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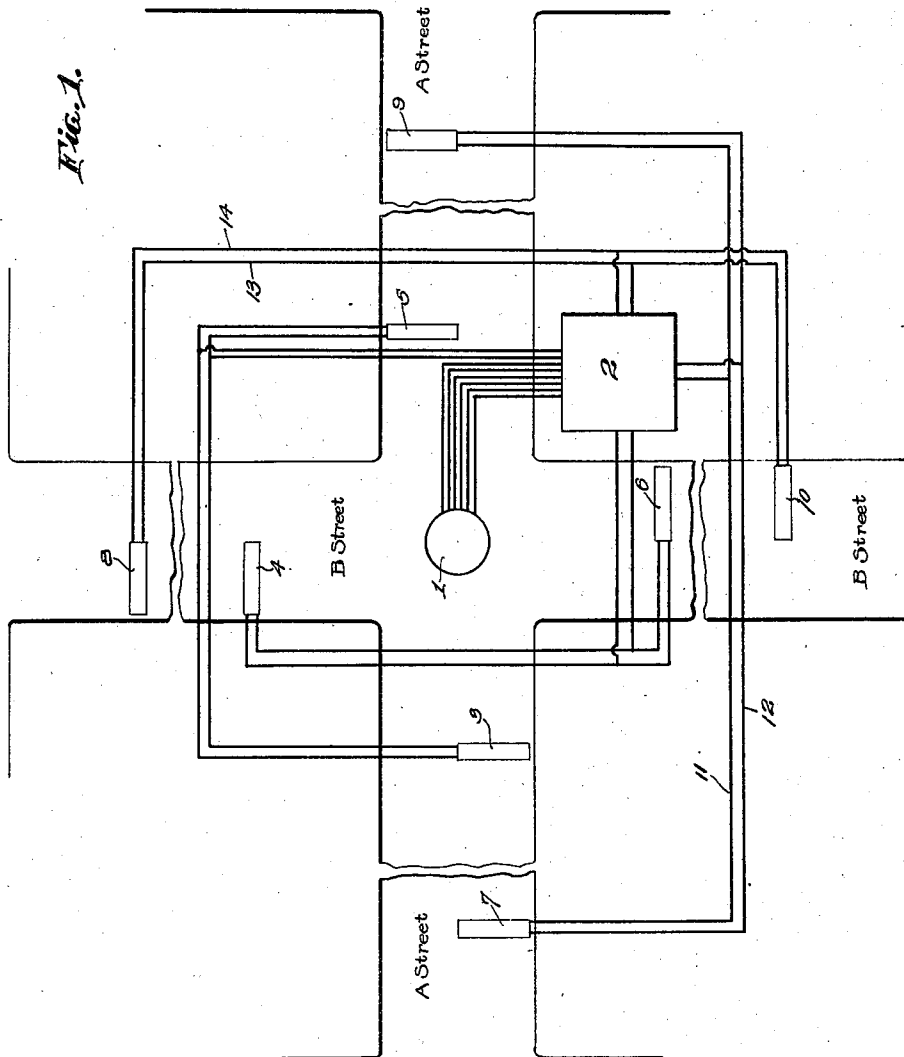
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2,045,136

TRAFFIC ACTUATED SIGNAL SYSTEM

Filed March 10, 1928

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

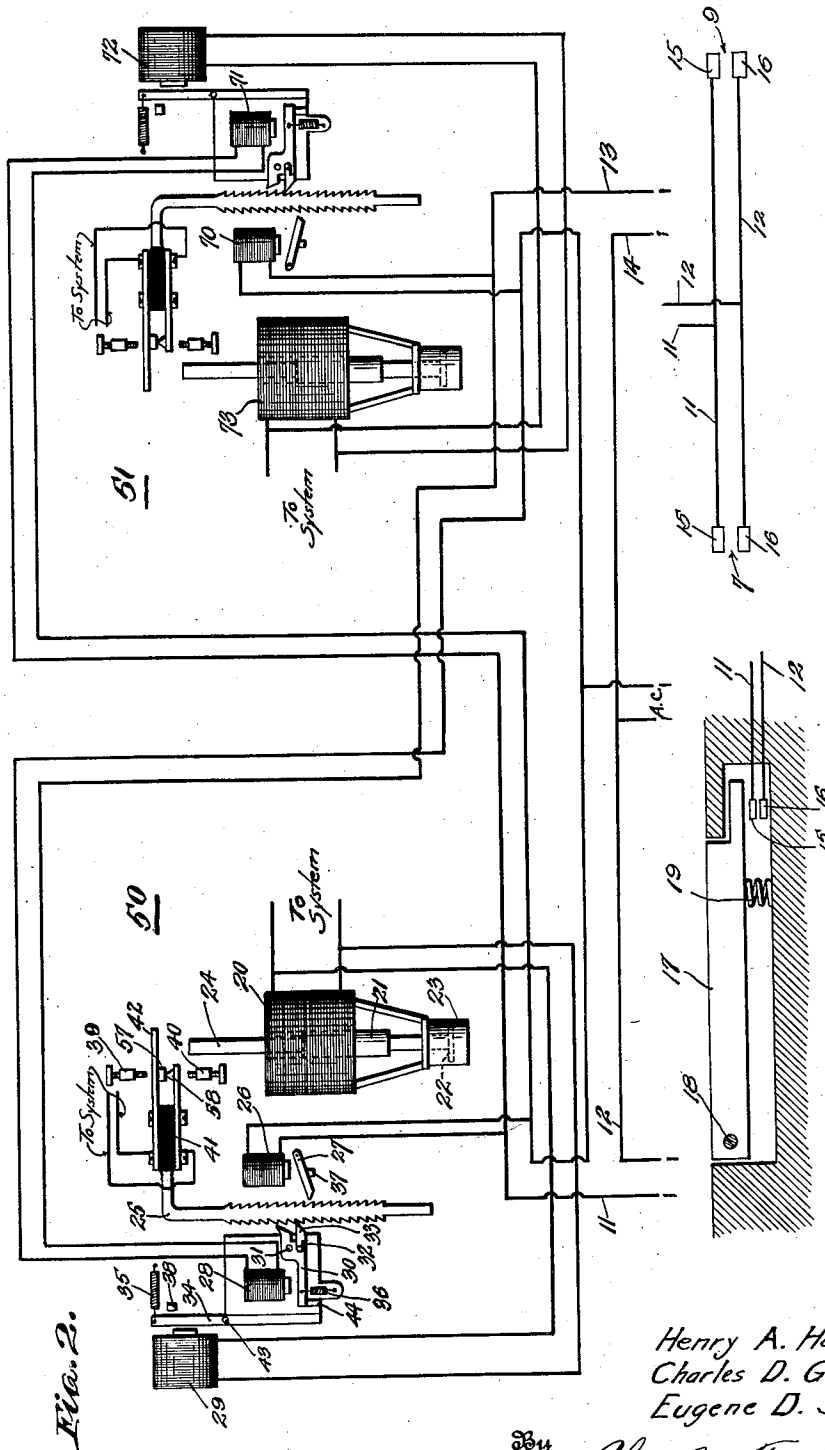


Fig. 2.

