April 19, 1938. W. C. NEIN ET AL 2,114,968

TRAFFIC CONTROL APPARATUS

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Fig.1.

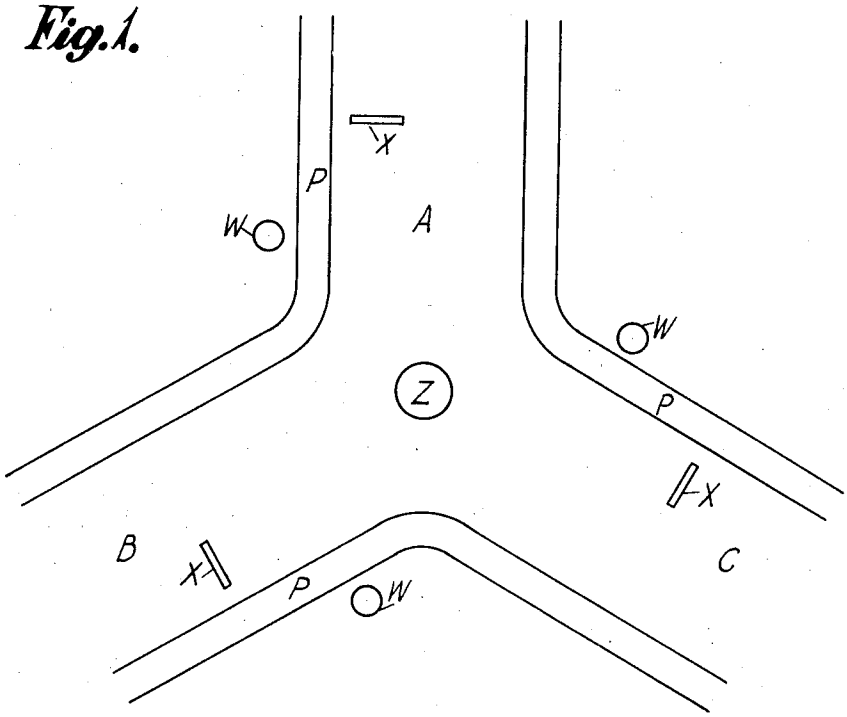


Fig.2.

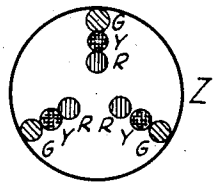


Fig.3.



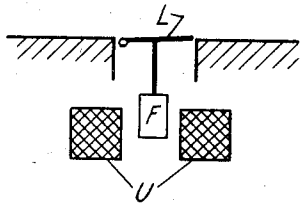


Fig.6.

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Fig.4.

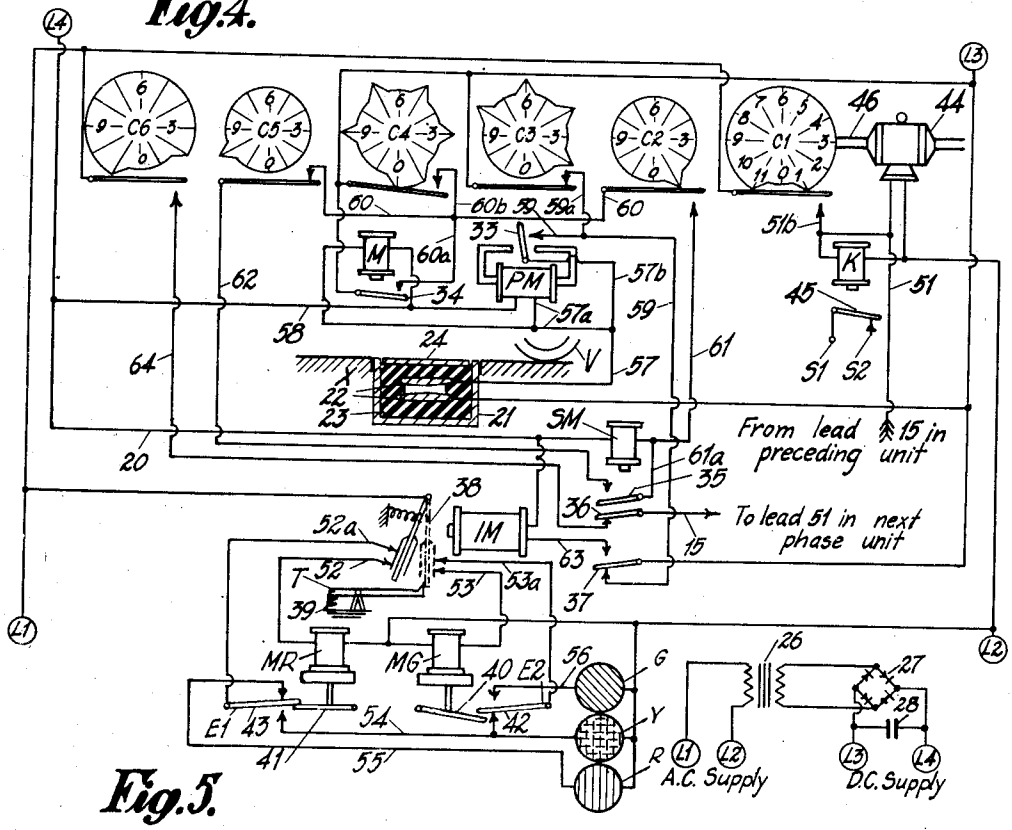
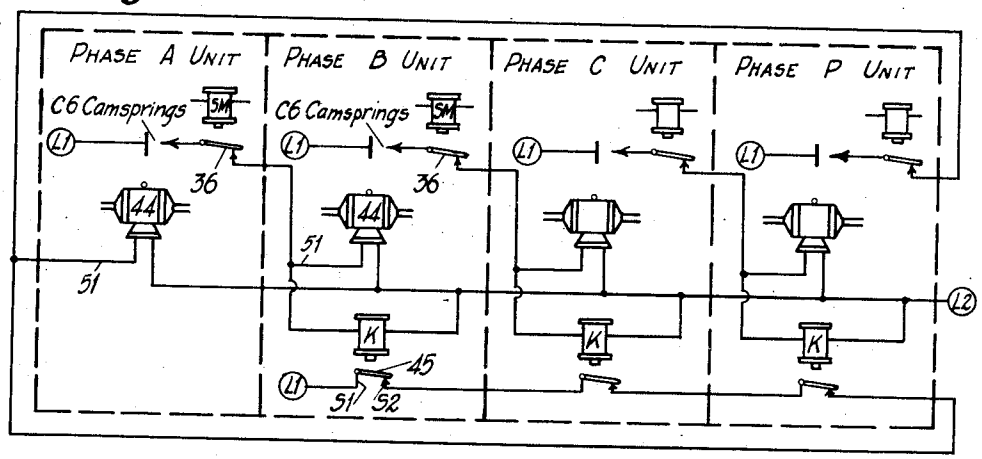


Fig.5.



