

March 11, 1941.

T. TONE

2,234,610

TRAFFIC SIGNAL WITH ELECTRIC CONTROL

Original Filed July 20, 1927 5 Sheets-Sheet 1

Fig. 1

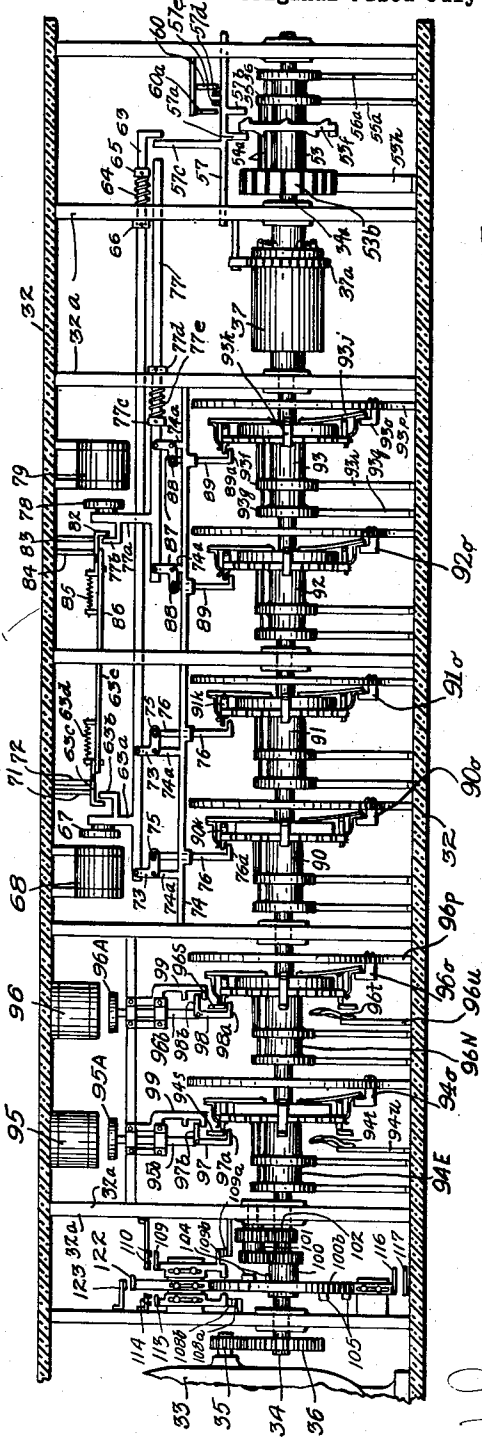
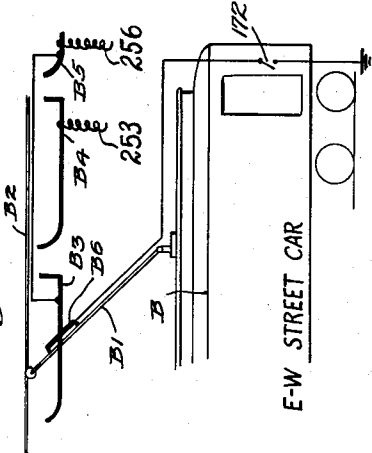


Fig. 13



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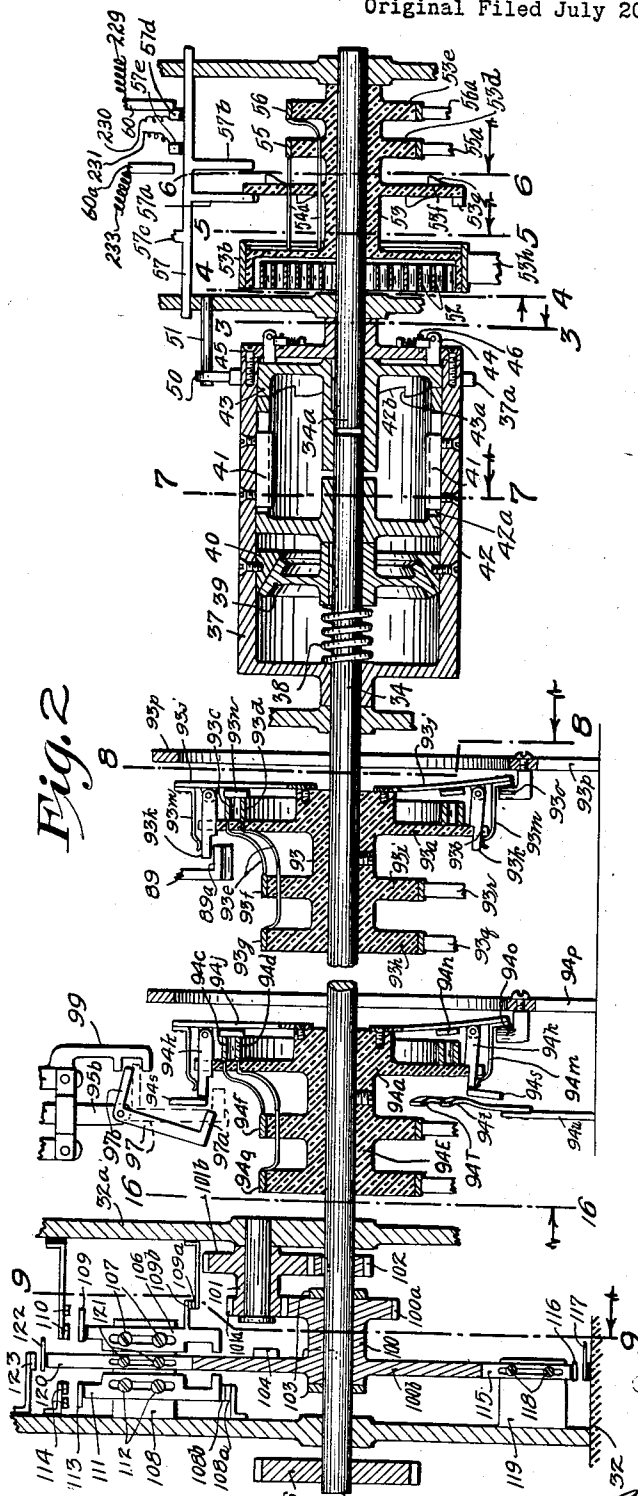


Fig. 2

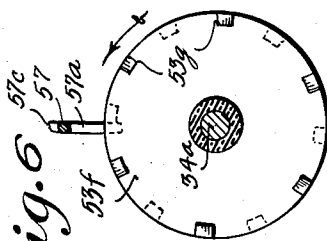


Fig. 6

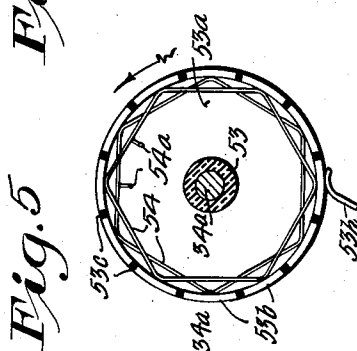


Fig. 5

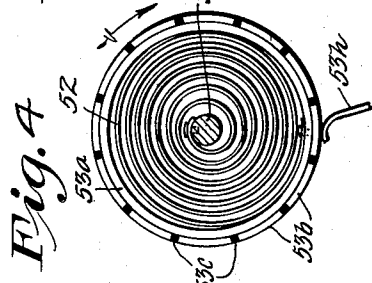


Fig. 4

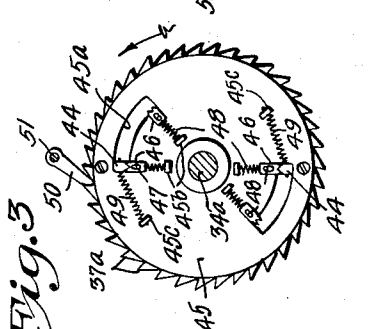


Fig. 3

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Fig. 7

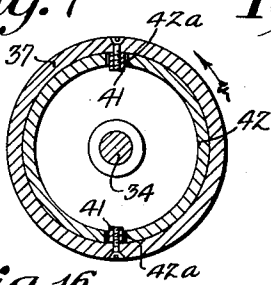


Fig. 8

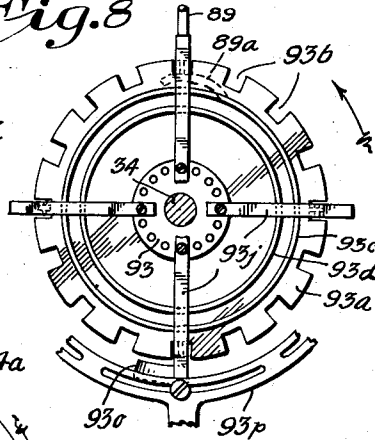


Fig. 9

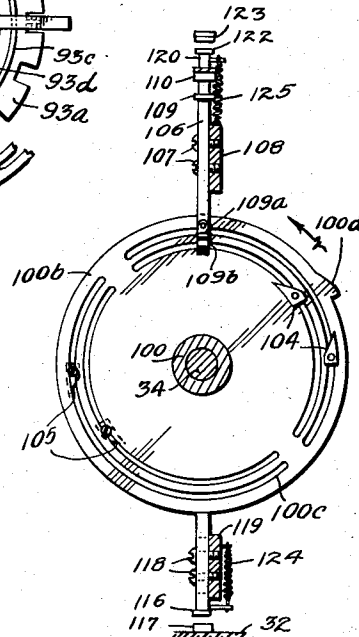


Fig. 16

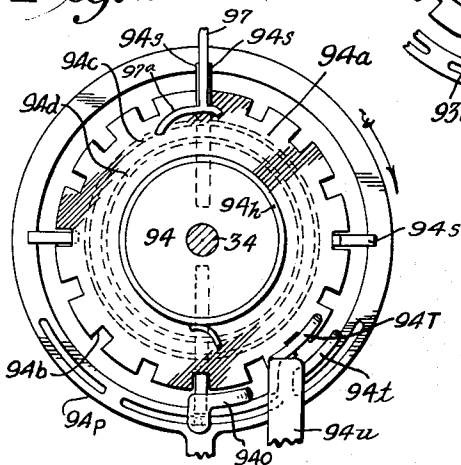


Fig. 10

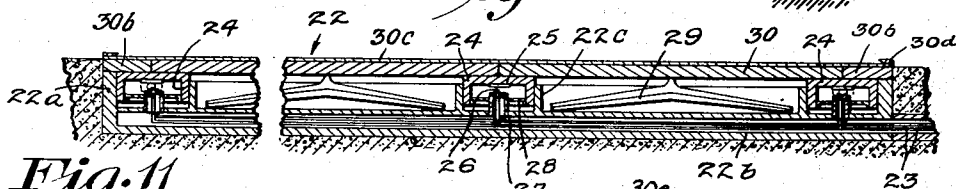


Fig. 11

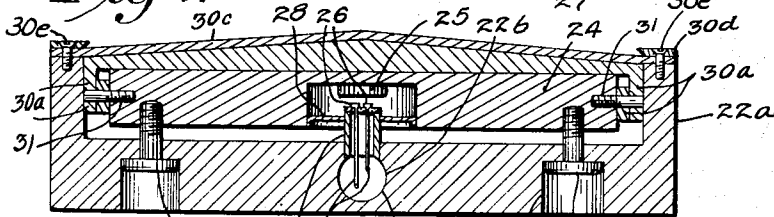
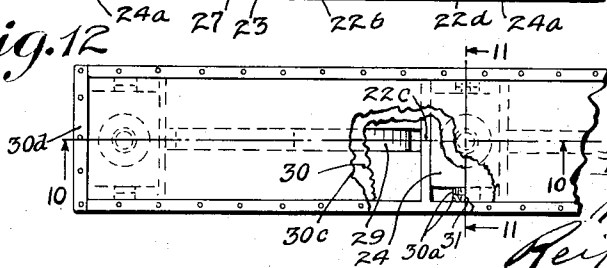


Fig. 12



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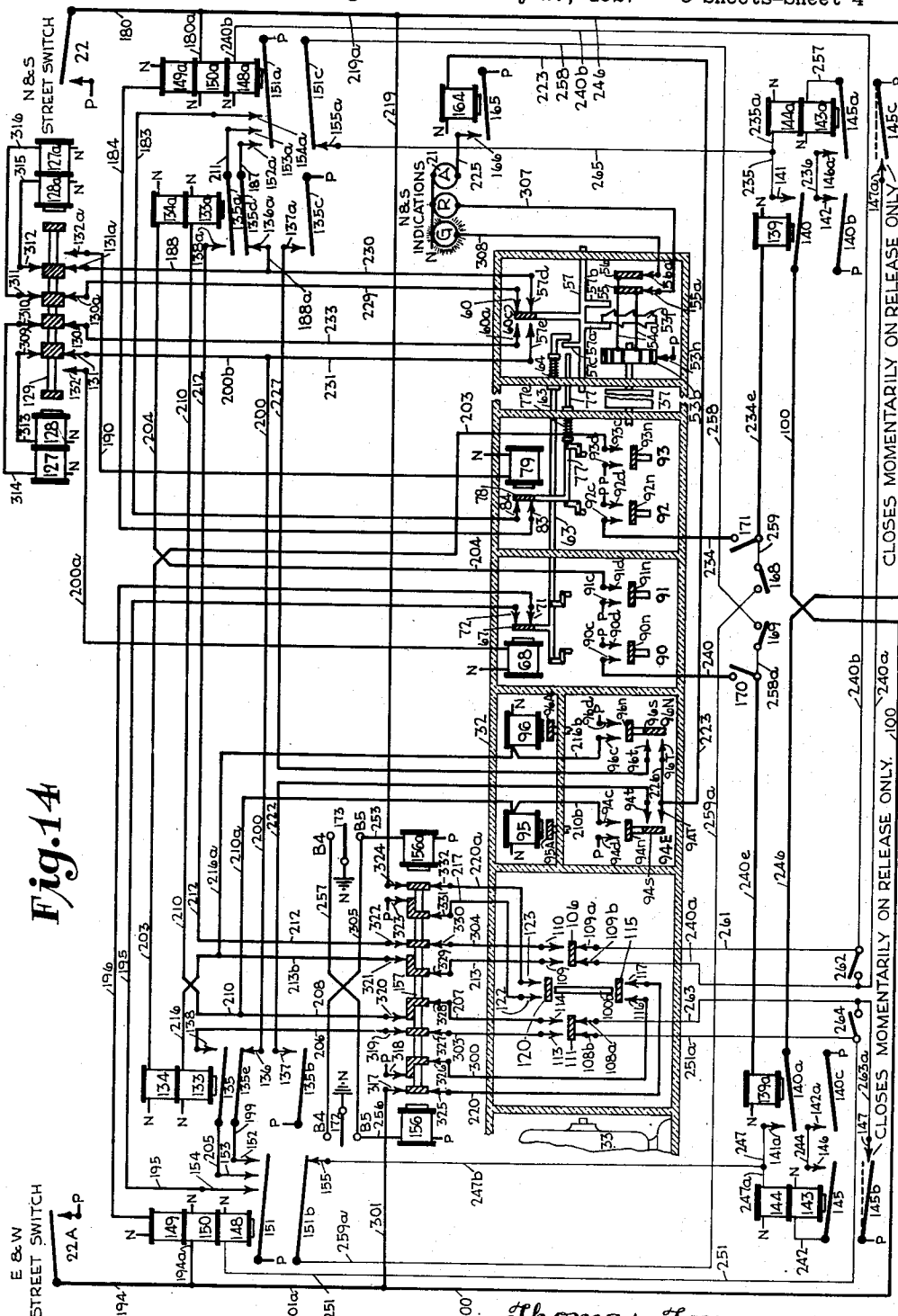
Fig. 14

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John L. Milton Attorney

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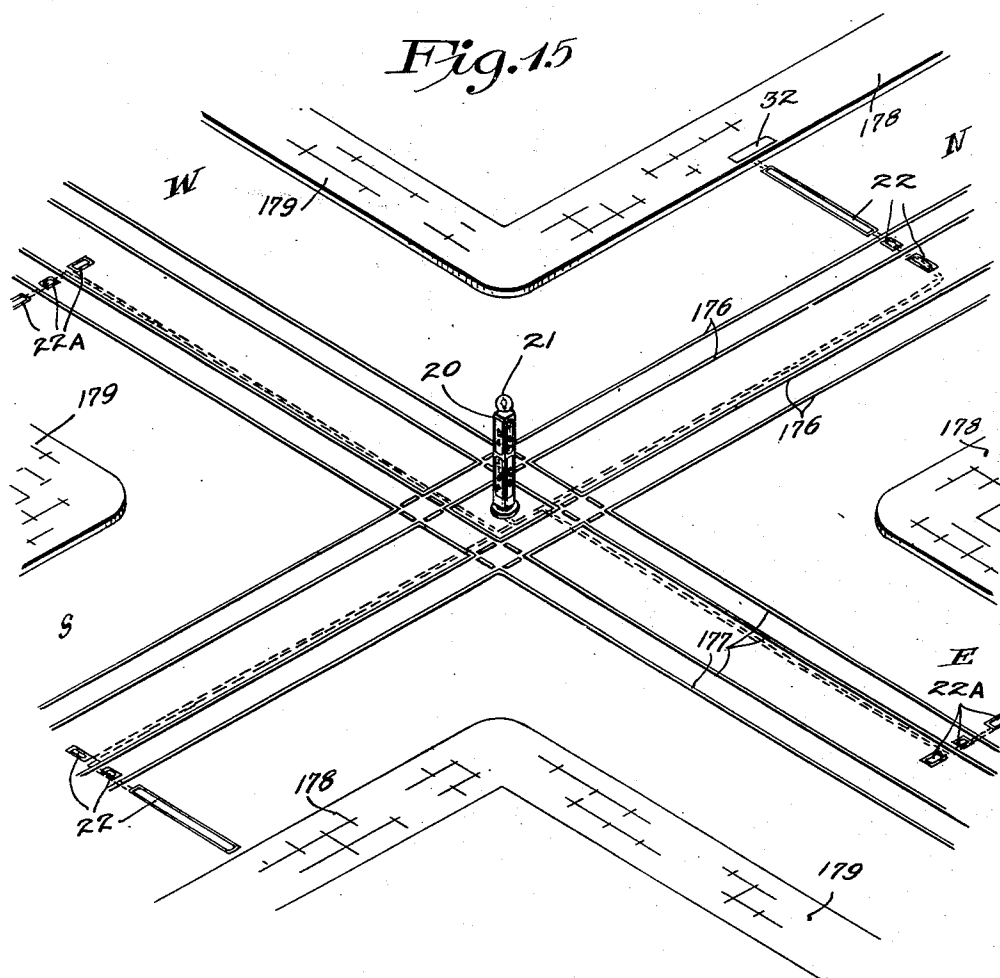
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TRAFFIC SIGNAL WITH ELECTRIC CONTROL

Original Filed July 20, 1927 5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,234,610

TRAFFIC SIGNAL WITH ELECTRIC CONTROL

Thomas Tone, Gilman, Iowa, assignor to Nachod & United States Signal Co., Incorporated, Louisville, Ky., a corporation of Kentucky

Continuation of application Serial No. 207,172, July 20, 1927. This application January 7, 1937, Serial No. 119,536

77 Claims. (Cl. 177—337)

The present application is a continuation of application Serial Number 207,172 filed by Thomas Tone on July 20, 1927 and entitled "Traffic signal controlled by vehicles." For any proceedings relating to this continuation application reference may be made to the file of the original application above identified, which is being abandoned in favor of this continuation application.

10 The invention relates to automatic self-regulating traffic signals, and the means for operating same.

As is well known, the regulation of traffic at intersections where there is a large amount of traffic is now quite a serious problem. Thus it is the principal object of this invention to provide means whereby the regulation of such traffic will be greatly improved by subjecting the signal to control by vehicles using the intersection.

20 It is a further object of this invention to provide a traffic signal for interfering traffic lanes adapted to be controlled either manually, automatically or by vehicles, so that there will be a minimum amount of delay to traffic, in such a way:

1. That the right-of-way will always be on one or the other of said traffic lanes,

2. That the right-of-way will never be on interfering lanes at the same time,

30 3. That the right-of-way will be immediately transferred to a vehicle approaching on a lane not receiving the right-of-way, if there are no vehicles operating the signal on the lane then receiving same,

35 4. That the right-of-way will not be immediately transferred to a vehicle approaching on a lane not receiving the right-of-way, if there are vehicles operating the signal on the lane then receiving same,

40 5. That the right-of-way, under Condition 4, will be transferred to the waiting vehicle a predetermined time after the last operation of the signal by vehicles moving on the lane then receiving same,

45 6. That the right-of-way, when operated in response to an approaching vehicle, will be established for a predetermined time sufficient to permit a vehicle, traveling at the usual rate of speed, to pass the intersection,

50 7. That the right-of-way will be retained by successive vehicles moving on a lane receiving the right-of-way, provided that each successive vehicle operates the signal within a predetermined time after each preceding operation thereof,

55 8. That the right-of-way for each succeeding

vehicle, in Condition 7, will be re-established for a predetermined time after each operation of the signal,

9. That the right-of-way will be retained on the lane then receiving the right-of-way, if two vehicles on interfering lanes simultaneously call for an operation of the signal,

10. That the right-of-way, in Condition 9, will be transferred to the waiting vehicle a predetermined time after the last operation of the signal by vehicles moving on the lane then receiving same,

11. That the right-of-way, when retained to permit a continuous stream of traffic to pass on one lane, may be arranged to be automatically interrupted at predetermined times,

12. That the right-of-way, when retained to permit a continuous stream of traffic to pass on one lane, may be arranged to be interrupted at predetermined times only when vehicles approach on an interfering lane,

13. That the right-of-way will be automatically alternately and repeatedly established at predetermined times, first to one lane, then to the other, and so on cyclically, when a continuous stream of traffic operates the signal on each lane,

14. That the cyclical establishment of the right-of-way will be governed by a constantly operating timing switch, whose operation and timing continues at all times regardless of traffic conditions,

15. That when the right-of-way is transferred in response to a vehicle calling for same within a predetermined time after operation by a vehicle on a lane previously receiving same, it will be automatically returned to said lane when vehicles cease to operate on the lane to which it was transferred,

16. That the right-of-way, after being established on other lanes, will always automatically return to one certain lane,

17. That the right-of-way may be selectively established on either lane by an approaching street car, but when the car occupies its usual stopping point, the signal may be selectively established only to the lane in which the said car is operating,

18. That a warning signal will be displayed for a predetermined time when the right-of-way is automatically interrupted within a predetermined time after the signal was operated by a vehicle on the lane receiving same,

19. That the warning signal will not be displayed when the right-of-way is interrupted after

vehicles cease to operate on the lane previously receiving same,

20. That the display of the warning signal will be progressively shortened when the right-of-way is automatically interrupted between the times provided in Conditions 17 and 18,

21. That, during the absence of vehicular traffic on either lane, the right-of-way will be alternately and repeatedly transferred at predetermined times in such a way that the right-of-way will display for a predetermined time, first on one lane and then on the other and so on cyclically, all of the various conditions previously set forth being arranged to accompany the operation of the signal under vehicle operation,

22. That, during the absence of vehicular traffic, the right-of-way will be normally alternately and repeatedly presented for predetermined times to the several streets, which will automatically revert to right-of-way presentations of shorter duration when light traffic operates on each street, and which will automatically re-establish the normal presentations of the right-of-way when a continuous stream of traffic operates the signal on each street,

23. That the right-of-way may, under certain conditions, be arranged to remain always on the lane to which it was last actuated,

24. That one or more of the previous conditions may be omitted or used in various combinations according to the particular requirements of the intersection,

25. That by simple alterations, all time intervals and responses to traffic in the various lanes may be adjusted to meet various distributions and densities of traffic.

