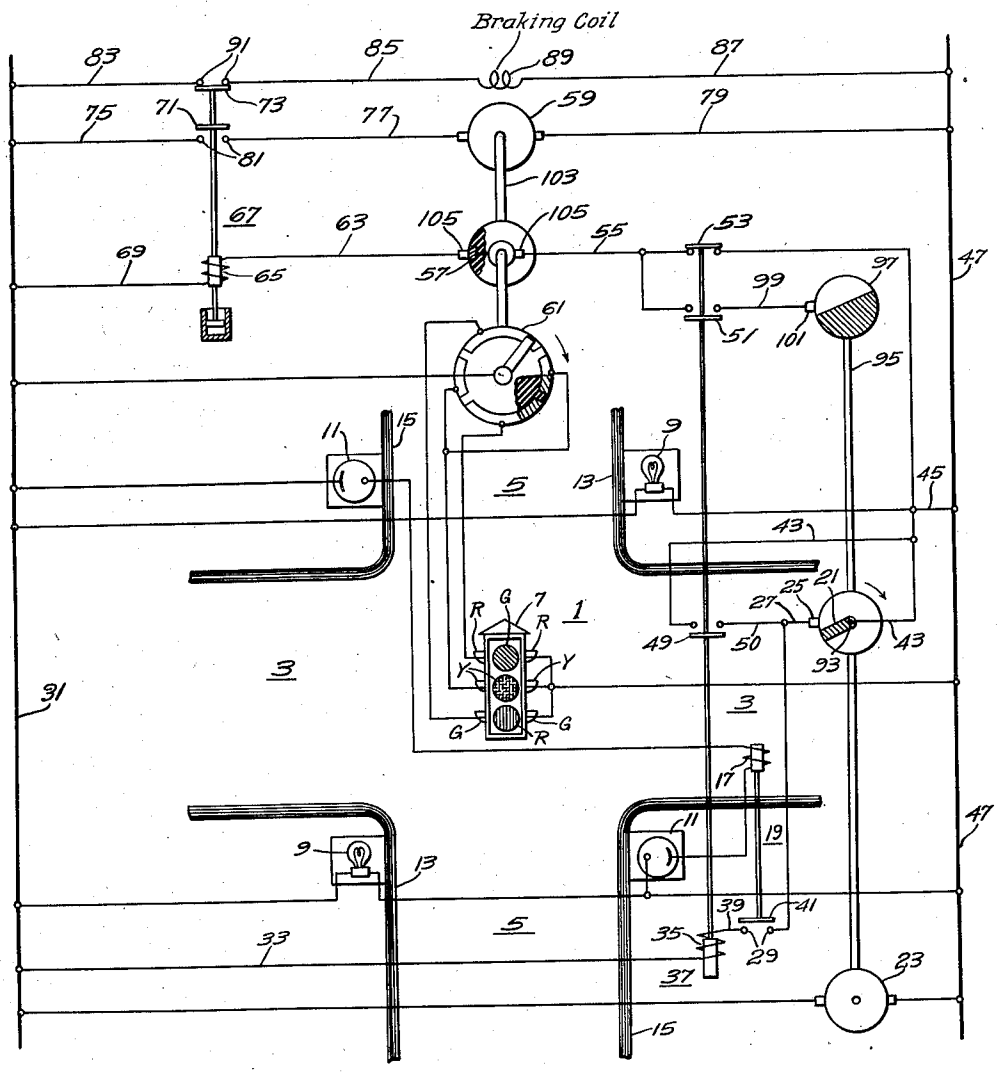
Oct. 5, 1937. R. C. HITCHCOCK 2,094,598

TRAFFIC CONTROL SYSTEM

Filed Dec. 27, 1930 2 Sheets-Sheet 1

Fig. 1.