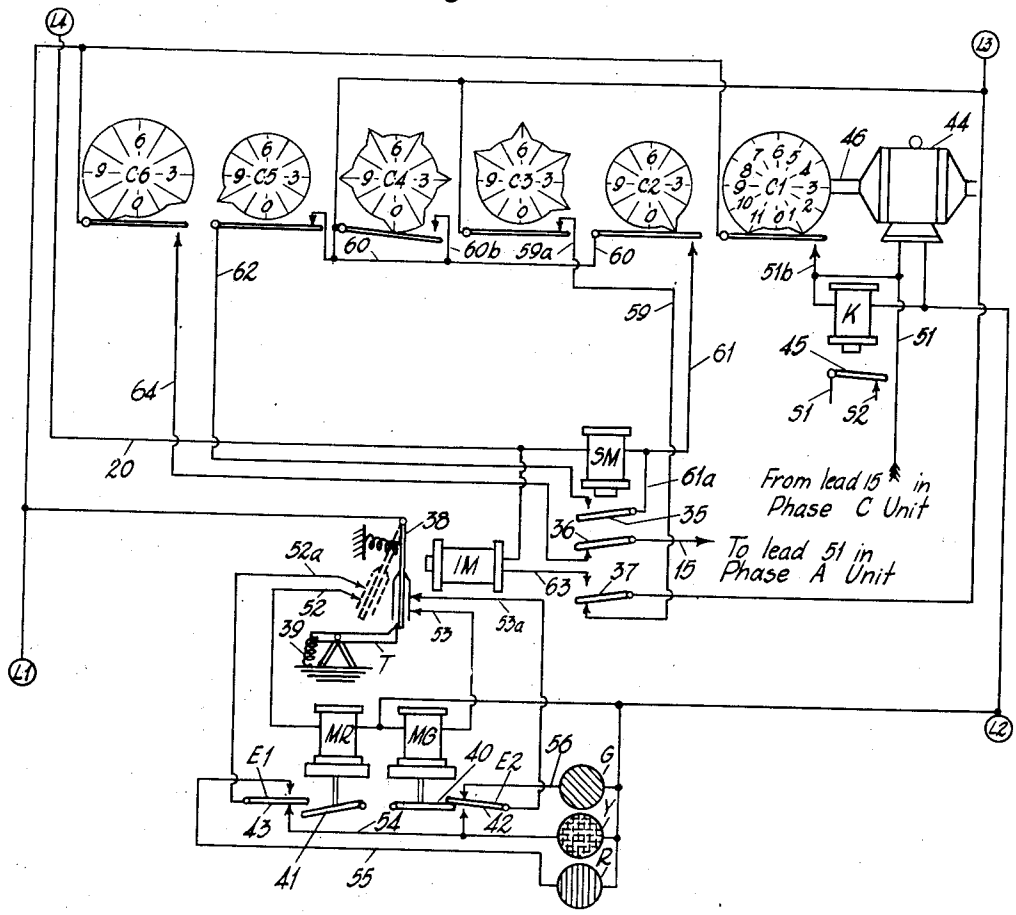
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TRAFFIC CONTROL APPARATUS

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Fig. 1.



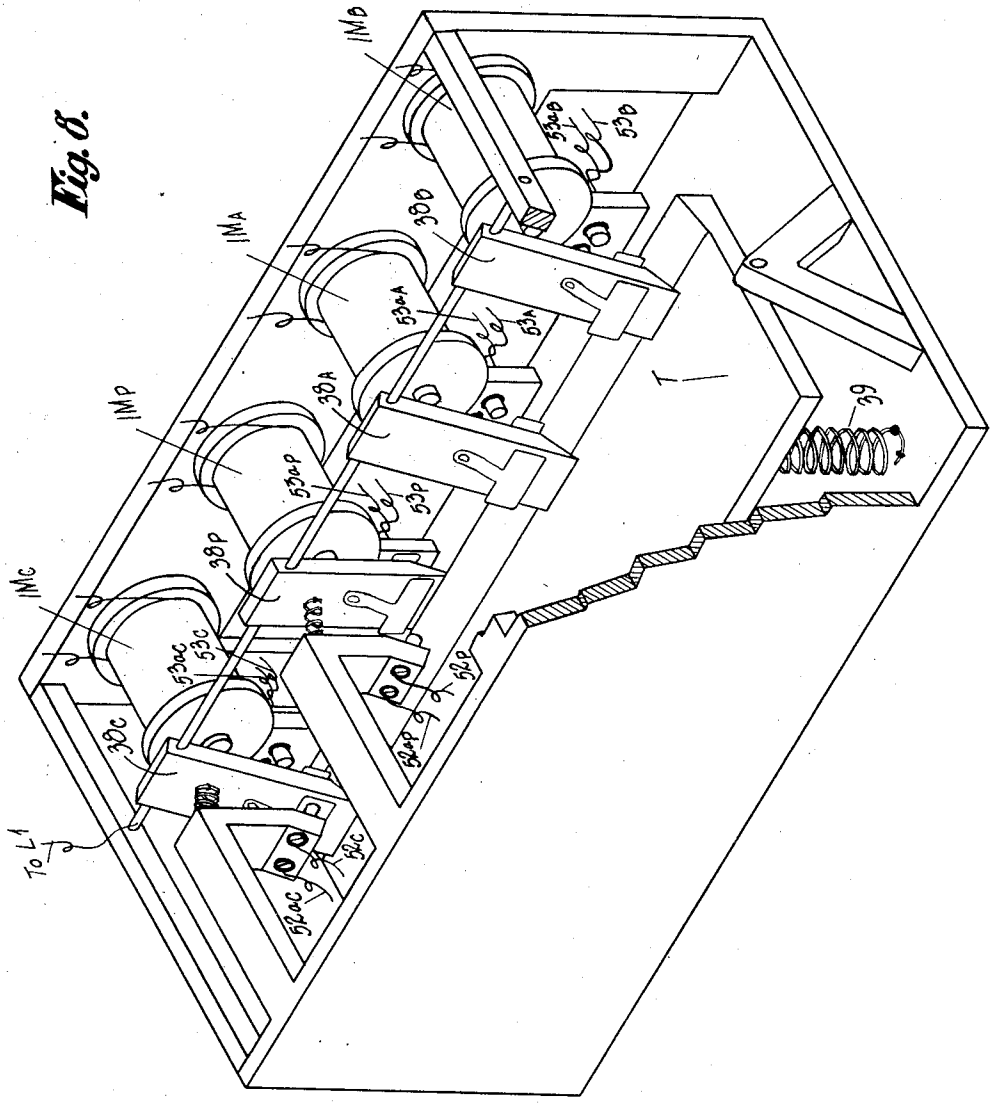
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Fig. 8.



