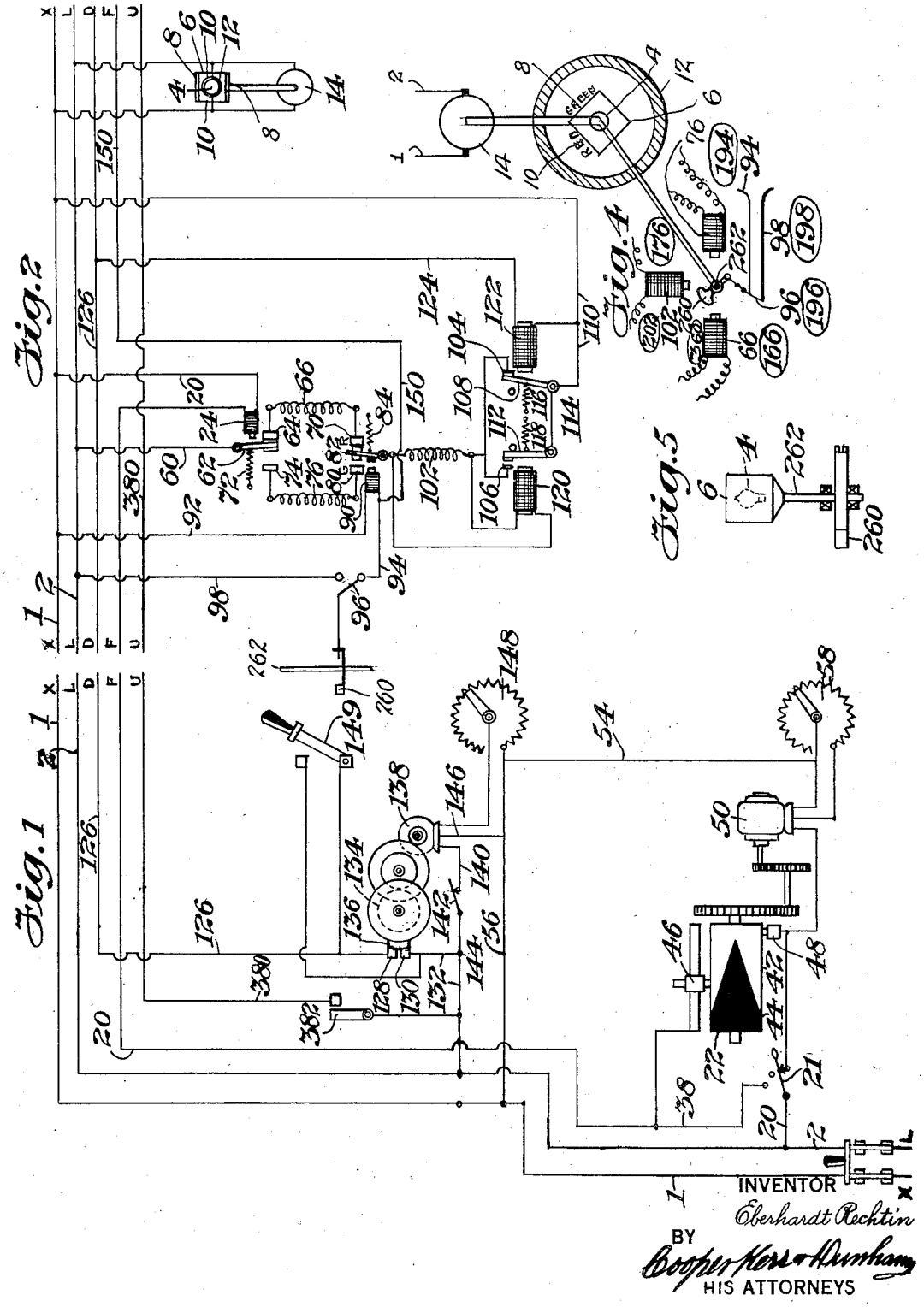
Dec. 17, 1935. E. RECHTIN 2,024,948

METHOD OF AND APPARATUS FOR SIGNALING

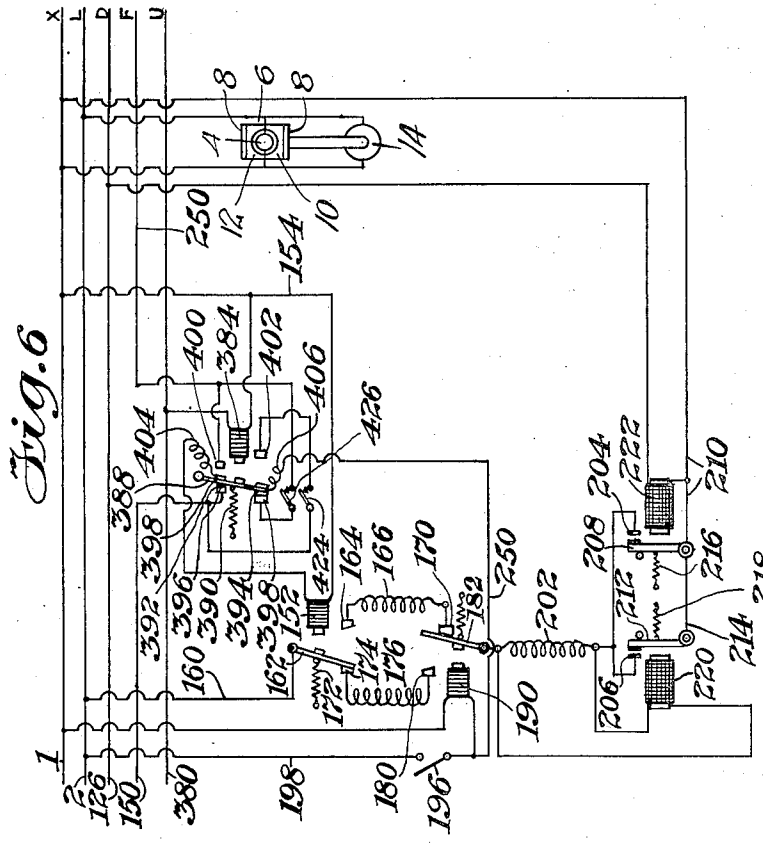
Filed March 16, 1927 4 Sheets-Sheet 1

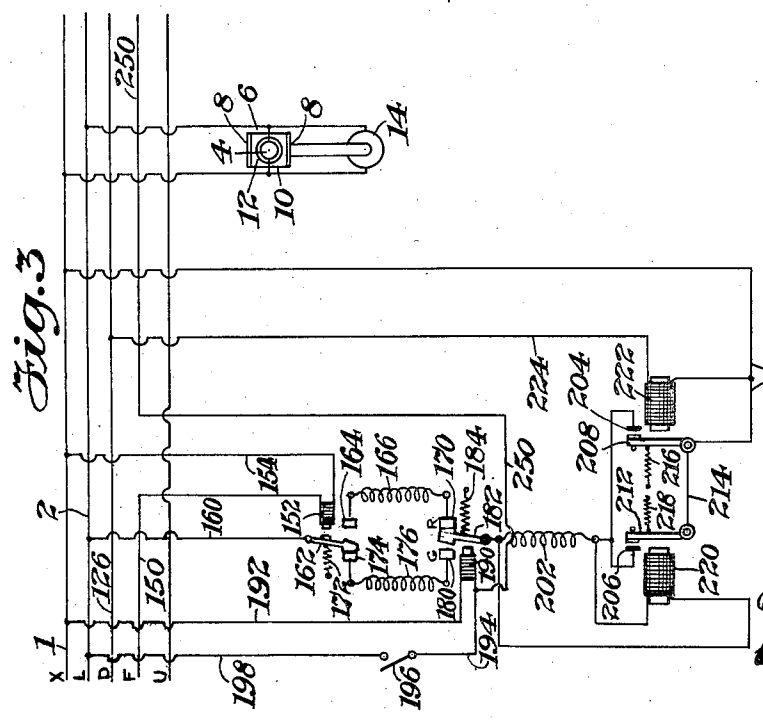


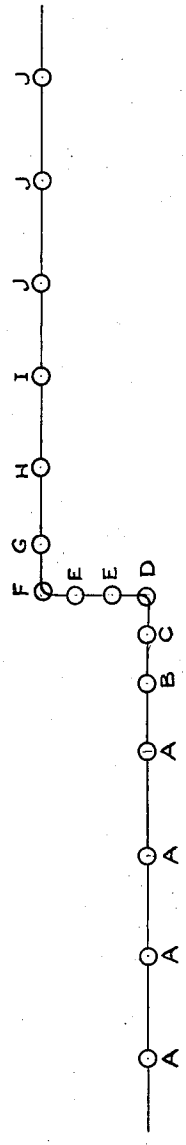