Fig. 3.

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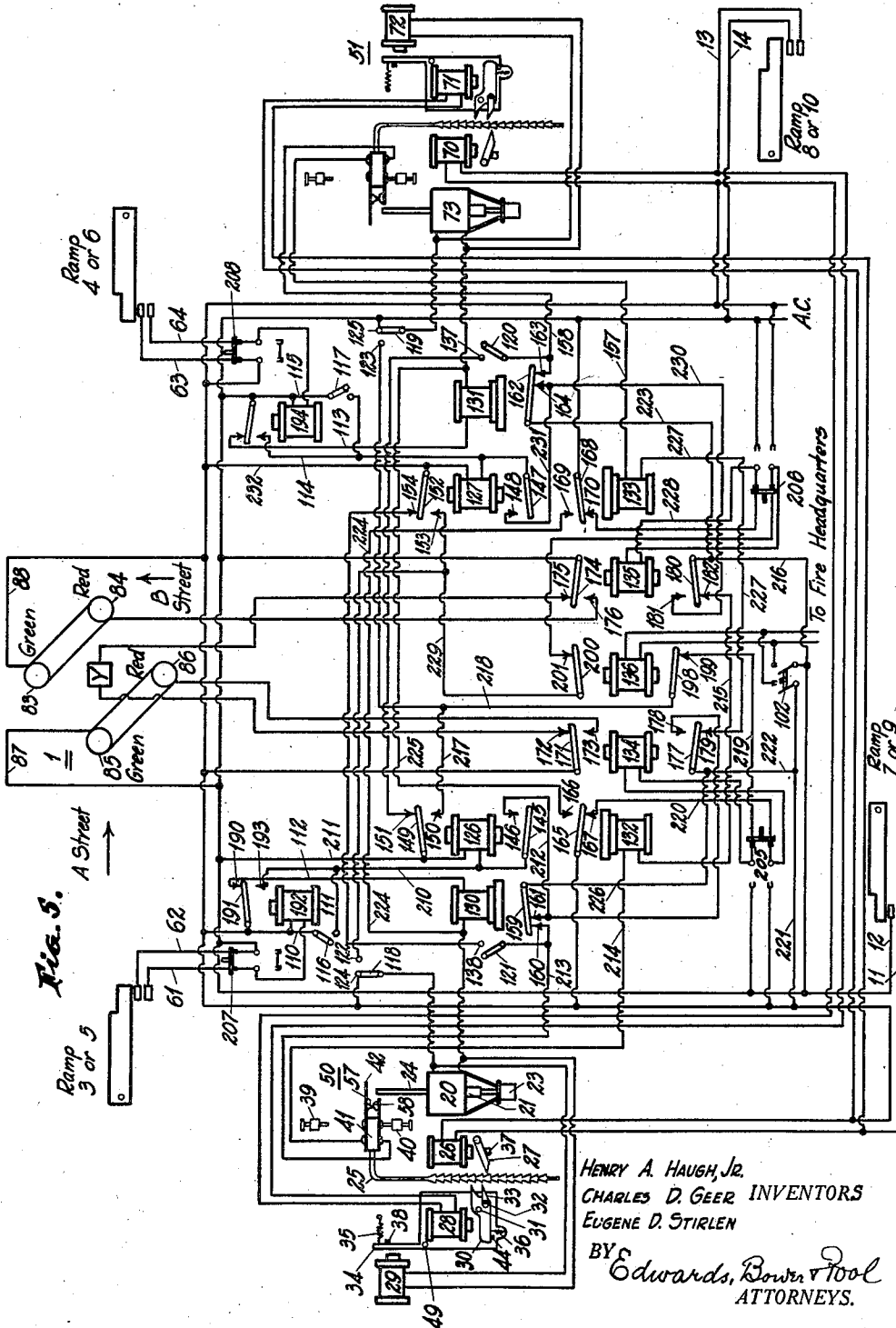
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UNITED STATES PATENT OFFICE

2,045,136

TRAFFIC ACTUATED SIGNAL SYSTEM

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25 Claims. (Cl. 177—337)

This invention relates to automatic traffic control systems, and more particularly to a self-regulating signal system for controlling vehicle traffic at intersections of very busy streets in congested down-town areas of cities.

One form of automatic control system to which this invention may be applied is set forth in British Patent No. 299,040 and relates to a traffic signal system in which the signal is operated through a controller by means of traffic moving in the street. In this system the traffic is regulated at each intersection by vehicle-actuated means located near the intersection.

The claims in the present application are restricted to subject matter not disclosed in the aforesaid British Patent No. 299,040 which was filed under the International Convention, being based on a corresponding sole U. S. application of Henry A. Haugh, Jr., Serial Number 227,490 and which is still pending with claims relating to the invention disclosed in the British patent aforesaid. The present application and the aforesaid Haugh application, Serial No. 227,490 have a common assignee.

One object of this invention is to provide apparatus which may be used in conjunction with an automatic traffic control system such as that set forth, whereby the system shall be more flexible in operation and shall have a wider range of application, and this object is accomplished by providing apparatus which shall function in response to the volume of traffic moving on the highway at a distance from the intersection.

Another object of this invention is to provide a variable time limit relay mechanism which shall operate in conjunction with automatic vehicle actuated systems now in use, to control the period of time which traffic shall wait on one cross street before the signal is taken away from continuous traffic to allow waiting vehicles on the intersecting street to proceed.

A further object of the invention is to provide variable time limit relays for use in highway traffic control systems of the character designated, the time limits of which shall be varied by vehicular traffic at a distance from the intersection, so that the signal for traffic to proceed shall be given through variable maximum periods of time, depending upon the volume and/or density of traffic in the highways.

A further object of the invention is to provide variable maximum time limit relays for traffic control systems of the character designated in which the maximum time period at which the relays operate shall be in part a function of the

volume and/or density of traffic on the streets leading to the intersection.

Other objects will be more manifest by reference to the following specification and drawings and as particularly set forth in the claims.

In the drawings:

Figure 1 is a diagrammatic view of a traffic signal system embodying our invention.

Figure 2 is a diagrammatic drawing of one embodiment of our invention showing in detail the electrical circuits and various components.

Figure 3 shows in diagram form a vehicle actuated means for completing an electrical circuit and subsequently breaking it as the wheel of a car passes over it.

Figure 4 is a wiring diagram illustrating the electrical connections to the vehicle actuated means.

Figure 5 is a diagrammatic view showing the connections as employed in an automatic traffic control system.