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TRAFFIC CONTROL SYSTEM

Filed Dec. 27, 1930 2 Sheets-Sheet 2

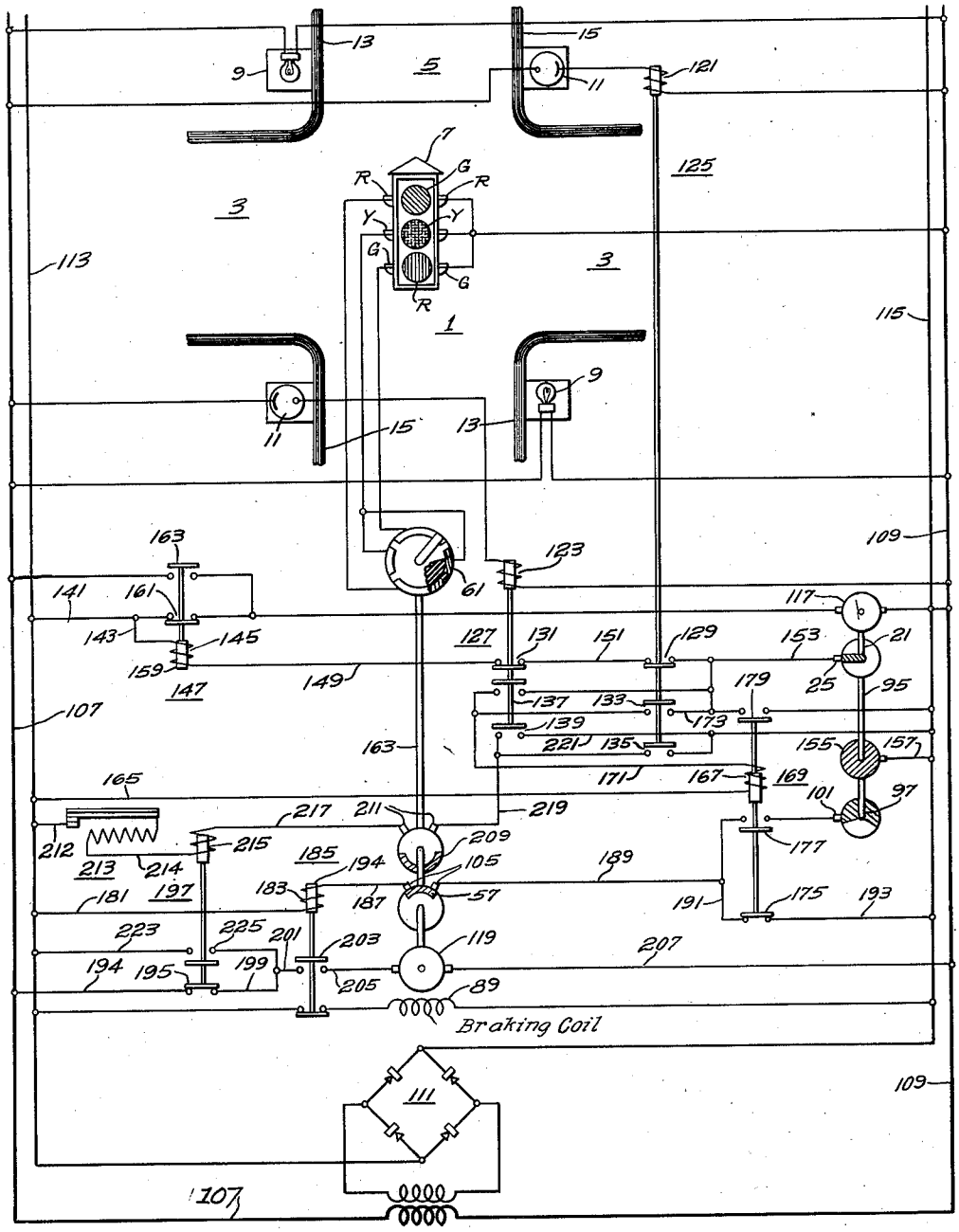


Fig. 2.

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2,094,598

TRAFFIC CONTROL SYSTEM

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Application December 27, 1930, Serial No. 505,071

4 Claims. (Cl. 177—337)

My invention relates to traffic control systems and has particular relation to photo-sensitive automatic traffic control systems.

Automatic traffic control systems are ordinarily provided for regulating the right-of-way at an intersection of a plurality of thoroughfares. Although they in general apply to intersections of any type they are more urgently needed at an intersection of major and minor thoroughfares than at intersections where all of the thoroughfares are major.