Dec. 17, 1935. E. RECHTIN 2,024,948

METHOD OF AND APPARATUS FOR SIGNALING

Filed March 16, 1927 4 Sheets-Sheet 2







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METHOD OF AND APPARATUS FOR SIGNALING

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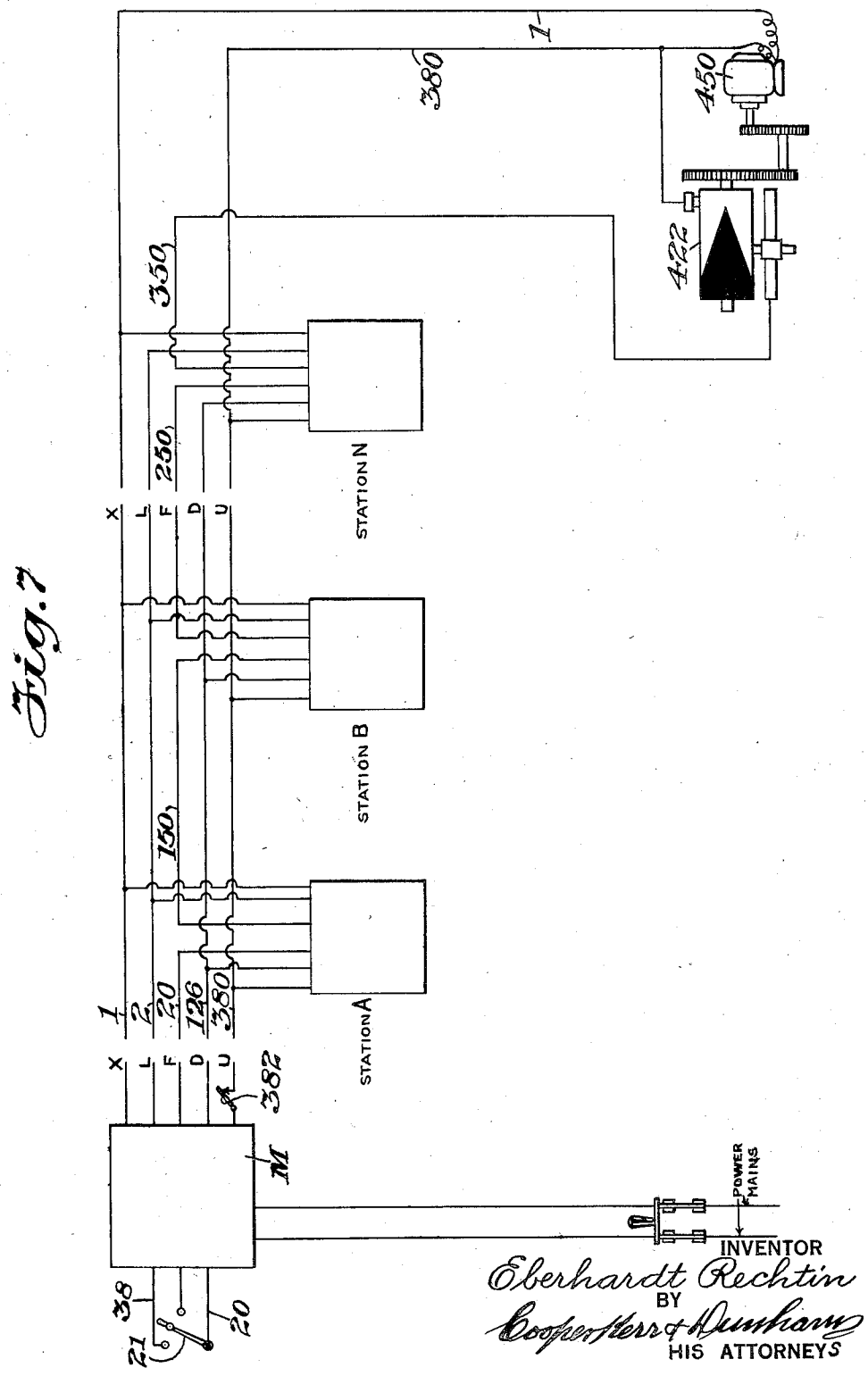