An automatic traffic control system embodying our invention comprises three parts: 1. Any automatic traffic control system employing a relay or timer system to control the operation of the signal means; 2. A variable time limit control device having a minimum and a maximum period which can be set arbitrarily for any predetermined time and arranged so that its time of operation will vary between these two set arbitrary periods in accordance with impulses received; 3. Traffic actuated means placed in the streets which pass through the intersection on which the signal means is used, but placed at a distance from the intersection. In practice we contemplate placing these street devices in the streets at the intersections adjacent to the intersection on which the signal is placed.

While we have described above in general an improvement on an automatic traffic control system embodying our invention, and have shown that this invention is comprised of three main and interconnected parts, we now describe in detail one complete and specific system embodying our invention. In this specific and complete embodiment of our invention, we illustrate the device used in conjunction with an automatic traffic control system such as set forth in the British Patent No. 299,040 above referred to. We do not describe in detail all of the features of the operation and construction of the system shown in the British patent referred to except in so far as to show its relation to this embodiment of our invention. The system shown in the British patent referred to as one embodiment of our invention is capable

of numerous methods of operation as described in the specification of the patent under the several connections and combinations of connections, and it is clear that our invention may be applied to
 5 any one or more of the British systems of operation, regardless of whether the traffic actuated means shown in the British patent are connected or disconnected under any of the modes of operation so long as the maximum limit relays 20 and 73
 10 in our application, or their equivalent in the British patent referred to, are a governing factor in the timing.

In Figure 1, the elements 1, 2, 3, 4, 5 and 6 represent the units of an automatic traffic control system to which our invention may be applied. 1 is
 15 a signal means, 2 is the controller, 3, 4, 5 and 6 are vehicle actuated means used to affect the operation of the controller. 7, 8, 9 and 10 are vehicle actuated means located at a distance from the intersection and employed to control the operation
 20 of the variable time limit relays called for by our invention. The wiring will be fully explained by reference to the other figures.

Figure 3 shows a vehicle actuated means consisting of a ramp arm 17 pivoted at 18, and supported by spring 19. When a wheel passes over the
 25 ramp arm it is depressed, pressing contacts 15 and 16 together closing the circuit in wires 11 and 12. When the wheel has passed off of the ramp arm, spring 19 again raises the arm, allowing contacts 15 and 16 to separate and open the circuit in wires 11 and 12.
 30

Figure 4 shows in further detail the method of wiring the vehicle actuated means together.

Figure 2 shows the wiring in further detail, and the construction and function of the variable time limit relays in diagram form. The variable time limit relays are designated in 50 and 51. They are constructed as follows: 20 is a solenoid. 21 is
 35 the solenoid core, and is movable. 23 is a cylinder containing oil and 22 is a piston containing a valve which will allow rapid downward motion, but a slow restricted upward motion. This construction is the same as in the usual "oil dash pot" time
 40 limit relay known to the arts. When 20 is energized, the core 21 rises slowly against the resistance of the dash pot in the well-known manner. When 20 is de-energized the core drops back at once. Contacts 57 and 58 which are opened by rod
 45 24 when core 21 has risen sufficiently to allow it to press against 42 are attached to an insulated block 41, which is in turn attached to a movable rod 25. This movable rod 25 has ratchet teeth along its lower end as illustrated. Adjacent to the
 50 ratchet is a magnet 26 whose armature 27, rests against stop 37. Armature 27 is arranged so that when magnet 26 is energized, the ratchet teeth are engaged and the ratchet is lifted one tooth. Magnet 29 is connected so as to be energized whenever solenoid 20 is energized. Attached to armature
 55 34 of magnet 29 is a magnet 28 and its armature 30. Armature 34 is pivoted at 43, and is held against stop 38 by spring 35. When 29 is not energized armature 30 of magnet 28 is disengaged from the ratchet on arm 25. When magnet 29 is energized, armature 34 pulls over to the magnet, and the pivot 43 causes the lower end of the armature which carries magnet 28 and its armature
 60 30, to move toward the ratchet so that armature 30 may engage the ratchet with pawl 33. Attached to armature 30 is a small pawl 33, hinged at 32, and arranged so that when armature 34 is against stop 38 it is disengaged from the ratchet as is armature 30. When magnet 29 is energized,
 65 and magnet 28 is not energized, armature 30

which is pivoted at the point 31 is kept against stop 44 by spring 36 and pawl or check 33 engages the teeth of the ratchet while the point of armature 30 does not. By the construction of the check as illustrated, the ratchet can be raised, inasmuch
 5 as the check will not prevent upward motion, but the ratchet cannot fall. On the other hand, if magnet 28 is energized while magnet 29 is energized, the pointed end of armature 30 will move toward the ratchet, while the check 33 will
 10 move away slightly. The construction as illustrated is such that energizing magnet 28 and then de-energizing it will lower the ratchet one tooth. When magnet 29 is energized, and magnet 28 is not energized, if magnet 26 is energized it will lift
 15 its armature 27 which will raise the ratchet one tooth. The check 33 will allow this to occur, but prevent the ratchet from falling back upon the deenergizing of 26.

Thus it is clear that when 29 is energized, every
 20 time the circuit to 26 is made and broken, the ratchet will rise one tooth, and every time the circuit to 28 is made and then broken, the ratchet will fall one tooth. Stops 39 and 40 are adjustable and represent the maximum that the ratchet
 25 can rise or fall.

In this time limit relay, the time at which contacts 57 and 58 are separated after energizing of solenoid 20 will depend upon the position of the arm bearing the contacts and the ratchet. If
 30 the arm is near or at stop 40 the period will be short, if the arm is near or at stop 39 the period will be long. The position of the arm will depend upon the relative number of impulses received by the two magnets 26 and 28.
 35

Referring to Fig. 5, the following description illustrates our invention as applied to the automatic control system set forth in the British Patent No. 299,040 referred to above. To more
 40 clearly explain the operation of this system we will first describe it without considering the modifying action of our invention. To do this we will temporarily disregard ramps 7, 8, 9, and 10, shown in Figure 1 and their effect on variable time limit relays 50 and 51. We shall also assume that coil
 45 20 will require 30 seconds, continuous energizing, before it breaks contacts 57 and 58.

Referring to Figures 2 and 5 of the drawings, the wiring diagram shows the connections arranged for the operation of the system when the
 50 yellow light is visible from both streets in the absence of traffic on either street.

