

Dec. 8, 1931.

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1,835,916

CIRCUIT CONTROLLING MEANS

Filed Aug. 2, 1926

2 Sheets-Sheet 1

Fig.1.

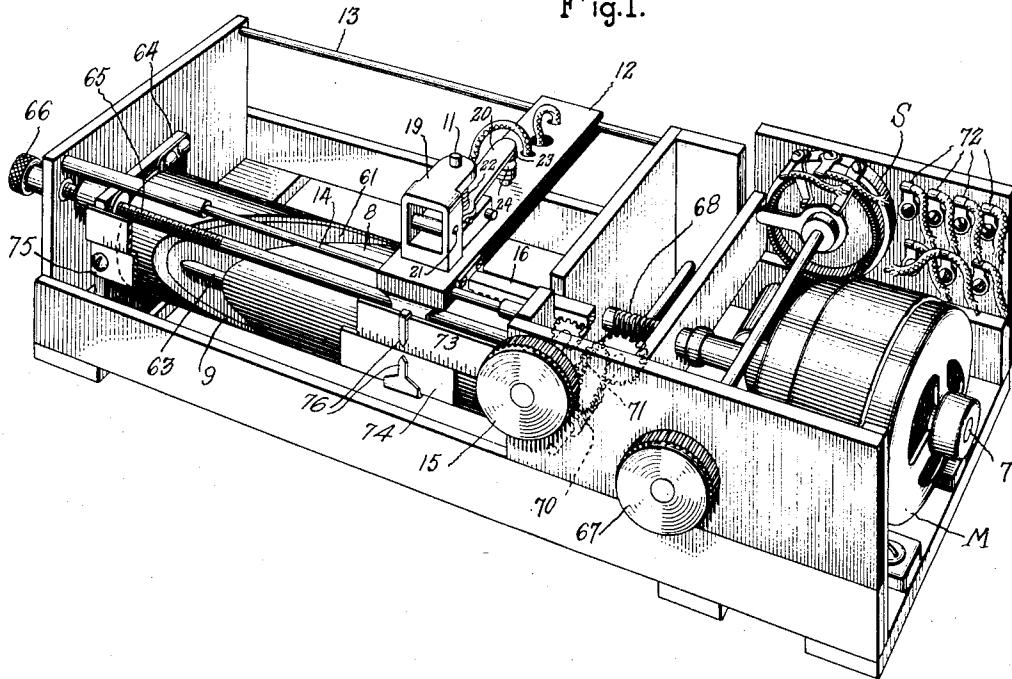
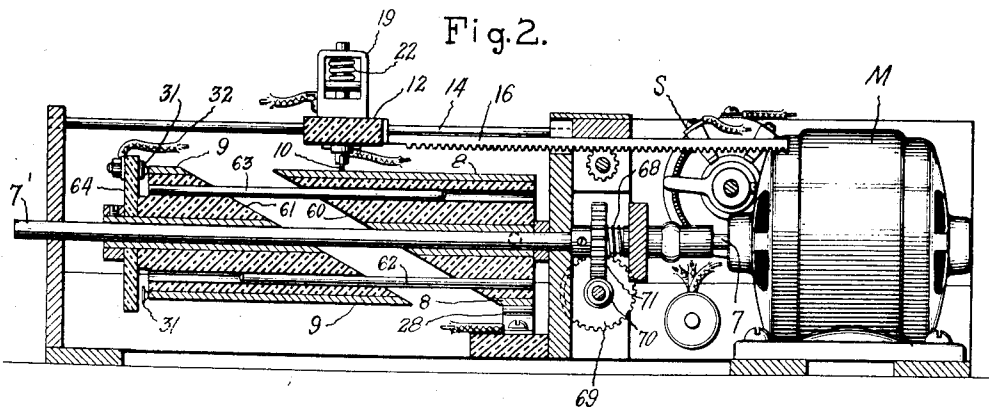


Fig.2.