Fig. 7

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Fig. 8

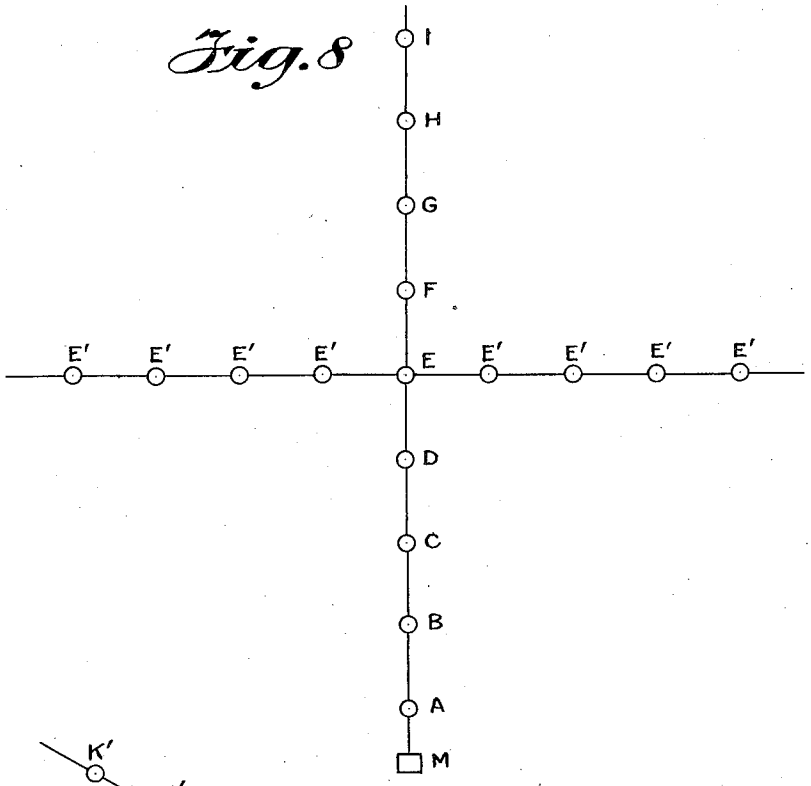


Fig. 9

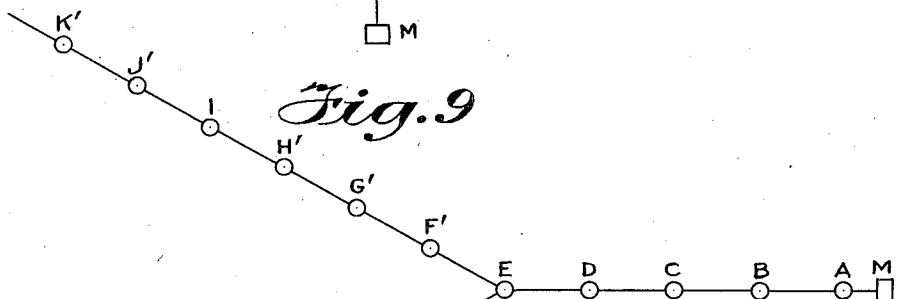
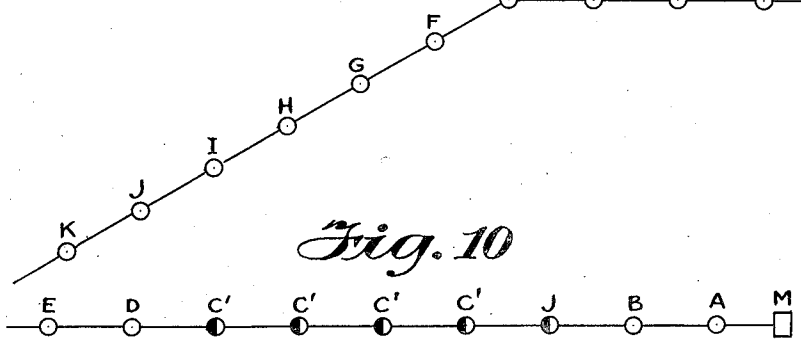


Fig. 10



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Patented Dec. 17, 1935 2,024,948

UNITED STATES PATENT OFFICE

2,024,948

METHOD OF AND APPARATUS FOR SIGNALING

Eberhardt Rechtin, East Orange, N. J., assignor to George G. Raymond, Weehawken, N. J.

Application March 16, 1927, Serial No. 175,756

13 Claims. (Cl. 177—337)

The present invention relates to method and apparatus for the control of railroad, highway or other traffic to give signals to indicate that a particular way is open or closed to passage and to method of operation of such apparatus.

Various objects and advantages of the invention will be obvious from the following description of a new and useful apparatus embodying the invention and of a varying or alternate form thereof and from the drawings; and the invention also consists of the apparatus, parts, and combinations and methods set forth in the claims.

The invention will be exampled in apparatus illustrated diagrammatically in the drawings and herein described for the purpose of directing road or railroad traffic in successive waves. On railroads the waves will consist of single trains with clear gaps between to insure safety. In highway traffic the waves can include a number of vehicles and the gaps utilized to permit the passage of cross traffic.

In the drawings are shown diagrams of apparatus illustrating the invention.

Fig. 1 is a diagram of connections and apparatus used in one of the signal control stations of my invention.

Figs. 2, 3, and 6 show diagrams of connections and apparatus used in the signal stations operated by the control station of Fig. 1.

Fig. 4 is a diagram of the apparatus used to change the signal.

Fig. 5 shows a diagram of the signal actuating means.

Figs. 7, 8, 9, 10, and 11 show diagrams of modifications of the invention.