Case 1—Single vehicle approaching from A Street.—Assume a vehicle approaches on A Street and actuates ramp 5, as shown in Figure 1, closing the circuit between wires 61 and 62. This
 55 energizes coil 192 through wires 62 and 61, coil 192 and wire 240, pulling up armature 191, breaking the circuit between armature 191 and contact 190 and closing the circuit between armature 191
 60 and contact 193. This allows current from a suitable source to flow through relay 126 by way of wires 111, 110, 210 and 211 thereby operating armatures 145 and 149. The contact of armature 145 with contact 146 causes current to continue
 65 to flow through relay 126, by way of wires 212, contact 161, armature 159, wires 226, 222 and 221, thus holding relay 126 in the operated position after the passing of the wheel has permitted contacts 191 and 193 to separate. Armature 149
 70 makes contact with 150, by way of wires 217, 218, armature 198, contact 199, wire 219, relay 134 and wire 220, armature 165 being already in contact with 167, thereby causing armature 177 to break contact 179 and make contact 178. Current being
 75

interrupted between armature 177 and contact 179 de-energizes relay 133, which was energized through wires 221, 222, armature 177, contact 179, wire 227, wires 157, 158, contacts 163 and 162, wire 223 and wire 216. This causes armature 168 to break from contact 170 thereby preventing energization of relay 135 and action of the latter through armature 174 and contact 176 to light the green light on B Street and the red light on A Street. Armature 168 making contact with 169 causes current to flow through wire 224 and solenoid 20 and relay 130. Solenoid 20 and relay 130 thereupon begin to operate. If no other car approaches from A Street to connect wires 61 and 62 and thus separate contacts 190 and 191 shown in Fig. 5, relay 130 is continuously energized. 10 seconds after relay 130 is energized, armature 159 breaks from contacts 160 and 161 thereby stopping the flow of current by way of wires 210, armature 145, contact 146, wire 212, contact 161, contact 160, wire 213, contacts 57 and 58 and wire 214, through relay 132 which permits armature 165 to break from contact 167 and make contact with 166 thereby de-energizing relay 134 and through wire 225 energizing relays 73 and 131 causing armature 171 to break from contact 173 and make contact with 172, thereby extinguishing green light 85 and red light 86 and lighting the yellow light 89. When relay 134 is de-energized, armature 177 breaks from contact 178 and makes contact with 179. Breaking contact 178 opens the holding circuit and releases the armature of relay 126, thus dropping it back to its normal unoperated position. Armature 177 making contact with 179 energizes relay 133. Two seconds after relay 133 is energized, armature 168 breaks from contact 169 thereby de-energizing solenoid 20 and relay 130 and makes contact 170. The de-energizing of solenoid 20 has no effect on the circuit inasmuch as it had not been energized continuously for 30 seconds. The release of relay 130 causes armature 159 to make contact with 160 and 161 thereby energizing relay 132, from wire 226 which, after 2 seconds, causes armature 165 to break from contact 166 thereby de-energizing solenoid 73 and relay 131 and make contact with 167. The de-energizing of solenoid 73 and relay 131 has no effect on the circuit, inasmuch as neither had been energized long enough to operate. A yellow light is now shown in both streets and the entire system has returned to its original condition.

Case II—Continuous traffic on A Street with no traffic on B Street.—If in the preceding operation no cars had approached the intersection from B Street, but vehicles had approached on A Street and actuated ramp 5 or 7 within 10 seconds of the previous actuation of either ramp, thereby breaking the coil circuit of 10 second relay 130 at contacts 190 and 191, shown in Fig. 5, then armature 159 would have maintained a continuous contact with 160 and 161, thus preventing 10 second relay 130 from causing the circuit to operate as in Case I so as to extinguish green light 85 showing in A Street and red light 86 showing in B Street. This circuit provides in addition, that current flow through the coil of relay 126, armature 145 and contact 146 even after armature 177 has broken contact from 178. The purpose of this is brought out later. The 30 second time-limit relay 20 which was energized at the same time that 10 second relay 130 was energized, breaks the circuit between contact 57 and contact 58 30 seconds after it is energized, thereby releasing the 2 second time limit relay 132. Armature

165 breaks from contact 167 thereby interrupting the current operating relay 134. Armature 171 breaks contact from 173 and makes contact with 172 thereby extinguishing green light 85 showing in A Street and red light 86 showing in B Street, and lighting the yellow light 89. Armature 177 breaks from contact 178 but in this particular case does not interrupt the current operating relay 126 because of the fact that said current is supplied through contacts 159 and 161 on relay 130 which are connected in parallel with contacts 177 and 178. The fact that relay 126 therefore remains energized, causes lights 85 and 86 to show after yellow light 89 has been lighted for 4 seconds, thus returning the right of way to A Street after giving pedestrians a 4 second period in which to cross A Street.

The actual operation of the circuit to produce this effect is as follows. Armature 177 connects with contact 179, thereby energizing the 2 second time limit relay 133 as before described. Two seconds after relay 133 is energized armature 168 breaks from contact 169 thereby opening the circuit to solenoid 20 and relay 130, through wire 224, whereupon contact 57 makes contact with 58 and energizes the 2 second relay 132. Two seconds after relay 132 is energized, armature 165 makes contact with 167, thereby energizing relay 134 whereupon armature 171 breaks from contact 172 thus extinguishing the yellow light and makes contact with 173 thus lighting the A Street green light 85 and the B Street red light 86. This cycle of operations repeats as long as vehicles operate either ramp in A Street within intervals of 10 seconds and none operate a ramp in B street. In the event that vehicles fail to operate either A Street ramp within an interval of 10 seconds, the subsequent operation is as described in Case I.

Case III—One vehicle on A Street followed within 10 seconds by one vehicle on B Street.—Under this condition, the circuit operates as in Case I with the following changes. When relay 134 is de-energized through the breaking of armature 165 from contact 167, armature 177 makes contact with 179. A vehicle operates either ramp 4 or 6 in B Street which causes current to flow through the coil of relay 127. The contacts of ramps 4 and 6 as shown in the drawings, control relay 127 through wires 63 and 64 and relay 194 just as contacts in ramps 5 and 3 control relay 126, and they control relay 131 just as contacts in ramps 5 and 3 control relay 130. Relay 127 is now held in the operated position by current flowing through armature 147 and contact 148, contact 164 and armature 162, and wires 223 and 216. Armature 177 making contact with 179 energizes relay 133 through wires 157, 158 contacts 163, and 162. Two seconds after relay 133 is energized, armature 168 makes contact with 170 thereby operating relay 135 through switch 206, wire 228, contacts 201, 200, wire 229, contacts 152 and 153, and wire 230 and breaks contact with 169 thereby deenergizing relay 130 which thereupon returns to its unoperated condition, causing armature 159 to make contact with 160 and 161. The operation of relay 135 causes armature 174 to break contact from 175 thus extinguishing the yellow light and to make contact with 176 thereby lighting the green light 83 on B Street and red light 84 on A Street. Thus the effect has been that the vehicle in A Street has retained the right of way for 10 seconds and at the end of this 10 second period, the signal has gone

through the cautionary yellow period to an indication of right of way on B Street.