At a major-minor intersection the traffic signalling is so adjusted that in the absence of vehicles along the minor thoroughfare, the right-of-way signal is given to the major thoroughfare, and the signalling system remains in this condition as long as there is no traffic along the minor thoroughfare. However, after a predetermined period after a vehicle moving towards the intersection along the minor highway appears at the intersection, the signalling system is motivated and the right-of-way signal is given to the minor highway.

To simplify the structure of the system it is desirable that the element, whereby the change in the signalling system is produced, and which shall hereinafter be designated as a street device, be so disposed that it comes under the influence of all vehicles passing between the longitudinal boundaries of the thoroughfare. That is to say, the street device comes under the influence of vehicles moving away from the intersection as well as vehicles moving up to the intersection. This feature of the system introduces the problem of providing a device whereby the system is not operated by vehicles that under ordinary circumstances have no necessity of operating it; that is, vehicles moving away from the intersection.

In experimenting with traffic control systems, I have found that the provision of such a device is not at all a simple matter. Relays of the pendulum type are most commonly utilized in this connection in equipment constructed as dictated by the teachings of the prior art, with which I am familiar. However, my experiments have indicated that relays of this type cause considerable interference troubles in the radio-receiving equipment of people living in the neighborhood of the intersection where the system is installed. The relays of the dash-pot type and relays of the thermostat type of which I am aware are unstable and unreliable in the present connection, and require considerable servicing.

It is accordingly an object of my invention to provide apparatus for introducing a time delay in the action of a street device in an automatic traffic control system, that shall be stable and reliable.

Another object of my invention is to provide a continuance for producing a time-delay in the action of a street device in a traffic control system that shall not produce a radio interference.

A further object of my invention is to provide a simple and inexpensive time-delay element for an automatic traffic control system.

A still further object of my invention is to provide an automatic traffic control system wherein a device is introduced whereby a time-delay of predetermined length in the action of the street device is attained.

An ancillary object of my invention is to provide an automatic traffic control system wherein the duration of the signals along the highways is regulated by traffic traversing the highways.

A further ancillary object of my invention is to provide a traffic system for a major-minor intersection wherein the signalling lights are actuated in such a manner that the major highway receives a right-of-way signal for a predetermined minimum period after the motivation of the system has been initiated by a vehicle on the minor highway.

More concisely stated it is an object of my invention to provide a simple and inexpensive traffic control system wherein the action of the street device is delayed for an interval of time of predetermined length after it is excited by a vehicle, and wherein the length of the signal is regulated by the density of the traffic.

According to my invention I provide an automatic traffic control system wherein the time-delay in the ultimate action of the street device is effected by the coaction of a plurality of sectors rotated by a motor. One of the sectors may be utilized to initiate the action of the traffic signal system, in response to the disturbance of a street device, while another sector is utilized to time the action. In addition to the time delay motor the system is, of course, also equipped with a motor that drives a program controller, which, in turn, regulates the periodicity of the traffic.

To accurately time the delay produced, the sectors of the time delay contrivance are driven through a synchronous motor which may be instantly stopped by the application of a direct current to its windings. The motor is so connected in the circuit of the system that the direct current is applied after a predetermined interval of time and the motor stops in such a position

that the sectors occupy their original positions.

Finally, the system is made responsive to the density of the traffic along the thoroughfares by connecting the motor, through which the program controller is driven, in an electrical circuit similar to the circuit of the delay motor, discussed hereinabove. The motor in this case is also synchronous and responds to the application of direct current by stopping. The direct current is applied when the street device comes under the instantaneous influence of a vehicle, simultaneous with the indication of a right-of-way signal for the thoroughfare where it is located, and along which the vehicle is moving.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in connection with the accompanying drawings, in which:

Figure 1 is a diagrammatic view showing the arrangement of the elements of a simple embodiment of my invention, and

Fig. 2 is a diagrammatic view showing the arrangement of the elements of a more complex embodiment of my invention.