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Patented Apr. 19, 1938 2,114,968

UNITED STATES PATENT OFFICE

2,114,968

TRAFFIC CONTROL APPARATUS

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Application March 13, 1935, Serial No. 10,776

22 Claims. (Cl. 177—337)

This invention relates to traffic control systems and has for a general object the provision of a system and apparatus therefor for the control of traffic at an intersection of a plurality of mutually interfering traffic lanes.

An object of the invention is to provide an improved automatic system of traffic actuated traffic control, capable of numerous different associations and of especial utility at the intersection of more than two traffic lanes.

Another object is to provide a control apparatus comprised of a number of standard, individual and similar mechanical units or sections such that for the intersection of any number of interfering traffic courses or routes the control apparatus may be assembled of a corresponding number of these units.

A further object of the invention is to provide an apparatus of this character having separate right of way indicators for each of the several interfering vehicular traffic lanes, and in addition thereto, a further separate set of signal indicators and period of right of way for pedestrians.

Another object is to provide by one arrangement a traffic control system in which right of way remains displayed on the lane to which it was last accorded until transferred to some other lane where actuation of a traffic actuatable device has occurred, and by another arrangement a traffic control system in which right of way always reverts automatically to pedestrians only, after the last vehicle actuation and in the absence of further actuation, and which provides a pedestrian right of way interval automatically in each cycle of signal indications.

A further object is to provide apparatus of this character which will utilize a minimum of simple and ruggedly constructed parts which will operate for long periods of time free from electrical and mechanical difficulties.

Still another object is to provide a traffic control system of the character disclosed in which right of way is accorded to traffic approaching the intersection for a minimum or greater period of time, the length of the right of way period beyond the minimum being entirely dependent upon the traffic conditions existing on the several lanes.

Further and more specific objects will subsequently appear in the following specification, reference now being had to the accompanying drawings, wherein:

Figure 1 illustrates diagrammatically the intersection of a plurality of vehicular traffic lanes and their accompanying pedestrian paths, with apparatus embodying the present system associated therewith. It will be understood that while this figure shows three vehicle lanes for example this invention may readily be applied to two or more interfering lanes.

Figure 2 represents diagrammatically a form of signal for indicating right of way to each of the intersecting vehicle lanes.

Figure 3 similarly represents a form of signal for indicating right of way to pedestrians.

Figure 4 shows somewhat diagrammatically a unit or portion of the control apparatus, vehicle actuatable device, and the interconnections required for one of the interfering traffic lanes or phases, these being similar to corresponding units or portions of the control apparatus required for each other phase.

Figure 5 represents schematically the interconnections between the several units of the control apparatus.

Figure 6 shows diagrammatically an alternative type of vehicle actuatable device which may be substituted for the embodiment of this device shown in Figure 4.

Figure 7 represents diagrammatically a unit or portion of the control apparatus, generally resembling that of Figure 4, except that the structure herein shown is adapted for one embodiment of the pedestrian or phase P unit and has no actuatable device associated with it. It is connected to the other units of the control apparatus in the manner indicated in the figure, and shown in Figure 5.

Figure 8 shows an illustrative view of the IM relays of the several timing units, of which one unit is shown in Figure 4, and their common interlocking tongue T.

Referring to Figure 1 the intersection of a plurality of traffic lanes A, B, and C and their associated pedestrian paths P are shown. Signals for indicating right of way to each of the vehicular traffic lanes and the control apparatus therefor may for instance be conveniently located in unit Z, and signals for the pedestrian phase or element may for example be suitably displayed from posts W in the several pedestrian paths, or any other well known signal arrangement may be employed. A vehicle actuatable device X, which upon the arrival of a vehicle to pass thru the intersection will control an operating circuit, is located in each lane and is connected to the controlling apparatus. Right of way is accorded to one interfering lane, or phase, at a time and there may be any desired number of phases.

Right of way indications may be displayed by any conventional system of colored lamps, lenses,

and reflectors which may display, for instance, green, red, or yellow, indicating respectively right of way (go), interruption of right of way (stop), or an impending change in right of way from one lane to another (caution).

The function of the control apparatus is to control changes of indication of the signals W, Z, to the several elements or phases, and its operation is governed by actuation of the vehicle responsive devices X so that in effect right of way is jointly controlled by the vehicle responsive devices and the control mechanism.