When relay 135 was energized armature 180 broke the lircuit with contact 182 and made contact with 181. Breaking of the circuit between 180 and 182 causes relay 132 to remain de-energized after armature 159 has made contact with 160 and 161. When relay 132 was originally de-energized by the separation of armature 159 from contact 160, as explained in Case I, armature 165 made contact with 166 thereby energizing time limit relays 73 and 131. Ten seconds after relay 131 was energized, due to the fact that neither ramp in B Street had been operated by a second vehicle, which would have de-energized relay 131, armature 162 breaks contact with 163 and 164 thereby de-energizing relay 133 thus permitting armature 168 to break contact from 170 and make contact with 169. The breaking of the circuit between 168 and 170 de-energized relay 135, thus breaking contact between 174 and 176 thereby extinguishing green light 83 and red light 84 and making contact between 174 and 175 thus lighting the yellow light 89. Armature 180 breaks from contact 181 thereby de-energizing relay 127 by way of wires 230 and 231, whereupon armature 147 breaks contact with 148. Armature 180 in making contact with 182 energizes the 2 second relay 132 through contacts 57, 58, 160 and 159, on relays 20 and 130. Two seconds after relay 132 is energized armature 165 makes contact 167 and breaks from contact 166 thereby de-energizing time limit relays 73 and 131. Inasmuch as relay 73 had not been energized for a sufficient length of time to operate its armature, it has not acted to control the circuit. The de-energizing of relay 131 permits armature 162 to make contact with 163 and 164 thereby energizing relay 133, through contacts 178 and 179. Two seconds after relay 133 is energized, armature 168 breaks from 169 thereby de-energizing relays 20 and 130 and makes contact with 170 so that relay 135 operates immediately when relay 127 is energized. The circuit has now completed its cycle and has returned to the condition at the beginning of Case I, and as shown in Fig. 2.

Case IV—Continuous traffic on A Street with one vehicle waiting on B Street.—Under these conditions, the circuit operates as outlined in Case II until a vehicle operates one of the ramps in B Street. The opening of the circuit between contacts 57 and 58 which occurs 30 seconds after relay 20 is energized, de-energizes relay 132 causing armature 165 to break from contact 167 and make contact with 166. Connecting armature 165 with contact 166 energizes relays 73 and 131. Breaking the circuit between armature 165 and contact 167 de-energizes relay 134 whereupon armatures 171 and 177 fall back extinguishing the A Street green light 85 and the B Street red light 86 through breaking the circuit between armature 171 and contact 173. Armature 171 making contact with 172 lights the yellow light 89. Armature 177 breaking from contact 178 does not de-energize relay 126 because current for relay 126 is supplied through wire 225, armature 159 and contact 161, armature 145 and contact 146. In the meantime a vehicle has operated one of the ramps on B Street energizing relay 127. Current to keep relay 127 energized after said vehicle has crossed the ramp flows through armature 147, contact 148, contact 164, and armature 162. Armature 152 now makes contact with contact 153. Armature 177 which made contact with

contact 179 when relay 134 was de-energized thereupon energized relay 133 through wires 157 and 158, contacts 163 and 162. Two seconds after relay 133 is energized armature 168 breaks from contact 169 thereby de-energizing relays 20 and 130. Armature 168, through making contact with contact 170, now energizes relay 135 through switch 206 and contacts 201, 200, 153, and 152. Armature 174 now breaks from contact 175, thus extinguishing the yellow light, and makes contact with 176, thereby lighting the B Street green light 83 and the A Street red light 84. Armature 180 breaks from contact 182 and makes contact with 181 thereby causing relay 132 to remain de-energized despite the closing of contact 57 with contact 58. Armature 165 therefore remains in contact with 166 keeping relay 73 energized and also relay 131 energized, inasmuch as this case assumes that a second car does not pass over a B Street ramp. Hence 10 seconds after relay 131 was energized, armature 162 breaks from contact 163 and contact 164 thereby de-energizes relay 133. Armature 168, of relay 133, now breaks from contact 170 and makes contact with 169 thereby energizing relays 20 and 130. Relay 135 is now de-energized through the break between armature 168 and contact 170. Armature 174 now breaks from contact 176 thereby extinguishing the B Street green light 83 and the A Street red light 84. The yellow light 89 is now lighted through armature 174 and contact 175. Armature 180 at the same time breaks from contact 181 thereby de-energizing relay 127 inasmuch as armature 162 is not now in contact with 164. Armature 180 makes contact with contact 182 thereby energizing relay 132 through contacts 57, 58, 159, and 160. Two seconds after relay 132 is energized, armature 165 breaks from contact 166, thereby de-energizing relay 73 and relay 131, and makes contact with 167, thereby energizing relay 134 through switch 205, contacts 199, 198, wires 218 and 217, contacts 150 and 149. Armature 171 now breaks from contact 172 extinguishing the yellow light and makes contact with 173 again lighting the A Street green light 85 and the B Street red light 86. Armature 177 also breaks from contact 179 thereby insuring that relay 133 will remain de-energized even though wire 157 be in contact with wire 158 and armature 162 be in contact with 163. Armature 177 now makes contact with 178 thus paralleling armature 159 and contact 161. The system has now returned to the condition in which it was when the single vehicle actuated the ramp in B Street. In this description we have shown how continuous traffic in A Street would be interrupted for a sufficient period to allow a single vehicle from B Street to use the intersection, and how right of way would return immediately thereafter to A Street in which the continuous stream of traffic had been interrupted.

Case V—Continuous traffic in both streets.—Under these conditions the circuit operates as it did in Case II to transfer the right of way from A Street to B Street. But, continuous traffic in B Street opens the contacts through which the current energizing relay 131 passes. Armature 162 therefore continues to make contact with 163 and 164. Relay 133 therefore remains energized until wire 157 breaks from wire 158 which will take place 30 seconds after relay 73 is energized. The energizing of relay 73 is caused in accordance with the description given in Case II. Wire 157 now breaking contact with 158 de-energizes relay 133. Armature 168 breaks contact from 170

and makes contact with 169 thereby de-energizing relay 135 and energizing time limit relays 20 and 130. Armature 174 now breaks contact with 176, thereby extinguishing B Street green "go" signal 83 and A Street red light 84, and makes contact with 175 thereby lighting the yellow light. Armature 180 now breaks from contact 181 which action has no effect on the circuit inasmuch as this connection is also made by armature 162 and contact 164. Armature 180 makes contact with 182 thereby energizing relay 132. Two seconds after relay 132 is energized, armature 165 breaks from contact 166 thereby causing the de-energizing of relays 73 and 131, thereby causing wire 157 to make contact with 158 and makes contact with 167 thereby energizing relay 134 through switch 205, contacts 199, 198, 150 and 149. Armature 171 now breaks from contact 172 extinguishing the yellow light and makes contact with 173 lighting the A Street green light 85 and the B Street red light 86. Armature 177 breaks from contact 179 thereby causing relay 133 to remain de-energized even though wire 157 makes contact with 158 and armature 162 makes contact with 163. Armature 177 now makes contact with 178 and the circuit has returned to the condition in which it was at the beginning of this description.

It is apparent from the foregoing description that the relay 20 limits the length of time during which traffic may flow continuously on A Street. As soon as the "go" signal is given to A Street, relay 20 is energized and if traffic is continuous on A Street the "go" signal remains on A Street for 30 seconds. Then relay 20 operates so as to remove the "go" signal from A Street and give it to B Street. Simultaneously relay 20 is de-energized and relay 73 is energized. Relay 73 performs the same functions for B Street as relay 20 does for A Street.