In Fig. 1 the intersection 1 of a major highway 3 and a minor highway 5 is illustrated. A system of traffic signals 7 is situated at a convenient point in the intersection of the highways 3 and 5 and, with no traffic along the minor highway 5, indicates a right-of-way signal for the major highway 3. Street devices, comprising a source of light 9 and a photo-sensitive element 11, influenced by the light from the source, are disposed along the minor highway 5 on each side of the intersection 1.

Although other relative orientations of the source of light 9 and the photo-sensitive device 11 are possible, I have found that a preferable arrangement is attained by disposing the source 9 on one side 13 of the thoroughfare, and the photo-sensitive device 11 on the opposite side 15 thereof.

The photo-sensitive device 11 is illustrated in the drawings with the conventional symbol of a photo-cell. However, the illustration should only be regarded as symbolical. The device may be a photo-cell. On the other hand, it is preferable that a system for amplifying the photo-cell current be supplied. This system may be simply an ordinary thermionic amplifier. However, I have found particularly useful in this connection an amplifying system comprised chiefly of a grid-glow tube that is energized or deenergized from the photo-cell. The unit that may be used with advantage in the particular systems illustrated in the drawings is described in a Patent No. 1,905,276 to Ellis O. Erickson, filed February 11, 1930 and assigned to Westinghouse Electric & Manufacturing Company.

The current from the photo-sensitive devices 11 passes through the exciting coil 17 of a relay 19 and energizes the relay under ordinary circumstances. The relay 19 is in an energized condition when, as is illustrated in Fig. 1, no vehicles are present along the minor thoroughfare 5 in the vicinity of the intersection 1.

However, when a vehicle stops in such a position as to obstruct the light from the source 9 to the photo-sensitive element 11, the relay 19, associated with the photo-sensitive device 11 is deenergized.

The relay 19 must remain in a deenergized condition until an initiating sector 21 rotated from a motor 23 comes into contact with a brush 25 connected to a lead 27 which, in turn, is connected to one element of the fixed contact 29 of the relay 19. When the circuit to contact 29 is closed, a circuit is completed from one bus line 31 of the power supply source, through a lead 33, connecting the bus line 31 to the coil 35 of a second relay 37, the function of which will be described hereinafter, through the coil 35 of the relay 37, a further lead 39, the movable contactor 41 of the first relay 19, the lead 27, the initiating sector 21, a branch lead 43, and the lead 45 to the remaining bus line 47 of the power supply source.

The second relay 37, to which reference was made above, is equipped with two normally open contactors 49 and 51 and one normally closed contactor 53. When the relay 37 is in a deenergized state a circuit is completed, from one power line 47, through the lead 45, the closed contactor 53, a second lead 55, a conducting segment 57, adapted to be rotated from the motor 59 which drives a program controller 61, through a lead 63, the exciting coil 65 of a third relay 67, a lead 69 and the remaining bus line 31 of the power source. It is seen that the third relay 67 is in an energized condition as long as the second relay 37 is in a deenergized condition.

The third relay 67 is equipped with one contactor 71, which is open when the relay 67 is energized and one contactor 73, which is closed when the relay 67 is energized. The leads 75, 77, and 79 whereby power is supplied to the motor 59 which drives the program controller 61 are connected to the fixed contacts 81 of the open contactor 71, while the leads 83, 85 and 87, whereby power is supplied to a braking device 89 for the motor 59, are connected through the fixed contacts 91 of the closed contactor 73.

It is seen, therefore, that when the relay 67 is in an energized condition; (that is to say, when the light from the source 9 to the photo-sensitive device 11 is not obstructed) the program control motor 59 is not rotating. Furthermore, when the light from the source 9 is obstructed and the initiating segment 21 makes contact through the exciting coil 35 of the relay 37, the closed contactor 53 of the relay 37 is opened, but a second circuit is completed from one bus line 47 through the lead 45, the lead 43, connected to the central point 93 of the initiating sector 21, the shaft 95, on which the initiating sector 21 is rotated, a timing sector 97, centrally disposed on the shaft 95 of the initiating sector 21 and rotated from the motor 23 that drives the initiating sector, a lead 99, a contactor 51 that has been closed by the excitation of the relay 37, the lead 55, the conducting segment 57, the lead 63, the exciting coil 65 of the relay 67, and the lead 69, to the bus line 31, as was the case with the circuit described above.