In the system of electrical distribution and signaling apparatus shown diagrammatically in Figs. 1, 2, and 3 for illustrating the invention, Fig. 1 shows a main control station and apparatus, and connected thereto is a signal station and apparatus shown in Fig. 2, to which is connected another similar signal station illustrated in Fig. 3. The control station is at any suitable place such as at a point along a highway from any other place. The signal stations are placed which traffic conditions can be observed or at at intervals along a traffic route preferably at street intersections and at distances apart to suit the traffic requirements and conditions of any particular route or highway. In the drawings the mains 1 and 2 serve to connect to a source of electrical energy either of direct or alternating current and can extend unbroken as far throughout the system as the source designated is used.

At each of the signal stations is connected an electric lamp 4 connected across mains 1 and 2 and having mounted thereabout a vertical four sided screen, or lantern element, 6 comprising the oppositely mounted green glass panes 8 and the alternate red panes 10. Around screen 6 and about lamp 4 there is mounted, in the preferred form of this embodiment of the invention, a Fresnal lens 12 having vertical light concentrating ribs and having a motor 14 for rotating it about said lamp 4, which motor is also connected across mains 1 and 2.

From main 2 at the main control station illustrated in Fig. 1 there is connected a relay line 20 through the switch 21 and the commutator 22, to the relay solenoid 24 at the signal station illustrated in Fig. 2 and thence to main 1. The switch 21 at the main station enables the line 20 to be energized through the commutator 22, or to be directly connected to main 2, or to be entirely disconnected from the source at the main station.

The commutator 22 comprises a cylinder 42 of conducting material and a cylinder 44 of insulating material, the two cylinders having a V-notch engagement with each other, as shown in Fig. 1. Commutator 22 is connected to main 2 on one side through the switch 21 and the brush 48. The other side of the commutator is connected to relay line 20 through a slidable brush 46, which can be placed directly opposite brush 48 to give a continuous flow of current to line 20, or can be fixed at the opposite end of commutator 22 from brush 48. In the last named position no current will flow through the commutator, at all intermediate positions of brush 46 the relative period of current flow and interruption thereof will depend on the relative amounts of conducting surface of the cylinder 42 and insulation surface of the cylinder 44, which brush 46 traverses, and the speed of rotation of the commutator. The commutator is driven by a motor 50 connected to brush 48, and to line 1 by a connection 56. The field winding of motor 50 is provided with a rheostat 58 to regulate its speed.

At the signal station of Fig. 2 a wire 60 connects from main 2 through a two contact relay switch lever 62 mounted in operable relation to relay solenoid 24 which when energized by line 20 is operable to move lever 62 to contact with a contact point 64 to which is connected one end of a solenoid 66 the other end of which is connected to a contact point 70. The solenoid 66 is shown diagrammatically in Fig. 2. It constitutes one of a group of three magnets used to shift

the signal position of the lantern element, or screen 6, as will be understood from Fig. 4 in which these magnets are marked 66, 76, and 102. As further indicated in Fig. 4, each succeeding signal station is provided with a like group of magnets, used for the same purpose.

A spring 72 opposed to solenoid 24 tends to move lever 62 into contact with a point 74 which is connected to one end of solenoid 76 which at its other end connects a contact point 80. A relay switch lever 82 is mounted in operable relation to points 70 and 80 and has a spring 84 which tends to move it to contact with point 70. A solenoid 90 connected on one side through a wire 92 to main 1 and on the other side to main 2 through a wire 94, armature operated switch 96, and wire 98, serves when energized to oppose spring 84 and to move lever 82 into contact with contact 80. The switch 96 is operated by an armature 260, shown in Figs. 4 and 5 and is described more fully below.

From switch lever 82 connection is made to one side of a solenoid 102 the other side of which connects to two parallel contact points 104 and 106. A switch lever 108 in operable relation to point 104 connects through a wire 110 to main 1 and a switch lever 112 in operable relation to point 106 connects through a wire 114 to wire 110. Springs 116 and 118, respectively, tend to hold levers 108 and 112 from contact with their respective points 104 and 106. A solenoid 120 connected in parallel with solenoid 102 (it can be in series) serves when energized to move lever 112 into contact with its point 106 and a solenoid 122 connects from main 1 through wire 110 on one side and on its other side by a wire 124 to a relay main 126. Solenoid 122 serves when energized to move lever 108 into contact with its point 104.

Relay main 126 extends along the whole series or along a given series of signal stations and to the main station where it connects to a contact point 128 which is spaced apart from a cooperating point 130 which connects through a wire 132 to main 2. A gear 134 carries a brush 136 mounted to move across and connect contacts 128 and 130 for a given portion of a rotation of said gear 134. A motor 138 connected to main 2 through a wire 140, a switch 142, and a wire 144 and to the main 1 through a wire 146 and wire 56 serves to rotate said gear 134 and brush 136 at a given rate of speed and the rheostat 148 serves to regulate the speed of motor 138. A switch 149 is provided for the purpose of short circuiting points 128 and 130 or for the manual control of the circuit thereof.

Referring to Figs. 2 and 3, a wire 150 connects from a point between switch 96 and solenoid 90 to the solenoid 152 at the next signal station, herein illustrated in Fig. 3, and therefrom through a wire 154 to main 1. At the signal station shown in Fig. 3, a wire 160 connects from main 2 through a two contact relay switch lever 162 mounted in operable relation to relay solenoid 152 which when energized is operable to move lever 162 to contact with a point 164 to which is connected one end of a solenoid 166, the other end of which is connected to a point 170. A spring 172 opposed to solenoid 152 tends to move lever 162 into contact with a point 174 which is connected to one end of a solenoid 176 which connects at its other end to a contact point 180. A relay switch lever 182 is mounted in operable relation to points 170 and 180 and has a spring 184 which tends to move it to contact with point 170. A solenoid 190 connected on one side through a wire 192 to main 1 and on the other side through a wire 194, armature operated switch 196, and wire 198 to main 2, serves when energized to oppose spring 184 and to move lever 182 into contact with point 180.