Nevertheless the maximum period during which traffic may flow undisturbed is fixed and cannot be varied by the traffic. The purpose of our invention is to vary this maximum period by electrical impulses caused by traffic operating vehicle actuated devices in the streets. The method of obtaining this variation and the value is set forth below.

While in the above description the application of our invention to one form of traffic control systems has been set forth and one embodiment of our invention has been illustrated, it will be obvious to those skilled in the art that the invention may take many forms and may be applied to many types of traffic control systems, and it is not intended to limit our invention to the particular form illustrated. It will be appreciated that numerous changes in construction and rearrangement of parts with respect to the construction of the timer, of the time adjustment means, of the traffic responsive means, and in the mode of installation and point of application of these several means might be resorted to without departing from the spirit of the invention as defined by the claims.

A Street, vehicle actuated means 7 and 9 are connected in parallel by wires 11 and 12. Vehicle actuated means 8 and 10 are connected in parallel by wires 13 and 14. Variable time limit relay 50 functions to control the maximum period through which a continuous stream of traffic can hold the "go" signal on A Street. Wires 11 and 12 are connected to magnet 26 in relay 50 and to magnet 71 in relay 51. When the "go" signal is given to A Street, solenoid 20 will immediately be energized

and functions as heretofore described. Magnet 29 will be energized simultaneously inasmuch as in our invention this magnet is connected in parallel with the solenoid. Also since B Street has the stop signal, solenoid 73 will be deenergized as heretofore described. Since magnet 72 is in parallel with solenoid 73, it will also be de-energized. When the "go" signal is on A Street, vehicles moving toward the intersection on A Street will pass over ramp 7 or ramp 9, and will send electrical impulses through wires 11 and 12 to variable time limit relays 50 and 51. Impulses going into variable time limit relay 50 through wires 11 and 12 operate magnet 26 causing ratchet 25 to raise, and since A Street has the "go" signal, solenoid 20, and magnet 29 are energized, so that when magnet 26 causes the ratchet 25 to be raised, pawl 33 will prevent its return. Since ratchet 25 has been raised, rod 24 has to move through a greater distance than formerly before it separates contacts 57 and 58 and this allows solenoid 20 to be energized for a longer period than 30 seconds. Impulses going to variable time limit relay 51 through wires 11 and 12 energize magnet 71. Since B Street has the "stop" signal, solenoid 73 and magnet 72 are de-energized, and the ratchet will not operate, but remains in its minimum time position. Thus the true effect of cars arriving on A Street during the period which it holds the "go" signal is to increase the length of the maximum period for which A Street can hold the "go" signal. Cars approaching on B Street pass over vehicle actuated means 8 and 10, and send electrical impulses through wires 13 and 14 to variable time limit relays 50 and 51. Impulses going to relay 50 through wires 13 and 14 energize magnet 28 causing ratchet to drop one tooth for each impulse. Impulses going to relay 51 through wires 13 and 14 energize magnet 70. Inasmuch as solenoid 73 and magnet 72 of time limit relay 51 are not energized, there is no effect produced in time limit relay 51. Hence, when A Street has the "go" signal, cars approaching the intersection on A Street tend to lengthen the maximum period during which A Street can hold the "go" signal, while cars approaching the intersection on B Street tend to shorten the period which A Street can hold the "go" signal.

When the "go" signal is taken from A Street and given to B Street time limit relay 50 becomes de-energized and time limit relay 51 becomes energized so that cars approaching on B Street tend to lengthen the maximum period which B Street can hold the "go" signal while cars approaching on A Street tend to shorten the period during which B Street can hold the "go" signal.

The result of this operation is as follows. Suppose both streets have a more or less continuous traffic flow, but, A Street has a fairly dense flow while B Street has a sparse and scattered flow, and suppose the "go" signal is on A Street. As the vehicles on A Street approach the intersection, magnet 26 will be operated very frequently by the passage of the large number of vehicles over ramps 7 and 9. Vehicles approaching the intersection on B Street, will pass over ramps 8 or 10, energizing magnet 28 from time to time. The vehicles will move forward into the block and stop at A Street. Since there are many more cars on A Street than B Street, A Street will hold the "go" signal either up to the maximum or somewhere near the maximum period. When A Street loses the light, traffic on A Street will be in the least congested condition since it has been flowing freely, barring some other conges-

tion in the path of the traffic moving on A Street. Traffic on B Street will be condensed into a waiting block. When B Street traffic moves forward, any new cars arriving on B Street will tend to
 5 lengthen the B Street maximum period as determined by relay 13, while cars moving into the waiting block on A Street will tend to shorten the B Street "go" period. Since there is not a dense flow on B Street the maximum period, as
 10 determined by relay 13, will be shortened so as to almost coincide with the minimum period as determined by relay 13 and B Street will lose the "go" signal at, or shortly after, the expiration of the minimum period. If the traffic on both streets
 15 becomes about equal, and is light in volume, streets A and B will alternately hold the "go" signal for equal minimum or nearly equal minimum periods, giving a frequent shifting of the "go" signal back and forth between the streets. If traffic be-
 20 comes unbalanced between the two streets the maximum periods will lengthen out on the street having the heavier traffic flow. If traffic on both streets increases to a degree of congestion, the periods will lengthen on both streets, for cars
 25 moving on the "go" street will increase its period, while on the "stop" street, congestion will prevent cars coming into the block and thus prevent a decrease in the "go" street's time period. This is especially desirable for it is believed by
 30 some traffic engineers that where traffic is especially dense long "go" periods are the most efficient, whereas in light traffic short "go" periods are more desirable.

What we claim is:

35 1. In a traffic control system, a signal device for intersecting traffic lanes for indicating stop and go signals, vehicle actuated means located in the traffic lanes and at a distance from the in-
 40 tersection, a control mechanism connected to said vehicle-actuated means for regulating the display of signals alternately to the traffic lanes including automatic variable maximum time limit relay
 45 means for determining the maximum period of said displays, said relay means being actuated by the vehicle means in such a manner that traf-
 50 fic moving in the traffic lanes shall vary the maximum period as determined by said maximum time limit relay means and during which a "go" signal may be displayed to one of the lanes while traffic is accumulating in an intersecting lane.

2. In a traffic signal control system for inter-
 55 secting traffic lanes, a signal device to be disposed at the intersection of the lanes, vehicle actuated means located in or adjacent to the traffic lanes near the intersection, other vehicle actuated means placed in or adjacent to the traffic
 60 lanes at a distance from the intersection; a control mechanism connected to said vehicle actuated means for operating the signal device to display "go" signals alternately to the said lanes in re-
 65 sponse to impulses received from both of the vehicle actuated means and including automatic variable time limit relay means which determine the maximum period of said displays, said relay
 70 means being operated by the vehicle actuated means in such a manner that traffic moving in the traffic lanes shall influence the period as determined by said maximum time limit relay
 means and during which a "go" signal may be displayed to one traffic lane while traffic is waiting in another traffic lane to receive the "go" signal.