Some features of the traffic control system according to this invention may be briefly described as follows:

The control mechanism cyclically tests the vehicular phases and the pedestrian phase one at a time in a predetermined order, and if the lane being tested is one on which a traffic unit is approaching the intersection and has operated the traffic responsive device therein, right of way is accorded to this lane and interrupted on all other lanes. Should there be no such vehicle approaching the intersection or awaiting right of way on the lane being tested, the controller does not effect transfer of right of way to that lane but proceeds to test the next phase in its cycle in a similar fashion. When right of way is transferred in response to actuation, the testing operation on the next phase is delayed for a predetermined minimum or greater period of time, but not longer than a predetermined maximum period.

Actuations of the responsive device in a lane to which right of way is then being accorded, if the portion of the right of way remaining on that lane is too short for the actuating vehicle to pass through the intersection, will either produce an extension of the period or affect the control in such a manner that right of way will be returned to the said lane when the control mechanism next tests this phase.

In the particular embodiment illustrated there is no actuatable device in the pedestrian phase and for this reason right of way is accorded to this phase for a predetermined period each time this phase is tested. As will later appear, the pedestrian paths may, however, be equipped with actuatable devices such as push buttons accessible for actuation by persons desirous of crossing the intersection, whereupon the pedestrian phase is only accorded right of way upon specific demand or actuation, similar to the other phases. In this case, in the absence of actuation of any of the vehicle or pedestrian responsive devices in all the other phases, right of way will remain indefinitely on the phase where the last demand was received.

On the other hand, traffic responsive devices may be omitted from one or more of the vehicle lanes whereupon right of way is accorded to each of such lanes for a predetermined period each time these phases are tested. Operation of the controller in according right of way to a lane having no traffic responsive device is in effect the same as if the said lane contained a responsive device which was being continuously actuated by an uninterrupted flow of traffic.

While the general operation of an automatic traffic control system embodying this invention has been outlined above, and it has been pointed out that the apparatus may be comprised of traffic responsive means and signal indicating devices, each connected to a control mechanism of several interconnected units, the construction and operation of one specific and complete system embodying the invention will now be described in detail.

In Figure 1 of the drawings the vehicle actuatable devices X may be of the type shown in section in Figure 4 or 6, or may be of any other suitable design. In the type illustrated in Figure 4, a U-shaped steel trough **21** is shown set into the roadway. Two rust proof metal plates or coacting contactors **22**, are spaced apart and supported by resilient rubber **23** in the trough in such a manner that the weight of a vehicle will cause the contactors to flex into contact with one another and operate an electrical circuit. For mechanical protection there is placed on the rubber a steel plate **24** to be traversed by the wheel V of a passing vehicle. Contact between the plates closes a circuit from L3, one side of a D. C. power line, to a lead **57**. Other types of pressure operated switches which are operated by the weight of vehicles traversing them, or any other form of device which will control an operating circuit upon the approach of a vehicle to the intersection may be employed in lieu of the devices illustrated.

In Figure 6 is shown a detecting or vehicle responsive device having a solenoid winding U and a core F which is depressible by a lever L. As a vehicle wheel passes over this lever L embedded in the pavement, the movement of the core causes a change in the current value in the solenoid winding U and the change may be utilized to start a sequence of operations.

The control mechanism for operating the indications of the several signals is comprised of an individual unit for each phase, with the units for the several phases interconnected, as will be shown. The parts and electrical circuits for one unit, for example, the phase B unit, and similar to the parts and circuits in the unit for any other phase, are shown diagrammatically in Figure 4. Traffic through an intersection having any number of interfering traffic lanes or phases may be efficiently dispatched by a system of this character, each phase having its individual vehicle responsive devices and signals, connected to a separate unit in the control mechanism.

A single transformer-rectifier assembly furnishes a supply of direct current for the direct current relays in all the units of the control mechanism. L1 and L2 are terminals of a source of alternating current of suitable potential. Direct current is obtained therefrom at the terminals marked L3 and L4 by means of a transformer **26** and rectifier **27**. A filter condenser **28** across the rectifier output terminals maintains a substantially constant unidirectional current.

Referring further to Figure 4, the vehicle responsive device X of phase B when actuated closes a circuit from L3 through leads **57**, **57***a* to energize a polarized relay PM permanently connected to L4 by lead **58**. A locking-in circuit through lead **57***b*, armature **33** of the polarized relay, and lead **59**, which will subsequently be traced to L3, continues to supply power to the polarized relay PM after actuation of device X has energized it, and thus in effect the demand of a traversing vehicle for right of way is stored.

The polarized relay PM is very high speed in its operation and for this reason it can be energized by actuations of short duration. A relay M of slower action is placed in parallel with the polarized relay PM across leads **57***a* and **58**, and when energized it closes by means of its armature **34** a circuit from L3 to lead **60***a*. Since in this

embodiment there are no traffic responsive devices for the pedestrian phase, in the phase P unit of the control apparatus as shown in Figure 7, L3 is connected permanently to lead 60.

Each timer unit of the control mechanism includes a motor 44 which preferably may be of the self-starting synchronous type, and which may be energized by alternating current from terminals L1, L2. The motor drives a camshaft 46 on which are mounted a number of cams, cams C1, C2, C3, C4, C5 and C6, each one of which operates a control circuit by means of camsprings. The cams may be cut into the required shapes from circular discs of suitable material, and mounted firmly on the camshaft.

The cams on the camshaft may be divided into a number of sections or positions; in the embodiment shown there are twelve equal sectors or positions to each cam, yet any greater or lesser number may be used. When the camshaft revolves into position 1 cam C1 closes the locking-in circuit for the motor from L1 to lead 51*b* and 51 and retains this circuit closed until the cams rotate to their starting position, position zero or 12. The motor, once having been energized, thus continues to receive power for the duration of one complete revolution of its camshaft, and then, in order to continue revolving or to restart, must be supplied power from another circuit. A locking-in circuit for the polarized relay PM thru leads 59, 59*a*, is completed by cam C3 in positions 1, 3, 5, 7, 9, 10, 11 and 12 or 0, and interrupted for de-energizing this relay in positions 2, 4, 6 and 8.