From switch lever 182 connection is made to a solenoid 202 which is a counterpart of solenoid 102 of the station of Fig. 2. Other parts and wires connected with solenoid 202 and numbered from 204 to 224 and counterparts of similar parts and wires number 104 to 124 of Fig. 2 connect from solenoid 202 to said main 1 and to said relay main 126. Said parts and counterparts have similar relations and function in the operation of the system and therefore further description will not be made of the counterparts. A wire 250 connects from wire 194 at the station of Fig. 3 and extends to the next subsequent or to another subsequent signal station where it connects to a solenoid corresponding to solenoids 24 and 152 of the stations of Figs. 2 and 3, respectively.

Referring to Figs. 2, 3, 4, and 5 switch 96 (196) is connected mechanically to an actuating armature 260 (360) which is in operative relation to solenods 66 (166), 76 (176) and 102 (202) which are mounted thereabout in a horizontal plane and at 90° apart, as shown in Fig. 4. When solenoids 66 and 102 are simultaneously energized armature 260 is drawn to a point there-between and switch 96 is closed, by the mechanical connections indicated in Fig. 2 between armature 260 and the switch 96, and thereafter when solenoids 76 and 102 are energized and solenoid 66 deenergized armature 260 is moved through 90° to a position between solenoids 76 and 102 and switch 96 is opened. Into the vertical shaft 262 fixed to armature 260 is mounted a screen 6 which is thereby caused to be rotated at different times to positions 90° apart. For purposes of illustration let it be considered that when solenoids 66 and 102 are energized the green screen faces a given direction and when the solenoids 76 and 102 are energized the red screen faces the given direction.

In the use and operation of the apparatus and system above described with mains 1 and 2 connected to a source of electric energy, either alternating or direct current, each one of the lamps 4, 4 will be illuminated and each of the Fresnal lenses 12 will be constantly rotated about its axis by its respective motor 14. With the operating circuit and apparatus of Fig. 1 and the signal station apparatus of Figs. 2 and 3 in the positions and relations as shown in the drawings the red screens 10, 10 will be facing in a given direction for example, in the same direction along a given thoroughfare and traffic will be stopped. At the same time motors 50 and 138 are in operation and current will flow from main 2 through wire 20, switch 21, brush 48, commutator 22, brush 46 to the main part of wire 20, and thence to solenoid 24 at the signal station of Fig. 2 and to the other main 1 whereby solenoid 24 is energized and lever 62 is actuated to be moved into contact with said contact 64 to prepare the circuit of solenoid 66 for the energization thereof.

Contactor 136 makes and breaks contact at comparatively short intervals, say about once every five to twenty-five seconds, the make being on for about one-tenth of a second. The commutator 22 makes and breaks contact for intervals of minutes, say the make for four minutes and the break for two minutes.

When commutator 22 is in circuit and contactor 136 closes contact between points 128 and 130 current flows from main 2 along relay main 126

to the solenoid 122 at each of the signal stations. At the station of Fig. 2 the lever 108 is brought into contact with point 104 thereby establishing a complete current path from main 1, along wire 110, lever 108, solenoid 102, lever 82, solenoid 66, lever 62, wire 60, to main 2 whereby said solenoids 66 and 102 are energized and armature 260 drawn over to the position shown in Fig. 4 whereby the green screens 8, 8 are moved into the place of the red and to show to the traffic in said given thoroughfare thereby permitting traffic to advance past that station. At the same time armature 260 moves switch 96 to close it whereupon solenoid 90 closes switch 82 to point 80 to prepare the station for the next signal change thereat; also, the solenoid 152 at the station of Fig. 3 is energized to close switch 162 to point 164 to prepare that station for the next signal change thereat. By this time said contact 136 has moved past points 128 and 130 and will make contact again therewith several times before commutator 22 breaks contact. When contactor 136 is open the solenoids 120 and 122 are deenergized so that none of the solenoids 66, 76 or 102 can be energized. The solenoid 24 will remain energized so that no change will occur in the signal of the station of Fig. 2 at this time nor until commutator 22 breaks circuit.

At the next closing of contactor 136 current will energize solenoids 122 and 222 and other corresponding solenoids to close switches 108, 208 and all corresponding switches but current will flow only at the station of Fig. 3. At the station of Fig. 2 no current will flow in the main operating solenoids (66, 76 or 102) because switch 62 is on contact 64 and switch 82 is on contact 80.

At the station of Fig. 3 however current will flow through solenoid 222 to close switch 208. It will be remembered that at the closing of switch 96 at station of Fig. 2 that solenoid 152 Fig. 3, was energized and switch 162 was closed to point 164. Also spring 184 is holding switch 182 on contact 170. Upon the closing of switch 208 current will flow from main 2, along wire 160, switch 162, solenoid 166, switch 182, solenoid 202, switch 208, wire 210 to main 1, thereby changing the light from red to green and closing switch 196, Fig. 3 thereby closing at the next station a switch corresponding to switch 162 of Fig. 3, and preparing the next station for operation. When the next impulse comes along main 126 the next station will operate to turn the green light on said thoroughfare just as the stations of Figs. 2 and 3 have been successively operated. A whole series of stations will in this manner have the light turned from red to green successively one after another and will all remain green until a time determined by the opening of commutator 22 whereupon the first light to turn from red to green will turn from green to red and the others will change afterward in successive steps. It is to be understood that the light at the first station is turned from green to red or from red to green without any particular relation to the color of any other station in the system. In the system now described in form and operation the purpose is to send successive and alternate bands or strips of red and green light along the thoroughfare to permit traffic to move along with and in the area of the green strips and at the same time to permit cross traffic to pass at those places at which red light faces the thoroughfare.

When commutator 22 arrives at the open circuit phase solenoid 24 will be deenergized and spring 72 will move lever 62 into contact with point 74 to prepare the station of Fig. 2 for a change from green to red which will occur upon the next impulse made upon closing circuit by contactor 136.

When contactor 136 next closes circuit between points 128 and 130 current will flow through solenoid 122 to close switch 108 and as solenoid 90 is still energized switch 82 is in contact with point 80. Current now will flow from main 2, through wire 60, switch 62, solenoid 76, switch 82, solenoid 102, switch 108, wire 110 and thence to main 1 whereby said solenoids 76 and 102 are energized and armature 260 moved from the position between solenoids 66 and 102 to a position between solenoids 76 and 102 thereby moving the light screens to change the green to red and also opening switch 96 to deenergize solenoids 90 and 152. The deenergizing of solenoid 90 permits spring 84 to move switch lever 82 to contact with point 70 and thereby make the first preparatory step in the subsequent change of the station of Fig. 2 from the red back again to the green light along the given thoroughfare.