These and other objects and advantages of my invention, not specifically enumerated above, are more fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views, and in which:

Figure 1 is an elevational view of the timing mechanism for my signal, the enclosing casing being shown in vertical section;

Fig. 2 is an enlarged vertical section of a portion of the mechanism shown in Fig. 1 taken along operating shaft 34;

Fig. 3 is a vertical section taken along line 3-3 of Fig. 2 showing the end of drum 37;

Fig. 4 is a vertical section taken along line 4-4 of Fig. 2 showing spiral spring 52 and commutator 53;

Fig. 5 is a vertical section taken along line 5-5 of Fig. 2 showing the electrical connections of commutator 53;

Fig. 6 is a vertical section taken along line 6-6 of Fig. 2 showing stop lugs 53g on disk 53;

Fig. 7 is a vertical section taken along line 7-7 of Fig. 2 showing the relation of keys 41 and cam shell 42;

Fig. 8 is a vertical section taken along line 8-8 of Fig. 2 showing an end view of timing member 93;

Fig. 9 is a vertical section taken along line 9-9 of Fig. 2 showing an end view of timing disk 100b;

Fig. 10 is a vertical section of the street switch taken along line 10-10 of Fig. 12, showing the arrangement of spring members 29 and support plates 30;

Fig. 11 is an enlarged vertical section taken along line 11-11 of Fig. 12, showing the electrical contacts 25-26 and pivot studs 31;

Fig. 12 is a partial plan view of the street switch sectionally shown in Figs. 10 and 11;

Fig. 13 is a diagrammatic representation of the apparatus employed to control the signal by a motorman on a street car;

Fig. 14 is a wiring diagram for the device;

Fig. 15 is an isometric view showing a street intersection with car tracks thereon and the signal at the center of the intersection; and

Fig. 16 is a vertical section taken along line 16-16 of Fig. 2 showing the relation of contacts 94T and cam 94o, which cam resets triggers 94k.

GENERAL

Referring now to Fig. 15 of the drawings, it will be observed that the invention utilizes a signal device, and, while this device may be made in various forms, in the embodiment of the invention it is illustrated as a post 20 having means thereon for alternately permitting traffic to proceed on one street while restraining traffic on the other. Such means is indicated by the words "stop" and "go" shown on post 20. In Fig. 14 the lamps for illuminating the words "stop" and "go" are indicated by characters R and G respectively. A warning signal 21 visible to both streets is also shown at the top of post 20, which warning light is further indicated in Fig. 14 by the character A.

The signal device is adapted to be controlled by street switches 22 and 22A placed a suitable distance from the intersection, and, while this distance may be varied for different occasions, it is intended that the distance will be such that a vehicle, traveling at the usual speed for vehicles at intersections, will have time to stop before reaching the intersection, if the signal device is prevented from changing immediately as a result of traffic moving on an intersecting thoroughfare.

It is also intended to have the signal device controlled by a motorman on a street car, and for the details of the apparatus provided for this purpose reference may be made to Fig. 13.

In Fig. 13 the trolley wire on the E-W street is indicated by B2 while B3, B4 and B5 represent contact segments. B1 represents the trolley pole of an E-W street car, while B6 represents a contact member for engaging segments B3, B4 and B5 on the E-W street. The contact member B6 is connected by a suitable conductor to a switch 172 located in the cab of the E-W street car B.

In Fig. 15 the streets are designated by N, S, E and W, and car tracks are indicated by 176 and 177. While not shown in Fig. 15, it is intended that the street cars for each street be equipped as illustrated in Fig. 13.

Therefore, it is to be understood that each N-S street car is provided with a similar contact member B6, and a switch 173 corresponding with switch 172 of the E-W street car. Likewise, the trolley wire on the N-S street is provided with contact segments B3, B4 and B5 arranged similarly to that illustrated in Figure 13. However, contact segments B3 and B5 on the E-W street are electrically connected and connected to conductor 256 for energizing relay coil 156, while the similar contact segments B3 and B5 on the N-S street are electrically connected, and connected to conductor 253 for energizing relay coil 156a. Likewise, the connections for the contact segments B4 on the E-W and N-S streets are transposed. Thus, as illustrated in Figure 13, the contact segment B4 on the E-W street is connected to conductor 253 for energizing relay coil 156a, while the corresponding contact segment

B4 on the N-S street is connected to conductor 256 for energizing relay coil 156. The aforesaid electrical connections are diagrammatically illustrated in Figure 14, in which figure the contact segments B3 are not indicated inasmuch as each is electrically connected to its corresponding contact segment B5.

Contact segment B3, for each track, is preferably placed approximately at the location of its corresponding street switch 22 or 22A. Contact segment B4, for each track, is placed between its associate contact segment B3 and the usual stopping point for the street car, while contact segment B5, for each track, is placed so that the contact member B6 will be in engagement therewith while a car is stopped at the intersection.

STREET SWITCHES

While the street switches 22 and 22A may be variously constructed, in the embodiment of my invention they are shown in Fig. 10 as comprising a casing 22a having a longitudinal conduit 22b through which extend conductors 23. The casing 22a has a series of pairs of upstanding partitions 22c forming narrow channels in which are disposed vertically movable blocks 24. As illustrated in Fig. 11, each block 24 has a centrally located recess, within which is disposed a movable contact member 25 and stationary contacts 26. The stationary contacts 26 are supported by and extend through a small casing 27 communicating with conduit 22b, and having conductors 23 connected thereto. The recess in each block 24 is closed at its bottom by a plate 28 that embraces casing 27. As shown in Fig. 10, casing 22a also has wide vertically extending channels between the pairs of partitions 22c for receiving semi-elliptical springs 29 that support plates 30. As further illustrated in Fig. 11, plates 30 have side portions fitted within side flanges of casing 22a. Plates 30 also have downwardly extending lugs 30a pivoted on studs 31 threaded into the sides of block 24. It will be understood that the number of plates 30 and blocks 24 will vary with the length of the switch casing 22a, there being two of the plates 30 shown in the vertical section Fig. 10. End plates 30b are secured to casing 22a, and plates 30 and 30b are covered by a sheet of flexible material 30c secured by an overlying strip 30d fastened by suitable screws 30e. The blocks 24 are limited in their upward movement by headed screws 24a that have their heads movable in recesses 22d fashioned in casing 22a.

TIMING MECHANISM

The timing mechanism for the signal device is preferably held in a casing 32, and, while this casing may be located at any convenient place, in Fig. 15 it is shown disposed in the sidewalk. The mechanism within the casing is partly shown in Fig. 1, and comprises a motor 33. A shaft 34 is driven by the motor 33 through reducing gears 35 and 36. The shaft 34 is journaled in a plurality of partitions 32a that extend vertically in casing 32, and said shaft at its end opposite motor 33 extends into a drum 37.

As shown in Fig. 2, the drum 37 is disposed between two adjacent partitions 32a, and has a compression spring 38 that engages one inner end thereof. The other end of spring 38 engages a friction clutch cone 39 splined on shaft 34. The cone 39 is adapted to move into and out of engagement with an inner conical surface of a co-operating clutch member 40 secured to drum 37.

The drum 37 also has guide keys 41 secured to opposite sides of its inner wall by countersunk screws. A shell 42, longitudinally movable on shaft 34, is disposed within the drum 37, and has slots 42a in opposite sides thereof embracing keys 41. The shell 42 is also formed at one end with a plurality of cam ratchet teeth 42b. The teeth 42b co-operate with similarly formed teeth 43a on another short shell 43. Shell 43 is also provided with a hub, keyed to a shaft 34a and journaled on the end of shaft 34. In Fig. 1, shaft 34a is shown journaled in the end pair of partitions 32a. Shell 43 also has a pair of oppositely disposed angularly movable dogs 44 projecting from its end face through arcuate slots 45a formed in an end disk or closing member 45 of drum 37. As shown in Fig. 3, member 45 is secured to the end of drum 37 by countersunk screws.

The member 45 carries on its outer face oppositely disposed pairs of radially movable dogs 46 that have pointed notches in their outer ends adapted to engage pointed or beveled sides of dogs 44. The dogs 46 also have slots therein, through which extend pins 47 projecting outwardly from member 45, forming guide means for the radially movable dogs 46. Dogs 46 are urged outwardly radially by compression springs 48 that react against lugs 45b. Each dog 44 is attached to a tension spring 49. The other end of each spring 49 is connected to a lug 45c projecting from member 45.

The periphery of drum 37 is provided with ratchet teeth 37a adjacent member 45. A pawl 50 co-operates with ratchet teeth 37a, and is pivoted on a rod 51 projecting from one of the partitions 32a.

The shaft 34a, as shown in Fig. 4, is connected to one end of a spiral spring 52. The other end of spring 52 is connected to a drum portion 53a of a commutator 53 journaled on shaft 34a.

The commutator 53 is of insulating material, and has at its periphery contact segments 53b of metal, separated by insulating portions 53c. As shown in Fig. 5, conductors 54 connect alternate segments 53b, which, as shown in Fig. 2, are connected by conductors 54a to collector rings 55 and 56 that surround disk portions 53d and 53e of commutator 53. A brush 53f engages the segments 53b, while brushes 55a and 56a engage collector rings 55 and 56. As shown in Fig. 6, commutator 53 also has a disk portion 53f that has alternately arranged stop lugs 53g disposed adjacent its edge and at opposite sides thereof.

As shown in Fig. 2, a rectangular bar 57 extends through apertures in the end pair of partitions 32a, and is arranged to slide and not rotate therein. The bar 57 has a pair of projecting arms 57a and 57b that embrace opposite faces of disk 53f, and an arm 57c that is employed in moving the bar 57. Bar 57 also carries a pair of contact members 57d and 57e that are connected to conductors 230 and 231. The contacts 57d and 57e are, in the movement of member 57, adapted to be connected to contact members 60 and 60a, respectively, which are connected to conductors 229 and 233.

As shown in Fig. 1, a slidable bar 63 is provided with a hooked end adapted to engage arm 57c for moving bar 57 to the left. Bar 63 is normally biased to the right by a compression spring 64 that reacts between a partition 32a and a collar 65 fixed to bar 63. A stop collar 66, secured to bar 63, serves to limit the movement of the bar to the right. At its other end, bar 63 has an upstanding arm 63a carrying an armature 75

67 of an electro-magnet 68. Arm 63a also carries a right angled extension 63b, adapted to engage a depending end of an arm 63c to disconnect a pair of contacts 71 and 72 when the bar 63 is moved to the left. A tension spring 63d is attached to one end of arm 63c and to a stationary support 63e projecting from a partition 32a, for holding arm 63c normally in position to connect contacts 71 and 72. Bar 63 also has, pivotally connected thereto, the vertical ends of a pair of bell-crank levers 73 that are pivoted at their corners to upstanding arms 74a carried by a horizontal bracket 74 that extends between several of the partitions 32a. The horizontal ends of said bell crank levers are slotted, and receive pins 75 carried by vertically movable arms 76 that are slidable in bracket 74.

Another slidable bar 77 is provided, being disposed below and at one side of the bar 63, and is adapted to have one end thereof engage arm 57c for moving bar 67 to the right. Bar 77 is normally biased to the left by a compression spring 77e that reacts between a partition 32a and a collar 77c fixed to bar 77. A stop collar 77d secured to bar 77 serves to limit the movement of the bar to the left. At its other end, bar 77 has an upstanding arm 77a carrying an armature 78 of an electromagnet 79. Arm 77a also carries a right-angled extension 77b adapted to engage a depending end of an arm 82 to disconnect a pair of contacts 83 and 84 when the bar 77 is moved to the right. A tension spring 85 is attached to one end of arm 82 and to a stationary support 86 projecting from a partition 32a, for holding arm 82 normally in position to connect contacts 83 and 84. Bar 77 also has, pivotally connected thereto, the vertical ends of a pair of bell crank levers 87 that are pivotally connected at their corners to a pair of arms 74a. The horizontal ends of said bell crank levers are slotted, and receive pins 88 secured to vertically movable arms 89 that are slidable in bracket 74.

Shaft 34 has secured thereto four timing members 90, 91, 92 and 93, constructed of insulating material. These members are similar, therefore the description of one will suffice for all of them. For this purpose member 93 has been selected, and reference may be made to Figs. 2 and 8.

Member 93 comprises a disk portion 93a having a series of circumferentially spaced open slots 93b at its periphery. The disk portion 93a also carries a pair of concentric contact rings 93c and 93d that are connected by conductors 93e to collector rings 93f and 93g, which rings surround the peripheries of disk portions 93h and 93i, respectively, of member 93. Rings 93h and 93i are engaged by brushes 93q and 93r that extend from one wall of casing 32. Member 93 also has, secured to one end of its central hub, a plurality of radially extending arms 93j made of resilient material, each of which has a projecting lug to which is pivoted a trigger 93k biased inwardly by a spring 93m secured to the outer end of arm 93j.

Triggers 93k have shoulders adjacent their outer ends arranged to engage the edge of disk 93a to hold arms 93j in an outward position, as shown at the bottom of disk 93a in Fig. 2, thereby holding contact members 93n out of engagement with rings 93c and 93d. The free end of each trigger member 93k is arranged to be engaged by a horizontal extension 89a of arm 89 already referred to. The arms 93j are arranged to be engaged and restored to normal by a circumferentially adjustable hook cam 93o carried by an upstanding bracket 93p. In Fig. 8 only four of

these arms 93j are illustrated, but it is to be understood that there will be one for each hole indicated in the hub of member 93.

To assist in the understanding of the construction of members 90, 91 and 92, corresponding parts have been designated by similar characters.

Shaft 34 also has secured thereto timing members 94E and 96N that are similar in construction to members 90 and 93. The parts of members 94E and 96N that correspond to similar parts of member 93 have been designated by similar characters. It is to be observed, however, that each trigger 94k of member 94E is provided with an insulated contact member 94s that is adapted to engage stationary contact members 94t—94T carried by an insulating bracket 94u. Each trigger 96k of member 96N has a similar insulated contact member 96s that is adapted to engage contact members 96t—96T carried by insulating bracket 96u.

Electro-magnets 95 and 96 are provided, and have armatures 95A and 96A, respectively, to which are secured downwardly extending arms 95b and 96b. These arms have angled levers 97 and 98 pivotally attached to their lower ends. Levers 97 and 98 have horizontally projecting arms 97a and 98a at their lower ends that are adapted, at certain times, to extend under and lift triggers 94k and 96k respectively. The upper ends of said levers have horizontal extensions 97b and 98b that operate between horizontal projections carried by downwardly extending brackets 99.

As shown in Fig. 2, shaft 34 also has journaled thereon, adjacent motor 33, a timing member 100 that is held in place by a pair of collars 103. Member 100 has at one end a gear 100a meshing with a gear 101a carried on a member 101. Member 101 also has another gear 101b thereon, meshing with a pinion 102 secured to shaft 34.

Member 100 also comprises a disk 100b that has secured to opposite sides thereof pairs of cams 104 and 105, respectively, that are circumferentially adjustable in slots 100c shown in Fig. 9.

Cams 104 are located to the right of disk 100b and are adapted to operate a contact closing member 106. The member 106 has an elongated slot that receives screws 107 secured in a stationary bracket 108 for frictionally securing member 106 in its operative positions. The member 106 also carries contacts 109 and 109b. Normally, contact 109b engages a stationary contact 109a, but, when the member 106 is operated by cams 104, the latter contacts are disengaged and contact 109 engages a stationary contact 110.

Cams 105 are located to the left of disk 100b and are adapted to operate a contact closing member 111. The member 111 has an elongated slot that receives screws 112 secured in the stationary bracket 108 for frictionally securing member 111 in its operative positions. The member 111 also carries contacts 108b and 113. Normally, contact 108b engages a stationary contact 108a, but, when the member 106 is operated by cams 105, the latter contacts are disengaged and contact 113 engages a stationary contact 114.

As shown in Fig. 9, disk 100b also has on its periphery a cam projection 100d. This projection is adapted, in the revolution of said disk, to operate a downwardly-movable contact-closing member 115 that carries at its lower end a contact 116. When the member 115 is thus operated, contact 116 engages a stationary contact 117 carried by the lower wall of casing 32. The member 115 also has an elongated slot that freely receives

screws 118 secured in a stationary bracket 119 carried by a partition of casing 32. A tension spring 124 is provided for member 115 that serves to maintain contacts 116 and 117 disengaged normally. The projection 100a is also adapted, in the revolution of disk 100b, to operate an upwardly-movable contact-closing member 120, which carries at its upper end a contact 122. When the member 120 is thus operated, contact 122 engages a stationary contact 123 carried by a partition 32a. The member 120 also has an elongated slot that freely receives screws 121 secured in stationary bracket 108. A tension spring 125 is provided for member 120 that serves normally to maintain contacts 122 and 123 disengaged.

SUMMARY OF MECHANICAL OPERATION

The operation of the mechanical parts so far described may be summarized as follows: When a vehicle operates one of the street switches 22 or 22A, the plates 30 are depressed against the pressure of springs 29. Depending upon the position of the vehicle, these plates swing about one or all of the pairs of pivots 31, and one or more of the blocks 24 are depressed, thus bringing a contact member 25 into engagement with a pair of stationary contacts 26 and closing a circuit through said contacts.

Motor 33 continuously rotates and, through gears 35 and 36, rotates shaft 34. Compression spring 38 normally holds clutch cone 39 in engagement with clutch member 40, causing drum 37 to rotate, which in turn imparts rotary movement to shell 42 through keys 41. Plate 45 is secured to drum 37 and accordingly rotates therewith. The rotation of plate 45, through tension springs 49 and associate dogs 44 and 46, rotates shell 43. Shell 43 is secured to shaft 34a, and, when rotated, winds spiral spring 52, thereby placing shaft 34a under tension to rotate.

Referring to Figs. 2 and 3, it will be observed that the tension of spiral spring 52 acts against the pressure of compression spring 38, tension springs 49 and the latching action of dogs 44 and 46. Thus, when the tension of spiral spring 52 is sufficient to overcome this pressure, dogs 44 will rapidly disengage the dogs 46 with which they are shown engaged in Fig. 3, and move to the opposite ends of arcuate slots 45a and engage the other dogs 46. This action will cause shell 43 to rotate relative to shell 42 and, by reason of cam teeth 43a and 43b, also cause shell 42 to move longitudinally to the left and thereby disengage clutch cone 39 from clutch member 40 carried by drum 37. When the tension of spiral spring 52 decreases sufficiently, the tension springs 49 will return dogs 44 back into engagement with the dogs 46 as shown in Fig. 3. Spiral spring 52 is thus maintained under definite tension, which tends to rotate shaft section 34a. It is pointed out that the purpose of dogs 46 is to prevent unnecessary movement of dogs 44 in arcuate slots 45a, and to withhold any such movement until there is considerable difference in pressure between spiral spring 52 and compression spring 38, or tension springs 49.

Rotation of shaft 34a is normally prevented by one of the arms 57a or 57b of bar 57 engaging a stop lug 53g on member 53f. Bars 63 and 77 are adapted to engage an arm 57c of bar 57, to shift bar 57 to the left or right, and accordingly cause the arms 57a and 57b to engage alternately stop lugs 53g. When bar 57 is thus shifted, spiral spring 52 causes the commutator 53 to rotate par-

tially as determined by the spacing of stop lugs 53g.

The members 90 to 93, 94E and 96N, are continuously rotated with shaft 34, and the trigger members 90k, 91k, 92k, 93k, 94k and 96k, are normally in the position shown for triggers 93k and 94k at the bottom of the disks 93a and 94a in Fig. 2. As the members 90 to 93, 94E and 96N rotate, the spring arms carrying the triggers are engaged by their respective hook cams 90o, 91o, 92o, 93o, 94o and 96o, and are swung outwardly. When so swung, the shoulder on each trigger engages the edge of its respective disk 90a, 91a, 92a, 93a, 94a, 96a and is held in that position. Each trigger remains in that position until it is lifted by its respective arm 89, 76, or lever 97, 98. When, for example, the trigger 93k is lifted, it will remain in that position and hold rings 93c and 93d connected by contact member 93n until the cam 93o is reached at the bottom, when it will be swung outwardly and cause rings 93c and 93d to be disconnected.

When, for example, the trigger 94k is lifted, so that rings 94c and 94d are connected, an insulated contact 94s carried by trigger 94k will engage contacts 94T and 94t a few seconds before its cam 94o is reached and before its corresponding member 93 operates to change the signal.

The disk 100b is constantly rotated at reduced speed by motor 33 through gears 100a, 101a, 101b and 102. As disk 100b revolves, one of the cams 104, namely, the one in advance in the direction of rotation, will engage under a projecting lip of contact closing member 106, thereby raising said member so that contacts 109 and 110 will be connected and contacts 109a and 109b disconnected. The member 106 will remain in this raised position until the other cam 104 engages the upper portion of said projecting lip and lowers member 106. As previously mentioned, the member 106 is frictionally held in either its raised or lowered position.

The cams 105 at the left side of the disk 100b will likewise operate to raise and lower member 111, so that contacts 113 and 114 will be connected and contacts 108a and 108b disconnected, until a second cam 105 engages member 111, thereby disconnecting contacts 113 and 114 and reconnecting contacts 108a and 108b.

As disk 100b rotates, its cam projection 100d alternately and repeatedly actuates members 115 and 120 to close temporarily pairs of contacts 122—123 and 116—117 respectively. These actuations occur at predetermined times with respect to the operation of contacts by pairs of cams 104 and 105. For example, cams 104, on the right side of disk 100b, are preferably positioned with reference to cam 100d so that the forward cam 104 will raise member 106 to connect contacts 109—110 and disconnect contacts 109a—109b before cam 100d operates member 120 to close contacts 122—123, while the trailing cam 104 is set to restore the normal connections of member 106 after cam 100d permits member 120 through action of spring 125 to disconnect contacts 122—123. A similar relation likewise prevails between the operation of members 111 and 115 by cams 105 and 100d. It is to be understood, however, that cams 104 and 105 may also be adjusted to operate their respective contacts either before or after the cam 100d operates. Particular attention is directed to the relatively wide range of adjustment for cams 104 and 105 as indicated in Fig. 9.