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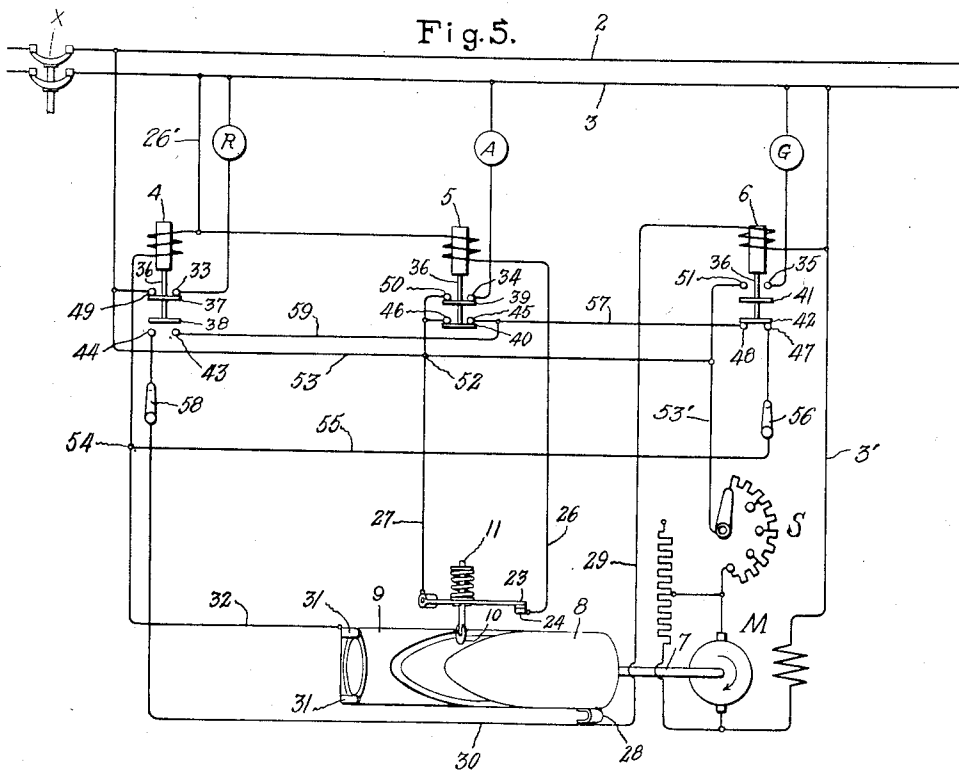
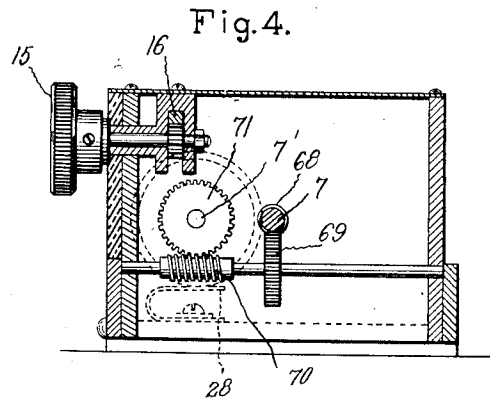
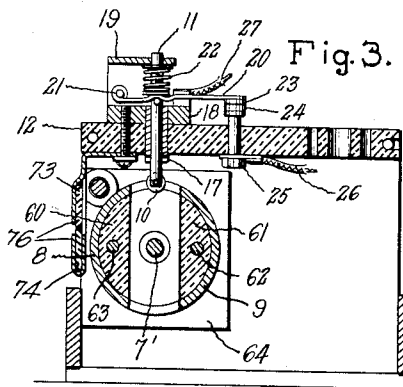
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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CIRCUIT CONTROLLING MEANS

Application filed August 2, 1926. Serial No. 126,464.

The invention relates to circuit controlling means in the form of a system especially adapted for use in connection with the control of traffic signals. One of the objects of the invention is to provide an improved system in which a plurality of relays, operatively interrelated, are used. Another object of the invention is to provide an improved circuit controller for said system, said controller having means for regulating the time intervals of the signals and the proportion of the intervals of one signal with respect to another. Claims for the controller are the subject of a divisional application, Serial No. 416,977, filed December 27, 1929.

The details of my invention for accomplishing the foregoing and other objects are hereinafter more fully set forth and claimed, reference being had to the accompanying drawings, in which Fig. 1 shows the controller of my invention in perspective; Fig. 2 is a longitudinal section through the commutator cylinder; Fig. 3 is a section approximately across the central portion of the device taken through the carriage which carries the contact roller, which operates in conjunction with the commutator cylinder; Fig. 4 is a section just to the right (Fig. 1) of the knob, by means of which the carriage shown in Fig. 3 is adjusted; and Fig. 5 is a diagrammatic layout of the circuit connections employed in connection with the device.