The deenergization of solenoid 152 permits spring 172 to move lever 162 to contact with point 174 and thereby prepares the station of Fig. 3 for the next change which will be from green to red. This change will occur upon the next impulse along main 126 made by the closing of that main by contactor 136. Following successive changes will be made in steps along the system upon each impulse sent through main 126 as hereinbefore described.

It can thus be seen that each opening of the control circuit 20 by commutator 22 will start a wave of red light along the thoroughfare and this wave will continue to move along the thoroughfare. A green wave will be started after the red upon the closing of circuit 20 by the commutator 22 and the back end of the red wave will change to green in successive steps, each step being instituted by each successive impulse sent through said main 126 by said contactor 136. The length of the alternate strips of green and red signals will be determined by the length of time commutator 22 is on or off. And the time relation can be changed by sliding brush 46 to any desired position on commutator 22. The rate of make and break by contactor 136 determines the time interval between the changing of two successive signals from a given color to the other color and thereby determines the maximum speed of traffic between two given points. This rate is adjustable by the adjustment of the speed of motor 138 through said rheostat 148 to increase or decrease the number of makes and breaks made by contactor 136 in a given unit of time.

Each time solenoid 102 (or a corresponding solenoid) is energized the solenoid 120 (or a corresponding solenoid) is energized and switch lever 112 is closed to point 196 thereby providing a circuit in parallel to that of switch 108, and provides that the circuit of solenoid 102 is not opened until said armature 260 completes its movement to change the signal from one color to another. The deenergization of solenoid 120 and the opening of switch 112 is accomplished when armature 260 finishes its movement and either opens or closes said switch 96 in a manner above described. This provision is made to insure a sufficient time for movement of armature 260 and the screens and switches moved thereby in case the friction and inertia of these parts precludes movement in such small intervals of time as sole-

noid 122 is energized. Of course, the use of this parallel circuit is optional to suit operating conditions.

From the above description it will be clear that the waves or strips of light of a given color can be made any given length, determined by the number of impulses which the contactor 136 sends out during a given period either of contact or of open circuit of commutator 22. It also insures that a change of make to break or of break to make by commutator 22 starts a new wave of a given color from the starting end of the system. Further, regulation of the time between changes can be accomplished by regulating the rate of speed of rotation of said commutator 22; and this can be done, of course, either with or without changing the relative lengths of the red and green waves.

The system can be hand operated or can be operated or controlled partly automatically and partly by hand by using either or both of the said switches 21 and 149 said switch 142 being opened when switch 149 is used, in place of their respective automatic parts which are respectively commutator 22 and contactor 136.

The system also can be regulated or controlled to have the order of change of light reversed so that a wave travels in the direction opposite to that for which the system was above described. This is done with the addition of the whole or part of a master station at the opposite end of the series of stations similar to that of Fig. 1 and also of the following apparatus which is added to each of the signal stations such as those of Figs. 2 and 3, together with the lead or main 380 which connects at the main station of Fig. 1 and extends to each of the signal stations of the system, such for example as those of Figs. 2 and 3, main 380 connecting at the main station of Fig. 1 through the single pole switch 382 to main 2 and on the other side extends throughout the length of the system to the additional control station at the other end. Fig. 7 illustrates somewhat diagrammatically a system having at M a main master station such as that of Fig. 1; station A which is a first signal station next to the main master station; station B which is any intermediate signal station; and station N which is the last signal station away from the main master station and beyond which is connected a motor 450 to mains 1 and 380, and a commutator 422 which is driven by motor 450 and is connected across said main 380 on one side and to the lead 350 which corresponds to lead 20 of Fig. 2 and to lead 250 of Fig. 6. At a signal station such as A, B, or N of Fig. 7 and illustrated diagrammatically at Fig. 6 line 380 connects through a solenoid 384 or a corresponding one to main 1. Solenoid 384 is operable when energized to move a switch lever 388 against the action of a tension spring 390. Lever 388 carries two contact points 392 and 394 which are insulated from each other and which when moved by spring 390 contact with the points 396 and 398, respectively. When actuated by solenoid 384 points 392 and 394, respectively, connect with the points 400 and 402. This arrangement is described as being connected to the station of Fig. 3 with conductor 150 connected to contact point 396 instead of to solenoid 152. Connection is also made from conductor 388 to point 402. Connection from contactor point 392 is made through a flexible lead 404 to solenoid 152 and from thence through lead 154 to main 1 as in Fig. 3. Contact points 398 and 400 are connected to conductor 250 and contactor point 394 connects through the flexible lead 406 to a point between solenoid 190 and switch 196. With this arrangement (referring particularly to Fig. 6) the apparatus will operate as above described and traffic waves will originate at the control station of Fig. 1. When it is desired for traffic to move in the opposite direction the switch 382 of Fig. 1 is closed and switches 21 and 149 are opened. When switch 382 is closed the solenoids 384 at the station of Fig. 6 and all those corresponding to it at the other signal stations are energized and lever 388 is actuated to move points 392 and 394 from contact with points 396 and 398, respectively, and into contact with contact points 400 and 402, respectively.

Also motor 450 beyond station N of Fig. 7 is energized and current is passed from main 380 intermittently through commutator 422 to the solenoid corresponding to solenoid 152 of Fig. 6 whereby the apparatus of the station is set prepared for a signal change. In the lead between contacts 392 and 402 is provided a similar switch 424 which at station A is left open because it will not be needed inasmuch as it is used at the other stations for relaying a preparatory signal backwardly of the series of stations; and a switch 426 in the lead between contacts 398 and 400 is left open at station N inasmuch as connection between these contacts is needed only at station A and intermediate station up to station N to relay preparatory signals forwardly through a series of stations. In practice these switches 424 and 426 are in the form of jumpers or leads between the respective contacts, and these jumpers are left out at the proper stations, that between 398 and 400 at station A and between 392 and 402 at station N. When such switching operations have been done impulses starting at other control stations by commutator 422 can be sent in a manner already described above for the control station of Fig. 1 for the purpose of originating successive alternate bands or waves of red and green lights which move in the direction opposite to that in which first station sends them and traffic can be controlled to move in waves in said opposite direction, with time intervals between waves to permit passage of cross traffic.