A right of way controlling relay SM is permanently connected to L4 by lead 20 and may be energized for according right of way to lane B by connection to L3 thru lead 61, camsprings of cam C2 which are closed only in position 1, leads 60, 60*a* and armature 34 of relay M, energized. Relay SM may be locked-in by a circuit thru leads 61*a*, armature 35, lead 62, camsprings of cam C5 which are closed in all positions except position 10, lead 60*b*, and to L3 over camsprings of cam C4 which are closed in positions 2, 4, 6, 8, 10, and 11, and open in all other positions. Another lock-in circuit for relay SM is furnished by wire 60 from wire 60*a* and armature 34 of relay M to L3. When relay SM is in its de-energized position, alternating current from L1 may be connected thru camsprings of cam C6, which are closed in positions 2 thru 11 inclusive, lead 64, armature 36 in its de-energized position, out of the unit illustrated as the phase B unit, and into the unit of the phase next in sequence in the testing cycle, for example, phase C, and thru lead 51 therein to energize the motor 44 of the phase C unit.

In the de-energized position of relay SM, armature 37 completes another locking-in circuit for the polarized relay PM thru lead 59 to L3. This circuit parallels the locking circuit for the same relay over camsprings of cam C3 described above. When right of way controlling relay SM is energized, its armature 37 completes a circuit to energize a right of way signal transferring relay IM over lead 63.

The function of the right of way transferring relay IM in each unit is to govern change of the indications of the traffic signals in the lane controlled by the said unit. The relay IM for each of the several phases is positioned in the control mechanism adjacent to the corresponding IM relays of other phases in such a manner that a common tongue T operates to lock-in the armature 38 of any IM relay upon energization of the latter. An illustration of this portion of the apparatus by which any one of armatures 38 of the several IM relays may be locked in its energized position by a common tongue T is shown in Figure 8. The armature of relay IM in each of the units is permanently connected to L1. In its energized position it engages leads 53, and 53*a*, and in its out or de-energized position, leads 52 and 52*a*.

When the IM relay of one phase unit, for example the phase B unit, is energized, and its armature thereby attracted, the movement of this phase B armature 38 into its energized position depresses a catch at the end of tongue T and releases the armature 38 of the relay IM of any other phase which was at that time being locked-in by the tongue. The spring 39 quickly restores tongue T into its locking position where the tongue now holds the phase B armature 38 in its energized position, in which the said armature completes a circuit from L1 thru lead 53 to energize retarded pick-up relay MG of the B phase unit and thru lead 53*a* to supply power for the signal lights. In the A, C, and P phase units, the armature 38 will now engage leads 52*a* and 52, whereupon a retarded pick-up relay MR in each of these units will be energized thru lead 52.

Considering again the phase B unit of the control mechanism, the inward or rising movement of the armatures 40, 41 of the retarded pick-up relays MG and MR is slow. A single pole double throw switch E1 is arranged to be operated by armature 41 of relay MR, as said armature 41 nears its inner, or energized, position. When the armature 41 of relay MR is in its innermost position, the end of said armature presses the armature 43 of switch E1, into its upper position where it engages lead 55. When armature 41 of relay MR is in any other but its innermost position, the armature 43 of switch E1 engages its lower contact 54. Although the armature of relay MR is slow to rise and requires an appreciable period to proceed from its de-energized or outer position to its inner position, the time required between the breaking of the circuit from armature 43 to lead 54 and the making of the circuit to lead 55 is negligible, because of the proximity of the contacts at the ends of leads 54 and 55. Armature of relay MG is similarly co-operable with switch E2 which is similar to switch E1.

Green signal G is illuminated when the armature 40 of relay MG is in its innermost position holding armature 42 in its upper position where the latter completes a circuit from L1, armature 38 thru lead 53*a*, armature 42, lead 56, green signal G, to L2. Likewise red signal R is illuminated when armature 43 is held in its upper position by armature 41 of relay MR, completing the circuit from L1, over armature 38, lead 52*a*, armature 43, lead 55, red signal R, to L2. Yellow or caution signal Y may be illuminated by either of two circuits from L1 and armature 38; one over lead 53*a*, armature 42 in its lower position, and lead 54, the other over lead 52*a*, armature 43 in its lower position, and then over lead 54, yellow signal Y to L2.

Referring to the phase B unit in Figure 4 again, relay K is placed in parallel with synchronous motor 44 between lead 51 and terminal L2; consequently relay K is energized whenever the motor 44 receives power. Now referring to Figure 5, a series starting circuit from A. C. power terminal L1 thru armature 45 of relay K in the phase B unit and a back contact S2 co-operating

therewith, extends in series thru corresponding armatures and contacts in the phase C and P units to lead 51 in the phase A unit. This circuit is closed to supply power to the motor of phase A unit at such times as the motors in the several units are all in their rest positions. Ordinarily the phase A unit will be started by energization of its motor over cam springs of cam C6, lead 64 and armature 36 of relay SM in the preceding phase P or pedestrian unit and over lead 15 to lead 51 of the phase A unit as will be subsequently more fully described, but the series starting circuit controlled by the relays K is provided as an independent means for starting the phase A unit motor when all the units are in their zero or rest position and the ordinary starting circuits via cam C6 are all interrupted, as might result, for instance, from having the power shut off in such fashion as to allow one or more of the camshafts to revolve by their own momentum into the zero position. Any unit might be chosen as the starting unit instead of the phase A unit, but in each case the starting unit need have no relay K.

Operation of this traffic control system through one complete cycle of the control mechanism will now be described. Assume that there are no vehicles approaching the intersection on any of the lanes and that the green signal G on the pedestrian phase and the red signals on phases A, B, and C are illuminated. A cycle of control commencing with phase A will be described.

In the phase A, B, and C units, armature 38 of relay IM is in its de-energized position. The MR relay in each of these units is thus energized from L1 thru lead 52. Thru lead 52*a*, armature 43, and lead 55, in the manner aforedescribed, the red or stop signal R is illuminated on lanes A, B, and C. In the phase P unit armature 38 of relay IM is held locked in by tongue T, and the circuit to energize relay MG is completed thru lead 53. Consequently on the pedestrian phase P, green signal G will be energized by a circuit from L1 thru armature 38 of relay IM, lead 53*a*, armature 42, lead 56 to signal G and L2.