Referring more in detail to the drawings, it will be seen that in Fig. 5 the source of power is represented by the lines 2 and 3. From this line current is drawn for operating the traffic signals R, A and G, for operating the motor M, and for operating the relays 4, 5 and 6. The function of the motor is to rotate the shaft 7, and through gears a commutator cylinder which is constructed in two metallic sections 8 and 9, which sections are diagonally cut and insulated from each other and from the frame, as indicated in Fig. 2. Associated with the commutator, there is a brush 10 in the form of a roller on the end of the shaft 11 (see Fig. 3). This brush device is mounted on a carriage 12 (see Fig. 1), which is adapted to slide as

a whole lengthwise of the device along the rods 13 and 14 under the control of the knob 15 through the medium of a rack 16. The shaft 11, Fig. 3, extends through the carriage 12 and is journaled in a metal bearing 17, Fig. 3, which passes through frame 12 of the carriage and which is in intimate metallic contact with a metal block 18. This block is provided with a metallic frame 19, to which latter a spring 20 is pivotally secured by means of the pin 21. Between the spring 20 and the frame 19 there is provided a compression spring 22, which serves to maintain the spring 20 in intimate contact with the pin which passes through the shaft 11 just below the spring 20, thus insuring good electrical connection between the spring 20 and the roller 10. Roller 10 is mounted on a metallic pin on the lower end of the shaft 11, which serves as a bearing for the roller 10.

From an examination of Fig. 3, it will be seen that the forward end of the spring 20 is provided with a contact element 23 which operates in connection with a corresponding contact 24 secured to the pin 25. The arrangement is such that connection may be made and broken between the contacts 23 and 24 under the control of the commutator through the medium of the roller 10. As shown in Fig. 3, the contacts are in engagement and therefore circuit connection is closed between the spring 20 and the pin 25, and consequently, also between the pin 25 and the metallic block 18. It will be seen that the pin 25 is connected with a conductor 26, while the block 18 is connected with a conductor 27.

Referring to the commutator, in connection with the segment 8 I have provided a brush 28, see Figs. 2, 4 and 5. This brush has connected to it two conductors 29 and 30. In connection with the other segment 9 of the commutator I provide a pair of brushes 31. I provide two brushes merely for convenience and for insuring contact between the conductor 32 and the commutator element 9. The brushes 31, it will be seen, rub along the end of the cylinder 9, as clearly indicated in Figs. 5 and 2, while the brush 28 is ar-

ranged to rub along the side of the cylinder 8.

As shown in Fig. 5, the signals R, A and G are all connected on one side to the conductors 3, while on the other side they are connected respectively with contacts 33, 34 and 35 of the relays 4, 5 and 6. Each of these relays 4, 5 and 6 is preferably in the form of a solenoid, and each is therefore provided with a plunger 36. Each plunger carries a pair of circuit closing contacts each insulated from the other; for example, the relay 4 is provided with contacts 37 and 38, relay 5 with contacts 39 and 40, and relay 6 with contacts 41 and 42. It will be seen that the contact 38 has associated with it a pair of contacts 43 and 44, while the contact 40 has associated with it a pair of contacts 45 and 46, and the contact 42 has associated with it a pair of contacts 47 and 48. Associated with the contact 33, there is a contact 49; associated with the contact 34 there is a contact 50; and associated with contact 35 is a contact 51. Therefore, as indicated, when the relay 4 is energized the contacts 33 and 49 are electrically connected through the contact 37. However, when the relay 4 is deenergized, connection is broken between contacts 33 and 49, and connection is closed between the contacts 43 and 44 by the contact 38.

When relay 5 is energized both connections controlled by the contacts 39 and 40 are closed as shown in Fig. 5 and when the relay is deenergized both connections are opened. The operation of the relay 6 is the same as that of the relay 4. When relay 6 is energized, contact 41 closes the circuit between contacts 51 and 35, and contacts 42 breaks the circuit between contacts 47 and 48, and when the relay is deenergized the reverse condition obtains.

I will now describe more in detail the operation of the circuits. Assume that the contact roller 10 is in engagement with the segment 8 when the switch X is first closed. Motor M is started over conductors 53 and 53' on one side and conductor 3' on the other. Also the relay 6 is energized over conductors 53 and 27, contact 10, segment 8 and conductor 29, opening the circuit between the contacts 47 and 48 and closing the circuit between the contacts 35 and 51, thus causing the operation of the signal G over conductor 53 and contacts 51 and 35.

As the motor continues to operate, the edge of segment 8 advances toward the contact 10 and finally contact 10 descends into the space between the two segments 8 and 9. As a result contacts 23 and 24 are closed, thereby causing the energization of relay 5 over conductors 53 and 27, contacts 23 and 24, and conductor 26 on one side and conductor 26' on the other. Relay 5 closes the circuit for the signal A at the contacts 50 and 34 from line 2, over conductor 53 on one side and on the other side directly to line 3,

thereby operating the signal A. At the same time relay 5 closes a holding circuit for relay 6 by way of conductor 53, contacts 46 and 45 of relay 5, contacts 43 and 44 of relay 4 and conductors 30 and 29, thus holding the relay 6 energized after the segment 8 leaves the contact 10 and preventing its deenergization until the segment 9 strikes the contact 10.

