are pivoted about a common axis on the pin 74, which latter is secured to the frame of the device. Referring to the same figure, the arm 14 is provided with a spring 75 which normally tends to rotate the arm 14 toward the arm 73. The arm 73 is in turn provided with a spring 76 which normally tends to rotate the arm 73 toward the arm 14. The spring 76, however, is stronger than the spring 75 so that when the cams permit it, the arm 14 is rotated by the arm 73 as the result of the tension of the spring 76. It will be seen that the arm 73 is provided with a tail piece 73' which is bent at right angles to the face of the arm and which engages the cams 8 and 9 under the tension of spring 76. Similarly the arm 14 is provided with a tail piece 72' which is bent at right angles to the face of the arm and

which extends parallel to the axis of the shaft 13. This tail piece is adapted to operatively engage the cams 10, 11 and 12 during certain intervals, under the tension of spring 75. When the current is turned on the motor armature disk 4 rotates in the direction of the arrow, Fig. 2, with the result that the gear 7 is rotated in the direction of the arrow Fig. 1, carrying with it the cams Fig. 6 in the direction of the arrows Fig. 6. During the course of operation the tail piece 73′ of the arm 73 passes from the surface S1 of cam 8 to the surface S2 of cam 9. During this interval the tail piece 72′ of the arm 14 reaches the surface S9 of the cam 10 with the result that the rod 16, Fig. 1, assumes the position in which spring 20 is closed. As the cams advance the tail piece 73′ of the arm 73 drops from surface S2 to surface S3 with the result that the arm 14 is advanced by the arm 73 to a second position, in which position the spring 18 is closed. As the cams continue to advance the tail piece 73′ falls from surface S3 to surface S4 and advances the arm 16 to the position shown in Fig. 1 with the spring 19 closed. As the cams continue to advance the tail piece 73′ rises along surface S5 toward surface S1, thereby causing the arm 73 to recede from 14. During this interval the tail piece 72′ is passing over the surface S6 and S7 of cams 10 and 11 and finally falls on surface S8, advancing the arm 16 to a position in which spring 17 is closed. As the cams continue to advance the tail piece 72′ falls from surface S8 to surface S9 on cam 10, advancing the arm 16 to the position in which the spring 20 is again closed, thus completing the cycle of operation.

Referring to Fig. 1, the current for operating the motor and the signals may be supplied, as already indicated, from the mains 21 and 22. The circuit for operating the motor may be traced as follows: From conductor 21 over conductors 85, 86 and 87 to the coils 3 and 2 of the motor; from thence the circuit continues over conductors 88 and 89 back to the line 22. The circuit over which the signals are operated are as follows: From line 21 over conductors 85 and 86, spliting over conductors 90 and 91, to contacts 92 and 93, thence by way of the contact springs 17, 18, 19 and 20, and conductors 94, 95, 96, 97, to the signals, thence by way of conductor 98 to conductor 89 and back to line conductor 22.

Therefore, by means of the controller shown in Fig. 1 and through the action of the cams 8, 9, 10, 11 and 12 the springs 17, 18, 19 and 20 may be operated in a given cycle for correspondingly operating the signals R, A, G. For example, these signals may be operated so as to appear north and south so as to appear during a given cycle in the following order—G, A, R, A. It will be seen that by adjusting the cams through the medium of the levers shown in Fig. 5, the lengths of the signals may be varied and if desired the amber may be altogether suppressed. For example, if the cam 12 completely overlaps the cam 11 there would be no amber signal between the green and the red, that is, between G and R. On the other hand, if the cam 9 completely overlaps the surface S3 of cam 8, there will be no amber between the red and the green, that is, between R and G.

It will be seen that the gear 7 through the medium of pinions 7′ and 8′ and shaft 24 drives an auxiliary gear 23. The gear 23 is loose to slide and turn on shaft 13 and is provided with a pin 25. This pin is also shown in Figs. 2 and 3. The gear ratio of the pinions 7′ and 8′ is 1 to 1. As indicated in Fig. 2 interposed between the pin 25 and the disk 4 is the brake device which comprises the electromagnet 26, the armature 27, the arm 28 and the brake shoe 29. As indicated in Fig. 2, while the electromagnet 26 is deenergized, the pin 25 on the gear 23 may rotate without striking the arm 28. However, when the electromagnet is energized as indicated in Fig. 3 the forward end of the arm 28 is raised to a position in the path of the pin 25, as represented by the solid lines in Fig. 3. As the solid lines indicate, the brake 29 does not engage the motor disk 4 until the pin 25 advances and strikes the forward end of the arm 28. As soon as it does so, the forward end of the arm is depressed as indicated by the dotted lines and the rear end of the arm carrying the brake 29 is forced against the disk 4, stalling the motor. Comparing the device Fig. 1 with the device in my said copending application, it will be seen that the gear 7 corresponds with the gear 20 of the copending case and that the gear 23 has replaced the gear 47 of the copending case.

Referring to Fig. 1, it will be understood that at each street intersection a set of signals similar to the signals N—S and E—W and a corresponding control device is provided. This control device I have represented at one intersection by the coil 30 and at the third intersection by the coil 31, the coils 30 and 31 corresponding in such case to the coil 26 associated with the disk 4 of the motor at intersection A.