The motors of all the units of the control apparatus for this illustration are assumed to be de-energized and for this reason the several relays K are also not energized. Upon connecting proper power supply to L1, L2, either the motor of one of the units, (A phase for instance) is started over armature 36 of relay SM and camsprings of cam C6 of the preceding phase unit (P phase, for instance), or in the event that all of the cam groups are in their zero positions, the series starting circuit from L1 thru the armature 45 and the back contacts S2 of the relays K of units B, C, and P energizes the motor of the phase A unit thru lead 51. The motor will thus be started and maintained energized in either one fashion or the other described until in position 1 its associated cam C1 closes a circuit to energize the motor independently of the starting circuit for the balance of its camshaft cycle. Also in position 1 cam C2 closes its contact to prepare or partially complete an operating circuit for relay SM via wire 61 to wire 60 and via wire 60*a* to the contact associated with armature 34 of relay M. This action of cam C2 thus in effect potentializes relay SM for operation to cause transfer of right of way through energization of relay IM in event relay M has been energized by traffic actuation as already described. After the cam shaft has passed position 1 the cam C2 breaks this preparatory circuit for relay SM and the relay cannot be energized through the remainder of one revolution of the cam shaft. When relay SM is deenergized it cannot operate the relay IM to transfer right of way and it may thus be considered depotentialized by action of cam C2 in opening its preparatory circuit. The cam C2 may thus be considered to potentialize relay SM for right of way transfer in position 1 and to depotentialize it in position 2 and other positions. In the present instance it was assumed there was no traffic actuation on phase A and relay SM remains deenergized as the cams turn in to position 2. In position 2, cam C6 completes over its camsprings the circuit from L1 thru lead 64, armature 36 of relay SM which remains de-energized in the absence of actuation as assumed, to energize thru lead 51 the motor 44 of the next phase in the sequence, phase B, and this motor commences to revolve in the manner just described. In position 12 of the phase A unit camshaft, power is disconnected from the phase A unit motor by cam C1 and the camshaft rests in this position. Power is also disconnected from the feed circuit to phase B unit at cam C6. Phase B unit motor 44, however, continues to revolve, since it now receives power independently thru its lead 51*b*, from its own cam C1 camsprings.

The phase B unit in position 2 in its cycle by cam C6 similarly energizes the motor of the phase C unit, which also commences to operate in a manner similar to that of the phase A and B units. There have been no signal changes or changes in the relays in the several units of the control mechanism, excepting the starting circuit embracing the relays K which are energized when their respective motors are energized, the condition of the several remaining circuits being as described at the start of the control cycle. Since there have been no actuations of the vehicle responsive devices in any of the several lanes the relays M, SM, and IM of each unit will remain de-energized.

Considering further the control mechanism cycle, when the camshaft of phase C unit reaches position 2, the phase P unit motor is started and the independent power circuit over camsprings of cam C1 is closed. As pointed out above and shown in Figure 7, the pedestrian or phase P unit in one embodiment has no pedestrian actuatable device and associated relays PM and M, and in this case lead 60 is permanently connected to L3. In position 1 of the phase P unit, its cam C2 closes the circuit from L3 thru leads 60, 61 to energize right of way controlling relay SM, which locks-in over lead 61*a*, armature 35, lead 62, camsprings of cam C5, lead 60 to L3. Armature 37 completes a circuit from L3 thru lead 63 to energize right of way transferring relay IM. Since green is being displayed to phase P, as already described, the armature 38 of relay IM of phase P is already locked-in in its energized position by tongue T, thus no change in the energization of the signals will occur, and green will persist on the pedestrian phase. Cam C2 in position 2 has opened the circuit between leads 60 and 61 which originally energized the SM relay, but this relay remains energized by its lock-in circuit thru its armature 35, leads 62, 60, to L3.

At position 2 cam C6 prepares a circuit from terminal L1 to lead 64, for energizing the motor of the succeeding phase unit (phase A), but the energized condition of relay SM prevents the circuit from being completed at armature 36

until the camshaft revolves to position 10 where cam C5 opens the locking-in circuit for relay SM between leads 62 and 60 and de-energizes relay SM. In position 10, therefore, armature 36 assumes its de-energized position, and thus the circuit for starting the motor of the next unit, phase A, is completed from L1 over the camsprings of cam C6, lead 64, armature 36 of relay SM and lead 15 in the phase P unit to lead 51 and motor 44 of the phase A unit, as shown in Figure 5. With relay SM energized from position 2 to position 10 as described, its contact and armature 36 remain separated and prevent the energization of the next (phase A) unit motor and thereby assure maintenance of the pedestrian phase right of way during this time. Change of right of way can only occur by energization of the IM relay of another phase and this can only occur at position 1 in the cycle of the camshaft of another phase after the motor of that phase has been energized over armature 36 of relay SM and contacts of cam C6 of the preceding phase unit as described above.

If now it is assumed a vehicle has passed over the actuable device X in the lane A, a circuit thru device X from L3 thru leads 57, 57*a*, will energize relay PM, which locks in over lead 57*b*, its own armature 33, leads 59, 59*a*, springs of cam C3, to L3. Slower acting relay M, in parallel across leads 57*a* and 58, is also energized and maintained energized with relay PM by the lock-in circuit for the latter just described and by means of its armature 34, relay M closes a circuit from L3 to lead 60*a*. The phase A unit motor, started by the circuit from armature 36 of the phase P unit, receives power during its cycle by the circuit to L1 thru camsprings of cam C1. In position 1 cam C2 again closes the circuit from lead 60 to 61 to "test" for a demand for right of way. Since an actuation has locked in relay M and connected lead 60 to L3 over armature 34, relay SM is energized and is locked in over lead 61*a*, armature 35, lead 62, camsprings of cam C5, lead 60, then in position 1 over lead 60*a*, armature 34 of relay M to L3, and in position 2 over lead 60*b*, camsprings of cam C4 to L3. In position 2 the locking-in circuit for relays PM and M is broken by operation of cam C3.