RELATIVE SETTINGS OF TIMING MECHANISM

Timing members 90, 91, 94E and cam operated contacts 108a—108b, 113—114, and 116—117 are utilized in the control of the "go" signal for the E—W street, while timing members 92, 93, 96N and cam operated contacts 109a—109b, 109—110 and 122—123 are utilized in the control of the "go" signal for the N—S street. The timing members function only when a vehicle operates its corresponding street switch, but the cam operated contacts are alternately and repeatedly operated for short intervals regardless of traffic conditions. Therefore, it will be obvious that vehicle actuation of the street switches is entirely haphazard relative to the predetermined time of operation of the cam operated contacts 108a—108b, 113—114 and 116—117 for the E—W street, and cam operated contacts 109a—109b, 109—110 and 122—123 for the N—S street.

Disk 100b rotates slower than shaft 34 and for the purpose of illustration may be said to make one revolution every two minutes. Accordingly cam 100d on the periphery of disk 100b, alternately and repeatedly causes pairs of contacts 116—117 and 122—123 to close momentarily, first one pair, followed one minute later by the other pair, and so on cyclically.

Cams 105 are adjusted to close pairs of contacts 113—114 and open pairs of contacts 108a—108b for a definite interval, during which time the contacts 116—117 are preferably operated.

Similarly, cams 104 are adjusted to close pairs of contacts 109—110 and open pairs of contacts 109a—109b for a definite interval, during which time the contacts 122—123 are preferably operated.

Thus the contacts operated by cams 104 and 105 are alternately and repeatedly operated for definite intervals, first those operated by cams 104 and one minute later those operated by cams 105, and so on cyclically.

Timing members 90 and 91 are simultaneously placed into operation by a vehicle actuating a street switch on the E—W street. Member 91 is adjusted so that its contacts 91c—91d will remain closed for 10 seconds after operation, while member 90 is adjusted so that its contacts 90c—90d will remain closed for 15 seconds after operation, or 5 seconds longer than member 91.

Timing members 92 and 93 are similarly adjusted and operated for the N—S street. Member 93 being set for 10 seconds and member 92 being set for 15 seconds.

Timing member 94E is adjusted to open its contacts 94c—94d after member 93 opens its contacts 93c—93d. This is to assure that timing member 94E will not restore before member 93 when they are placed into operation simultaneously.

Contacts 94t—94T of timing mechanism 94E are employed to control a warning signal, and are adjusted to close for a definite time during the operation of member 94E. The adjustment of contacts 94t—94T is made according to the setting of contacts 93c—93d of member 93, such that the contacts 94t—94T will close and cause the warning signal to display for a definite time before member 93 disconnects contacts 93c—93d to yield the control of the "go" signal to E—W street when the members 94E and 93 are placed into operation simultaneously. Under light traffic, the member 93 may be placed into operation before member 94E, then the display of the warning signal will be shortened by the amount

of time elapsing between the operation of members 93 and 94E.

Obviously, if the amount of time elapsing between the operation of members 93 and 94E is equal to the normal time of display of the warning signal, then no warning signal is necessary, since the vehicle operating member 93 had sufficient time to clear the intersection, and therefore the immediate transfer of the "go" signal without a warning signal as provided for in my invention is desirable.

Under continuously moving traffic, on the N—S street, member 93 will be repeatedly operated, and accordingly the final timing of member 93 will begin substantially with the operation of member 94E. It is seen, therefore, that the warning signal is displayed for its full time only when waiting traffic on one street causes continuously moving traffic on the other street to be abruptly stopped or when vehicles on each street place members 94E and 93 into operation simultaneously.

Timing mechanism 96N is similar to member 94E and is similarly adjusted and set according to timing member 91 for displaying the warning signal for traffic moving on the E—W street.

Relay system

To accomplish the objects of my invention, various relays having magnet coils and armatures controlling electrical circuits, are used in addition to the timing mechanism in casing 32, and these are shown in my wiring diagram Fig. 14.

The arrangement of the circuits and relays is generally in duplicate, one set being provided for one street and a duplicate set for the other.

The relay, having coils 148, 149, and 150, is provided with armatures 151 and 151b, and is employed to register operations for the E—W street. Normally these coils are de-energized and armature 151b engages back contact 155, but when either of the coils is energized the latter contact is disengaged and armature 151 engages front contacts 152, 153 and 154. The relay having coils 148a, 149a and 150a is the equivalent for the N—S street.

The relay having coils 133 and 134 is provided with armatures 135, 135e, and 135b, and is employed to transmit selectively an operation registered by the relay having coils 148, 149 and 150 to the timing mechanisms in casing 32. Normally these coils are de-energized and armature 135e engages back contact 136, but when either of the coils is energized the latter contact is disengaged and armatures 135 and 135b engage front contacts 138 and 137 respectively. The relay having coils 133a and 134a is the equivalent for the N—S street.

The relay having coils 143 and 144 is provided with armatures 145 and 145b, and is employed to cause the "go" signal to return to the E—W street under various conditions of operations. Normally the coils are de-energized and neither of the armatures 145 or 145b engage contacts. When either of the coils is energized, the armatures are raised and armature 145 engages a front contact 146. The armature 145b is constructed so that it will not engage contact 147 while it is being raised or remains in its raised position. When the coils are de-energized, armature 145 will disengage contact 146 and armature 145b will momentarily engage contact 147 in its movement to its normal retracted position.

The relay having coils 143a and 144a is the equivalent for the N—S street.

The relay having coil 139a is provided with armatures 140a and 140c, and is employed to operate selectively the relay having coils 143 and 144 when a vehicle on the N—S street calls for the "go" signal within a predetermined time after the last vehicle registers on the E—W street to hold the "go" signal. Normally the coil 139a is de-energized and neither of the armatures 140a or 140c engage contacts. When the coil is energized the armatures are raised and engage front contacts 141a and 142a respectively. The relay having coil 139 is the equivalent for the N—S street.

The relay having pairs of coils 127—128 and 127a—128a is a three-position relay, and is employed to transmit selectively operations registered by relays having coils 148—149—150 and 148a—149a—150a, in the event such registrations are received substantially at the same time, and it is further arranged to give preference to the street for which the "go" signal was already set. Normally the coils are de-energized and the plunger type armature 129 is biased to a central position, and pairs of contacts 131—309, 130—310, 130a—311 and 131a—312 are engaged. When the plunger is moved to the left by either of the coils 127—128 in response to an E—W street operation, pairs of contacts 131—309 and 130—310 maintain their engagement while pairs of contacts 130a—311 and 131a—312 are disengaged. It is important to note that when the plunger is moved to the left, a contact 132 is then connected to contact 131. When the plunger is moved to right by either of the coils 127a—128a in response to an N—S operation, the reverse operation of the contacts is effected and a contact 132a is connected to contact 131a. The four coils are substantially equal in power, and are arranged so that both coils 127—128 will be energized in response to an E—W operation if the "go" signal is already displaying to that street, while only one coil 128a will be energized if an N—S operation is registered at that time. Thus the plunger will shift to the left by reason of the greater power provided by the pair of coils 127—128. The reverse operation will occur if the "go" signal is displaying to the N—S street, since the pair of coils 127a—128a will provide greater power than the single coil 128.

Another three-position relay having coils 156 and 156a is provided, and is employed to control selectively the "go" signal in response to operations by a motorman on a street car. Normally the coils are de-energized and the plunger type armature 157 is biased to a central position, and pairs of contacts 317—325, 318—326, 319—327, 320—328, 321—329, 322—330, 323—331 and 324—332 are engaged. When the plunger is moved to the left by coil 156, all of the pairs of contacts engaged in the central position are opened and contacts 317—318 and 319—320 are connected. When the plunger is moved to the right by coil 156a, all of the pairs of contacts engaged in the central position are opened and contacts 323—324 and 321—322 are connected.

The relay having coil 164 is provided with an armature 165 and is employed to control the circuit of a warning signal 21 for both streets. Normally coil 164 is de-energized and no contact is engaged, but when the coil 164 is energized its armature 165 engages a front contact 166.

OPERATION

The operation of my invention may be conveniently divided into five distinct parts, as follows:

1. The simple or usual method of operating the "go" signal, which is ordinarily brought about by the operation of a street switch bringing into action a timing unit to prevent a further change in the "go" signal for 10 seconds.

2. The positive transfer of the "go" signal, which is effected by electro-magnets 95 and 96, whereby one street takes the "go" signal from a stream of traffic on another street for at least 10 seconds.

This positive operation of the "go" signal may be sub-divided into two distinct operations as follows:

A. The automatic positive transfer of the "go" signal, which is effected jointly by the operation of a street switch on the street not receiving the "go" signal, and the closing of a pair of cyclically operated contacts 113—114 or 109—110, whereby the traffic on the said street takes the "go" signal from a stream of traffic on another street.

B. The manual positive transfer of the "go" signal, which is effected by the operation of a manual switch located in the cab of a street car, whereby the "go" signal is immediately taken from a continuous stream of traffic on one street and given to another.

3. The automatic cyclic transfer of the "go" signal, which is brought about at certain definite times regardless of traffic on either street, by the alternate and repeated closing of sets of contacts 116—117 and 122—123.

4. The automatic return of the "go" signal, which is the automatic return of the "go" signal to one street when traffic ceases to use the "go" signal on another. There are also two methods of automatic return:

A. The vehicle operated automatic return of the "go" signal, which is the automatic return of the "go" signal to the street from which it was taken, by the operation of a street switch on the street to which it was transferred.

B. The arterial automatic return of the "go" signal, which always returns the "go" signal to a given street when traffic ceases to use it on other streets.

5. The automatic display of a warning light, which is provided only when traffic on either street interrupts a continuous stream of traffic on the other, by a positive transfer of the "go" signal.

Under various conditions of traffic, different combinations of the above operations are utilized to provide a minimum amount of delay to the traffic. However, before giving specific illustrations as to the operation of my invention under various conditions of traffic, I will first describe each operation enumerated above by itself. It being understood that, where the operation is applied to a specific street, the same operation for the other street will occur if the traffic conditions are reversed, in which case corresponding apparatus provided for the other street will be utilized in the operation.

PART 1

The simple method of operating the "go" signal

This method of operating the "go" signal is employed either to transfer or retain the "go" signal, as the case may be, when there is insuf-

ficient traffic on either street to cause an operation of the signal by the positive transfer method.

The relay having magnet coils 148—149—150 is employed to register signal operations for the E—W street, and may be energized by: an operation of the street switch 22A; a movement of plunger 157 to the left by magnet coil 156; the closing of cyclically operated contacts 116—117, or; an operation of the relay having magnet coils 143—144.

For the purpose of illustration, it will be assumed that the relay having magnet coils 148—149—150 is operated in response to an operation of the street switch 22A.

It will also be assumed that no traffic has operated on either street for some time, the "go" signal is on the N—S street and that a vehicle approaches on the E—W street.

The approaching vehicle operates street switch 22A, thereby completing a circuit for energizing magnet coil 150, from positive potential P, through street switch 22A, wires 194—194a, magnet coil 150 to negative potential N. The energization of magnet coil 150 raises armature 151—151b and thereby completes a circuit for energizing auxiliary magnet coil 149, from positive potential P, through armature 151, contact 154, wire 195, through contacts 72—71, wire 196, magnet coil 149 to negative potential N. The energization of auxiliary magnet coil 149 retains armatures 151—151b raised after magnet coil 150 becomes de-energized. With the armatures raised, another circuit for energizing magnet coil 128 is completed from positive potential P, through armature 151, contact 152, wire 199, armature 135e, contact 136, wire 200, wire 200b, through contacts 131—309, wire 313, magnet coil 128 to negative potential N. The energization of magnet coil 128 shifts plunger armature 129 to the left, retaining contacts 131—309 connected and connecting contact 132 to contact 131, thereby completing an additional circuit for energizing electro-magnet 68 via wire 200a. The energization of electro-magnet 68 moves bars 63 and 57 to the left, thereby alternating the engagement of the stop lugs on member 53f and permitting the commutator contact segments 53b, via wires 54a and collector rings 55 and 56, to de-energize wire 308 and energize wire 307. This alternation in the energization of wires 308 and 307 transfers the "go" signal from the N—S street to the E—W street.

The movement of bar 63 disconnects contacts 71—72, which opens the circuit of auxiliary magnet coil 149 and permits armatures 151—151b to release. The releasing of armature 151 de-energizes magnet coil 128 and electro-magnet 68 by opening the circuit previously established via contacts 152 and 136. The de-energization of the latter permits plunger armature 129 to restore to its centrally biased position, and bar 63 to restore to its normal position through the action of compression spring 64. The member 57, however, remains in the position to which it was last operated, and retains the "go" signal on the E—W street.

The movement of bar 63 also caused contacts 91c—91d to be connected for ten seconds by operation of a trigger contact member 91n. With these contacts connected, a circuit is completed for energizing magnet coil 134a, from positive potential P, through contacts 91c—91d, wire 204, magnet coil 134a to negative potential N. The energization of magnet coil 134a raises armatures 135a—135d—135c, and thereby prevents a

simple transfer of the "go" signal to the N—S street via contacts 152a and 136a.

From the foregoing it will be evident that, should a following vehicle operate street switch 22A within ten seconds after the last operation thereof, the above operations will be repeated, except that bar 57 will not be operated again, since it is already in a position to establish the "go" signal on the E—W street. The operation of street switch 22A by a following vehicle will, however, cause another trigger contact member 91n to connect further contacts 91c—91d and thereby maintain the circuit for energizing magnet coil 134a, via wire 204, closed for 10 seconds after the last operation. Therefore, vehicles following within 10 seconds of each other will retain electro-magnet 134a energized, and the "go" signal on the E—W street via the simple method initially outlined.

If more than 10 seconds elapse from the last operation of the E—W street switch 22A, the contacts 91c—91d disconnect, thereby de-energizing magnet coil 134a and releasing armatures 135a—135d—135c. In the meantime, if no vehicle has operated the N—S street switch 22, no change in the signal indications will occur, and the "go" signal will remain on the E—W street to which it was last actuated.

With the "go" signal displaying to the E—W street, and a vehicle operating the E—W street switch 22A more than ten seconds after the last operation thereof, it will be evident that the same operations described for the simple method of retaining the "go" signal will be repeated, but no further change in the position of bar 57 will result, since it is already in a position to establish the "go" signal on the E—W street. At this time, however, the contacts 91c—91d will be re-connected by operating a trigger contact member 91n, and thereby re-energize contact coil 134a for raising its respective armatures to prevent a simple transfer of the "go" signal to the N—S street for at least 10 seconds.

It is important to note that, when the "go" signal is transferred to the E—W street, bar 57 is moved to the left, thereby connecting contacts 60a—57e. Therefore, if the wire 200 is energized while the "go" signal is on the E—W street to bring about a repeated energization of magnet coil 128, a circuit will also be completed for energizing magnet coil 127, from wire 200 via wire 231, contacts 57e—60a, wire 233, contacts 130—310, wire 314, magnet coil 127 to negative potential N. It is also important to note that when a vehicle operates the E—W street switch 22A to bring about a simple transfer of the "go" signal from the N—S to the E—W street, only the single magnet coil 128 is energized. Accordingly, it will be evident that should a vehicle operate the E—W street switch 22A simultaneously with an operation of the N—S street switch 22, with the "go" signal on the E—W street, the plunger 129 will move to the left by reason of the greater power provided by the energization of magnet coils 127—128, and cause the "go" signal to be retained for an additional 10 seconds on the E—W street. If no further vehicles operate the street switch 22A, the contacts 91c—91d will disconnect after 10 seconds, and permit a circuit to be completed via contacts 152a and 136a to bring about a simple transfer of the "go" signal to the N—S street, since the registration of the vehicle on the N—S street will be retained by relay having coils 148a—149a—150a until the

auxiliary magnet coil 149a is de-energized by reason of a movement of bar 77.

PART 2

The positive transfer of the "go" signal

This method of operating the "go" signal is employed to transfer the "go" signal to traffic waiting whenever a stream of traffic on another street is retaining the "go" signal.

PART 2A

For the purpose of illustrating the automatic positive transfer of the "go" signal, it will be assumed that a continuous stream of traffic is retaining the "go" signal on the E-W street via the simple method of operation, and that a vehicle approaches on the N-S street.

As outlined in Part 1, vehicles continually operating the E-W street switch 22A, with 10 seconds after the last operation thereof, repeatedly operate trigger contact members 91n and retain contacts 91c-91d connected. As long as these contacts are connected, a circuit is completed for energizing magnet coil 134a via wire 204. With magnet coil 134a energized the armatures 135a-135d-135e are raised, thereby preventing a simple transfer of the "go" signal to the N-S street via contacts 152a and 136a.

The approaching vehicle on the N-S street operates street switch 22, thereby completing a circuit for energizing magnet coil 150a, from positive potential P, through street switch 22, wires 180-180a, magnet coil 150a, to negative potential N. The energization of magnet coil 150a raises armatures 151a-151c and thereby completes a circuit for energizing the auxiliary magnet coil 149a, from positive potential P, through armature 151a, contact 154a, wire 183, through contacts 84-83, wire 184, magnet coil 149a to negative potential N. The energization of auxiliary magnet coil 149a retains armatures 151a-151c raised after magnet coil 150a becomes de-energized. With the armatures raised, wire 187 is connected to positive potential P, via contacts 152a and armature 151a, but armature 135d is raised and disconnected from contacts 136a, thereby preventing a simple transfer of the "go" signal to N-S street.

As previously mentioned, in the description concerning the relative settings of the timing mechanism, the cam operated contacts 109-110 are connected for definite intervals every two minutes regardless of traffic conditions. Therefore when the contacts 109-110 are connected, a circuit is completed for energizing magnet coil 133 and electro-magnet 96, from positive potential P, armature 151a, contact 153a, wire 211, armature 135a, contact 138a, wire 212, contacts 322-330, wire 304, contacts 110-109, wire 213, contacts 329-321, wire 213b, wire 216, magnet coil 133 to negative potential N. The wire 213b also connects electro-magnet 96 through wire 216a. The energization of electro-magnet 96 operates a trigger contact member 96n and causes contacts 96d-96c to be connected for a time longer than contacts 91c-91d. With contacts 96d-96c connected, a circuit is established for retaining electro-magnet 96 and magnet coil 133 energized from positive potential P, through contacts 96d-96c, wire 216b, electro-magnet 96 to negative potential N. The circuit from contacts 96d-96c is further completed through wires 216b-216a-216, magnet coil 133 to negative potential N. The energization of magnet coil 133 raises armatures 135-135e-135b and thereby prevents fur-

ther operation to retain the "go" signal on the E-W street by the simple method via contacts 152 and 136. Therefore the contacts 91c-91d will disconnect 10 seconds after the last operation of street switch 22A. When the contacts 91c-91d disconnect, the magnet coil 134a will de-energize and release armatures 135a-135d-135c. With armature 135d re-connected to contact 136a, a circuit is completed for energizing magnet coil 128a, from positive potential P, through armature 151a, contact 152a, wire 187, armature 135d, contact 136a, wire 188a, wire 188, through contacts 131a-312, wire 315, magnet coil 128a to negative potential N. The energization of magnet coil 128a shifts plunger armature 129 to the right, retaining contacts 131a-312 connected and connecting contact 132a to contact 131a, thereby completing an additional circuit for energizing electro-magnet 79 via wire 190. The energization of electro-magnet 79 moves bars 77 and 57 to the right, thereby alternating the engagement of the stop lugs on member 53f, and permitting the commutator contact segments 53b, via wires 54a and collector rings 55 and 56, to de-energize wire 307 and energize wire 308. This alternation in the energization of wires 307 and 308 transfers the "go" signal from the E-W street to the N-S street.

The movement of bar 77 disconnects contacts 84-83, which opens the circuit of the auxiliary magnet coil 149a and permits armatures 151a-151c to release. The releasing of armature 151a de-energizes magnet coil 128a and electro-magnet 79 by opening the circuit previously established via contacts 152a and 136a. The de-energization of the latter permits plunger armature 129 to restore to its centrally biased position, and bar 77 to restore to its normal position through the action of compression spring 77e. The member 57, however, remains in the position to which it was last operated, and retains the "go" signal on the N-S street.

The movement of bar 77 also caused contacts 93d-93c to be connected for 10 seconds by operation of a trigger contact member 93n. With these contacts connected, a circuit is completed for energizing magnet coil 134, from positive potential P, through contacts 93d-93c, wire 203, magnet coil 134, to negative potential N. The energization of magnet coil 134 retains armatures 135-135e-135b raised, and thereby prevents a simple transfer of the "go" signal to the E-W street via contacts 152 and 136.

Shortly after the contacts 91c-91d disconnect, the contacts 96d-96c will disconnect and open the circuit of magnet coil 133, but no further operation will occur at this time, since armatures 135-135e-135b are held raised by magnet coil 134.

Thus the effect of transferring the "go" signal, by the automatic positive change method, is to prevent further operation to retain the "go" signal as determined jointly by waiting traffic and a constantly operating time switch, the predetermined time of which operation is entirely hazardous in relation to traffic actuations.

It is to be noted that the signal is not transferred in the positive manner just described, unless there has been an operation of the street switch on the street to which the "go" signal is to be transferred. Therefore, if there is traffic only on one street, the "go" signal will remain standing for that street, or if there is no traffic on either street, the signal will not change, and will remain on the street where it was last actu-

ated by traffic. When the "go" signal is transferred by the automatic positive change method the warning signal is also displayed, but it is desired not to burden or confuse the operation of Part 2A with the operation of the warning signal, since this is described in detail in Part 5.

PART 2B

For the purpose of illustrating the manual positive transfer of the "go" signal, it will be assumed that a continuous stream of traffic is retaining the "go" signal on the E-W street, and that a motorman of an N-S street car causes wire 253 to be grounded, via switch 173 and contact segment B3 or B5 of the N-S street, to energize magnet coil 156a.

As outlined in Part 2A, a vehicle operating the N-S street switch 22 interrupts a continuous stream of traffic on E-W street when the cyclically operated contacts 109-110 close.

The operation of the manual positive transfer of the "go" signal is identical with the automatic positive method outlined in Part 2A, except that the transfer of the "go" signal in the former is made entirely independently of the contacts 109-110.

When the wire 253 is grounded, magnet coil 156a is energized, thereby shifting plunger armature 157 to the right. A movement of plunger armature 157 to the right disconnects all the pairs of contacts normally engaged in its central position, and connects contacts 323-324, thereby completing a circuit for energizing magnet coil 150a, from positive potential P, through contacts 323-324, wires 219-219a-180a, magnet coil 150a, to negative potential N. With magnet coil 150a energized, the same series of operations is established as effected in the automatic positive transfer of the "go" signal.

The plunger armature 157 in moving to the right also electrically connects contacts 321-322, thereby immediately closing the circuit normally completed by the engagement of contacts 109-110. It will be evident therefore, that under the manual positive transfer of the "go" signal it is not necessary to wait for an engagement of the contacts 109-110, since the operation of plunger 157 simulates the operation of part 2A with the immediate closing of the circuit controlled contacts 109-110.

Thus the effect of transferring the "go" signal by the manual positive method is to immediately prevent further operation to retain the "go" signal when a motorman of a street car causes wire 253 to be grounded. When the "go" signal is transferred by the method outlined in Part 2A the warning signal is also displayed, but it is desired not to burden or confuse the operation of Part 2B with the operation of the warning signal, since this is described in detail in Part 5.