When the segment 9, advancing, strikes the contact 10, it closes a circuit through the relay 4 by way of the segment 9 and the contact 10 over conductors 53, 27 and 32, and winding of relay 4, to line 3, thereby energizing relay 4. At the same time the contacts 23 and 24 are separated causing the deenergization of relay 5. As a result of the energization of relay 4 the holding circuit for the relay 6 is broken between the contacts 43 and 44, thereby retiring the signal G. At the same time the circuit for the signal R across conductors 2 and 3 is closed by way of the contacts 33 and 49, whereupon the signal R appears. Since the circuit of relay 5 is interrupted as indicated, and since it therefore deenergizes, the signal A retires. The deenergization of the relay 5 also breaks the holding circuit of the relay 6 at a second point, that is, between the contacts 45 and 46.

As the segment 9 continues to advance under the contact 10 the signal R persists. When the space between the segments 9 and 8 is reached, the contacts 23 and 24 again engage, energizing the relay 5 and once more operating the signal A by closing the circuit between the contacts 34 and 50. At the same time a holding circuit for relay 4 is established by way of conductor 53, contacts 46 and 45, conductor 57, contacts 48 and 47, conductor 55, winding of relay 4 and conductor 26'. The holding circuit prevents the deenergization of the relay 4 until segment 8 reaches contact 10. When segment 8 strikes the contact 10 the energizing circuit for the relay 6 is again closed as before by way of the contact 10 and the segment 8. At the same time the circuit for the relay 5 is broken between the contacts 23 and 24, when the contact 10 rides upon the segment 8, and causes their separation. The result of this last is that the signal A is again retired and the holding circuit for relay 4 is broken, thus retiring signal R. The energization of relay 6, on the other hand, causes the appearance at the same time of the signal G and the rupture of the holding circuit for the relay 4 at the second point, that is, between the contacts 47 and 48.

The above operation of the relays 4, 5 and 6 is repeated as long as the motor continues to rotate the segments 8 and 9, thus operating the signals R, A, G in the order described, the signal A appearing just before the signal G is retired and appearing also just be-

fore the signal R is retired. In other words, signal A is operated twice during each cycle of operation in which the G signal is operated once and the R signal is operated once.

For the purpose of regulating the speed of the motor, I provide the rheostat S in connection with the motor, and by this means the length of the signals can be varied without changing the relation of their time intervals. However, as is well known, the relation of the time intervals should be changed as the traffic conditions change and for this purpose I provide means for changing the ratio of the time intervals. This may be accomplished by moving the segments 8 and 9 with respect to each other, or by moving one of the segments with respect to the other, and by adjusting the roller 10 axially along segments 8 and 9. With the arrangement shown I provide means for moving the segment 9 with respect to the segment 8. As indicated in Fig. 2, the segments 8 and 9 are mounted on cores 60 and 61 of insulating material. These cores are mounted on the shaft 7', which is driven by the motor M and arranged to rotate therewith. The core 60 is permanently secured to the shaft 7'. This core is also provided with a rod 62, which is embedded in the core 60. The core 61 is provided with a similar rod 63 which is embedded in the core 61. It will be seen that in the core 61 there is a bore into which the rod 62 projects and within which it may slide, while in the core 60 there is a bore into which the rod 63 projects and in which it may slide. With this arrangement the segments 8 and 9 are caused to rotate with the shaft 7', but the segment 9 may be adjusted along the shaft 7'. The core 61 is further provided with a collar 64 of insulating material and this collar is mounted at the end of the core 61 in such a manner that the core 61 may rotate relatively to the collar 64. The collar 64 is provided with a threaded bearing through which the threaded shaft 65, see Fig. 1, passes. It will be seen, therefore, that by rotating the knob 66, which is on the end of the shaft 65, the collar 64 may be caused to travel back and forth, that is, to the right or to the left, Fig. 2, with the result that the core 61, together with the commutator 9, may be adjusted back and forth, even while the motor M is rotating.