In the manner described above for the phase P unit, the energization of relay SM causes power to be supplied over armature 37 and lead 63 to relay IM which attracts its armature 38. As the armature 38 of relay IM in the A phase unit moves into its energized position, it depresses tongue T common to all the units and releases the armature 38 of the phase P unit which was being locked-in. Thus in the phase P unit, circuit from L1 and armature 38 to leads 53 and 53*a* is thereby broken and circuit to leads 52 and 52*a* is made. When the armature 38 breaks from lead 53, the relay MG is de-energized, and at the same time, by breaking the circuit from the armature 38 to lead 53*a*, the green signal G is extinguished. The armature 38 immediately completes a circuit over lead 52*a*, armature 43, which is in its lower position, lead 54, to illuminate the yellow signal Y. Simultaneous with completion of this circuit, the same armature completes a circuit over lead 52 to energize the retarded pick-up relay MR, which slowly attracts its armature. The yellow signal Y persists during the time required for armature 41 of relay MR to rise from its out or de-energized position until armature 41 causes armature 43 of switch E1 to break circuit with lead 54. When armature 43 of switch E1 makes circuit with lead 55, the red signal R is illuminated.

Meanwhile the signals to phase A change from red to yellow to green. In this case armature 38 of relay IM in the phase A unit breaks circuit with leads 52 and 52*a* de-energizing the associated relay MR, and moves into its energized position, as pointed out above, where L1 is connected thru the armature 38 to leads 53 and 53*a* for energizing relay MG. When power is disconnected from the lead 52*a*, red signal R to phase A is extinguished and when power is immediately thereafter connected to lead 53*a*, yellow signal Y is energized over lead 53*a*, armature 42 of switch E2 and lead 54. Correspondingly when power is disconnected from lead 52, relay MR becomes de-energized, and when power is connected over lead 53 to relay MG, the latter relay slowly attracts its armature 40. Yellow signal Y persists until armature 40 causes armature 42 of switch E2 to break circuit with lead 54. Armature 42 then engages lead 56 completing the circuit to illuminate green signal G on phase P. By adjusting the time delay devices associated with the slow-to-pull-in relays, the duration of the amber signal may be fixed as desired.

As the camshaft 46 of the phase A unit revolves, in position 2 cam C2 operates to break the pull-in circuit of relay SM between leads 60 and 61. In position 2, cam C3 operates to open the lock-in circuit for relay PM and relay M, from lead 59*a* to L3, and these relays are thereby de-energized. Also in position 2, cam C4 makes a circuit from leads 62, 60 to L3 maintaining relay SM locked-in. In the succeeding position, position 3, the cam C4 breaks this circuit and relay SM is de-energized. Relay IM thereupon is de-energized since armature 37 breaks circuit thru lead 63, but the armature 38 of relay IM remains locked-in by tongue T. Armature 36 completes the energizing circuit from L1 thru springs of cam C6, leads 64, and 15 to start the motor of the phase B unit.

Assume now that a vehicle has traversed the responsive device X in lane B. Polarized relay PM and relay M are energized in a manner similar to that described above in connection with phase A, and the energization of relay SM when the phase B unit motor has rotated the camshaft into position 1 is likewise similar to the manner of operation aforedescribed. Signals change from green thru yellow to red for phase A and from red thru yellow to green for phase B. Assume now that another vehicle actuates the device X in lane B after cam C3 has opened and reclosed its camsprings in position 2 and before cam C4 opens its camsprings in position 3. The actuation re-energizes and locks-in relays PM and M over the circuits for this purpose already described. Accordingly, although a locking-in circuit from L3 to relay SM thru camsprings of cam C4, leads 60 and 62 is opened by operation of cam C4 during position 3, the relay is retained in its energized state by power from L3 thru armature 34, leads 60*a*, 60 and 62. If there are no further actuations after cam C3 in position 4 opens the locking-in circuit to the polarized relay PM and to relay M and until cam C4 opens its camsprings in position 5, the operation of cam C4 will open the remaining locking-in circuit thru lead 62 for relay SM, which is thereupon de-energized. The motor of the phase C unit is then connected to power in the manner aforedescribed.

Such factors as the speed of the camshaft,

shape of the cams, distance of the vehicle responsive devices from the intersection, and timing of the caution signal following green, or any one or more of these or other factors, may be arranged to permit any vehicles that actuate the responsive devices in a lane between the initial actuation which secured transfer of right of way to the said lane and the actuation which as described secured extension of right of way to pass thru the intersection.

Should there have been a substantially continuous stream of traffic on lane B, such that vehicle responsive device X in that lane had been actuated and relay PM again locked-in after cam C3 had broken its locking-in circuit in position 4 and before relay SM became de-energized in position 5, relay SM would have remained energized until position 7, and with similar additional vehicular actuation at the end of position 6 would have remained energized until position 9, as will be apparent with an examination of the shape of cams C3 and C4 in Figure 4, in view of the foregoing description. If actuations continue to keep relay PM energized, right of way will be forcibly removed from phase B in position 10 where cam C5 operates to break the locking-in circuit to right of way controlling relay SM between leads 60 and 62. Once de-energized, the relay SM in any unit cannot again be energized until the camshaft reaches position 1, in the succeeding cycle of operation of the unit.

An actuation of the responsive device in any phase, after relay SM for that phase has been de-energized, will energize relay PM in the customary manner and will lock it in with relay M over lead 59 and armature 37 to L3. Similarly, if actuation occurs in any phase while its cam shaft is rotating and has passed position 1 and is in an intermediate position when that phase does not have right of way, such actuation will occur with relay SM in its deenergized position, and relays PM and M will become energized by such actuation and be locked in over armature 37 of relay SM as just described. Such "late" actuations will thus in effect be stored, until the camshaft in that phase unit is again started from its rest position. Since in either case after the cam shaft has passed position 1, the initial energizing circuit for relay SM and operated by cam C2 is kept open as the cam shaft continues to rotate, the relay SM remains in its deenergized position keeping the relays PM and M locked in. If the actuation was too late to energize relay SM in position 1 right of way will not be transferred to this particular phase during this cycle of rotation of its cam shaft, but in position 2 the cam C6 will operate to close the circuit over a wire 64 and via armature 36 of relay SM to start the cam shaft of the next phase into rotation as has been already described, and both the next phase cam shaft and the current phase cam shaft will continue to rotate back to their initial rest positions 0. The cam shaft of the current phase, on which the "late" actuation occurred, is again initiated into activity by action of the cam shaft of the preceding phase in the manner already described. As the camshaft again becomes activated and revolves into position 1, "testing" for actuation, a circuit embracing relay SM will be completed between L4 and L3 thru relay SM over lead 61, camsprings of cam C2, leads 60, 60a, and armature 34 of relay M in its energized position. Relay SM is thereby energized and obtains a transfer of right of way in favor of the waiting vehicle. The locking-in circuit for the relays PM and M over lead 59 and armature 37 to L3 is broken upon the energization of relay SM.