PART 3

The automatic cyclic transfer of the "go" signal

This method of operating the "go" signal is employed to transfer the "go" signal from one street to another at certain times regardless of traffic on either street.

For the purpose of illustration it will be assumed that no vehicles have operated on either street for some time, and that the cam 100d is used to cause the "go" signal to be alternately and repeatedly established on each of the streets.

As previously mentioned, in the description concerning the relative settings of the timing

mechanism, the cam 100d of disk 100b alternately and repeatedly closes contacts 116-117 and 122-123, first one pair, followed one-half revolution later by the other pair, and so on cyclically. For the purpose of illustration it will be assumed that disk 100b makes one revolution in two minutes.

It will be assumed that the "go" signal is on the E-W street, and that cam 100d is closing contacts 122-123, thereby completing a circuit for energizing magnet coil 150a from positive potential P through contacts 323-331, wire 217, contacts 122-123, wire 220a, contacts 332-324, wires 219-219a-180a, magnet coil 150a to negative potential N. In the absence of vehicle operation of the E-W street switch 22A, the energization of magnet coil 150a will immediately bring about a simple transfer of the "go" signal to the N-S street as outlined in Part 1. The "go" signal will then be retained on the N-S street for at least 10 seconds, and after this time will remain on the N-S street awaiting further operation. If vehicles do not operate either street switch 22 or 22A, the "go" signal will remain on the N-S street for one minute, whereupon contacts 116-117 will be closed and complete a circuit for energizing magnet coil 150, from positive potential P through contacts 318-326, wire 300, contacts 116-117, wire 220, contacts 325-317, wires 301, 301a, 194a, magnet coil 150 to negative potential N. This energization of magnet coil 150 will bring about a simple transfer of the "go" signal to the E-W street. The "go" signal will then be retained on the E-W street for at least 10 seconds, and after this time will remain on the E-W street awaiting further operation. If vehicles do not operate either street switch 22 or 22A, the "go" signal will remain on the E-W street for one minute, whereupon the contacts 122-123 will again be closed to cause a simple transfer of the "go" signal to the N-S street.

Thus the effect of the automatic cyclic change of the "go" signal, in the absence of vehicle operation, is to transfer alternately and repeatedly the "go" signal from one street to another via the simple method, in which case the "go" signal is displayed to each street for one minute intervals.

It will now be assumed that when contacts 122-123 are closed to provide an automatic cyclic transfer of the "go" signal from the E-W street to the N-S street, a vehicle had operated the E-W street switch 22A just prior to the closing of contacts 122-123. As described in Part 1, the operation of the E-W street switch 22A, will cause the "go" signal to be retained on the E-W street for at least 10 seconds, and will also energize magnet coil 134a to prevent a simple transfer of the "go" signal to the N-S street during this 10 second period. As previously mentioned in the description concerning the relative settings of the timing mechanism, the cam operated contacts 109-110 are preferably adjusted to close for a definite interval when the contacts 122-123 are operated. Therefore, under these conditions, the closing of contacts 122-123 will cause an automatic positive transfer of the "go" signal to the N-S street as outlined in Part 2A. It will be apparent that a similar operation will be effected when contacts 116-117 and 113-114 are closed to bring about an automatic cyclic transfer of the "go" signal to the E-W street if a vehicle operates N-S street switch 22 just prior to the closing of contacts 116-117.

is operated to connect contacts 91c—91d for 10 seconds and thereby energizes magnet coil 134a to prevent a simple transfer of the "go" signal to the N—S street for 10 seconds. Simultaneously with the operation of trigger contact member 91n, a corresponding trigger contact member 90n is operated to connect contacts 90d—90c for 15 seconds. As long as contacts 90d—90c are connected, a circuit is completed for energizing magnet coil 139a, from positive potential P, through contacts 90d—90c, wire 240, disconnecting switch 170, wire 240e, magnet coil 139a to negative potential N.

A vehicle operating the N—S street switch 22 within 15 seconds after the operation of trigger contact member 90n, will operate the relay having magnet coils 148a—150a to bring about a simple transfer of the "go" signal to the N—S street as outlined in Part 1. If the operation of N—S street switch 22 is made within 10 seconds after the operation of trigger contact member 91n, then the N—S vehicle will be required to wait until member 91n disconnects contacts 91c—91d and permits the "go" signal to be transferred to the N—S street. On the other hand if the operation of the N—S street switch 22 is made within 5 seconds after member 91n disconnects contacts 91c—91d, then the "go" signal will be immediately transferred to the N—S street.

In either case, so long as the N—S street switch 22 is operated within 15 seconds after the operation of trigger contact member 90n, a circuit is completed for energizing magnet coil 144, from positive potential P, through street switch 22, wires 190—219a—246, armature 140a, contact 141a, wires 247—247a, magnet coil 144, to negative potential N. The subsequent operation of armatures 145—145b and the relay having magnet coils 148—149—150 is identical to that outlined in the forepart of description 4A. Therefore, it is apparent that, 10 seconds after the "go" signal is transferred to the N—S street, it will return automatically to E—W street.

It is important to note in the above, that a vehicle operating the N—S street switch 22, more than 10 seconds after the last operation of the E—W street switch 22A, will immediately transfer the "go" signal to the N—S street, and if the operation of the N—S street switch 22 is within 15 seconds after the last operation of the E—W street switch 22A the "go" signal will return automatically to the E—W street by virtue of an operation of armature 145b and contact 147, but if more than 15 seconds elapse, then armature 145b and contact 147 will not operate to return the "go" signal to the E—W street automatically.

From the foregoing it will be seen that a vehicle between the E—W street switch 22A and the intersection, when the "go" signal is transferred to the N—S street, will be permitted to proceed immediately after traffic ceases on the N—S street.

PART 4B

For the purpose of illustrating the arterial automatic return of the "go" signal, it will be assumed that the "go" signal is to return always to the N—S street. For this purpose disconnecting switches 170, 169 and 262 are closed. It is to be noted that, in order to place the disconnecting switch 169 in circuit with contacts 90d—90c of 15-second timing mechanism 90, the disconnecting switch 170 must also be closed. Therefore, whenever the arterial automatic return of the "go" signal is provided for the N—S street, the vehicle-

operated automatic return of the "go" signal is provided for the E—W street.

The principal object of always returning the "go" signal to a given street, is to facilitate the movement of traffic thereon. In other words, the street to which the signal is always to return, is an arterial street, and will normally have considerably more traffic than the other streets of the intersection. Obviously only one street of an intersection can be provided with the arterial automatic return of the "go" signal. Accordingly, whenever the N—S street is provided with the arterial automatic return feature, disconnecting switches 171, 168 and 264 are opened, and vice versa.

For the purpose of illustration, I will assume that the "go" signal is on the N—S street and that no traffic has operated thereon for some time, and that a single vehicle operates the E—W street switch 22A.

The operation of the vehicle-operated automatic return of the "go" signal to the E—W street is identical to that outlined in Part 4A.

The operation of the E—W street switch 22A energizes magnet coil 150, and raises armatures 151—151b to bring about a simple transfer of the "go" signal to the E—W street as outlined in Part 1. As further outlined in Part 1, when the "go" signal is transferred to the E—W street, a trigger contact member 91n is operated to connect contacts 91c—91d for 10 seconds, and thereby energize magnet coil 134a to prevent a simple transfer of the "go" signal to the N—S street for at least 10 seconds. Simultaneously with the operation of trigger contact member 91n, a similar trigger contact member 90n is operated to connect contacts 90d—90c for 15 seconds, or for 5 seconds longer than contacts 91c—91d. When the contacts 90d—90c are connected, a circuit is established for energizing magnet coil 144a, from positive potential P, through contacts 90d—90c, wire 240, disconnecting switch 170, wire 258a, disconnecting switch 169, wire 258, armature 151c, contact 155a, wires 265—235a, magnet coil 144a to negative potential N. The energization of magnet coil 144a raises armatures 145a—145c. As mentioned in the description of the relay system, armature 145c in raising will not connect contact 147a, therefore no change in operation is effected at this time. If no vehicles operate the N—S street switch 22 for 15 seconds after the last operation of the E—W street switch 22A, then the "go" signal will remain on the E—W street for 5 seconds after contacts 91c—91d are disconnected. However, 15 seconds after the last operation of the E—W street switch 22A, the contacts 90d—90c will disconnect, and de-energize magnet coil 144a. The de-energization of magnet coil 144a permits armatures 145a—145c to release, which causes armature 145c to connect contact 147a momentarily and to complete a circuit for energizing magnet coil 148a, from positive potential P, through armature 145c, contact 147a, wire 240a, disconnecting switch 262, wire 240b, magnet coil 148a to negative potential N. The energization of magnet coil 148a raises armatures 151a—151c and thereby effects a simple transfer of the "go" signal to the N—S street as outlined in Part 1. Thereafter, if no vehicles operate either street switch, the "go" signal will remain on the N—S street.

I will now assume that a single vehicle operates the N—S street switch 22 within 10 seconds after an operation of the E—W street switch 22A.

The operation of the E—W street switch 22A

From the foregoing it will be evident that, regardless of traffic conditions, the automatic cyclic transfer will cause the "go" signal to be alternately and repeatedly transferred from one street to another via either the simple or positive methods of operation. In this case the "go" signal will be prevented from further change for at least 10 seconds after each cyclic transfer, and, in the absence of vehicle operation on either street during this period, will remain on the street to which it was last actuated, awaiting further operation by the cyclic transfer method or approaching vehicles. It is also apparent that, 10 seconds after each operation of contacts 116—117 and 122—123, the "go" signal may be retained or transferred according to the simple method of operation outlined in Part 1. If it is desired not to have the "go" signal transferred at fixed intervals, then cam 100d is not used.

PART 4

The automatic return of the "go" signal

This method of operating the "go" signal is employed to return the "go" signal automatically to the street from which it was taken when traffic ceases to use the "go" signal on the other streets. One object of this arrangement is to assure a transfer of the "go" signal to traffic that was abruptly stopped by the interruption of a continuous stream of traffic.

PART 4A

For the purpose of illustrating the vehicle-operated automatic return of the "go" signal, it will be assumed that a continuous stream of traffic is retaining the "go" signal on the E—W street, and that a vehicle approaches on the N—S street. It will be assumed that the "go" signal is to be returned to the E—W street, and for this purpose the disconnecting switch 170 is closed.

It will be remembered that the street switches 22 and 22A are placed back from the intersection a distance sufficient to permit a vehicle, traveling at the usual rate of speed, to stop before reaching the intersection, if the "go" signal is prevented from being immediately transferred to the approaching vehicle. With the street switches so located, it will be evident that it is possible that either a slow moving vehicle or a stream of vehicles, abruptly stopped by reason of a positive transfer of the "go" signal to another street, will not have sufficient time to pass the intersection after operating its street switch. Therefore, I have provided vehicle actuated means for returning the "go" signal to the street from which it was taken, when traffic on the intersecting street ceases. I have further provided that the vehicle operated return of the "go" signal will function only when the signal is taken from a street within 15 seconds after the last operation of the street switch thereon. That is, if considerable time elapses after operation of the street switch on the street receiving the "go" signal before the "go" signal is transferred to a cross street, then the "go" signal will not be automatically returned, since the 15 second period is arbitrarily selected as representing the time required for slow moving vehicles to pass the intersection.

To provide for the vehicle-operated automatic return of the "go" signal to the E—W street, the disconnecting switch 170 is closed, while to provide for this feature for the N—S street, disconnecting switch 171 is closed. Thus the use of

the vehicle-operated return of the "go" signal is set according to the requirements of the traffic using the intersection. For the purpose of illustration, I will assume that disconnecting switch 170 is closed, and disconnecting switches 168, 169, 171, 262 and 264 are opened.

As outlined in Part 1, vehicles continually operating the E—W street switch 22A, within 10 seconds after the last operation thereof, repeatedly operate trigger contact members 91n and retain contacts 91c—91d connected for 10 seconds after each operation of a trigger contact member 91n, which retains magnet coil 134a energized and thereby prevents a simple transfer of the "go" signal to the N—S street. Simultaneously with the operation of each trigger contact member 91n, a similar trigger contact member 90n is also operated to connect contacts 90d—90c for 15 seconds after each operation of a trigger contact member 90n. Therefore, as long as the simple transfer of the "go" signal to the N—S street is prevented, and for a period of 5 seconds after such transfer is granted, contacts 90d—90c remain connected. As long as contacts 90d—90c are connected, a circuit is completed for energizing magnet coil 139a, from positive potential P, through contacts 90d—90c, wire 240, disconnecting switch 170, wire 240e, magnet coil 139a to negative potential N. A vehicle operating N—S street switch 22 while traffic is continually operating the E—W street switch 22A, operates relay having magnet coils 148a—149a—150a to bring about a positive transfer of the "go" signal to the N—S street as outlined in Part 2A.

Incident to the operation of the N—S street switch 22, a circuit is completed for energizing magnet coil 144, from positive potential P, through street switch 22, wires 180—219a—246, armature 140a, contact 141a, wires 247—247a, magnet coil 144 to negative potential N. This energization of magnet coil 144 raises armatures 145—145b and completes a circuit for energizing auxiliary magnet coil 143, from positive potential P, through armature 140c, contact 142a, wire 244, contact 146, armature 145, wire 242, electro-magnet 143 to negative potential N. The energization of the auxiliary magnet coil 143 retains armatures 145—145b raised after the magnet coil 144 becomes de-energized. As mentioned in the description of the relay system, armature 145b does not engage contact 147 while it is being raised. Therefore, five seconds after the positive transfer of the "go" signal to the N—S street, contacts 90d—90c disconnect and de-energize magnet coil 139a. The de-energization of magnet coil 139a de-energizes magnet coil 143, thereby causing armatures 145—145b to release. During the movement of armature 145b to its normal released position, it will momentarily connect contact 147 and energize magnet coil 148, from positive potential P, through armature 145b, contact 147, wires 263a—263, contacts 108a—108b, wires 251a—251, magnet coil 148, to negative potential N. This energization of magnet coil 148 raises armatures 151—151b and accordingly registers an operation for the E—W street to bring about a simple transfer of the "go" signal to the E—W street.

I will now assume that a single vehicle operates the N—S street switch 22 within 15 seconds after a single vehicle operated the E—W street switch 22A.

Under these conditions the "go" signal is established on the E—W street as outlined in Part 1, in which case a trigger contact member 91n

energizes magnet coil 150, and raises armatures 151—151b to bring about a simple transfer of the "go" signal to the E—W street, as outlined in Part 1. As further outlined in Part 1, when the "go" signal is transferred to the E—W street, a trigger contact 91n is operated to connect contacts 91c—91d for 10 seconds, which energizes magnet coil 134a to prevent a simple transfer of the "go" signal to the N—S street for at least 10 seconds. Simultaneously with the operation of trigger contact member 91n, a similar trigger contact member 90n is operated to connect contacts 90d—90c for 15 seconds, or for 5 seconds longer than contacts 91c—91d. When the contacts 90d—90c are connected, a circuit is established for energizing magnet coil 144a, from positive potential P, through contacts 90d—90c, wire 240, disconnecting switch 170, wire 258a, disconnecting switch 169, wire 258, armature 151c, contact 155a, wires 265—235a, magnet coil 144a to negative potential N. The energization of magnet coil 144a raises armatures 145a—145c. As mentioned in the description of the relay system, armature 145c in raising does not connect contact 147a, therefore no further operation is effected at this time.

A vehicle operating the N—S street switch 22 within 10 seconds after the above described operations, energizes magnet coil 150a and raises armatures 151a—151c, thereby calling for a transfer of the "go" signal to the N—S street, which is prevented from being immediately transferred to the N—S street by reason of the previous energization of magnet coil 134a in response to the operation of trigger contact member 91n by the vehicle on the E—W street. As soon as armature 151c disconnects contact 155a, the arterial return circuit of magnet coil 144a from contacts 90d—90c is opened, thereby permitting armatures 145a—145c to release. Armature 145c in releasing momentarily connects contact 147a, and completes a circuit for energizing magnet coil 148a. However, since armatures 151a—151c were previously raised in response to an energization of magnet coil 150a, no further operation will occur at this time.

As long as the trigger contact member 90n connects contacts 90d—90c a circuit is completed for energizing magnet coil 139a from positive potential P through contact 90d, trigger contact member 90n, contact 90c, wire 240, disconnecting switch 170, wire 240c, magnet coil 139a, to negative potential N, thereby raising armatures 140a—140c. Therefore, when the N—S street switch 22 was operated, an auxiliary circuit was completed for the energization of magnet coil 144 from positive potential P, through street switch 22, wires 180, 219a and 246, armature 140a, contact 141a, wires 247—247a, magnet coil 144 to negative potential N, thereby raising armatures 145—145b. When armature 145 connects contact 146, a circuit is established for energizing magnet coil 143 to retain armatures 145—145b in their operated positions, the latter circuit being completed from positive potential P through armature 140c, contact 142a, wire 244, contact 146, armature 145, wire 242, magnet coil 143, to negative potential N. As mentioned in the description of the relay system, armature 145b does not connect contact 147 while it is being raised.

10 seconds after the operation of the E—W street switch 22a, trigger contact member 91n disconnects contacts 91c—91d, and thereby de-energizes magnet coil 134a. The de-energization of magnet coil 134a provides a simple trans-

fer of the "go" signal to the N—S street, as outlined in Part 1, by virtue of the previous energization of magnet coil 150a.

As soon as the "go" signal is transferred to the N—S street, magnet coil 134 is energized to prevent a return of the "go" signal to the E—W street, for 10 seconds, and armatures 151a—151c release. When armature 151c releases, it re-connects contact 155a, and thereby re-establishes the arterial return circuit of magnet coil 144a from contacts 90d—90c. Therefore, 5 seconds after the transfer of the "go" signal to the N—S street, contacts 90d—90c disconnect, and de-energize magnet coil 144a, which in turn permits armature 145c to release and momentarily connect contact 147a. Armature 145c connecting contact 147a completes a circuit for energizing magnet coil 148a, which, in turn, raises armatures 151a—151c and operates trigger contact member 93n to retain the "go" signal on the N—S street for 10 seconds after the 15 second contacts 90d—90c disconnect. The disconnection of contacts 90d—90c also de-energizes magnet coil 139a, which, in turn, de-energizes magnet coil 143 and permits armature 145b to release and momentarily connect contact 147. Armature 145b connecting contact 147 completes a circuit for energizing magnet coil 148 from positive potential P through armature 145b, contact 147, wires 263a—263, contacts 108a—108b, wires 251a—251, magnet coil 148 to negative potential N, and thereby raises armatures 151—151b to bring about a vehicle-operated return of the "go" signal to the E—W street, as outlined in Part 4A. Therefore, 10 seconds after the "go" signal is transferred to the N—S street, the trigger contact member 93n disconnects contacts 93d—93c, and provides a return of the "go" signal to the E—W street via the simple method outlined in Part 1, by virtue of the previous energization of magnet coil 148. As soon as the "go" signal is returned to the E—W street, trigger contact member 90n re-connects contacts 90d—90c, and thereby re-energizes magnet coils 139a—144a.

Assuming that no further vehicle operation of either street switch 22 or 22A is effected, contacts 90d—90c will disconnect 15 seconds after the "go" signal is returned to the E—W street, and de-energize magnet coils 139a—144a. The de-energization of magnet coil 139a will produce no further operation as the N—S street switch 22 was not operated during the immediately preceding 15 seconds. However, the de-energization of magnet coil 144a will permit armature 145c to release and momentarily connect contact 147a to bring about the arterial return of the "go" signal to the N—S street.

It will be noted that the arterial return circuit for automatically returning the "go" signal to the N—S street, is completed through armature 151c and contact 155a.

Therefore, for a single operation of the N—S street switch 22 within 15 seconds after the transfer of the "go" signal to the E—W street, the arterial return circuit energizes operating coil 144a after the "go" signal is transferred to the N—S street, and retains the "go" signal on the N—S street for 10 seconds after contacts 90d—90c disconnect. However, when traffic continually operates the N—S street switch 22, the arterial return circuit is retained open. Thus, the vehicle-operated return of the "go" signal, when used in connection with the arterial automatic return, cannot function to transfer the "go" signal to the E—W street until the "go" signal has dis-

played for at least 15 seconds on the arterial street, in the event the N—S and E—W street switches are operated within 15 seconds of each other.

- 5 Since the arterial automatic return of the "go" signal, outlined in Part 4B, is effective only when vehicles cease to use the "go" signal on the E—W street, then it is desirable to have this return effective even though contacts 109a—109b are disconnected. Therefore, disconnect switch 262 is provided to jumper these contacts when the N—S street is made arterial. Similarly, when the E—W street is made arterial, disconnect switch 264 is closed to jumper contacts 108a—108b.

15 *Explanation of contacts 108a—108b and 109a—109b*

- Contacts 108a—108b and 109a—109b are provided to prevent vehicle-operated returns of the "go" signal to one street when traffic continually operates the street switch on an intersecting street.

- In the description of the vehicle-operated automatic return of the "go" signal, outlined in Part 4A, it was stated that disconnecting switches 264 and 262 were left in their normal open positions so that the circuit of magnet coils 148a and 148, respectively, were completed through contacts 108a—108b and 109a—109b.

- 30 In the description embracing the relative settings of the timing mechanism, it was pointed out that the latter mentioned contacts are alternately and repeatedly disconnected, first one pair, followed one minute later by the other pair, and so on cyclically. Taking for example contacts 108a—108b, it will be remembered that these contacts are disconnected when contacts 113—114 are connected, and that the contacts 113—114 are employed in bringing about a positive transfer of the "go" signal to the E—W street, as outlined in Part 2A.

- As described under Part 4A, an operation of the N—S street switch 22, while the contacts 90d—90c are connected, energizes operating coils 143—144 which, in turn, brings about the energization of operating coil 148 to return the "go" signal to the E—W street 10 seconds after the last operation of the N—S street switch 22. It will be obvious, therefore, that continual operation of the N—S street switch 22 will compel the "go" signal to be returned to the E—W street via the positive transfer method, outlined in Part 2A. As soon as the "go" signal is returned to the E—W street, contacts 90d—90c are reconnected, and, since the illustration assumes continual operation of the N—S street switch 22, the vehicle-operated automatic return feature would re-energize magnet coil 148 and provide an unnecessary return of the "go" signal to the E—W street. To eliminate this unnecessary return of the "go" signal, the vehicle-operated automatic return circuit connecting contact 147 and operating coil 148 is opened by the disconnection of contacts 108a—108b. Obviously, therefore, when the vehicle-operated automatic return feature is provided for the E—W street, cams 105 on disk 100b are adjusted to maintain contacts 108a—108b disconnected slightly longer than contacts 90d—90c are connected.

- 70 For the purpose of illustration, I will assume that a single vehicle operates the E—W street switch 22A, while traffic is continually operating the N—S street switch 22.