It is seen that by the action of the vehicle on the street device the circuit, whereby the relay 67 controlling the program control motor 59 is held in a state of excitation, has been transferred from a simple contactor 53 to a timing sector 97. The initiating sector 21 and the timing sector 97 are so disposed on their driving shaft 95 that the brushes 25 and 101 associated with them make contact simultaneously. However, since the contact of the initiating sector is only instantaneous a lock-in circuit is provided

therefore, from a bus line 47, of the power supply source, through the lead 45, the remaining normally open contactor 49 of the relay 37, the lead 50, the now closed contactor 41, the lead 39, the coil 35 of the relay 37 and the remaining bus line 31 of the source. The contactor 41 of relay 19 and the contactor 49 of relay 37 are connected in series relationship with the coil 35 of relay 37 and, therefore, the lock-in is completely broken if the relay 19 is re-energized as happens when the vehicle moves away from the intersection 1 and no longer obstructs the radiation to the photo-cell.

The relay 67 remains in an energized condition as long as the timing sector 97 is in contact with its associated brush 101. When the brush 101 and the timing sector 97 are disengaged, the relay 67, associated with the program control motor 59, is deenergized, the motor windings are energized and the program controller 61 is rotated. The result of the rotation of the program controller 61 is to cause the system of signals 7, located at the intersection, to go through the customary cycle, indicating right-of-way for the minor highway after a predetermined time.

Simultaneously with the rotation of the program controller 61, the conducting segment 57 disposed on the same shaft 103 as the program controller is rotated and the circuit through the relay 67, associated with the program control motor 59, is opened. As a result, it is possible for the photo-sensitive device 11 to become re-energized, the relay 19 associated therewith to be re-excited, and the relay 37 associated with the time-delay equipment to be deenergized without disturbing the cycle of the traffic signals.

More concisely stated, the system operates as follows:

As soon as the vehicle obstructs the control light from lamp 9, relay 19 closes contacts 29, and as soon as initiating sector 21 reaches brush 25 and brush 101 makes contact with sector 97, current flows through bridging member 51 of relay 37 to brushes 105, even though relay 37 is still energized and contacts 53 still open. Relay 67 remains closed and keeps the braking coil 89 energized. The signals stand in their last mentioned condition as long as brush 101 makes contact with sector 97. When these two break contact, braking coil 89 is deenergized provided relay 37 is still raised, this latter being the case if a vehicle still interrupts the light beam from 9, deenergizing the braking coil 89, and simultaneously closing of motor circuit starts the program controller in rotation a second consecutive time.

It is well to point out that the system is reverted to its initial condition when the conducting segment 57 associated with the program controller 61 engages its corresponding brushes 105. In this condition, the program control motor 59 is inactive, the right-of-way signal is indicated for the main thoroughfare 3 while a stop signal is indicated for the auxiliary thoroughfare 5.

It should be noted that the relay 67, associated with the program controller 61, is slow acting and does not drop out when the contactors 49, 51 and 53 of the relay 37 associated with the time-delay sectors are in motion.

In the system of Fig. 1, therefore, the main thoroughfare keeps the "go" signal until a car stops on the auxiliary thoroughfare in front of the street device for the time period required for the initiating sector 21 to move into contact with its brush 25 and the predetermined period required for the timing sector 97 to revolve through the angle in which it is in engagement with its brush 101. After this time period, the stop signal is given the main thoroughfare for a predetermined time. The auxiliary thoroughfare remains open, and cars may pass thereon, throughout the period of time last-mentioned; thereafter it remains cut-off until a car has stood before the street device thereon for the period mentioned above; and the above-described cycle of signals is repeated.

In systems of the type illustrated in Fig. 1, the time-delay is to a certain extent variable. Furthermore, provisions are not made in systems of this type for taking care of the density of traffic along the minor thoroughfare. Although automatic traffic control systems wherein these two features are omitted are highly useful in many localities, there are certain regions wherein it is highly desirable that the two characteristics discussed above shall be included.