3. A traffic control system to be disposed at the point of intersection of two vehicle lanes and
 75 including signalling means for according right

of way periods to each lane, means operable to limit the time of right of way in each lane and vehicle actuated means for varying the limiting point of the limiting means on the right of way period in response to changes in the difference
 5 between the number of cars traversing each lane.

4. A traffic control system to be disposed at the intersection of two vehicle lanes, and including signalling means for according and interrupting
 10 right of way indication to each lane, operating means for said signalling means, vehicle actuated means disposed in at least one of said lanes for controlling said operating means to cause said
 15 signalling means to indicate right of way to said lane, means forming a part of said operating means to limit the time period of right of way in each lane and other vehicle actuated means for
 20 varying the time period of said right of way limiting means in response to changes in the difference between the number of cars traversing each lane.

5. A traffic control system to be disposed at the intersection of two vehicle lanes, and including signalling means for according and interrupting
 25 right of way indication to each lane, operating means for said signalling means, vehicle actuated means disposed in at least one of said lanes for controlling said operating means to cause said
 30 signalling means to indicate right of way to said lane, means forming a part of said operating means to limit the time period of right of way in each lane and other vehicle actuated means in at least one lane and disposed at a point further from the intersection than the first named
 35 vehicle actuating means, said last named means being operable during the right of way period of said lane to increase the time period of said right of way limiting means.

6. A traffic control system to be disposed at the intersection of two vehicle lanes, and including signalling means for according and interrupting
 40 right of way indication to each lane, operating means for said signalling means, vehicle actuated means disposed in at least one of said lanes for controlling said operating means to cause said
 45 signalling means to indicate right of way to said lane, means forming a part of said operating means to limit the time period of right of way in each lane, and other vehicle actuated means in at least one lane and located at a point further from the intersection than the first named
 50 vehicle actuating means, said last mentioned means being operable during the right of way period of the other lane to decrease the time period of said right of way limiting means.

7. A traffic control system to be disposed at the
 55 intersection of two vehicle lanes, and including signalling means for according and interrupting right of way indication to each lane, operating means for said signalling means, vehicle actuated means disposed in at least one of said lanes for
 60 controlling said operating means to cause said signalling means to indicate right of way to said lane, means forming a part of said operating means to limit the time period of right of way in each lane and other vehicle actuated means in at least one
 65 lane and located at a point further from the intersection than the first named vehicle actuating means, said last named means being connected to said operating means to increase the time period of said right of way limiting means during
 70 the right of way of said lane and to decrease the time period of said right of way limiting means during right of way to the other lane.

8. A traffic control system to be disposed at the intersection of a plurality of interfering traffic
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lanes, comprising "stop" and "go" indicators in each of said lanes, traffic actuated means disposed in at least one of said lanes and connected to said indicators to cause the display of a "go" signal in said lane upon actuation by an approaching vehicle, means associated therewith for retaining said "go" signal for a predetermined period of time, and means for varying said predetermined period of time in response to changes in the ratio that the number of cars traversing said last mentioned lane bears to the number of cars traversing an interfering lane.

9. A traffic control system to be disposed at the intersection of a plurality of interfering traffic lanes, comprising "stop" and "go" indicators in each of said lanes, traffic actuated means disposed in at least one of said lanes and connected to said indicators to cause the display of a "go" signal in said lane upon actuation by an approaching vehicle, means associated therewith for retaining said "go" signal for a predetermined minimum period of time, means for retaining said "go" signal beyond the predetermined minimum period of time upon the subsequent actuation of said first mentioned means, means for terminating the display of said "go" signal upon the elapse of a predetermined maximum period of time and means for varying the predetermined maximum period of time in response to changes in the difference between the number of cars traversing each of said lanes.

10. A traffic control system to be disposed at the intersection of a plurality of interfering traffic lanes, comprising "stop" and "go" indicators in each of said lanes, traffic actuated means disposed in each of said lanes, means connected to said traffic actuated means and said indicators for causing the display of a "go" signal in a lane upon operation of the traffic actuated means in said lane, means associated therewith for retaining said "go" signal in said lane for a predetermined minimum period of time, means for retaining said "go" signal in said lane beyond said predetermined minimum period of time upon the subsequent actuation of the traffic actuated means disposed in said lane, means for terminating the display of said "go" signal upon the elapse of a predetermined maximum period of time, and additional traffic actuated means disposed in each of said lanes for varying the length of the predetermined maximum period of time in response to changes in the comparative density of traffic in said lanes.

11. A traffic control system to be disposed at the intersection of two vehicle lanes including signalling means for according and interrupting right of way in each lane, traffic actuated means in at least one of said lanes and connected to said signalling means for according right of way indication to said lane when actuated by an approaching vehicle, a minimum time control device associated therewith for retaining right of way in said lane for a predetermined period, means for retaining said right of way beyond said period upon the subsequent actuation of said traffic actuated means, a variable maximum time control device for interrupting said right of way, and other traffic actuated means for varying the period of operation of said variable maximum time control device.

12. A traffic control system to be disposed at the intersection of two vehicle lanes including signalling means for according and interrupting right of way in each lane, traffic actuated means in at least one of said lanes and connected to said

signalling means for according right of way indication to said lane, a minimum time control device associated therewith for retaining right of way in said lane for a predetermined period, means for retaining said right of way beyond said period upon continued actuation of said traffic actuated means, a variable maximum time control device connected to said signalling means for interrupting said right of way after the elapse of a predetermined period of time, and other traffic operated means located in at least one of said traffic lanes, said last named means being operable during the right of way period of said lane to lengthen the predetermined period as fixed by said variable maximum time control device.

13. A traffic control system to be disposed at the intersection of two vehicle lanes including signalling means for according and interrupting right of way in each lane, traffic actuated means in one of said lanes and connected to said signalling means for according right of way indication to said lane, a minimum time control device associated therewith for retaining right of way in said lane for a predetermined period, means connected to said traffic actuated means for retaining said right of way beyond said period upon the continued approach of vehicles, a variable maximum time control device for interrupting said right of way after the elapse of a predetermined period of time, and other traffic control means located in the other of said traffic lanes, said last named means being operable during the right of way period of the first lane to shorten the predetermined period of said first lane as fixed by said variable maximum time control device.

14. In combination with a traffic control system adapted to be disposed at the intersection of interfering traffic lanes, signalling means for according and interrupting right of way to each lane, timing mechanism connected thereto for causing the alternate display of said signalling means in each lane for predetermined periods of time, and means associated therewith for varying the predetermined periods of time in response to changes in the difference between the number of cars in each lane.

15. In combination with a traffic control system adapted to be disposed at the intersection of interfering traffic lanes, signalling means for according and interrupting right of way to each lane, timing mechanism connected thereto for causing the alternate display of said signalling means in each lane for predetermined periods of time, and means for varying the predetermined periods of time in response to changes in the difference between the number of cars in each lane, said last named means including traffic actuated devices disposed in each lane for increasing the period of right of way accorded that lane when actuated during the period of right of way in said lane and for decreasing the period of right of way accorded an interfering lane when actuated during the period of right of way in said interfering lane.