Referring to the gear 23 in Figs. 1 and 4, this gear is loose on the shaft 13 and is free to be slid between the frame plate 13′ and the collar 34 subject to the tension of coiled spring 35. The relation between this gear and gear 7 (and the signals controlled thereby) may be changed by sliding it to the right on shaft 13 thereby demeshing it from the pinion 8′, then turning it on shaft 13 and restoring it in engagement with pinion 8′ in the new position. For example, in Fig. 2 the pin 25 is shown in one position with respect to the tip 32 of the arm 28. In Fig. 3 the position of the pin 25 has changed, it having advanced nearer the tip 32. This advance, however,

has been caused by the rotation of the disk 4 of the motor and if desired the position of the pin 25 may be changed from that of Fig. 2 to that of Fig. 3 or to any other position desired as above indicated, that is, by withdrawing gear 23 from 8′ against the tension of the spring 35 and resetting it in its new position in engagement with gear 8′.

Therefore, with the foregoing means if the motor at one intersection drops out of synchronism with the motors at the other two intersections they may all be readily brought into the proper relation by simultaneously energizing the coils 26, 30 and 31. For example, assuming that the motors corresponding to coils 30 and 31 (intersections B and C) are in synchronism and that their position is represented by the pin 25, Fig. 3, and assuming that the motor corresponding to coil 26 (intersection A) has fallen back to a position represented by the pin 25, Fig. 2, then when all of the coils 26, 30 and 31 are energized by the closure of the switch X at any suitable central point, the motors corresponding to coils 30 and 31 will continue to advance until the pin 25 engages the tip 32 of the arm 28. The result is that the brake will be applied at each of these motors and they will simultaneously come to a standstill. The motor represented by coil 26, will, however, continue to advance until its pin 25 strikes the tip 32 of its arm 28, whereupon this motor will also be stalled, thus bringing all of the motors into the proper relation in a stalled position. After this has taken place if the switch X is opened all of the coils 26, 30 and 31 will become deenergized, thereby releasing all of the motors and allowing them to start simultaneously and to continue in operation in synchronism. Obviously, therefore, as often as the motors fall out of step they may be reset by closing the switch X at the central point for an interval of time not less than the time that it takes the pin 25 to make one complete revolution.

With this arrangement the "Go" signals for example, along a given highway may be set to begin in any desired time relationships by displacing the pins 25 in successive timers in definite angles with respect to their cam positions. For example, the gears 23 in all timers could be meshed with the pinions 8′ in such manner that when the pins 25 engage the tips 32 of the brake arms, all timers will stop at the beginning of the "Go" period. With this arrangement the "Go" signals would all appear simultaneously and there would be no progression. However, if progression is desired the gears 23 may be so meshed with the pinions 8′ that the pins 25 bear a definite angular relationship with respect to the cam position corresponding to the beginning of the "Go" signals. Therefore, the cams in successive timers bear a definite relationship with respect to each other, thus producing a definite progression of the beginning of the "Go" signal. Changes in the rate of progression may be made by changing the angular displacement in each timer between the pins 25 and the cam position corresponding to the beginning of the "go" period.

It will be seen, therefore, that I provide means for readily synchronizing all the controllers within an arbitrary short interval corresponding to the time of one revolution of gear 23 without the necessity of having to send anyone out to the different signals and without the prolonged resulting confusion that necessarily follows when it is necessary to send some one a long distance to reset the device.

It will be understood that the means for stopping the motors contemplated by this invention may be applied to motors of different types in systems of different types. For example, while I have shown the type of motor and control similar to that shown in my application, Serial No. 339,349, any other type of motor may be employed and the controlling circuits, as well as the signals controlled, may be varied in any suitable manner.

While I have elected to demonstrate my invention by illustrating a particular embodiment, I do not wish to be limited to the particular form of device illustrated, inasmuch as I contemplate variations which do not depart from the spirit of my invention or the scope of the claims contained herein.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, a plurality of circuit controllers each comprising a shaft and a motor for driving said shaft, means for operating said motors in timed relation relatively to each other, means for maintaining said motors in synchronism comprising at each controller a projection which is rotated by the shaft, an arm normally out of but movable into the path of movement of said projection, an electromagnet for effecting movement of said arm, and means actuated by the arm when engaged by said projection for stopping turning movement of the shaft, and means for simultaneously energizing said electromagnets.

2. In combination, a plurality of circuit controllers each comprising a shaft and a motor for driving said shaft, means for operating said motors in timed relation relatively to each other, means for maintaining said motors in synchronism comprising at each controller a projection which is rotated by the shaft, means whereby said projection may be adjusted circumferentially on the shaft, an arm normally out of but movable into the path of movement of said projection, an electromagnet for effecting movement of said arm, and means actuated by the arm when engaged by said projection for stopping turn-

ing movement of the shaft, and means for simultaneously energizing said electromagnets.

3. In combination, a circuit controller comprising a shaft, a motor for driving the shaft, a projection rotated by the shaft, an arm normally out of but movable into the path of movement of said projection, means for moving said arm, and means actuated by the arm when engaged by said projection for stopping turning movement of said shaft.

4. In combination a circuit controller comprising a shaft, a motor for driving the shaft, a projection rotated by the shaft, means for adjusting the angular position of said projection relatively to the shaft, an arm normally out of but movable into the path of movement of said projection, means for moving said arm, and means actuated by the arm when engaged by said projection for stopping turning movement of said shaft.

5. In combination, a circuit controller comprising a shaft, a gear wheel on the shaft, a motor for driving the gear wheel, a second gear wheel loosely mounted on the shaft, a countershaft and pinions connecting said gear wheels, means whereby said second gear wheel may be moved from mesh with its pinion and adjusted circumferentially on the shaft, a projection carried by the second gear wheel, an arm movable into the path of movement of said projection, means for moving the arm, and means actuated by the arm when engaged by said projection for stopping turning movement of said shaft.

In witness whereof I have hereto set my hand this 13th day of June, 1929.

CHESTER I. HALL.