The system above described can also be used for turning the same color signal throughout the whole system at once by closing switch 149 to keep closed relay 122 at station of Fig. 2 and the relays at the other stations which correspond to it. In such a case when contact is made or broken by switch 21 or commutator 22 the first signal station will change color and each of the following stations will operate immediately upon the change of the preceding station. The interval of time taken for the operation of each station will be practically instantaneous, especially as regards adjacent stations. With this manner of operation the traffic directed can proceed in both directions at once in the thoroughfare on which the system is used. However, the wave control of traffic above described is best adapted for one way traffic, except where intervals between change between consecutive stations is not short and the waves of light are comparatively long in which case the traffic can pass in both directions with suitable time intervals for passage of cross traffic without causing confusion.

By suitable variations the apparatus above described can be used for directing traffic on a multiplicity of thoroughfares at the same time. For example, in a system illustrated diagrammatically by Fig. 8 a series of signals E', E' ar-

ranged along a cross street are connected in parallel with a signal station E positioned at a corner of a main thoroughfare and the operation of said stations E', E' will be simultaneous and like that of said station E whereby cross traffic is directed synchronously with the traffic in the main thoroughfare.

In Fig. 9 a main thoroughfare along which are arranged stations A, B, C, D, E divides into two other diverging or conveying thoroughfares on each of which the system is continued in branches which are in parallel with each whereby the stations F and F', G and G', etc., will operate simultaneously in pairs to control traffic passing thereby to or from said main thoroughfare.

In Fig. 10 is illustrated in diagram a series of stations C, C', C', along the same thoroughfare which are connected to operate simultaneously to give the same signal at the same time whereby a congestion of traffic, for example, at a given portion or zone of a given thoroughfare is taken care of as when a confluence of traffic enters the main thoroughfare, continues on it for a given distance, and then passes off by cross thoroughfares leaving the state of traffic on the subsequent portion somewhat like that which is on the portion before said congested portion is reached.

In Fig. 11 is illustrated in diagram a thoroughfare having sudden turns on account of which it is desirable to slow up traffic for a portion of the thoroughfare. This control is secured by spacing the signal stations closer together at the corners and between the corners whereat the traffic waves will be shorter and whereby signals permitting advance will be given at shorter distance along the route. With such an arrangement of the signal stations the drivers of vehicles at the dangerous portions of the thoroughfare will be held in bounds and speed between signal stations will be reduced. It will be understood that the time interval between changes in signals for adjacent stations is the same between stations which are close together as they are between stations that are further apart. This is illustrated in this Fig. 11 by the stations A, A, A which are at a given distance apart whereas at the following stations B, C, D, and E the distance apart of signals becomes gradually less after which beginning with the station F the distance gradually increases until station J is reached after which the stations are uniformly apart and at a greater distance than at the curves or other dangerous portions of the road. This feature, of course, is applicable in controlling the speed at different portions of a route for other reasons.

Various permutations and combinations of operations and traffic passage controls can be secured by control methods which will be obvious from the above description of the apparatus and operations used for the illustration of the invention.

The structural details of the signal and switch operating mechanism are shown, described and claimed in a co-pending application of Eberhardt Rechtin, Serial No. 137,452, filed September 24, 1926. This application has now matured into Patent No. 1,988,569, dated January 22, 1935.

I claim:

1. In a system of electrical distribution for signaling, a series of electrically operated signal stations arranged in a sequence and each having a pair of electromagnets and an armature in operable relation with said magnets and adapted to be actuated thereby severally to move it to and fro into different signal operation positions, the ends of each of said magnets being open, a two point relay switch for making connection to one side of either of said magnets, a second two point relay switch for making connection to the other side of either of said magnets, means tending to close first said switch to a first one of said magnets, means tending to close the second said switch to the second one of said magnets, a relay coil in operable relation to first said switch and adapted to oppose the said moving means thereof and close it to the second said magnet, a second relay coil in operable relation to said second switch and adapted to oppose the said moving means thereof and close it to the first said magnet, a pair of current source mains between consecutive signal stations, connection from first said relay coil through a third switch to said mains, mechanical connection between said armature and said third switch whereby in one signaling movement or position it closes and in the other position it opens said third switch, a connection from a point between said first relay coil and said third switch to the second said relay coil of another signal station, connection from second said two point relay switch to one of said current mains, connection from first said two point relay switch through a third relay coil and thence through a fourth switch which is a relay switch to the other of said mains, a fifth switch which is a relay switch in shunt with said fourth switch and in operable relation with said third relay coil and adapted to be held closed thereby, means tending to hold said fifth switch open, a fourth relay coil in operable relation to said fourth switch and adapted when energized to close it, means tending to open said fourth switch, a third main extending along said series of stations, said fourth relay coil being connected across said first and third mains, means for intermittently energizing the second relay coil of the first station of the series, and means for intermittently connecting said third main to said second main.

2. In a system of electrical distribution for signaling, a series of electric signals arranged in a sequence along a given route, means for connecting each of said signals to a source of electrical energy comprising a pair of feed mains extending along said sequence of signals, a relay circuit for each of said signals connected from one of said mains through a switch at said signal to a solenoid at the next signal in the sequence and thence to the other of said mains, a second solenoid at each of said signals connected from said other main through said switch to first said main, a lead from first said main to an armature switch having two contact points, first said solenoid being in operable relation to said switch to close it to one of said points when energized, a spring tending to move said switch to contact with the other of said points, a third solenoid connected to second said point at one end and to a third contact point at its other end, a fourth solenoid connected at one end to first said contact point and at its other end to a fourth contact point, a second armature switch movable to contact with either of said third and fourth contact points, a spring tending to hold said second armature switch in contact with said fourth point, second said solenoid being in operable relation with second said armature switch to hold it in contact with third said point when energized, a contact from said second armature switch through a fifth solenoid, thence through a third armature switch to said other main, a spring tending to hold said

third armature switch open, a third main extending along said sequence, a tap at each signal station from said third main through a sixth solenoid to a return, said sixth solenoid being in operable relation to said third armature switch to close it when energized, a tap from a point between said fifth solenoid and said third armature switch to a fourth armature switch and thence to the said other main, a spring tending to hold last said switch open, said fifth armature switch being in operable relation to last said switch to close it when energized, an armature between said third and fourth solenoids and mechanically connected to first said switch for selectively opening and closing said switch when they are alternately energized, and a signal operable by said armature.