- As outlined in Part 1, continual operation of the N—S street switch 22 retains the "go" sig-

nal on the N—S street for 10 seconds after each operation of the street switch. Therefore, transfer of the "go" signal to the E—W street in response to the single operation of the E—W street switch 22A can be accomplished only by the positive transfer method, outlined in Part 2A.

Each operation of the N—S street switch 22, as previously mentioned, operates the mechanism to retain the "go" signal on the N—S street for 10 seconds after each operation. With the "go" signal on the N—S street, and a vehicle operates E—W street switch 22A, magnet coil 150 is energized to call for a transfer of the "go" signal to the E—W street. As outlined in Part 2A when contacts 113—114 are subsequently connected, magnet coil 133a is energized to discontinue operation of the mechanism in response to operation of the N—S street switch 22. Therefore, as soon as the contacts 93d—93c disconnect, magnet coil 134 is de-energized, and the "go" signal is transferred to the E—W street. As outlined in Part 4A, contacts 90d—90c remain connected for 15 seconds after the "go" signal is transferred to the E—W street, which completes a circuit for energizing magnet coil 139a.

Since the illustration is assuming that traffic is continually operating the N—S street switch 22, the next operation of the N—S street switch 22, after the magnet coil 139a is energized, will complete the vehicle-operated return circuit via wires 219a—246, and bring about the energization of magnet coils 143—144. 15 seconds after the "go" signal is transferred to the E—W street, contacts 90d—90c disconnect and de-energize magnet coil 139a, which, in turn, de-energizes magnet coil 143 to permit armature 145b to release, and momentarily engage contact 147. However, since the "go" signal was transferred to the E—W street via the positive method outlined in Part 2A, contacts 108a—108b are disconnected, which prevents an energization of magnet coil 148 to bring about a vehicle-operated return of the "go" signal to the E—W street.

Thus, a vehicle operated return of the "go" signal to the E—W street is prevented when traffic is continually operating the N—S street switch 22.

Referring to the forepart of Part 4A, it will be observed that the purpose of the vehicle-operated return of the "go" signal is to prevent a slow moving vehicle from being trapped between the E—W street switch 22A and the intersection, when a vehicle operates the N—S street switch 22 within 15 seconds after the operation of the E—W street switch 22A. Obviously, in the foregoing illustration, the E—W vehicle, because of continual operation of the N—S street switch 22, had sufficient time to approach the intersection before it received its 10 second display of the "go" signal. Dependent upon the relative time of operation of the E—W street switch 22A, with respect to the engagement of contacts 113—114, the E—W vehicle may have considerable time before the positive transfer of the "go" signal outlined in Part 2A can occur.

Therefore, to illustrate the operation of the vehicle-operated return under another condition, it will be assumed that the E—W street switch 22A is operated while the contacts 113—114 are connected.

Under this condition, the "go" signal is immediately transferred to the E—W street via the positive method outlined in Part 2A, since

the contacts 113—114 are connected. As soon as the "go" signal is transferred to the E—W street, contacts 90d—90c engage, and, since the illustration is assuming continual operation of the N—S street switch 22, the next operation of the N—S street switch 22 will bring about the energization of magnet coils 143—144.

As hereinbefore mentioned, contacts 108a—108b remain disconnected slightly longer than contacts 90d—90c remain connected. Therefore, since the E—W street switch 22A was operated while the contacts 108a—108b were disconnected, the latter contacts will reconnect before contacts 90d—90c disconnect. Thus, when contacts 90d—90c disconnect, magnet coil 143 will be de-energized, and permit armature 145b to momentarily engage contact 147. Contacts 108a—108b being closed at this time, magnet coil 148 will be energized to provide a vehicle-operated return of the "go" signal to the E—W street, which will not occur until contacts 113—114 are subsequently connected.

When contacts 113—114 subsequently connect to permit the vehicle-operated return of the "go" signal to the E—W street, the contacts 90d—90c will disconnect before contacts 108a—108b are reconnected, thereby preventing an unnecessary repeated return of the "go" signal to the E—W street.

In the foregoing illustrations, the operation of the vehicle-operated return for the E—W street was discussed, and it is to be understood that a similar relation of contacts 109a—109b and 92d—92c will exist when disconnect switch 171 is closed to provide the vehicle-operated return feature for the N—S street.

PART 5

Warning signal

In the usual form of traffic signal system that normally alternately and repeatedly displays a "go" signal to one thoroughfare and then to another, it is customary to display a warning signal for a short time before each transfer of the "go" signal. In systems of this type the constant use of a warning signal is necessary, since the "go" signal is operated independently of traffic. Therefore, no distinction is made between a "go" signal transfer in the presence of traffic over that in the absence of traffic. Thus, when the "go" signal is subjected to control by vehicles using the intersection, it is not necessary to display the warning signal before each transfer of the "go" signal, but only when the "go" signal is transferred in such a manner that it interrupts a continuous stream of traffic.

In my invention separate and distinct methods of transferring the "go" signal are employed, which differentiate between a transfer of the "go" signal from a street on which there is no traffic, and a transfer from a street on which there is a continuous stream of traffic. In describing the operation of my invention, I conveniently designated the transfer of the "go" signal from a continuous stream of traffic, as a positive transfer of the "go" signal, which was described in detail in Part 2. Thus, in the operation of my invention, I have provided that the warning signal will be displayed only when the "go" signal is transferred by the positive method.

For the purpose of illustration, I will assume that a continuous stream of traffic is retaining the "go" signal on the E—W street, and that a single vehicle approaches on the N—S street.

Under these conditions of traffic, the "go" sig-

nal will be operated in exact accordance with the operation outlined in Part 2A. In this plan of operating the "go" signal, the electro-magnet 96 operates a trigger contact member 96n and causes the contacts 96d—96c to be connected for a time longer than contacts 91c—91d. With continuously moving traffic on the E—W street, timing member 91 is repeatedly operated. Therefore, the operation of electro-magnet 96, to interrupt the operation of timing member 91, will result in the final timing of member 91, beginning substantially at the same time the electro-magnet 96 operates timing member 96N. As previously described, each trigger member 96k is provided with a contact member 96s that is adapted to connect contacts 96t—96T for a definite time before the trigger 96k is restored to normal by its hooked cam 96o. Thus, under the above conditions of operation, contacts 96t—96T are connected by contact member 96s for a definite time before hooked cam 91o causes trigger contact member 96n to disconnect contacts 91c—91d.

It will be noted that, when the contacts 91c—91d are connected, the magnet coil 134a is energized, thereby holding its armature 135c in engagement with contact 137a. Therefore, when the contact member 96s causes contacts 96t—96T to connect, a circuit is completed for energizing magnet coil 164 of the warning signal control relay, from positive potential P, through armature 135c, contact 173a, wire 227, contacts 96t—96T, wires 226—223, magnet coil 164 to negative potential N. This energization of magnet coil 164 raises armature 165, which completes the circuit of warning signal 21, from positive potential P, through armature 165, contact 166, wire 225, warning signal 21 to negative potential N.

As soon as the contacts 91c—91d are disconnected, the magnet coil 134a is de-energized, thereby causing armature 135c to open the circuit of magnet coil 164 of the warning signal control relay. Thereafter the "go" signal will be immediately transferred to the N—S street, and contacts 96d—96c disconnected, as described in Part 2A.

It will be observed that should the last operation of E—W street switch 22A be completed somewhat before the N—S vehicle causes the electro-magnet 96 to function, the contacts 91c—91d will de-energize electro-magnet 134a before contact 96s has left contact 96t. Therefore, the circuit of the warning signal will be energized for a shorter time than that described previously in Part 5.

Obviously, therefore, the warning signal will display for a fixed time only when the trigger contact members 91n and 96n begin their timing at substantially the same instant, while the display of the warning signal for other times will be shortened by the amount of time elapsing between the last operation of a trigger contact member 91n and the subsequent operation of a trigger contact member 96n. Therefore, when the amount of time elapsing between the last operation of timing member 91 and timing member 96N is equal to the normal time of display of the warning signal, no warning signal will be displayed. Obviously the display of a warning signal under these conditions is unnecessary since the last vehicle moving on the E—W street will have sufficient time to pass the intersection before the vehicle on the N—S street reaches the intersection.

From the foregoing it will be apparent that, since my invention is responsive to traffic, its operation will, of necessity, vary with different traffic conditions and different adjustments of the controlling mechanisms. Therefore, having thus described the fundamental operation of my invention, I will now give specific illustrations of its operations under various conditions of traffic and adjustments.

CONNECTION 1

Referring to Fig. 14 of the drawings, I will assume that switches 172 and 173 in the cabs of E—W and N—S street cars are not operated, and that cam 100d on disk 100b is not used. I will also assume that disconnecting switches 170, 171, 168, 169, 262 and 264 are opened, so as not to provide any automatic return of the "go" signal for either street.

With these adjustments of the mechanism, the "go" signal will remain on the street to which it is last actuated, and, as shown in Fig. 14, the "go" signal is now on the N—S street. Assuming that no vehicles have operated the street switches for some time, the following illustrations outline the specific operation of my invention under certain conditions of traffic. It is to be understood, however, that many other conditions of traffic may prevail other than those specifically outlined. Therefore, the operation of my invention is not to be regarded as applicable only to the particular illustrations provided hereinafter.

Illustration I

Single vehicle approaching on N—S street:

The approaching vehicle operates N—S street switch 22, and, via contacts 152a and 136a, brings about an energization of electro-magnet 79. This in turn operates a trigger contact member 93n and energizes magnet coil 134, thereby preventing a transfer of the "go" signal to the E—W street for 10 seconds, as outlined in Part 1. Therefore, the "go" signal remains on the N—S street for at least 10 seconds longer, and the vehicle, if traveling at the usual rate of speed, is assured the right-of-way for a time sufficient to permit its passage through the intersection.

Illustration II

Single vehicle approaching on N—S street, followed within 10 seconds by another vehicle on N—S street:

If, in the preceding illustration, a following vehicle operates N—S street switch 22 within 10 seconds of the preceding operation, the same operations are repeated, and another trigger contact member 93n is operated to maintain magnet coil 134 energized, and to thereby further prevent a transfer of the "go" signal to the E—W street for 10 seconds after the last operation, as outlined in Part 1. Therefore, the "go" signal remains on the N—S street for at least 10 seconds after the last operation of street switch 22 to assure the last vehicle, if traveling at the usual rate of speed, the right-of-way for a time sufficient to permit its passage through the intersection.

Illustration III

Single vehicle approaching on N—S street, followed within 10 seconds by a single vehicle on the E—W street:

The approaching vehicle operates N—S street switch 22 and produces the same operations outlined in Illustration I. A vehicle operating the

E—W street switch 22A within 10 seconds after the last operation of N—S street switch 22 energizes magnet coils 150—149 and calls for the "go" signal, which is prevented from being immediately transferred to the E—W street by reason of the previous energization of magnet coil 134.

Therefore, 10 seconds after the last operation of the N—S street switch 22, magnet coil 134 is de-energized, and, via contacts 136 and 152, electromagnet 68 is energized moving bar 63 to the left. This in turn causes the "go" signal to be transferred to the E—W street, and also operates a trigger contact member 91n for energizing magnet coil 134a, to prevent a transfer of the "go" signal to the N—S street for 10 seconds, as outlined in Part 1.

Thus a single vehicle operating on the street having the "go" signal followed within 10 seconds by a single vehicle on another street, will cause the "go" signal to be retained for 10 seconds on the first street and then be transferred to the second street for at least 10 seconds, after which the "go" signal will remain on the second street awaiting further operation by vehicles on either street.

Illustration IV

Single vehicle approaching on N—S street, followed after 10 seconds by a single vehicle on the E—W street:

In the preceding illustration, the E—W street switch 22A was operated within 10 seconds after the last operation of the N—S street switch 22. Therefore, the E—W vehicle was required to wait until magnet coil 134 was de-energized before the "go" signal was transferred to the E—W street. It can be seen, however, that if the E—W street switch 22A is operated after the 10 second period expires, the "go" signal will immediately transfer to the E—W street.

Thus, a vehicle operating a street switch on a street not having the "go" signal more than 10 seconds after the last operation of the street switch on the street having the "go" signal, will cause the "go" signal to be immediately transferred to the street not having same for at least 10 seconds, after which it will remain on the last mentioned street awaiting further operation by vehicles on either street.

Illustration V

Single vehicle approaching on E—W street:

The approaching vehicle operates E—W street switch 22A, and, via contacts 152 and 136, brings about an energization of electro-magnet 68, moving bar 63 to the left. This in turn causes the "go" signal to be immediately transferred to the E—W street, and also operates a trigger contact member 91n for energizing magnet coil 134a, to prevent a transfer of the "go" signal to the N—S street for at least 10 seconds, as outlined in Part 1. Therefore, the "go" signal is immediately transferred to the E—W street for at least 10 seconds to permit an uninterrupted movement of the E—W vehicle through the intersection, after which the "go" signal will remain on the E—W street awaiting further operation by vehicles on either street.

Illustration VI

Vehicles simultaneously approaching on both the N—S and E—W streets:

In illustrations I and V, a simple operation of the "go" signal was outlined for both the N—S and E—W streets, and it will be apparent that,

if the street switches 22 and 22A are simultaneously operated, the circuits via contacts 152a—136a and 152—136 are likewise simultaneously closed. Since connection 1 is assuming that the "go" signal is on the N—S street, examination of Fig. 14 will show that the above simultaneous operations will result in magnet coils 128a and 128 being energized at the same time. As these magnet coils are substantially equal in power, the plunger armature 129 will not move to either of its operated positions unless some means is provided to unbalance this condition. In this respect further inspection of Fig. 14 will show that when the bar 57 is moved to the right to cause the "go" signal to be displayed to the N—S street, contacts 57d—60 are connected to place magnet coil 127a in multiple with magnet coil 128a. Therefore, with the "go" signal on the N—S street, the plunger armature 129 will move to the right, by reason of the greater power provided by magnet coils 127a—128a, and cause the "go" signal to be retained for at least 10 seconds on the N—S street.

According to Illustration III, when the "go" signal is held on the N—S street, the magnet coil 134 is energized, which prevents a transfer of the "go" signal to the E—W street for 10 seconds after the last operation of N—S street switch 22. Therefore, 10 seconds after the last operation of the N—S street switch 22, magnet coil 134 is de-energized, and this permits a simple transfer of the "go" signal to the E—W street as outlined in Part 1.

Thus, the effect of vehicles simultaneously operating street switches on intersecting streets is to retain the "go" signal for 10 seconds on the street to which it was previously displaying, and to transfer the "go" signal to the waiting vehicle on the other street 10 seconds after the last operation of the street switch on the street on which it was retained, after which the "go" signal will remain on the said other street awaiting further operation by vehicles on either street.

Illustration VII

Continuous traffic on the N—S street with no traffic on the E—W street:

In Illustration II it was pointed out that a vehicle following a preceding vehicle, on the street having the "go" signal, will operate to hold the "go" signal for 10 seconds after the last operation. Therefore, it is obvious that a continuous stream of traffic operating N—S street switch 22, each following within 10 seconds of a preceding operation, will cause the "go" signal to remain on the N—S street as long as the continuous condition of traffic exists, and as long as no vehicle operates on an intersecting street.

Illustration VIII

Continuous traffic on N—S street with single vehicle on E—W street:

As outlined in the preceding illustration, a continuous flow of traffic on the N—S street will operate to hold the "go" signal continuously on the N—S street.

A vehicle operating the E—W street switch 22A, however, energizes magnet coils 150—149, and calls for the "go" signal, which is prevented from being immediately transferred to the E—W street by reason of the previous energization of magnet coil 134.

It will be recalled that contacts 113—114 are connected for definite intervals every two minutes regardless of traffic conditions. Therefore, when the magnet coil 134 is energized to prevent

a simple transfer of the "go" signal to the E—W street, and when contacts 113—114 are connected, a circuit is completed via contacts 153 and 138 for causing an automatic positive transfer of the "go" signal to the E—W street, as outlined in Part 2A.

Thus a single vehicle on the E—W street causes the "go" signal to be taken from a continuous stream of traffic on the N—S street. Accordingly the warning signal 21 is displayed prior to the transfer of the "go" signal, as outlined in Part 5. Ten seconds after the operation of the E—W street switch 22A, the "go" signal will transfer to the N—S street by reason of a subsequent operation of the N—S street switch 22, effected by reason of the continuous stream of traffic thereon.

Thus the effect of a single vehicle approaching on an intersecting street, when the "go" signal is being retained on another by a continuous stream of traffic, is to cause a positive transfer of the "go" signal to the waiting vehicle, preceded by a display of a warning signal, and to transfer the "go" signal in 10 seconds to the street from which it was taken.

Illustration IX

Continuous traffic on both N—S and E—W streets:

In the preceding illustration it was assumed that continuous traffic was on the N—S street and only a single vehicle on the E—W street. It will be apparent, however, that in the event continuous traffic operates on the E—W street, the "go" signal will also be retained on the E—W street, as outlined in Part 1. Therefore it will be necessary to return the "go" signal to the N—S street, via the positive method outlined in Part 2A, when contacts 109—110 are connected. Thus the effect of continuous traffic operating on both the N—S and E—W streets is to cause the "go" signal to be alternately and repeatedly transferred from one street to the other, as determined by the alternate and repeated operation of contacts 113—114 and 109—110, and further to accompany each transfer of the "go" signal with a short display of a warning signal.

Illustration X

Single vehicle on N—S street followed within 10 seconds by a single vehicle on the E—W street, while the contacts 113—114 are closed:

Inspection of Fig. 14 and Illustrations III and VIII will reveal that the "go" signal, under such conditions, will be transferred to the E—W street within 10 seconds after the last operation of the N—S street switch 22 via the positive method outlined in Part 2A.

It will be further evident that since the "go" signal is transferred via the positive method, the warning signal will be displayed shortly before the transfer of the "go" signal to the E—W street, and that the time of display of the warning signal will depend upon the time elapsing between the operation of N—S street switch 22 and the subsequent operation of the E—W street switch 22A, as outlined in the description of the warning signal in Part 5.

CONNECTION 2

The operations described in Illustrations I to X permitted the "go" signal to remain on the street to which it was last actuated when traffic ceased to operate on either street.

It can be readily seen, from an inspection of Fig. 14, that the "go" signal will always return

to the N—S street, as outlined in Part 4B, by making the following adjustments:

Open disconnecting switches 171—168—264;
Close disconnecting switches 170—169—262;

5 and

Omit cam 100d carried by disk 100b.

Under this system of connections it is important to note that the vehicle-operated automatic return of the "go" signal, as outlined in Part 4A, is provided for the E—W street only.

CONNECTION 3

It can be readily seen, by inspection of Fig. 14, that the conditions described for the N—S and E—W streets will be interchanged and the "go" signal will always return to the E—W street by making the following adjustments:

Open disconnecting switches 170—169—262;
Close disconnecting switches 171—168—264;

20 and

Omit cam 100d carried by disk 100b.

Under this system of connections it is important to note that the vehicle-operated automatic return of the "go" signal, as outlined in Part 4A, is provided for the N—S street only.

CONNECTION 4

Referring to Fig. 14 of the drawings, it will be seen that with the adjustments made exactly as in Connection 1, except that cam 100d carried by disk 100b is used, the "go" signal is alternately given to each street, and remains on each street for 1 minute if no vehicles operate on either street, as outlined in Part 3. If, on the other hand, vehicles operate only on the street not receiving the "go" signal, then the time the "go" signal is given to the other street will be reduced to any period between 1 minute and 10 seconds. In this case the reduction made in the "go" signal on the one street is added to the time the "go" signal is given to the other street in that particular cycle. Assuming that the "go" signal is on the N—S street, it will be obvious that each of the Illustrations I to VI, VIII, IX and X are applicable to connection 4. It is important to note that, with continuous traffic on each street, as described in Illustration X, the time of display of the "go" signal is the same as the normal cyclic operation described in Illustration XI.

Illustration XI

No traffic on either the N—S or E—W streets and using cam 100d carried by disk 100b:

Inspection of Fig. 14 will reveal that the use of cam 100d will cause contacts 116—117 and 122—123 to alternately and repeatedly energize magnet coils 150—149 and 150a—149a, first one, then the other 1 minute later, and so on cyclically, as outlined in Part 3, therefore simulating actuation of street switches 22 and 22A at fixed times.

Thus, in the absence of vehicular traffic on either street, the "go" signal is alternately and repeatedly given first to one street for 1 minute, then to the other for 1 minute, and so on cyclically.

Illustration XII

Continuous traffic of N—S street with no traffic on the E—W street and using cam 100d carried by disk 100b:

With continuous traffic on the N—S street, the contacts 116—117 will close and energize magnet coils 150—149 to bring about a transfer of the "go" signal to the E—W street. Referring to Fig. 14 and Illustration VIII, it will be obvious that the conditions are similar, and that the "go" signal

under such circumstances will be given to the N—S street for 1 minute and 50 seconds, and to the E—W street for 10 seconds.

Illustration XIII

Continuous traffic on both N—S and E—W streets and using cam 100d:

In the preceding illustration it was assumed that continuous traffic was on the N—S street with no traffic on the E—W street. It will be apparent, however, that in the event continuous traffic also operates on the E—W street, the "go" signal will also be retained on the E—W street, as outlined in Part 1. Therefore, it will be necessary to transfer the "go" signal to the N—S street, via the positive method outlined in Part 2A, when contacts 109—110 are connected. Therefore the effect of continuous traffic operating on both the N—S and E—W streets is to cause the "go" signal to be alternately and repeatedly transferred from one street to the other, as determined by the alternate and repeated operation of contacts 113—114 and 109—110, and further to accompany each transfer of the "go" signal with a short display of a warning signal.

With continuous traffic on both the N—S and E—W streets the magnet coils 150—149 and 150a—149a are repeatedly energized, therefore the operation of contacts 116—117 and 122—123 will not modify the operation of the "go" signal.

Thus, under these conditions, the "go" signal will be alternately and repeatedly displayed, first to the N—S street for 1 minute, and then to the E—W street for 1 minute, and so on cyclically. Referring to Illustration IX, it will be noted that the conditions are similar and that the display of the "go" signal is identical.

Illustration XIV

Single vehicle on N—S street within 10 seconds after "go" signal is operated to the E—W street by cam 100d:

As outlined in Illustration XI, the use of cam 100d will, by virtue of operation of contacts 116—117 and 122—123, cause the "go" signal to be alternately and repeatedly given first to one street for 1 minute, then to the other for 1 minute, and so on cyclically, in the absence of vehicular traffic on either street.

I will assume that cam 100d has just operated contacts 116—117 to bring about a transfer of the "go" signal to the E—W street, as outlined in Part 3, and that a single vehicle approaches on the N—S street within 10 seconds after the "go" signal is transferred to the E—W street.

The approaching vehicle operates N—S street switch 22 and energizes magnet coils 150a—149a, thereby calling for a transfer of the "go" signal to the N—S street, which is prevented from being immediately transferred to the N—S street by reason of the previous energization of magnet coil 134a in response to the operation of trigger contact member 81n.