16. A traffic control system, to be disposed at the intersection of a plurality of traffic lanes, comprising signalling means for alternately displaying "stop" and right of way indications in each lane, timing means connected thereto for controlling the period of right of way accorded one of said lanes, said timing means comprising switch mechanism in normally closed position, a magnet, switch operating means attracted slowly toward said magnet when energized to open said switch mechanism after the elapse of a prede-

terminated period of time, magnetically operated means for decreasing said predetermined period of time when energized, vehicle actuated devices disposed in a lane not having the right of way and connected to said magnetically operated means to energize it upon a vehicle actuating the vehicle actuated device in last said lane, other magnetically operated means for increasing said predetermined period of time when energized, and other vehicle actuated devices disposed in the traffic lane having the period of right of way and connected to said last named magnetically operated means to energize it upon the approach of a vehicle in said lane.

17. A traffic control system to be disposed at the intersection of two traffic lanes and comprising signalling means adapted to accord and interrupt right of way to such lanes, traffic responsive means associated with one of said lanes, a timer connected between said traffic responsive means and said signalling means and including means acting in response to traffic actuation of said responsive means for according and maintaining right of way in said one lane between predetermined minimum and maximum periods, further traffic responsive means in the second lane and means for reducing said maximum period in response to actuation of said further traffic responsive means in the second lane when the first lane has the right of way.

18. A traffic control system to be disposed at the intersection of two traffic lanes and comprising signalling means adapted to accord and interrupt right of way to such lanes, traffic responsive means associated with one of said lanes, a timer connected between said traffic responsive means and said signalling means and including mechanism acting in response to actuation of said responsive means to accord and maintain right of way in said lane up to a predetermined maximum period of time, further traffic responsive means in the second lane and means for reducing such maximum time period in response to operation of the further traffic responsive means in the second lane when the first lane has the right of way.

19. A traffic control system to be disposed at the intersection of two traffic lanes and comprising signalling means adapted to accord and interrupt right of way to such lanes, traffic responsive means associated with each of said lanes, a timer connected between said controls and said signalling means and including means acting in response to actuation of said responsive means for according and maintaining such right of way alternately in each lane for a minimum period of time, means for increasing the period of right of way beyond said minimum period in response to operation of said traffic responsive means in the lane having right of way, means for interrupting said right of way after a predetermined maximum period of time, and means for decreasing said maximum period on the lane having the right of way in response to actuation of traffic responsive means in the lane not having the right of way.

20. A traffic control system comprising at one intersection of a plurality of interfering traffic lanes signalling means for according and interrupting right of way in each lane, traffic responsive means in one of said lanes, timing means connected to the signalling means and traffic responsive means and including means operable upon actuation of the responsive means to accord right of way to said lane up to a predetermined

maximum period, and means operable in response to actuation at a remote intersection of interfering traffic lanes including one lane common to the first and second mentioned intersections to vary said maximum period.

21. A traffic control system including at one intersection of interfering traffic lanes signalling means for according and interrupting right of way in the lanes, traffic actuated means in the lanes of said intersection, operating means connected to said signalling means and traffic actuated means to cause said signalling means to transfer right of way back and forth between the lanes in response to actuations of said traffic actuated means, timing means associated with said operating means to provide time limits for the period of right of way accorded to such lanes and traffic responsive means located at a second intersection of traffic lanes including one lane common to both mentioned intersections, and means associated with said timing means and connected to said traffic responsive means and operable by actuation of said traffic responsive means at said second intersection to vary the time limit of said timing means.

22. A traffic control system including at one intersection of interfering traffic lanes signalling means for according and interrupting right of way in the lanes, traffic actuated means in the lanes of said intersection, operating means connected to said signalling means and traffic actuated means to cause said signalling means to transfer right of way back and forth between the lanes in response to actuations of said traffic actuated means, timing means associated with said operating means to provide time limits for the period of right of way accorded to such lanes and including traffic responsive means located at adjacent intersections of traffic lanes, each including one lane common with the first mentioned intersection, and means associated with said timing means and connected to said traffic responsive means and operable by actuation of said traffic responsive means at said adjacent intersection to vary the time limit of said timing means at said first mentioned intersection.

23. A traffic control system including at one intersection of interfering traffic lanes signalling means for according and interrupting right of way in the lanes, traffic actuated means in the lanes of said intersection, operating means connected to said signalling means and traffic actuated means to cause said signalling means to transfer right of way back and forth between the lanes in response to actuations of said traffic actuated means, timing means associated with said operating means to provide time limits for the period of right of way accorded to such lanes and including traffic responsive means located at adjacent intersections of traffic lanes, each including one lane common with the first mentioned intersection, and control means associated with said timing means and connected to said traffic responsive means and including means operable by actuation of said traffic responsive means at said adjacent intersections in each lane approaching said first mentioned intersection so as to tend to increase the time limit of such lane and decrease the time limit on other lanes.

24. A traffic control system for an intersection of traffic lanes comprising signal means for according and interrupting right of way in such lanes, a timer having an adjustable time setting and governing the operation of said signal means normally to accord right of way cyclically to each

of said lanes in succession for time periods determined by such time setting, means for adjusting said time setting between certain limits to vary such right of way period between corresponding limits, traffic responsive means in one of said lanes, and means connecting said adjusting means with said traffic responsive means to operate the former progressively to vary said setting away from one limit and toward the other upon successive actuations of the latter by traffic.

25. A traffic control system for the intersection of interfering traffic lanes comprising signalling means adapted to accord and interrupt right of way to such lanes, a timer connected to and governing the operation of said signalling means normally to accord right of way cyclically and alternately to each of said lanes for time periods predetermined by its time setting, traffic respon-

sive means in each of said lanes for actuation by traffic approaching the intersection, means forming a part of said timer and operating in response to successive actuations by traffic in a first of said lanes to progressively adjust the time setting of said timer to increase the time period for right of way in said first lane, and another means forming a part of said timer and operating in response to successive actuations by traffic in a second of said lanes interfering with the first to progressively adjust the time setting of said timer to decrease such time period for right of way on said first lane from any time setting to which the timer has been adjusted by the increase adjusting means.

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CERTIFICATE OF CORRECTION.

Patent No. 2,045,136.

June 23, 1936.

HENRY A. HAUGH, JR., ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 4, for "lircuit" read circuit; page 5, first column, line 4, for "'go" signal" read light; same page and column, strike out the paragraph beginning with the word "While" comprising lines 49 to 65 inclusive, and insert the same after line 33, page 6, first column; page 5, second column, line 6, after "described" insert a period; and line 73, for "light" read "go" signal; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of September, A. D. 1936.

Henry Van Arsdale

Acting Commissioner of Patents.

(Seal)