3. In a traffic control system, a central control station, a plurality of signal stations having display signals, a circuit means connecting the control station to each of said signals, a similar second circuit means, mechanism at the control station for periodically affecting the flow of current over the first circuit means, a second mechanism at the control station for periodically affecting the flow of current over the second circuit means, signal changing means responsive to periodic control over the first circuit means for changing the display of said signals successively, one signal, when changing, having means rendering the succeeding signal responsive to the signal changing means, and means responsive to each periodic control over the second circuit means, for establishing a condition for a second change of display by the third named means for the first changed signal of the successively changed signals whereby waves of display signals are obtained.

4. A system as in claim 3 including means at the control station for varying the time between the periodic operations of the said first mechanism for controlling the number of signals in a wave.

5. A system as in claim 3 including means at the control station for varying the time between the periodic operations of the said second mechanism for controlling the time between changes of the display at each signal.

6. In a system of distribution for electrical signaling, two or more electrical signals each having a plurality of signal indications arranged in sequence along a given route, a control station adjacent thereto connected electrically to each of said signals, a plurality of means for generating two series of current impulses of differing but constant periodicities located at said control station, and circuit control means located adjacent to each signal and electrically connected to said current generating means and adapted to set said signals periodically to a given like signal indication, and one after the other, in response to said two series of current impulses of differing but constant periodicities originating at the control station and transmitted to said circuit control means, one of these series of current impulses acting upon said control means to determine the rate of actuation of individual signal indications at each signal while the periodicity of the current impulses of the other said series corresponds to the rate of progression of the actuation of like signal indications of the successive signals.

7. In a traffic control system, the method of controlling from a central station the display signals at a plurality of signal units each of which has one of at least two different indications continually displayed, and for which preparation must be made for change of indication before a change can be accomplished, which comprises sending an operating manifestation from the central station to each of said signal units at periodic intervals, in response to one of said manifestations at a first unit changing the indication thereat and preparing a second signal unit to change its indication, in response to the next succeeding manifestation changing the indication at said second station and preparing a third signal unit to change its display, and so on; at intervals greater than the first said intervals preparing the first said station to again change its indication, and at the manifestation following the last said preparation, restarting the operations due to the first said manifestation.

8. In a method of operating a traffic control system according to claim 7, characterized in that the preparation of an intermediate signal unit to change its indication is made to take place substantially simultaneously with the completion of change of indication at the immediately preceding signal unit.

9. In a traffic control system, the method of controlling from a central station the display signals at a plurality of signal units each of which has one of at least two different indications continually displayed, and for which preparation must be made for change of indication before a change can be accomplished, which comprises sending an operating manifestation from the central station to each of said signal units at periodic intervals, in response to one of said manifestations at a first unit changing the indication thereat and preparing a second signal unit to change its indication, in response to the next succeeding manifestation changing the indication at said second station and preparing a third signal unit to change its display, and so on; at intervals not less than the first said intervals preparing the first said station to again change its indication, and at the manifestation following the last said preparation, restarting the operations due to the first said manifestation.

10. A traffic control signaling system comprising a control station and a succession of signals spaced along a highway, and connected by a common supply circuit to the signals, each of said signals having "stop" and "go" indications, means at each station which, when conditioned and then operated, changes the display of said signals from one exhibition of said indication to the other, said system also including a plurality of independent periodic current flow controlling means located at said central station, means connected to each of said signals to render the first named means operative in response to a periodic flow of current from one of said controlling means to change said signal display as aforesaid, other means at each signal operative upon a change of signal display as aforesaid to condition the first said means of the adjacent signal in the succession for similar operation by said one controlling means, and means at the first of said stations operated in response to a periodic flow of current from another of said controlling means to condition first said means at the first signal of said succession whereby the time of display of each indication is determined.

11. In a traffic control signaling system according to claim 10, means at each signal operative upon a change of signal display to condition the signal changing means thereat for a subsequent change in signal display.

12. In a traffic control apparatus, a control

station and a series of signal stations electrically connected thereto by a common supply circuit, a plurality of signal indications at each signal station, means at each signal station which, when conditioned and then operated, changes the signal indications thereat, a plurality of independent periodic current flow controlling means located at said control station, a control circuit including the control station and all of said signal stations and transmitting the periodic current flows from one of said controlling means; a first series of relays one at each signal station and in said control circuit which, when energized, renders the signal changing means associated with each signal station operable to change the signal indication thereat; a second series of relays one at each signal station and included in separate circuits, one of these separate circuits directly joining the first signal station to the control station, and the remaining separate circuits each connected to the control station through the preceding signal station, the first of the relays of said second series being energized by a periodic flow of current from another of said controlling means to condition the signal changing means at the first station for a subsequent change of signal, upon actuation of the corresponding relay in the control circuit; a third set of relays, one disposed at each signal station and in shunt to the relay of the second series at the immediately succeeding station; means associated with the signal changing means at each station for controlling the respective aforementioned separate circuits whereby, upon a change of indication at a station, the relay of the third series thereat is actuated as well as the relay of the second series at the immediately succeeding station, thereby preparing these stations for subsequent changes in signal indication.

13. In a traffic control system a control station and outlying signal stations along a line of traffic each station including signal means giving "stop" and "go" indications, transmission line means connecting the control station and the signal stations, means cooperating with said transmission line means and said signals to cause a succession of waves of "stop" indications to travel along said line of traffic alternating with a succession of "go" indications, including a single adjusting means at the central station for solely determining the time of display of the "stop" and "go" indications at each station without affecting the rate of progression, and a second single adjusting means at the control station for solely determining the rate of progression of the waves without affecting the said times of display.

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