Therefore, 10 seconds after the transfer of the "go" signal to the E—W street, magnet coil 134a is de-energized, and, via contacts 136a and 152a, electro-magnet 79 is energized to cause the "go" signal to be transferred to the N—S street and to operate a trigger contact member 93n for energizing magnet coil 134 so as to prevent a subsequent transfer of the "go" signal to the E—W street for 10 seconds, as outlined in Part 1.

Therefore the "go" signal, which was taken from the N—S street and transferred to the E—W street by virtue of an operation of con-

tacts 116—117 by cam 100d, was transferred in 10 seconds to the N—S street by reason of a vehicle approaching on the N—S street within 10 seconds after the "go" signal was operated to the E—W street by cam 100d.

Thus, under these conditions, the "go" signal will be given to the E—W street for 10 seconds, and to the N—S street for 1 minute and 50 seconds.

Illustration XV

Single vehicle on N—S street within 10 seconds after "go" signal is operated to the E—W street by cam 100d and followed within 10 seconds by a vehicle on the E—W street:

In the preceding illustration it was assumed that a single vehicle operated the N—S street switch 22 within 10 seconds after the "go" signal was transferred to the E—W street by reason of cam 100d operating contacts 116—117, whereupon the "go" signal was displayed for 10 seconds on the E—W street and 1 minute and 50 seconds on the N—S street.

I will now assume that a vehicle approaches on the E—W street and operates street switch 22A within 10 seconds after the "go" signal was transferred to the N—S street by reason of the operation of the N—S street switch 22.

The operation of the E—W street switch 22A energizes magnet coils 150—149, and thereby calls for a transfer of the "go" signal to the E—W street, which is prevented from being immediately transferred to the E—W street by reason of the previous energization of magnet coil 134 in response to the operation of trigger contact member 91n by the vehicle on the N—S street.

Therefore, 10 seconds after the transfer of the "go" signal to the N—S street, magnet coil 134 is de-energized, and, via contacts 136 and 152, electro-magnet 79 is energized to transfer the "go" signal to the E—W street and to operate a trigger contact member 91n for energizing magnet coil 134a so as to prevent a subsequent transfer of the "go" signal to the N—S street for 10 seconds, as outlined in Part 1.

Thus, under these conditions, the "go" signal will be given to the E—W street for 10 seconds by virtue of an operation of contacts 116—117, and to the N—S street for 10 seconds by virtue of an operation of N—S street switch 22, and then transferred to E—W street for 40 seconds by virtue of an operation of the E—W street switch 22A, whereupon contacts 122—123 will be operated by cam 100d to cause the "go" signal to be given to the N—S street for 1 minute.

Illustration XVI

Single vehicle on N—S street within 10 seconds after "go" signal is transferred to the E—W street by cam 100d, followed within 10 seconds by a vehicle on the E—W street, and then followed by a second vehicle on the N—S street within 10 seconds after the "go" signal is operated to the E—W street in response to an operation by the E—W vehicle:

In the preceding illustration it was assumed that a single vehicle operated the N—S street switch 22 within 10 seconds after the "go" signal was transferred to the E—W street by reason of cam 100d operating contacts 116—117, and that a single vehicle operated the E—W street switch 22A within 10 seconds after the "go" signal was transferred to the N—S street by reason of the vehicle operating the N—S street switch 22A, whereupon the "go" signal was displayed for 10

seconds on the E—W street, then for 10 seconds on the N—S street, then for 40 seconds on the E—W street, and then subsequently transferred to the N—S street for 1 minute by virtue of an operation of contacts 122—123 by cam 100d.

I will now assume that a second vehicle approaches on the N—S street and operates street switch 22 within 10 seconds after the "go" signal was transferred to the E—W street by reason of the operation of the E—W street switch 22A.

The second operation of the N—S street switch 22 energizes magnet coils 150a—149a, and thereby calls for a transfer of the "go" signal to the N—S street, which is prevented from being immediately transferred to the N—S street by reason of the previous energization of magnet coil 134a in response to the operation of trigger contact member 91n by the vehicle on the E—W street.

Therefore, 10 seconds after the transfer of the "go" signal to the E—W street, magnet coil 134a is de-energized, and, via contacts 136a and 152a, electro-magnet 79 is energized to transfer the "go" signal to the N—S street and to operate a trigger contact member 93n for energizing magnet coil 134 so as to prevent a subsequent transfer of the "go" signal to the E—W street for 10 seconds, as outlined in Part 1.

Thus, under these conditions, the "go" signal will be given to the E—W street for 10 seconds by virtue of an operation of contacts 116—117, then to the N—S street for 10 seconds by virtue of the first operation of N—S street switch 22, then to the E—W street for 10 seconds by virtue of the operation of the E—W street switch 22A, and then to N—S street for 1 minute and 30 seconds by virtue of the second operation of the N—S street switch 22A. It will be noted that the subsequent operation of contacts 122—123 by cam 100d will not change the display of the "go" signal since the "go" signal was left displaying to the N—S street. Therefore, in the absence of further vehicle operation on either street, the subsequent operation of contacts 116—117 by cam 100d will begin the normal cyclic operation as outlined in Illustration XI.

CONNECTION 5

The operations described in Illustrations III, IV, VI, VIII, XIV, XV and XVI permitted the "go" signal to remain on the street to which it was last actuated at the expiration of 10 seconds after the last operation thereof.

It can be seen from an inspection of Fig. 14, that the "go" signal will return to the N—S street, as outlined in Part 4A, when the "go" signal is transferred to the E—W street by an energization of magnet coil 150 within 15 seconds after the last operation of electro-magnet 79 to set or retain the "go" signal on the N—S street, by making the following adjustments:

Open disconnecting switches 168—169—170—262 and 264; and close disconnecting switch 171

Under this system of connections it is important to note that the "go" signal will not return to N—S street when the "go" signal is transferred to the E—W street by an energization of magnet coil 150 more than 15 seconds after the last operation of electro-magnet 79. It is also important to note that the "go" signal will not return to the N—S street via the vehicle operated return of the "go" signal, outlined in Part 4A, when the contacts 109a—109b are disconnected. In this respect attention is directed to the de-

scription entitled "Explanation of contacts 108a-108b and 109a-109b."

CONNECTION 6

It can be seen, by inspection of Fig. 14, that the conditions described for the N-S and E-W streets will be interchanged and the "go" signal will return to the E-W street, as outlined in Part 4A, when the "go" signal is transferred to the N-S street by an energization of magnet coil 150a within 15 seconds after the last operation of electro-magnet 68 to set or retain the "go" signal on the E-W street, by making the following adjustments:

Open disconnecting switches 168-169-171-262 and 264; and close disconnecting switch 170

Under this system of connections it is important to note that the "go" signal will not return to the E-W street when the "go" signal is transferred to the N-S street by an energization of magnet coil 150a more than 15 seconds after the last operation of electro-magnet 68. It is also important to note that the "go" signal will not return to the E-W street via the vehicle operated return of the "go" signal, outlined in Part 4A, when contacts 108a-108b are disconnected. In this respect attention is directed to the description entitled "Explanation of contacts 108a-108b and 109a-109b."

CONNECTION 7

Referring to Fig. 14 it will be obvious, when a street car switch 172 or 173 is operated in any one of the plans of operation described under the above headings, Connections 1 to 6, that the "go" signal may be operated by either the simple method outlined in Part 1 or the manual positive transfer method outlined in Part 2B.

For the purpose of illustration, I will assume that a street car on the N-S street is equipped with a switch 173 that is arranged to be operated by the motorman of the car to ground wires 253 and 256 via contact member B6 and contact segments B3, B4 and B5.

Referring to Figs. 13 and 15 it will be recalled that contact segment B3 on the N-S street is preferably located a distance substantially equal to the distance that the N-S street switch 22 is spaced from the intersection; contact segment B4 on the N-S street is located at a point substantially midway of contact segment B3 and the usual stopping point of the N-S street car; while contact segment B5 on the N-S street is located so that the contact member B6, carried by the trolley pole B1 of the N-S street car, is in engagement therewith while the N-S street car is at its usual stopping point. Thus, I have arranged my invention so that the motorman of a N-S street car may change the "go" signal either to the N-S street on which his car is traveling or to the intersecting street E-W, without leaving the cab of the car. Therefore, if the motorman does not intend to stop his car, he can change the signal while contact member B6 is engaging contact segment B3, so that the car may pass the intersection uninterrupted. If he does intend to make a stop, he can change the signal while contact member B6 is engaging segment B4 to give intersecting traffic the right to proceed, and thereby obviate unnecessary delay to cross traffic. In order that the street car may be given the "go" signal so that it may pass the intersection immediately after loading, the motorman can

also change the signal while the member B6 engages contact segment B5.

On the N-S street, contact segments B3 and B5 are connected to wire 253, while segment B4 is connected to wire 256. On the E-W street, segments B3 and B5 are connected to wire 256, while segment B4 is connected to wire 253.

In Fig. 14, the trolley wire B2, contact member B6 and contact segments B3-B4-B5 are not shown, but the manual controls for street cars on both the E-W and N-S streets are symbolically represented by switches 172 and 173, respectively. Since the contact segment B3 is permanently connected to contact segment B5, the contact segment B3 is not represented in Fig. 14.

To simplify the illustrations, I will assume that no vehicles are operating the street switches 22 and 22A.

Illustration XVII

Street car on N-S street not to stop at intersection with the "go" signal on N-S street:

Since the "go" signal is on the N-S street, it will not be necessary for the motorman to cause a transfer of the "go" signal to the N-S street. It is necessary, however, that the motorman operate the signal to prevent its transfer to the E-W street for 10 seconds. Thus when the contact member B6 engages the contact segment B3, the motorman will cause wire 253 to be grounded via switch 173, and thereby cause magnet coil 156a to be energized and bring about the operation of electro-magnet 68 and the energization of magnet coil 134a, as outlined in Part 2B.

Illustration XVIII

Street car on N-S street not to stop at intersection with "go" signal on E-W street:

With the "go" signal on the E-W street, it will be necessary for the motorman to cause the signal to be transferred to the N-S street. Thus when the contact member B6 engages contact segment B3, the motorman will cause wire 253 to be grounded via switch 173, and thereby cause the magnet coil 156a to be energized and bring about the operation of electro-magnet 68 to shift bar 57 and the energization of magnet coil 134a, as outlined in Part 2B.

Illustration XIX

Street car on N-S street makes stop, then changes signal and immediately crosses intersection:

With the "go" signal on the E-W street, the motorman does not operate switch 173 while contact member B6 engages either contact segment B3 or B4. After discharging and loading passengers, the motorman operates switch 173 and grounds wire 253 via contact device B5. This energizes magnet coil 156a and brings about the operation of electro-magnet 68 and magnet coil 134a, as outlined in Part 2B.

With the "go" signal on the N-S street, the motorman will, however, operate switch 173 while contact member B6 engages contact segment B4 to energize magnet coil 156, and thereby bring about the transfer of the "go" signal to the E-W street so as to avoid any unnecessary delay to the E-W traffic while the street car on the N-S street is loading passengers.

In each of the preceding illustrations XVII, XVIII and XIX, it is obvious that a following street car on the N-S street or an approaching street car on the E-W street may also cause the "go" signal to be operated as outlined in any of

the preceding illustrations. It is important to note, however, that a street car will always receive a "go" signal within 10 seconds after calling for same when traffic is continuously operating on an intersecting street, and the street car will not be required to wait until the contacts 113—114 or 109—110 connect. As described in detail in Part 2B, this feature is made possible through the connection of contacts 319—320 and 321—322 when magnet coil 156 or 156a, respectively, is energized. It is also to be understood that, whenever a motorman of a street car causes the signal to be transferred through the operation of electromagnets 95 or 96, the warning light will be displayed as outlined in Part 5.

Having thus described my invention, I claim:

1. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, one of said thoroughfares having a car track thereon, said signal having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in each thoroughfare; means, actuated by operation of each of said devices, to set said signal to permit traffic to proceed on its respective thoroughfare; means, disposed in a car operating on said tracks, adapted to be operated by the operator of said car; and means, actuated by operation of the last mentioned means, to change said signal to permit traffic to proceed on either of said thoroughfares.

2. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, one of said thoroughfares having a car track thereon, said signal having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; means, disposed in a car operating on said tracks, adapted to be operated by the operator of said car; and means, actuated by operation of the last mentioned means, to set selectively said signal to permit traffic to proceed on one or the other of said thoroughfares.

3. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a constantly rotating shaft; a vehicle-operated device in each thoroughfare; a member connected to said shaft and placed under tension for rotation thereby; an escapement means for said member permitting intermittent rotation of said member; means, controlled by said rotation of said member, to change said signal alternately; and means, actuated by operation of each of said devices, operating said escapement to change the said signal as aforesaid, to permit traffic to proceed alternately on said thoroughfares.

4. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in each thoroughfare; a constantly rotating member; a pair of conducting rings carried by said member; a series of triggers carried

by said member, each trigger constituting a ring-bridging member for electrically connecting said pair of rings, said trigger being normally held out of engagement with said rings; means, actuated by operation of a vehicle-operated device in one thoroughfare, to set said signal to permit traffic on said one thoroughfare to proceed, said means operating to move one of said triggers to ring-connecting position; means disposed to move said trigger to ring-disconnecting position after a certain amount of rotation of said member; means, actuated by operation of a vehicle-operated device in the other thoroughfare, to set said signal to permit traffic on said other thoroughfare to proceed; and means, operated when said rings are connected, to prevent said signal being set by said last mentioned means.

5. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in each thoroughfare; means, actuated by operation of a vehicle-operated device in one thoroughfare, to display said traffic-directing means to permit traffic on said one thoroughfare to proceed; means, actuated by operation of a vehicle-operated device in a second thoroughfare, to change said traffic-directing means to permit traffic on said second thoroughfare to proceed; and other means, actuated by operation of the vehicle-operated device in said second thoroughfare, to change automatically said traffic-directing means to permit traffic on said one thoroughfare to proceed without further operation of the vehicle-operated device in the said one thoroughfare, said other means being actuated only when the vehicle-operated device in the said second thoroughfare is operated within a predetermined time after the operation of the vehicle-operated device in the said one thoroughfare, and not otherwise.

6. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; vehicle-operated devices in each thoroughfare; a constantly driven shaft; a resiliently mounted member, placed under tension, to be rotated by said shaft; segments carried by said member; a brush engaging said segments; a circuit including said segments and brush; means, controlled by said circuit, adapted to change said signal when said brush engages successive segments; an escapement operable to permit rotation of said member; means, actuated by operation of said vehicle-operated devices, operating said escapement to change the said signal as aforesaid, and means operating to disconnect said shaft and member when the tension on the latter reaches a certain amount, and to re-connect same when said tension decreases to a certain amount.

7. A traffic signal device, having in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; mechanism, oper-

able by traffic on one of said thoroughfares, to set said signal to permit traffic to proceed on said one thoroughfare; mechanism, operable by traffic on the second thoroughfare, to set said signal to permit traffic to proceed on said second thoroughfare; means rendering inoperative the last mentioned mechanism after each operation of the first mentioned mechanism in setting the signal, or while the signal is so set for a definite period of time in which traffic on said one thoroughfare, after so operating said first mentioned mechanism, will have time to pass said intersection before said last mentioned mechanism will be again operative; and other means, operable by traffic on said second thoroughfare, to operate automatically the first mentioned mechanism to set said signal to permit traffic on said one thoroughfare to proceed, said other means operating only when traffic on said second thoroughfare operates within a predetermined time after an operation of said first mentioned mechanism, and not otherwise.

8. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; mechanism, including an electro-magnet, for setting the signal for traffic to proceed on one of said thoroughfares and to restrain traffic on the other; a second mechanism, including an electro-magnet, for setting the signal for traffic to proceed on the last mentioned thoroughfare, and to restrain traffic on the first mentioned thoroughfare; a first electric circuit, including said first electro-magnet, which circuit, when closed, operates the said first mechanism as recited; a similar second electric circuit for the said second electro-magnet; a third electro-magnet and a fourth electro-magnet having a common armature, and acting oppositely thereon; means for closing said first mentioned circuit when said third mentioned electro-magnet attracts said armature; means for closing said second mentioned circuit when said fourth mentioned electro-magnet attracts said armature; a third electric circuit, including said third electro-magnet, which circuit when closed, energizes the said third electro-magnet to attract its armature; a similar fourth electric circuit, for said fourth electro-magnet; means, operated by traffic on said first mentioned thoroughfare, to close said third mentioned circuit; means, operated by traffic on said last mentioned thoroughfare, to close said fourth mentioned circuit; auxiliary means acting to attract said armature in conjunction with said third mentioned electro-magnet when the signal has been last set for traffic to proceed on said first mentioned thoroughfare; and a second auxiliary means acting to attract said armature in conjunction with said fourth mentioned electro-magnet when said signal has last been set for traffic to proceed on said last mentioned thoroughfare.

9. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; mechanism, adapted to be actuated by traffic on one of said thoroughfares, to set said signal to direct traffic to go on said one thoroughfare and to stop on the other; mechanism, adapted to be

actuated by traffic on the other thoroughfare, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; a pair of constantly rotating rings; a bridging member for connecting said rings; an electromagnetic device included in said first mentioned mechanism; means, actuated by said electromagnetic device, to move said bridging member to ring-connecting position; means for moving said bridging member to ring-disconnecting position after a fixed period of time; and means, operated by the connection of said rings to prevent a change of said signal, by said last mentioned mechanism, during said period of time.

10. A traffic signal device, having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in one of said thoroughfares; a pair of contacts; mechanism, actuated by operation of said traffic-operated device, to set said signal to direct traffic to go on said one thoroughfare and to stop on the other thoroughfare, only when said contacts are connected; a traffic-operated device in the other thoroughfare; a second pair of contacts; mechanism actuated by operation of the last mentioned traffic-operated device, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare, only when said second pair of contacts are connected; an electro-magnet for separating said first mentioned pair of contacts; a second electro-magnet for separating said second mentioned pair of contacts; means, operated by actuation of said first mentioned mechanism, to operate said second electro-magnet, and to maintain the same operative to separate said second mentioned pair of contacts for a definite period of time after actuation of said mechanism to set said signal, thus preventing setting of said signal by operation of said second mentioned traffic-operated device during said period; means, operated by actuation of said second mentioned mechanism, to operate said first mentioned electro-magnet, and to maintain the same operative to separate said first mentioned pair of contacts for a definite period of time after actuation of said mechanism to set said signal, thus preventing setting of said signal by operation of said first mentioned traffic-operated device during said latter period; other means, operated by actuation of said first mentioned mechanism, and maintained operated for a definite time after the actuation of said mechanism; and means, actuated by operation of said second mentioned traffic-operated device, to actuate said first mentioned mechanism to reset said signal to direct traffic to go on the first mentioned thoroughfare as recited, only when the said second mentioned traffic-operated device is operated within the time of operation of the said other means.

11. The structure set forth in claim 10, including means, operable after each of the first mentioned periods of time has expired, to discontinue operation of its corresponding magnet to permit the corresponding pair of contacts to engage.

12. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare;

a traffic-operated device in one of said thoroughfares; mechanism, actuated by operation of said traffic-operated device, to set said signal to direct traffic to go on said one thoroughfare and stop on the other; a traffic-operated device in the other thoroughfare; mechanism, actuated by operation of said latter traffic-operated device, to set said signal to direct traffic to go on said other thoroughfare and stop on said one thoroughfare; a constantly driven member; a pair of contacts periodically closed at regular intervals by said constantly driven member and means to actuate the second mentioned mechanism to direct traffic to go on said other thoroughfare, said means operable by the closure of said pair of contacts, only when the second mentioned traffic-operated device, is operated while the first mentioned mechanism is being repeatedly and continuously actuated by operation of the first said traffic-operated device to retain the signal so set to direct traffic to go on said one thoroughfare.

13. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; mechanism, including an electro-magnet, to set said signal to direct traffic to go on one thoroughfare, and to stop on the other; a second mechanism, including an electro-magnet, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; street car tracks on one of said thoroughfares; a first electric circuit including the said first electro-magnet; a second electric circuit including the said second electro-magnet; a contact means carried by a street car running on said tracks; a pair of contacts adapted to be engaged by said contact means; means, connecting one of said pair of contacts to the said first circuit, and the second to the said second circuit; a switch carried in said car; and means, operated by said switch, to energize selectively said circuits, depending upon which of the said contacts is engaged by said contact means, to set the corresponding electro-magnet to operate said signal.

14. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; street car tracks on one of said thoroughfares; mechanism, including an electro-magnet, to set said signal to direct traffic to go on one thoroughfare and to stop on the other; a second mechanism, including an electro-magnet, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; a first electric circuit including the said first electro-magnet; a second electric circuit including the said second electro-magnet; a contact means carried by a street car running on said tracks; a contact spaced a short distance from said intersection, and adapted to be engaged by said contact means; means connecting said contact to the said second circuit; another contact located to be engaged by said contact means while the street car is occupying its usual stopping point at the intersection; a switch carried in said car; and means, operated by said switch, to energize selectively said circuits, depending upon which of the said contacts is en-

gaged by said contact means, to operate the corresponding electro-magnet to set said signal.

15. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; street car tracks on one of said thoroughfares; mechanism, including a first electric circuit, to set said signal to direct traffic to go on one thoroughfare and to stop on the other; a second mechanism, including a second electric circuit, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; two spaced contact members adjacent said car tracks, said electric circuits each including one of said contact members respectively; a contact means carried by a street car running on said tracks adapted to engage said contact members individually; a switch carried in said street car adapted, when closed, to close one of said last mentioned circuits, when said contact means is in engagement with one of said two contact members, to operate one of said mechanisms to set said signal to direct traffic to go on said thoroughfare that said street car is on and to stop on the other thoroughfare; said switch being adapted, when closed, to close the other of said last mentioned circuits, when said contact means is in engagement with the other of said two contact members, to set said signal to direct traffic to go on the thoroughfare other than the one the street car is on and to stop on said latter thoroughfare.

16. The structure set forth in claim 15, including a third contact member adjacent said car tracks on the said one thoroughfare, and adapted to be engaged by the said contact means when the car occupies its usual stopping point at the intersection, said third contact member being connected to the said first electric circuit; said switch adapted, when closed, to close the first mentioned circuit, when the said contact means is in engagement with the third contact member, to set said signal to direct to go on the said thoroughfare that said street car is on and to stop traffic on the other.

17. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a vehicle-operated device in one of said thoroughfares; means, actuated by operation of said vehicle-operated device, to set said signal to direct traffic to go on said one thoroughfare; a vehicle-operated device in the other thoroughfare; means, actuated by operation of the second mentioned vehicle-operated device, to set said signal to direct traffic to go on said other thoroughfare; other means, actuated by operation of the said first mentioned vehicle operated device, when operated by said vehicle and other vehicles continually following said vehicle within a definite period, to prevent said signal being set by operation of the second mentioned vehicle-operated device for a certain period after each actuation of said other means; a contact means; a constantly operating timing device periodically operating said contact means at regular fixed intervals; and electrically operated means, operable by the operation of said contact means, only when the said second mentioned vehicle-

operated device is operated while the said other means is continually actuated, to change said signal to direct traffic to go on the said other thoroughfare.

18. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a vehicle-operated device in one of said thoroughfares; means, actuated by operation of said vehicle-operated device, to set said signal to direct traffic to go on said one thoroughfare; a vehicle-operated device in the other thoroughfare; means, actuated by operation of the second mentioned vehicle-operated device, to set said signal to direct traffic to go on said other thoroughfare; and other means, actuated by the operation of the first mentioned vehicle-operated device, when operated by said vehicle and other vehicles continually following said vehicle within a definite period, to prevent said signal being set by operation of the second mentioned vehicle-operated device for a certain period after each actuation of said other means; a contact means; a constantly operating timing device periodically operating said contact means at regular fixed intervals; and electrically operated means, operable by the operation of said contact means, only when the second mentioned vehicle-operated device is operated while the said other means is continually actuated, to change said signal to direct traffic to go on the said other thoroughfare; and a warning light operated only when the signal is changed in response to the operation of the said electrically operated means.

19. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in one of said thoroughfares; mechanism, actuated by operation of said traffic-operated device, to set said signal to direct traffic to go on said one thoroughfare and to stop on the other; a traffic-operated device in the other thoroughfare; mechanism, actuated by operation of the latter traffic-operated device, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; a constantly operating member; pairs of contacts continually operated by said member, and alternately and repeatedly closed thereby, first one pair, followed a definite fixed period later by the other pair, and so on cyclically; electrically operated means, operated by the closing of one of said pairs of contacts, to actuate said first mentioned mechanism; other electrically operated means, operated by the closing of the other pair of contacts, to actuate said second mentioned mechanism, whereby said mechanisms will also be automatically actuated to set said signal as recited for the traffic actuated devices; and means, operated by said member, permitting only momentary operation of said pairs of contacts, so that said signal can be set by operation of said traffic-operated devices during the said period elapsing between the automatic actuation of said mechanisms.

20. A traffic signaling system for interfering traffic lanes, having right-of-way signal indications; signal-timer means normally cyclically displaying said indications to give the right-of-

way successively to the several lanes; a vehicle-operated device in one of said lanes; control means, actuated by the operation of said device, when the said one lane does not have the right-of-way, to interrupt the normal display of said indications, and to change the display of indications so as to give the right-of-way to said one lane; a vehicle-operated device in another of said lanes; and means, actuated by the operation of the last mentioned device, when the said another lane has the right-of-way, to prevent an interruption in the normal display of said indications by said control means.

21. A street intersection traffic signalling system in which a vehicle operating on one street may take the right-of-way from the other street, including a plurality of right-of-way signal indications, signal-timer means normally cyclically displaying said indications to give the right-of-way alternately to the several streets; control means, carried by said vehicle, adapted to be operated by the operator of said vehicle; and means, actuated by operation of said control means, when the said one street does not have the right-of-way, to interrupt the normal display of said indications, and to change the display of said indication so as to give the right-of way to the said one street.

22. A street intersection traffic signalling system in which a vehicle operating on one street may take the right-of-way from the other street, including a plurality of right-of-way signal indications; signal-timer means normally cyclically displaying said indications to give the right-of-way alternately to the several streets; control means, carried by said vehicle, adapted to be operated by the operator of said vehicle; means, actuated by operation of the said control means, when the said one street does not have the right-of-way, to interrupt the normal display of said indications, and to change the display of said indications so as to give the right-of-way to the said one street; and means, actuated by operation of the said control means, to restore subsequently the normal display of said indications by said timer means.

23. A traffic signaling system for interfering traffic lanes in which a vehicle operating on one traffic lane may take the right-of-way from the other lanes, including a plurality of right-of-way signal indications; signal-timer means normally cyclically displaying said indications to give the right-of-way successively to the several lanes; a vehicle-operated device in the said one traffic lane; control means, actuated by the operation of said device, when the said one lane does not have the right-of-way, to interrupt the normal display of said indications, and to change the display of said indications so as to give the right-of-way to the said one lane; a vehicle-operated device in another of said lanes; and means, actuated by the operation of the last mentioned device, when the said another lane has the right-of-way, to prevent an interruption in the normal display of said indications by said control means for a continuous predetermined time after the operation of said prevention means.

24. In a traffic system for interfering lanes; a right-of-way signal indication; means displaying said indication to each of said lanes for predetermined times for the control of traffic; a vehicle-actuated device in one of said lanes; and means, operable upon actuation of said device, when the said lane does not have the right-of-way, to interrupt the display of the right-of-way

by the first named means, and to transfer the right-of-way to the said one lane.

25. A traffic signaling system for intersecting thoroughfares having, in combination, "stop" and "go" signals adapted to be displayed alternately to said thoroughfares for the control of traffic; switch means operable to alternate the display of said signals; timing means, periodically operating said switch means at regular intervals to alternate repeatedly the display of said signals; a traffic-operated device in each thoroughfare in advance of the intersection; control means, actuated by the operation of a device in the thoroughfare having the "stop" signal at a given instant, to operate said switch means to alternate the display of said signals; and means, actuated by the operation of a device in the thoroughfare having the "go" signal at a given instant, to delay the operation of said switch means by said control means, whereby operation of said switch means by said control means, when the said control means is actuated by the operation of a device in the thoroughfare having a "stop" signal, will be delayed when the device in the thoroughfare having the "go" signal is operated before the signals are alternated.

26. A traffic signaling system for intersecting thoroughfares having, in combination, "stop" and "go" signals; switch means displaying said signals alternately and repeatedly to each of said thoroughfares for predetermined times for the control of traffic; a traffic-operated device in one of said thoroughfares; means, actuated by operation of said device, when the said one lane has the "stop" signal displayed thereto, to interrupt the display of the "stop" signal to the said one lane, and to display the said "go" signal to the said one lane earlier than normally determined by the said switch means; and means operating to restore subsequently the normal operation of the said signals.

27. A traffic signaling device having, in combination, "stop" and "go" signals arranged to be disposed at the intersection of two thoroughfares, and adapted to give the "stop" signal on one thoroughfare at the instant it gives the "go" signal on the intersecting thoroughfare switch means operating to change said signals at regular intervals so that the signals will normally, alternately and repeatedly operate for definite periods on each thoroughfare; traffic-controlled means operable to interrupt the display of the "stop" signal; other traffic-controlled means operable to prevent the interruption of the display of said "stop" signal; and means whereby only traffic approaching the signal in the direction in which the "stop" signal is indicating can interrupt the display of the "stop" signal, and only traffic approaching in the direction in which the "go" signal is indicating can prevent such interruption of said "stop" signal.

28. A traffic signaling system for controlling traffic at the intersection of two thoroughfares; a signal on each thoroughfare including "stop" and "go" indications; timing means normally cyclically displaying said indications, whereby the signal on one thoroughfare changes from "stop" to "go" and then back to "stop", while the signal on the other thoroughfare changes from "go" to "stop" and then back to "go," and means, operative in response to the approach of a vehicle on one of said thoroughfares, when the "go" indication is displaying on the other thoroughfare, to interrupt the normal display of said "go" indication on said other thoroughfare, and to

display the "go" indication on the thoroughfare on which the vehicle is operating.

29. A traffic signaling system for controlling traffic at the intersection of two thoroughfares; a signal on each thoroughfare including "stop" and "go" indications; timing means normally cyclically displaying said indications, whereby the signal on one thoroughfare changes from "stop" to "go" and then back to "stop," while the signal on the other thoroughfare changes from "go" to "stop" and then back to "go," and means, operative in response to the approach of a vehicle on one thoroughfare, when the "go" indication is displaying on the other thoroughfare, to interrupt the normal display of said indications, and to display the "go" indication on the thoroughfare on which the vehicle is operating.

30. A traffic signaling system for interfering traffic lanes having right-of-way signal indications; signal-control means normally cyclically displaying said right-of-way signal indications successively to the several traffic lanes; a traffic-operated device in each of said lanes; and other control means, actuated in response to an operation of a device on the lane not receiving the right-of-way at a given instant, to interrupt the normal cyclic display of the said right-of-way signal indications to the other of said lanes, and to display the right-of-way signal indication on the last mentioned lane.

31. A traffic signaling system for interfering traffic lanes having right-of-way signal indications; mechanism operative to present said indications cyclically to the several lanes; a timing device controlling said mechanism and constantly operating the same to determine the normal period of right-of-way signal presentation; said mechanism having control means, when conditioned, providing right-of-way signal presentations of shorter duration than such periods; traffic-operated devices associated with each of said lanes; and means, actuated by the operation of a traffic-operated device associated with a lane that does not have the right-of-way displayed thereon, to condition said control means to provide a shorter than normal duration of right-of-way signal presentation to the lane that has the right-of-way signal displayed thereto at the time of operation of said traffic-operated device.

32. A traffic signaling system as outlined in the preceding claim, comprising means, actuated by the operation of a traffic-operated device associated with the lane that has the right-of-way displayed thereto, to delay the conditioning of said control means.

33. A traffic signaling system for interfering traffic lanes having right-of-way signal indications; signal timer means normally cyclically displaying said right-of-way indications successively to the several lanes; a vehicle-responsive device on one of said lanes; means, operative by response of said device to a vehicle approaching on said one lane, when the said one lane is not receiving the right-of-way, to immediately interrupt the normal display of said indications, and to immediately give the right-of-way indication to said one lane; a vehicle-responsive device on another of said lanes; and means, operative by response of the last mentioned device to a vehicle approaching on said another lane, when the said another lane is receiving the right-of-way, to prevent the last mentioned means from immediately effecting the display of said right-of-way, as recited.

34. A traffic signaling system for interfering

traffic lanes having right-of-way signal indications; signal-control means displaying said right-of-way indications successively to said traffic lanes at a normal rate; traffic-operated devices associated with each of said lanes; and means, actuated by alternate single operations of each of said devices within definite periods, to interrupt the normal rate of display by the said signal-control means, and to display said right-of-way indications to said lanes at an increased rate.

35. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; of a vehicle-operated device in one of said thoroughfares, means, actuated by an operation of said vehicle-operated device, to set said signal to permit traffic to proceed on said one thoroughfare; means holding said signal to set for a determined period until said vehicle has had time to pass said intersection; a vehicle-operated device in the other thoroughfare; means, actuated by operation of the last mentioned vehicle-operated device, to set said signal to permit traffic to proceed on said other thoroughfare; timing means, actuated by an operation of the first mentioned vehicle-operated device, when operated by a vehicle, or a plurality of subsequent vehicles following said vehicle, to delay setting of the said signal by an operation of the said last mentioned vehicle-operated device for a certain period after each actuation of the said timing means, whereby the means actuated by the said last mentioned vehicle-operated device will not change the signal until the last of said periods is ended; and constantly operating timing means, operating regardless of traffic conditions, actuating alternately and repeatedly the means actuated by the operation of the vehicle-operated device in the said one thoroughfare, and the means actuated by the operation of the vehicle-operated device in the said other thoroughfare, at the expiration of predetermined periods greater than said determined period.

36. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in one of said thoroughfares; means, actuated by an operation of said vehicle-operated device, to set said signal to permit traffic to proceed on said one thoroughfare; means holding said signal so set on the said one thoroughfare for a determined period of time until said vehicle has had time to pass said intersection; a vehicle-operated device in the other thoroughfare; means, actuated by an operation of the last mentioned vehicle-operated device, to set said signal to permit traffic to proceed on said other thoroughfare; means holding said signal so set on said other thoroughfare for a determined period of time until said vehicle has had time to pass said intersection; and constantly operating timing means, operating regardless of traffic conditions, actuating alternately and repeatedly the means actuated by the operation of the vehicle-operated device in the said one thoroughfare, and the means

actuated by the operation of the vehicle-operated device in the said other thoroughfare, at the expiration of predetermined periods of time greater than said determined periods.

37. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted to be displayed alternately to direct traffic to proceed on one thoroughfare and to restrain traffic on another thoroughfare; a traffic-operated device in each of said thoroughfares; means, actuated by operation of said traffic-operated devices, to set said signal to direct traffic to proceed on their respective thoroughfare; timing means, operated by the actuation of the last mentioned means in so setting the signal, and by each subsequent actuation of said last mentioned means while the said signal is so set, to prevent the signal being set by the operation of a traffic-operated device in another thoroughfare for a certain definite period of time after each actuation of said last mentioned means; control means, operating at intervals longer than said definite period of time, to render inoperative said timing means so that the signal may be actuated by the operation of a traffic-operated device in another thoroughfare to direct traffic to proceed thereon; and other means, operating regardless of traffic conditions, to actuate alternately and repeatedly the means actuated by operation of the said traffic-operated devices, whereby said traffic-directing means is alternately and repeatedly displayed to each thoroughfare for at least said definite period of time, first to the one, and then, followed after the said longer interval, to the other, and so on cyclically.

38. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted to be displayed alternately to direct traffic to proceed on one thoroughfare and to restrain traffic on another thoroughfare; a traffic operated device in each of said thoroughfares; mechanism actuated by the operation of said traffic-operated devices, to set said signal to direct traffic to proceed on their respective thoroughfare; means, operated by the actuation of said mechanism, to hold said signal so set for a certain determined period of time to prevent the signal being set by the operation of a traffic operated device in another thoroughfare, whereby traffic on one of said thoroughfares, after having operated the traffic-operated device thereon, will have time to pass the intersection before the signal can be changed by the operation of a traffic-operated device in another thoroughfare; control means, acting automatically after a fixed period of time longer than said determined period, to render inoperative the last mentioned means, whereby said mechanism may be actuated by the operation of a traffic-operated device in another thoroughfare; and other means, operating automatically to actuate alternately and repeatedly the mechanism actuated by the operation of said traffic-operated devices, whereby said traffic-directing means is normally, alternately and repeatedly displayed to each thoroughfare, first to one, and then, followed after said fixed period of time, to the other, and so on cyclically.

39. A traffic signal device for intersecting thoroughfares having, in combination, "stop" and "go" signals; a vehicle-operated device in one of said thoroughfares, means, actuated by oper-

ation of said vehicle-operated device, to display a "go" signal on the said one thoroughfare and a "stop" signal on the other; a vehicle-operated device in the other thoroughfare; means, actuated by operation of said latter device, to display a "go" signal on the said other thoroughfare and a "stop" signal on the said one thoroughfare; means, actuated by operation of the first mentioned vehicle-operated device, when operated by a series of subsequent vehicles, to delay actuation of the second mentioned means for a definite period of time after each of said vehicles operates the first mentioned vehicle-operated device, should the second mentioned vehicle-operated device be operated substantially at any time after the first operation of said first mentioned vehicle-operated device but before the end of the definite period effected by the last vehicle of said series, until the said definite period effected by the said last vehicle of said series expires, whereby each subsequent vehicle operating the first mentioned vehicle-operated device will respectively have time to pass the intersection before the signal can be changed by an actuation of the second mentioned means; and constantly operating timing means, operating regardless of traffic conditions, to actuate alternately and repeatedly the said means actuated by operation of the first mentioned vehicle-operated device, and the said means actuated by operation of the second mentioned vehicle-operated device, at the expiration of periods of time greater than said definite period.

40. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares and having traffic-directing means thereon adapted to be displayed alternately to direct traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in each of said thoroughfares; a mechanism, actuated by the operation of said devices, to set said signal to direct traffic to proceed on their respective thoroughfare; means, operated by the actuation of said mechanism, when the said mechanism is actuated by a single vehicle, or a plurality of subsequent vehicles following said vehicle, to hold said signal so set to direct traffic to proceed on the corresponding thoroughfare for a definite period of time after each operation of said mechanism regardless of the operation of a device in the other thoroughfare; and timing means limiting the time that said signal can be held by a plurality of vehicles to direct traffic to proceed on a thoroughfare; and other means, operating concurrently with the said timing means, to actuate automatically said mechanism to set said signal first on one thoroughfare, and a predetermined period of time later on the other thoroughfare, and so on cyclically, whereby said traffic-directing means is accordingly alternately and repeatedly displayed for definite periods of time in the absence of operation of said vehicle-operated devices.

41. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in one of said thoroughfares; means, actuated by an operation of said vehicle-operated device, to set said signal to permit traffic to proceed on the said one thoroughfare; means hold-

ing said signal so set for a determined period of time until said vehicle has had time to pass said intersection; a vehicle-operated device in the other thoroughfare; means, actuated by an operation of the last mentioned vehicle-operated device, to set said signal to permit traffic to proceed on the said other thoroughfare; other means, actuated by the operation of the first mentioned vehicle-operated device, when operated by said vehicle, or vehicles following said vehicle within a definite period of time, to delay setting of said signal by an operation of the second mentioned vehicle-operated device for a certain period starting anew after each actuation of said other means, whereby the means actuated by said second mentioned vehicle-operated device, at substantially any time during the said actuations of said other means, will not change said signal until the last certain period is ended; and constantly operating timing means, operating regardless of traffic conditions, to place alternately and repeatedly into operation the means actuated by an operation of the first mentioned vehicle-operated device, and the means actuated by an operation of the second mentioned vehicle-operated device at the expiration of periods of time greater than said determined period.

42. In a highway traffic signal system for intersecting highways having a signal for indicating "stop" and "go" to each highway; traffic-operated means associated with one highway for receiving an impulse; means, operated by said traffic-operated means upon receiving said impulse, to operate said signal to indicate "go" on the said one highway and "stop" on the other highway; a timing device, associated with the last mentioned means, holding said signal so set for a predetermined time starting anew after each impulse is received by said first mentioned traffic-operated means; traffic-operated means associated with the said other highway for receiving an impulse; means adapted and arranged to operate said signal to indicate "go" on said other highway and "stop" on said first mentioned highway, after any intermediate operation of said traffic-operated means on said other highway, and as soon as said time has elapsed after the last operation of said traffic-operated means on said first mentioned highway; and constantly operating timing means, having a time of operation greater than the said predetermined time, and operating automatically regardless of traffic conditions to transmit impulses to the said means associated with each highway, whereby said "stop" and "go" signals are normally, alternately and repeatedly displayed first to one highway and then to the other.

43. A traffic signal apparatus having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and operable to indicate "stop" and "go" indications to said thoroughfares respectively; a vehicle-operated device located in one thoroughfare; timing means, operated by the momentary operation of said device, operating said signal to indicate "go" to the said one thoroughfare and "stop" to the other of said thoroughfares, and maintaining said signal so indicating for a predetermined minimum time after each operation of said device; means limiting the time during which said device may operate said timing means, and permitting said timing means to maintain the signal so indicating for the unexpired time thereof after operation of said limiting means; a vehicle-

operated device in the other of said thoroughfares; means, operated by the momentary operation of said device, operating said signal to indicate "go" to the said other thoroughfare and "stop" to the said one thoroughfare as soon as said timing means ceases to operate for the said one thoroughfare; and means operating said signal automatically in such a manner that said signal will alternately and repeatedly indicate "stop" and "go" to said thoroughfares for predetermined times in the absence of operation of said vehicle-operated devices.

44. In a traffic control system for intersecting highways, signals for permitting traffic to proceed on one highway and for restraining traffic on the other highway, means for interchanging said signals for the highways, a mechanism continually operable in fixed cycles, means in said mechanism operable for a predetermined period in each cycle, thereby leaving a remaining period in each cycle, for operating said signal changing means to permit traffic to proceed on a first highway and restrain traffic on a second highway, vehicle actuated means in the second highway, means operable by said vehicle actuated means when actuated by a vehicle and co-operating with said mechanism for a fixed portion of said remaining period to actuate said signal changing mechanism to permit traffic to proceed on said second highway and restrain traffic on the first highway, and then for any remaining portion of said remaining period to operate the signal changing means to restore the proceed for the first highway and the restraint for the second highway.

45. In a traffic control system for intersecting highways, signals for permitting traffic to proceed on one highway and for restraining traffic on the other highway, means for interchanging said signals for the highways, a mechanism continually operable in fixed cycles, means in said mechanism operable for a predetermined period of each cycle, thereby leaving a remaining period in each cycle, for operating said signal changing means to permit traffic to proceed on a first highway and restrain traffic on a second highway, vehicle actuated means in the second highway, means operable by said vehicle actuated means when actuated by a vehicle and cooperating with said mechanism for a fixed portion of said remaining period to actuate said signal changing mechanism to permit traffic to proceed on said second highway and restrain traffic on the first highway, and then for any remaining portion of said remaining period to operate the signal changing means to restore the proceed for the first highway and the restraint for the second highway, and means cooperating with said mechanism, and operable by said vehicle actuated means when operated by a vehicle during said fixed portion, for operating during a second fixed portion of said remaining period to prevent the last named means from acting to restore the proceed to the first highway.

46. In a traffic signaling system for interfering traffic lanes, having means for displaying right-of-way signal indications; signal timer means normally cyclically displaying said right-of-way indications successively to the several traffic lanes for predetermined times, a vehicle-responsive device on one of said lanes; and means, operable by response of said device to a vehicle on said one lane, when the said one lane is not receiving the right-of-way, to render said timer ineffective to display said indications as afore-

said, and to give the right-of-way indication to the said one lane prior to the time normally provided by the said timer means.

47. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in each thoroughfare; means, actuated by the operation of a vehicle-operated device in one thoroughfare, to display said traffic-directing means to permit traffic on said one thoroughfare to proceed; means, actuated by the operation of a vehicle-operated device in a second thoroughfare, to change said traffic-directing means to permit traffic on said second thoroughfare to proceed and other means, operating to change said traffic-directing means, to permit traffic on said first mentioned thoroughfare to proceed without further action of the vehicle-operated device on said first mentioned thoroughfare, said other means operating only when said vehicle-operated device on said second mentioned thoroughfare is operated within a predetermined time after the actuation of the vehicle-operated device on said first mentioned thoroughfare.

48. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in one of said thoroughfares; a pair of contacts; mechanism, actuated by operation of said traffic-operated device, to set said signal to direct traffic to go on said one thoroughfare and to stop on the other thoroughfare, only when said contacts are connected; a traffic-operated device in the other thoroughfare; a second pair of contacts; mechanism, actuated by operation of the last mentioned traffic-operated device, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare, only when said second pair of contacts are connected; an electro-magnet for separating said first mentioned pair of contacts; a second electro-magnet for separating said second mentioned pair of contacts; means, actuated by said first mentioned mechanism, to operate said second electro-magnet and maintain the same operative to separate said second mentioned pair of contacts for a definite period of time after actuation of said first mentioned mechanism to set said signal, thus preventing an actuation of said second mentioned mechanism by the said second mentioned traffic-operated device during said period; and means, operable by said second mentioned mechanism, to operate said first mentioned electro-magnet and maintain the same operative to separate said first mentioned pair of contacts for a definite period of time after actuation of said second mentioned mechanism to set said signal, thus preventing an actuation of said first mentioned mechanism by said first mentioned traffic-operated device during the latter period.

49. The structure set forth in claim 48, including means, operable after each of the first mentioned periods of time have expired, to discontinue operation of its corresponding electro-magnet to permit the corresponding pair of contacts to engage.