In systems of the type illustrated in Fig. 2, these characteristics are included.

In apparatus of this type, the traffic signals 7 are normally in the same condition as the signals in systems of the type illustrated in Fig. 1. That is to say, under ordinary circumstances a "go" signal is indicated for the main highway 3 and a "stop" signal is indicated for the auxiliary highway 7.

In this case a plurality of bus lines 107 and 109 leading to a source of alternating current are provided. The lines are connected through a rectifying system 111 to a plurality of bus lines 113 and 115 which supply direct current to the system. When the system is adjusted for traffic along the major highway 3, the time-delay motor 117, which is in the present case a synchronous motor, is connected to the direct current supply source and the program control motor 119, also a synchronous motor, is on open circuit. Both of the motors 117 and 119 are therefore at rest.

The initiating sector 21 is in contact with its brush 25 and the conducting segment 57 of the program control system is also in contact with its brushes 105.

When a vehicle appears on the auxiliary highway 5 in such a position as to obstruct the light from the source 9 to the photo-sensitive element 11, of one of the street devices, the exciting coil 121 or 123 of a relay 125 or 127 associated therewith is deenergized. The relays 125 and 127 associated with the street devices are each equipped with a single normally closed contactor 129 or 131 and two normally open contactors 133 and 135, or 137 and 139.

In the following discussion it will be assumed that the street device associated with the relay 125 is disturbed and hence the relay 125 deenergized.

When the relay 125 is deenergized, the closed contactor 129 thereof is opened, a circuit from one direct current bus line 113 through a lead 141, a branch lead 143, the exciting coil 145 of a relay 147, (whereby the power applied to the windings of the motor 117 which drives the time-delay device is changed from alternating current to direct current), a lead 149, the closed contactor 131 of the relay 127, associated with the inactive street device, a lead 151, the closed contactor 129 associated with the active street device, a lead 153, the initiating sector 21, the shaft 95, through which the initiating sector 21 and the timing sector 97 are driven, a contacting sector 155 and a lead 157

to the remaining direct current bus line 115, is broken. When the relay 147 associated with the motor 117 of the time-delay device is deenergized its core 159 drops, the circuit, through the contactor 161, whereby direct current is supplied to the motor 117 is opened, and the circuit, through the contactor 163, whereby alternating current is supplied to the motor is closed. The motor 117 therefore begins to rotate.

Furthermore, the contactor 133 of the relay 125 associated with the active street device is closed by the obstruction of the light from the source 9 and as a result a circuit from one bus line 113 through a lead 165, the exciting coil 167 of a relay 169, associated with the delay device, a lead 171, the newly closed contactor 133 of the street device relay 125, a lead 173, the lead 153, the initiating sector 21, the contacting sector 155 and the lead 157 to remaining bus line 115, is closed. The relay 169 is therefore energized and its lower normally closed contactor 175 is opened while its two upper contactors 177 and 179 which are normally open, are closed.

One of the latter contactors 179 shunts the initiating sector 21, and as a result, provides a path for the current when the latter has passed out of engagement with its associated brush 25.

By the opening of the contactor 175, that is normally closed, a circuit from one bus line 113, through a lead 181, the coil 183 of a relay 185 associated with the program control system, a lead 187, the conducting sector 57 incorporated in this system, a lead 189, a branch lead 191, the newly open contactor 175 of the relay 169 associated with the time-delay system, and a lead 193, to the remaining bus line 115, is opened.

However, this circuit is not completely broken since it is closed by the remaining contactor 177 that is now closed. The new circuit is similar to the circuit discussed hereinabove in that it includes the exciting coil 183 of the relay 185 associated with the program control system and the conducting sector 57, incorporated in this system, but it also includes the timing sector 97, the shaft 95 whereon the timing sector 97 is mounted, the contacting sector 155, and the lead 157.