By adjusting commutator segment 9 relatively to commutator segment 8, the distance between the adjacent ends of the segments may be increased and decreased. This serves to increase and decrease the time during which roller 10 is between the two segments and hence the time during which contact 23 which controls the amber signal is in engagement with contact 24. By moving the carriage 12 to the left or to the right the time interval during which roller 10 is in contact with segments 9 and 8 may be varied, thereby adjusting the length of the red and green signals

relatively to each other. It will thus be seen that by adjusting segments 9 and 8 relatively to each other the duration of the amber signal is varied and by adjusting the roller 10 axially relatively to segments 9 and 8 the respective duration of the red and green signals is adjusted, the amber remaining the same.

Referring to Fig. 1, it will be seen that the rheostat S is provided with a knob 67, by means of which the speed of the motor is regulated. It will also be seen that on the left hand end of the shaft 7 there is provided a worm gear 68, which meshes with the gear 69. The gear 69 is mounted on the same shaft with a worm 70, which in turn meshes with the gear 71 on the right hand end of the shaft 7' for driving the latter. As shown in Fig. 1, the whole apparatus is assembled about a suitable base and frame, thus forming a compact portable unit. For the purpose of connecting the controller with the source of power and with the signals, suitable terminals 72 are provided. In connection with the construction, there is provided means for indicating the adjustment of the carriage 12 and the adjustment of segment 9 relatively to the frame. For this purpose a scale plate 73 is attached to the frame and adjacent to it is a strip 74 which is attached at one end to head 64, as is indicated at 75, so that the strip moves with the head and segment 9. The other end of strip 74 cooperates with scale plate 73 to indicate the adjustment of segment 9. Carried by carriage 12 is a pointer 76 which cooperates with the scale plate to indicate the adjustment of the carriage. The lower portion of the pointer is bent around under strip 74 to form a support for the free end of strip 74. This is indicated more clearly in Fig. 3.

The operation as described is such therefore that the R and A signals overlap at one time and the G and A signals overlap at another. But if desired such overlap can obviously be prevented by opening the switches 58 and 56. The result of this is that the holding circuits for relays 4 and 6 are left open and the R, A and G signals can only operate in sequence.

It will be seen, therefore, that by means of a central controller, Fig. 2, a set of signals, or a plurality of sets of signals, one set for each intersection along the highway, may be controlled from a common point, from which point the time intervals of the various signals of each intersection may be varied. By the provision of relays the circuits of the signals themselves, such as signals R, A, G, may each be made quite short without the necessity of having excessively large conductors in order to avoid excessive drop in voltage due to the comparatively high volume of current necessary for operating the signals. Furthermore, the provision of a central control means capable of varying the time inter-

val of each of the signals makes it possible to provide a minimum number of elements. Otherwise, and in order to accomplish the same result, a much larger number of parts would be necessary in order to insure an adequate number of variations in the signals.

While I have specifically described my invention in connection with the form of apparatus shown in the drawings, it will be obvious that the apparatus may be varied and modified without departing from the spirit of the 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 circuits to be controlled, a relay for closing each circuit, another circuit to be controlled, a relay for closing said other circuit, means for successively energizing the windings of said relays, and a holding circuit for the relay in one of said plurality of circuits controlled by the relay in said other circuit.

2. In combination, a plurality of circuits to be controlled, a relay for closing each circuit, another circuit to be controlled, a relay for closing said other circuit, means for successively energizing the windings of said relays, and holding circuits for the relays in said plurality of circuits controlled by the relay in said other circuit.

3. In combination, a plurality of circuits to be controlled, a relay for closing each circuit, another circuit to be controlled, a relay for closing said other circuit, means for successively energizing the windings of said relays, and a holding circuit for each relay in said plurality of circuits controlled by the relays, and a holding circuit for each relay of another of said plurality of circuits.

4. In combination, a plurality of circuits to be controlled, a relay for closing each circuit, means for successively energizing the windings of said relays, and holding circuits for the windings of certain of said relays controlled by another of said relays, whereby certain of the plurality of circuits are simultaneously closed.

5. In combination, a plurality of circuits to be controlled, a relay for closing each circuit, another circuit, a relay for closing the other circuit, a circuit controller for successively energizing first a relay of one of said plurality of circuits and then the relay of said other circuit, and a holding circuit for at least some of said first named relays controlled by said second named relay whereby at least some of said plurality of circuits to be controlled are maintained operative while said other circuit is operative.

In witness whereof, I have hereunto set my hand this 29th day of July, 1926.

HARRY W. VICKERY.

CERTIFICATE OF CORRECTION.**Patent No. 1,835,916.****Granted December 8, 1931, to****HARRY W. VICKERY.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 39, claim 3, strike out the words "relays, and a holding circuit for each" and insert instead relay of said other circuit and by the; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of February, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.