50. A traffic signal apparatus having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted to be displayed alternately to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device on each of said thoroughfares; mechanism, actuated by the operation of said vehicle-operated devices, and constructed and arranged for actuation by operation of said devices by a single vehicle or a plurality of vehicles following said vehicle, to set said signal to direct traffic to proceed on its respective thoroughfare for a definite period of time after each operation of said mechanism regardless of operation of a device in another thoroughfare; and a timing mechanism operating at regular intervals longer than said definite period of time actuating said mechanism to set said signal to direct traffic to proceed alternately, first on one thoroughfare, and then on the other, regardless of traffic operations on either thoroughfare.

51. A traffic signal apparatus having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device on one of said thoroughfares; means, actuated by operation of said device, to set said signal to permit traffic to proceed on said one thoroughfare; means holding said signal so set for a determined period; a vehicle-operated device in the other thoroughfare; means, actuated by operation of the last mentioned device, to set said signal to permit traffic to proceed on said other thoroughfare; other means, actuated by the operation of the first mentioned vehicle-operated device, when the first mentioned device is operated by a vehicle, or vehicles following said vehicle within a definite period, to prevent said signal being set by operation of the second mentioned device for a certain period after each actuation of said other means; and means operating to return the display of said signal to direct traffic to proceed on said one thoroughfare when traffic ceases to operate said vehicle-operated devices.

52. A traffic signal apparatus having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on the other thoroughfare; a vehicle-operated device in one of said thoroughfares; means, actuated by operation of said vehicle-operated device, to set said signal to permit traffic to proceed on said one thoroughfare; means holding said signal so set for a determined period; a vehicle-operated device in the other thoroughfare; means, actuated by operation of the last mentioned vehicle-operated device, to set said signal to permit traffic to proceed on said other thoroughfare; other means, operated by the actuation of the first mentioned vehicle-actuated means, when said first mentioned device is repeatedly operated by a vehicle, or vehicles following said vehicle within a definite period, to prevent said signal being set by operation of the second mentioned vehicle-operated device for a certain period after each operation of said other means;

means, operating after fixed periods of time, permitting said signal to be set by operation of the second mentioned vehicle-operated device, when said first mentioned device is repeatedly operated as recited; a warning light adapted to be displayed to said one thoroughfare; and means, operating only when the signal is set as last recited, to display the said warning light.

53. A traffic signaling system for controlling traffic at the intersection of two thoroughfares having, in combination, traffic-directing means adapted to be displayed alternately to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a vehicle-operated device in one thoroughfare; means, actuated by the operation of said device, to display said traffic-directing means to direct traffic to go on the said one thoroughfare for a definite period of time after the operation of said device; a vehicle-operated device in the other thoroughfare; means, actuated by the operation of the last mentioned device, to display said traffic-directing means to direct traffic to go on the said other thoroughfare for a definite period of time after the operation of said last mentioned device; and a master-timing mechanism actuating automatically the second and third mentioned means, at intervals longer than said definite periods of time, so that said traffic-directing means is alternately displayed at said longer intervals, first to one thoroughfare, and then followed a definite time later, to the other, and so on cyclically.

54. A traffic signaling system for intersecting thoroughfares having, in combination "stop" and "go" signals adapted to be displayed alternately to said thoroughfares for the control of traffic; switch means operable to alternate the display of said signals; timing means periodically operating said switch means at regular intervals to alternate repeatedly the display of said signals; traffic-operated devices in each thoroughfare; control means, actuated by the operation of a device in a thoroughfare having the "stop" signal at a given instant, to immediately operate said switch means to alternate the display of said signals; and means, actuated by the operation of a device in a thoroughfare having the "go" signal at a given instant, to delay the operation of said switch means by either said timing means or said control means for a predetermined time after the actuation of said delaying means.

55. A traffic signaling system for interfering traffic lanes; a right-of-way signal indication; means displaying said indication to each of said lanes for predetermined times for the control of traffic; a vehicle-operated device in one of said lanes; and means, actuated by the operation of said device, when the said one lane does not have the right-of-way, to interrupt the display of said indication by the first named means, and to display said right-of-way indication to the said one lane.

56. In a traffic-control system for intersecting highways; signals for permitting traffic to proceed on one highway and for restraining traffic on the other highway; means for interchanging said signals for the highways; a mechanism continually operating in fixed cycles; means in said mechanism operating said signal changing means to permit traffic to proceed on a first highway and to restrain traffic on a second highway, and providing a period during which said signal changing means may be operated by traffic on the said second highway to permit the traffic

on the said second highway to proceed and to restrain traffic on the said first highway; traffic-actuated means in the second highway; means, operated by the actuation of said traffic-actuated means, and co-operating with said mechanism during said period, to operate said signal changing means to permit traffic to proceed on the said second highway and to restrain traffic on the said first highway, and then, for any remaining portion of said period, to operate the signal changing means to restore the proceed for the first highway and the restraint for the second highway.

57. In a traffic-control system for intersecting highways; signals for permitting traffic to proceed on one highway and for restraining traffic on the other highway; means for interchanging said signals for the highways; a mechanism continually operating in fixed cycles; means in said mechanism, operating the said signal changing means, to set said signal to permit traffic to proceed on the first highway and to restrain traffic on the second highway for a predetermined period of each cycle; means holding said signal so set for a definite portion of said predetermined period, thereby leaving a remaining portion of said predetermined period during which said signal changing means may be operated to permit traffic to proceed on the said second highway and to restrain traffic on the said first highway; traffic-actuated means in the second highway; means, operated by the actuation of said traffic-actuated means, when the said traffic-actuated means is actuated within a predetermined time after the operation of said holding means, co-operating with said mechanism to actuate said signal changing means to permit traffic to proceed on said second highway and to restrain traffic on the first highway for a predetermined time, and then, for the remaining portion of said predetermined period, to operate the signal changing means to restore the proceed for the first highway and the restraint for the second highway.

58. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other; a traffic-operated device in one of said thoroughfares; a traffic-operated device in the other of said thoroughfares; mechanism operating said signal to direct traffic to go on said one thoroughfare and to stop on said other thoroughfare, when said first mentioned traffic-operated device is operated; mechanism operating said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare, when said second mentioned traffic-operated device is operated; means retaining the operation of said signal by the first mentioned mechanism, and preventing an operation of the said signal by the second mentioned mechanism, for a definite period of time after being operated by the first mentioned traffic-operated device; and means retaining the said signal operated to direct traffic to go on the said one thoroughfare and to stop on the said other thoroughfare, for a predetermined period of time after the expiration of said definite period of time, and then operating said signal to direct traffic to go on the said other thoroughfare and to stop on the said one thoroughfare, when the said second mentioned traffic-operated device is not subsequently operated substantially

during said definite period of time and said predetermined period of time.

59. A traffic signaling system for interfering traffic lanes; a right-of-way signal indication; means displaying said indication alternately and repeatedly to each of said lanes for predetermined times for the control of traffic; means, co-operating with the latter mentioned means, holding the indication displayed on one lane for a definite portion of the predetermined time of display therefor, thereby leaving a remaining portion during which the display of the said indication to the said one lane may be interrupted and then displayed to another of said lanes; a vehicle-operated device in the said another lane; means, actuated by the operation of said device, when the said device is operated during the said remaining portion of the predetermined time of display of the indication to the said one lane, to interrupt the display of the said indication to the said one lane by the first named means, and to display immediately the said right-of-way indication to the said another lane; and means, actuated by the operation of the said device, when the said device is operated during the said definite portion of the said predetermined time of display of the said indication to the said one lane, providing an interruption in the display of the said indication to the said one lane by the first named means and the display of the said right-of-way indication to the said another lane, at the termination of said definite portion.

60. A traffic signaling system for interfering traffic lanes; a right-of-way signal indication; means displaying said indication alternately and repeatedly to each of said lanes for predetermined times for the control of traffic; means, cooperating with the latter mentioned means, definitely holding the indication displayed on one lane for the first portion of the predetermined time of display therefor, thereby leaving a remaining portion during which the display of the said indication to the said one lane may be interrupted; a vehicle-operated device in the said another lane; means, actuated by the operation of said device, when the said device is operated during the said remaining portion of the predetermined time of display of the indication to the said one lane, to interrupt immediately the display of the said indication to the said one lane by the first named means, and to display immediately the said right-of-way indication to the said another lane; and means, actuated by the operation of the said device, when the said device is operated during the first portion of the said predetermined time of display of the said indication to the said one lane, providing an interruption in the display of the said indication to the said one lane by the first named means and the display of the said right-of-way indication to the said another lane, at the termination of the said first portion.

61. A traffic signal device, having in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in one of said thoroughfares; mechanism, actuated by operation of said traffic-operated device, to set said signal to direct traffic to go on said one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in the other thorough-

fare; mechanism, actuated by operation of the latter traffic-operated device, to set said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare; timing-means, operating regardless of traffic conditions, and actuating alternately and repeatedly the mechanisms actuated by the operation of the said traffic-operated devices, first one mechanism, and then, a definite fixed time later, the other mechanism, and so on cyclically, whereby said mechanisms are automatically actuated to set said signal as recited for the traffic actuated devices; and means, cooperating with said timing-means, providing only momentary operation of the said mechanisms by the said timing means, so that said signal can be set by operation of said traffic-operated devices during said definite fixed times elapsing between the automatic actuation of said mechanisms.

62. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted to be displayed alternately to direct traffic to proceed on one thoroughfare and to restrain traffic on another thoroughfare; a traffic-operated device in each of said thoroughfares; mechanism, actuated by the operation of said traffic-operated devices, to set said signal to direct traffic to proceed on their respective thoroughfare; means, operated by the actuation of said mechanism, to hold said signal so set for a certain determined period of time to prevent the signal being set by the operation of a traffic-operated device in another thoroughfare, whereby traffic on one of said thoroughfares, after having operated the traffic-operated device thereon, will have time to pass the intersection before the signal can be changed by the operation of a traffic-operated device in another thoroughfare; control means, acting after a fixed period of time longer than said determined period, to render inoperative the last mentioned means, whereby said mechanism may be actuated by the operation of a traffic-operated device in another thoroughfare; and other means, actuating alternately and repeatedly the mechanism actuated by the operation of said traffic-operated devices after definite periods of time longer than said determined period, whereby said traffic-directing means is alternately and repeatedly displayed to each thoroughfare, first to one, and then followed after a definite period of time, to the other, and so on cyclically.

63. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to permit traffic to proceed on one thoroughfare and to restrain traffic on another; an electro-magnet, for one of said thoroughfares, for setting said signal to direct traffic to proceed on said one thoroughfare and to restrain traffic on another thoroughfare; an electro-magnet, for the said another thoroughfare, for setting said signal to direct traffic to proceed on the said another thoroughfare and to restrain traffic on the said one thoroughfare; said first mentioned electro-magnet being included in an electric circuit; means, operated by traffic on the said one thoroughfare, to close said circuit; said second mentioned electro-magnet being included in an electric circuit; means, operated by traffic on the said another thoroughfare, to close the last mentioned circuit; control means rendering inoperative said last mentioned circuit closing means, after each

operation of said first mentioned electro-magnet in setting the signal, or while the signal is so set, for a definite period of time in which traffic on the said one thoroughfare, after operating said first mentioned circuit closing means, will have time to pass said intersection before said last mentioned circuit closing means will be again rendered operative; and means, operating alternately and repeatedly the said means operated by traffic on the said one thoroughfare and the means operated by traffic on the said another thoroughfare at intervals of time longer than said definite period of time, and interrupting operation of the said control means, when operating said means operated by traffic on the said another thoroughfare, so that the said signal is alternately and repeatedly set to direct traffic to proceed on one thoroughfare, and then, after the said longer interval of time, to the other.

64. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other thoroughfare; a traffic-operated device in one of said thoroughfares; a pair of contacts; mechanism, actuated by operation of said traffic-operated device, setting said signal to direct traffic to go on said one thoroughfare and to stop on the other thoroughfare, only when said contacts are connected; a traffic-operated device in the other thoroughfare; a second pair of contacts; mechanism, actuated by operation of the last mentioned traffic-operated device, setting said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare, only when said second pair of contacts are connected; an electro-magnet for separating said first mentioned pair of contacts; a second electro-magnet for separating said second mentioned pair of contacts; control means, actuated by said first mentioned mechanism, operating said second electro-magnet and maintaining the same operating to separate said second mentioned pair of contacts for a definite period of time after actuation of said first mentioned mechanism to set said signal, thus preventing an actuation of said second mentioned mechanism by the said second mentioned traffic-operated device during said period; control means, actuated by said second mentioned mechanism, operating said first mentioned electro-magnet and maintaining the same operating to separate said first mentioned pair of contacts for a definite period of time after actuation of said second mentioned mechanism to set said signal, thus preventing an actuation of said first mentioned mechanism by said first mentioned traffic-operated device during the latter period; and means, operating alternately and repeatedly the said mechanisms at intervals of time longer than said definite periods of time, and interrupting operation of the corresponding control means while operating the said mechanisms, so that the said signal is alternately and repeatedly set to direct traffic to proceed on one thoroughfare, and then, after the said longer interval of time to the other.

65. The structure set forth in claim 64, including means, operating after each of the said definite periods of time have expired, discontinuing operation of its corresponding electro-magnet to permit the corresponding pair of contacts to engage.

66. A traffic signal device having, in combination, a signal adapted to be disposed at the inter-

section of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other; a traffic-operated device in one of said thoroughfares; a traffic-operated device in the other of said thoroughfares; mechanism operating said signal to direct traffic to go on said one thoroughfare and to stop on said other thoroughfare, when the first mentioned traffic-operated device is operated; mechanism operating said signal to direct traffic to go on said other thoroughfare and to stop on said one thoroughfare, when the second mentioned traffic-operated device is operated; means retaining said signal operated by the first mentioned mechanism for a definite period of time after being operated by the first mentioned traffic-operated device and preventing an operation of the said signal, during said definite period of time, by the second mentioned mechanism; means retaining said signal operated by the said first mentioned mechanism for a predetermined period of time after the expiration of said definite period of time, and then operating said signal to direct traffic to go on the second mentioned thoroughfare and to stop on the first mentioned thoroughfare, when the device in the second mentioned thoroughfare is not operated during said definite period of time and said predetermined time; and means providing an operation of the said signal at the expiration of said definite period of time, when the device in the second mentioned thoroughfare is operated during said definite period of time.

67. The structure set forth in claim 66, including means providing an immediate operation of the said signal during said predetermined period of time, when the device in the second mentioned thoroughfare is not operated during said definite period of time, but is subsequently operated during said predetermined period of time.

68. A traffic-control system for intersecting highways having, in combination, a signaling means for directing traffic to proceed on one highway while restraining traffic on the other highway; a traffic-actuated device in each highway; control means, actuated by the actuation of a device in either one of said highways, to operate the said signaling means to direct traffic to proceed on the corresponding highway and to restrain traffic on the intersecting highway; means, forming a part of the control means, for definitely holding the signaling means so operated on either highway for at least a minimum period of time, and, in the absence of actuation of the traffic-actuated device in the intersecting highway, for maintaining the signaling means so operated beyond the said minimum period of time; and means, having a period of operation longer than said minimum period, operating in such absence of actuation of the traffic-actuated device in an intersecting highway, to simulate an actuation of the non-actuated device, whereby to produce automatically the same effect on the said control means as that of actuation of the non-actuated device.

69. A traffic-control system for intersecting highways having, in combination, signaling means for directing traffic to proceed on one highway while restraining traffic on the other highway; a traffic-actuated device in each highway; control means, actuated by the actuation of a device in either one of said highways, to operate the said signaling means to direct traffic to proceed on the corresponding highway while

restraining traffic on the intersecting highway; means, forming a part of the said control means, for definitely holding the signaling means so operated on either highway for at least a minimum period of time, and, in the absence of any actuation of the device in the intersecting highway, for maintaining the signaling means so operated beyond the said minimum period of time; and means, forming a part of said system and having a period of operation longer than said minimum period, operating in such absence of actuation of the device in the intersecting highway, to operate said signaling means to direct traffic to proceed on the highway of the non-actuated device.

70. A traffic-control system for intersecting highways having, in combination, a signaling means for directing traffic to proceed on one highway while restraining traffic on the intersecting highway; a traffic-actuated device in each highway; control means, actuated by the actuation of a device in either one of said highways, to operate the said signaling means to direct traffic to proceed on the corresponding highway while restraining traffic on the intersecting highway; means, operating when the said control means is so actuated, for definitely holding the signaling means so operated on either highway for at least a minimum period of time, and, in the absence of any actuation of the traffic-actuated device in an intersecting highway, for maintaining the signaling means so operated beyond the said minimum period of time; and means, having a period of operation longer than said minimum period, operating automatically to simulate actuation of the non-actuated device, for producing the same effect on said control means as that of actuation of the said non-actuated device.

71. A traffic-control system for intersecting highways having, in combination, a right-of-way signal indication; a traffic-actuated device in each highway; control means, actuated by the actuation of a device in either one of said highways, for displaying the said right-of-way indication to the corresponding highway; means, forming a part of the control means, for definitely holding the said indication so displaying on either highway for at least a minimum period of time, and, in the absence of actuation of the traffic-actuated device in the intersecting lane, for maintaining the said indication so displaying beyond the said minimum period of time; and means, having a period of operation longer than said minimum period, operating automatically to simulate an actuation of the non-actuated device, whereby to transfer the display of the said right-of-way indication to the highway of the non-actuated device even in the absence of traffic thereon.

72. A traffic signal system including, in combination, signaling means for directing traffic to proceed on one highway while restraining traffic on an intersecting highway; a timer connected to and controlling the operation of said signaling means; a traffic-actuated device in each highway and connected to said timer to operate said signaling means, responsive to actuation of said devices, to direct traffic to proceed on the highway of the actuated device while restraining traffic on the intersecting highway; means, forming a part of said timer, for definitely holding said signaling means so operated, for any one highway, for at least a minimum period of time, and, in the absence of actuation

of the device in the said intersecting highway, for maintaining the signaling means so operated beyond said minimum period of time; and means forming a part of said timer and functioning in such absence of actuation of the device in the said intersecting highway, after a period of time always longer than said minimum period and beginning substantially with the said operation of the signaling means to direct traffic to proceed on the said one highway, to simulate automatically an actuation of said device in said intersecting highway, whereby to operate said signaling means to direct traffic to proceed on said intersecting highway.

73. In a traffic-control system for intersecting highways, stop and proceed signals for each of the said highways adapted alternately to be displayed for permitting traffic to proceed on one highway while restraining traffic on the other highway; signal timer-means operating continuously in fixed cycles, said timer-means fixedly displaying the said signals, to permit traffic to proceed on a first highway and to restrain traffic on a second highway for a fixed period of time in each cycle of operation thereof, and retaining the said signals so displaying for a further predetermined period of time in each cycle, during which further period of time the display of the signals can be alternated to permit traffic to proceed on the said second highway and to restrain traffic on the said first highway; a traffic-actuable device in the said second highway; and control means, operating in response to an actuation of the said device, and cooperating with the said timer-means, for alternating the display of the said signals to permit traffic to proceed on the said second highway and to restrain traffic on the said first highway for a predetermined portion of the said further period of time; and means, operating in response to an actuation of the said device occurring at any time during the said fixed period of time, and cooperating with the said control means, for restoring the proceed for the first highway and the restraint for the second highway, for the remaining portion of the said further period of time.

74. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares, and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other; a traffic-operated device in one of said thoroughfares; a traffic-operated device in the other of said thoroughfares; mechanism operating said signal to direct traffic to go on the said one thoroughfare and to stop on the said other thoroughfare, when the said first mentioned traffic-operated device is operated; means retaining the operation of the said signal by the said mechanism for a certain definite period of time after being operated by the first mentioned traffic-operated device; timing means operating said signal to direct traffic to go on the said other thoroughfare and to stop on the said one thoroughfare, a predetermined time after the expiration of the said definite period of time; and mechanism operating said signal to direct traffic to go on the said one thoroughfare, prior to the time determined by the operation of the said timing means, when the said second mentioned traffic-operated device is operated substantially during

the said definite period of time and said predetermined time.

75. A traffic signal device having, in combination, a signal adapted to be disposed at the intersection of two thoroughfares and having traffic-directing means thereon adapted alternately to be displayed to direct traffic to go on one thoroughfare and to stop on the other; a traffic-operated device in one of said thoroughfares; a traffic-operated device in the other of said thoroughfares; mechanism operating to display said signal to direct traffic to go on said one thoroughfare and to stop on the said other thoroughfare, when the first mentioned traffic-operated device is operated; means operating to retain the display of the said signal by the first mentioned mechanism for a certain definite period of time after being operated by the first mentioned traffic-operated device; timing means operating to display said signal to direct traffic to go on the second mentioned thoroughfare and to stop on the first mentioned thoroughfare, a predetermined time after the expiration of the said definite period of time; and mechanism operating to display said signal to direct traffic to go on the said other thoroughfare and to stop on the said one thoroughfare, after the expiration of the said definite period of time but prior to the time determined by the operation of the said timing means, when the second mentioned traffic-operated device is operated substantially during said definite period of time.

76. A traffic-control system for intersecting highways having, in combination, signaling means for directing traffic to go on one highway while restraining traffic on the other highway; a traffic-actuated device in each highway; control means, actuated by the actuation of a device in either one of said highways, for operating said signaling means to direct traffic to proceed on the corresponding highway and to restrain traffic on the other highway; means, forming a part of the said control means, for definitely holding the said signaling means so operating on either highway for at least a minimum period of time, and, in the absence of actuation of the traffic-actuated device in the other highway, for maintaining the signaling means so operating beyond the said minimum period of time; and means, actuated by the actuation of a device in one of said highways at any time substantially during a predetermined period of time after an operation of the signaling means in response to an actuation of the device in the intersecting highway, and operating a definite period of time after the operation of the signaling means in response to the said actuation of the device in the said one highway, for simulating an actuation of the device in the said intersecting highway, for restoring the operation of the signaling means to direct traffic to go on the said intersecting highway and to restrain traffic on the said one highway, after the expiration of the said minimum period of operation of the signaling means in response to the said actuation of the device in the said one highway.

77. In a traffic-control system for intersecting thoroughfares; signals for directing traffic to go on one thoroughfare and to stop on the other; a traffic-actuated device in one of the said thoroughfares; means, operating in response to an actuation of the device in the said one thoroughfare, operating said signal to direct traffic to go on the said one thoroughfare and to stop on the other for a definite period of time; timing means, 75

operating a predetermined time after the expiration of the said definite period of time, for operating said signal to direct traffic to go on the said other thoroughfare and to stop on the said one thoroughfare; a traffic-actuated device 5 in the said other thoroughfare; and means, operating in response to an actuation of the device in the said other thoroughfare substantially during the said definite and said predetermined periods of time, for operating said signal to direct traffic to go on the said other thoroughfare and to stop on the said one thoroughfare after the expiration of the said definite period of time 5 and prior to the time otherwise determined by the said timing means.

THOMAS TONE.