It is seen that the system is now transferred to a condition wherein its future history is determined by the timing sector 97. When the latter becomes disengaged from its brush 101, the relay 185 associated with the program controller 105 is deenergized and its core 194 drops, opening a circuit through the coil 183, whereby braking is removed from the motor 119 and closing the circuit through the motor. It is to be noted that the circuit through the motor passes from one alternating current bus line 107, through a lead 194, the closed contactor 195 of a relay 197, a branch lead 199, a lead 201, the newly closed contactor 203 of the program control relay 185, the program control motor 119 and a lead 207 to the remaining alternating current bus line 109.

By reason of the rotation of the motor 119, the program controller 61 is rotated and the signals 7 pass through the predetermined cycle. However, an additional sector 209 is disposed on the motor shaft 163 and is rotated thereby. The sector 209 makes contact with a plurality of brushes 211 as long as the right-of-way signal is indicated along the auxiliary highway 5. Hence, when the vehicle which caused the change in the traffic lights moves away from the position where it disturbed the active street device and a second vehicle approaches and causes the relay 125 associated with the street device to become deenergized, and the contactors 133 and 135 to close, and contactor 129 to open, the circuits to which reference was made hereinabove are effected to a certain degree, but, in addition, a circuit which was not mentioned heretofore and which is associated with the contactor 135 of the relay 125 and with the sector 209 is now also affected.

The new circuit from one bus line 113 of the direct-current source, through a lead 212, the bimetal and heating coil of time-delay switch 213, the lead 214, the coil 215 of the relay 197, a lead 217, the sector 209, a lead 219, the contactor 139 of a street-device relay 127 and a lead 221, to the remaining bus line 115 of the direct-current source, is closed. The traffic-density relay 197 is therefore energized and a circuit from the direct-current bus line 113 through a lead 223, the newly closed contactor 225, of the traffic-density relay, the lead 201, the closed contactor 203 of the program control relay 185, the lead 205, motor 119, and the lead 207, to the remaining direct current bus line 115, is closed. At the same time the circuit, through the contactor 195, whereby alternating current is supplied to the motor 119 is opened and as a result the motor is stopped. It is seen that as vehicles moving along the minor highway 5 pass through the light beam, the traffic signalling system is delayed for an instant and tends to remain in a condition whereby it indicates a right-of-way for the minor highway.

The time-delay switch 213 functions in emergencies; that is to say, when the sources 9 burn out or when a vehicle stalls on the minor highway in the path of the exciting light beam. Under such circumstances the program controller 61 rotates until a "go" signal is indicated for the auxiliary highway 5 and then stops since the relay 197 is energized. However, this situation continues only until the bimetal of the time-delay switch 213 is heated to such a point that it opens. The relay 197 is then deenergized and the signal system is actuated from the program controller.

The mode of operation, under various traffic conditions of Fig. 2, may be described as follows: Normally the main thoroughfare has the "go" signal until a car has stood in front of the street device on the auxiliary thoroughfare for a sufficient interval of time to initiate operation of the signal control motors. It is to be noted that the coil 183 of the relay 185 is maintained energized through the movable contactor 175 of relay 169 as long as there is no vehicle on the minor lane 5. When there is a vehicle on the minor lane the relay 185 is maintained energized through the movable contactor 177 of relay 189 and through the conducting segment 97 as long as it is in engagement with the brush 101. In either case the motor 119 is deenergized and a go signal is displayed for the major lane 3.

When the sector 97 is disengaged from the brush 101 the "go" signal is given to the auxiliary thoroughfare. If no other cars appear on the auxiliary thoroughfare the "go" signal remains on the latter for a period of time determined by the synchronous speed of the motor 119. If additional cars appear during this period on the auxiliary thoroughfare each introduces a time delay equal to the period it consumes in passing the street device. The net result is, therefore, that the synchronous motor 119 rotates only during such periods of time as there is no interception of the light ray of the street device; and the "go" signal remains on the cross street until the sum of the time periods intervening between successive vehicles passing the street device equals the

time required for the synchronous motor 119 to rotate the signal control contactor to the position at which the signal 7 changes. In other words, the signals change after the sum of the times, during which the light beam of the street device is uninterrupted, equals a predetermined period. Thereupon the "go" signal is given to the main thoroughfare, and remains there until a vehicle has stood in front of the street device on the auxiliary thoroughfare for the time required to reinitiate action of the signal control; (i. e., until the sector 97 again disengages the brush 101), whereupon the above-described cycle is repeated.

My invention has herein been illustrated as specifically applied to a system wherein a photosensitive system is utilized for a street device. It is apparent that a system of this type has certain advantages which do not apply to systems wherein, for example, the street device is of the acoustic, electromagnetic, electrostatic, or mechanical type. It will furthermore be recognized that the time delay device incorporated in my novel system is particularly useful in connection with apparatus wherein the street device is of a photosensitive type. However, it should also be recognized that my invention may be utilized in connection with automatic traffic control systems wherein the street device is of the other types to which reference was made hereinabove.

In essence my invention comprises a traffic control system wherein either a variable or a constant rotary time-delay system is incorporated. It furthermore includes a traffic density responsive device which may be applied with simplicity.

As illustrated in the drawings, and as described above, the direct current for my system is derived from an alternating current supply source. It is apparent that the direct current may be supplied in any desirable manner, such, for example, as by independent batteries.

Finally it will be noted that the switches and the fuses which are ordinarily incorporated in traffic control systems are not incorporated in the above material. The disposition of these devices was deemed apparent, and hence it was felt that the drawings need not be unnecessarily complicated by their inclusion.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. Apparatus for controlling the movement of traffic along a plurality of highways comprising "stop" and "go" signals to be displayed for said highways, means including a moving element for determining by its average speed the time intervals between changes of said signals, a street device actuated only while a vehicle is opposite it, said street device being actuated by the first vehicle moving along one of said highways after a stop signal has been displayed thereon for initiating predetermined movement of said element during at least a part of which a go signal is displayed to the last-mentioned highway, and means for thereupon rearranging the functional relations between said street device and said element to stop the movement of said element during such times as succeeding vehicles on the highway last-mentioned are so positioned as to influence said street device as aforesaid and during the display of said go signal.

2. Apparatus for controlling traffic along a plurality of highways comprising "stop" and "go" signals to be displayed for said highways, a go signal being displayed for one of said highways and a stop signal for another of said highways, means for varying the display of said signals, traffic-actuated means of a type that operates to provide a single actuating impulse whose length is dependent upon the time the vehicle is opposite to it, one said impulse to be impressed on said varying means for each vehicle actuating said actuated means, the length of said impulse being proportional to the aggregate time a vehicle is opposite said actuating means, the impulse created by the first vehicle moving along the street having a stop signal displayed actuating said varying means to produce the display of a go signal for said last-named highway and a stop signal for the first-named highway for a predetermined time interval, and means actuated by succeeding impulses created by succeeding traffic actuations of said traffic-actuated means which occur within said time interval for prolonging said time interval proportional to the length of said succeeding impulses.

3. Apparatus for controlling the movement of traffic along a plurality of highways comprising "stop" and "go" signals to be displayed for said highways, means to be motivated for varying the display of said signals at a rate dependent on the speed of movement thereof, a synchronous motor for actuating said varying means, a circuit including said motor and an alternating current source, a circuit including said motor and a direct-current source, means for closing the first-named circuit and opening the last-named circuit to motivate said varying means and traffic-actuated means of the type that operates to provide only a single actuating impulse whose length is dependent upon the time the vehicle is opposite it to be impressed on said circuit varying means for each vehicle actuating said actuating means for opening the first-named circuit and closing the last-named circuit responsive to and for the duration of impulses created by said traffic-actuated means.

4. Apparatus for controlling the movement of traffic along a plurality of highways comprising "stop" and "go" signals to be displayed for said highways, means to be motivated for varying the display of said signals at a rate dependent on the speed of movement thereof, a synchronous motor for actuating said varying means, a circuit including said motor and an alternating current source, a circuit including said motor and a direct-current source, means for closing the first-named circuit and opening the last-named circuit to motivate said varying means, and traffic-actuated means of the type that operates to provide an actuating impulse for a definite time to be impressed on said circuit-varying means for each vehicle actuating said actuating means for opening the first-named circuit and closing the last-named circuit responsive to and for a time determined by the duration of impulses created by said traffic-actuated means.

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