The term "timer" is used herein for a device operating at a certain time rate, which may be adjustable, and which in its course of operation opens and closes or otherwise controls a series of electric circuits in predetermined time relation. In this application the timer is illustrated for example as a motor-driven series of cams with their associated contacts. In certain of the claims the SM relay is recited as part of the timer. As already described one such timer, including the cam shaft and contacts, driving motor and the SM relay, preferably is provided for each street or lane to which right of way is separately given in association with a mechanism for transferring the right of way to and from that lane. In this respect the several timers for the several lanes are designated as "unit timers". These timers are each arranged to be operated from an initial position thru their sequence of circuit controlling functions and returned to such initial position from which they can again repeat such operation. The timer in operating thru one such sequence of functions from initial position and returning to initial position is recited in the claims as "operable in a time cycle".

The term "mutually interfering lanes" as used herein designates a plurality of lanes of traffic movement each of which intersects all the others or in which the traffic movement interferes with traffic movement of the others. For example, in the case of three mutually interfering lanes each of the lanes interferes with the other two. The term "lane" as used herein does not necessarily mean a single path for traffic moving in one direction but is used to designate one or more lanes which are signalized as a unit. For example, the pedestrian phase already described may be considered a single interfering lane although it comprises several pedestrian paths crossing different parts of the intersection which are signalized as one unit and pedestrian movement in some one of these paths would normally interfere with other traffic movement.

As previously mentioned, pedestrian push buttons or other actuatable devices may be used in the pedestrian phase in the same manner in which vehicle responsive apparatus is employed in the vehicle phases. In this case right of way is not transferred to the pedestrian or P phase each time this phase is tested, as in the embodiment described, but only when actuation of the responsive device has locked-in the relay M in this phase with which the apparatus is then provided. The green signal G in this phase will be displayed for a minimum or greater period depending upon traffic actuations as explained above in connection with operation of the vehicular phase units A, B, or C.

It will be understood that the motors in the several phase units may be equipped with speed adjusting devices in order that by presetting the speeds of the several motors differences in the time required for vehicles on different lanes to pass thru the intersection after actuating their respective responsive devices, and other factors, may be taken into account. It may also be desirable to have a greater or less number of projecting points on the cams C3 and C4 for example, in order to provide more or fewer potential right of way extension periods on one or more of the intersecting lanes.

The terminals L3, L4 of the direct current

power for operating relays in the several units are labelled for the sake of simplicity of description only and either the L3 pole or the L4 pole shown in the drawings might be grounded. Alternating current relays might be used in lieu of those operating from direct current.

Numerous other changes in the structure or design of a traffic control system of the character shown in this specification, as the substitution of static timing devices of the retarded pick-up relay timers, or other changes, might be made without departing from the spirit of the invention as defined by the claims.

Having described our invention what we claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A traffic signal control apparatus for mutually interfering traffic lanes including right of way transferring mechanism for controlling signals to accord and interrupt right of way on the said lanes, traffic actuatable means for each lane, control means associated with each lane and operating solely in response to actuation of the actuatable means in that lane to cause only when potentialized said right of way transferring mechanism to accord right of way to the said lane, timing means continuously operating for normally cyclically and successively potentializing and depotentializing said control means for each lane, and means for delaying said cyclic potentializing upon such accord of right of way to any of the lanes.

2. A traffic signal control apparatus for mutually interfering traffic lanes including control mechanism for said signal and comprising an individual right of way transferring mechanism for each lane, in each lane a traffic actuatable device operable upon actuation by traffic to potentialize the right of way transferring mechanism associated therewith to accord right of way to the lane of the actuation, timing means continuously operating to cause cyclically one at a time the right of way transferring mechanisms only when potentialized to accord right of way to the lane of the mechanism, and means for delaying such cyclic operation of the timing means upon accord of right of way to any of the lanes.

3. A traffic control system for the intersection of a plurality of mutually interfering traffic lanes having a signal for displaying right of way according and interrupting indications in said lanes, a traffic actuatable device in each lane, a control mechanism for said signal and comprising an individual right of way transferring mechanism associated with each lane and connected to the traffic actuatable device therein, a timing means operating continuously cyclically to potentialize and depotentialize successively one right of way by the latter transferring mechanism at a time for transferring right of way to the lane associated therewith solely when so potentialized and rendered operable in response to actuation of its actuatable device, means operating upon such transfer of right of way to one lane to delay progress of the cyclic operation of the timing means for at least a minimum time period and means associated with each right of way transferring mechanism for mantaining the display of the signal upon such transfer of right of way to one lane until any other right of way transferring mechanism is rendered operable in response to actuation of its actuatable device.

4. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means, a plurality of right of way transferring mechanisms therefor, and a plurality of timers, each timer when activated operable thru a time cycle and connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting upon actuation of such traffic actuated means to cause accord of right of way to such lane by the transferring mechanism thru the signalling means in a part of such cycle and means forming a part of each timer and operable at a predetermined point in the time cycle of the same to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence.

5. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means, a plurality of right of way transferring mechanisms therefor, and a plurality of timers, each timer when activated operable thru a time cycle and connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting only in a predetermined part of the time cycle of said timer upon actuation of such traffic actuated means to accord right of way to such lane and means forming a part of each timer and operable in a further part of the time cycle of the same to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence.

6. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means adapted to accord and interrupt right of way, a plurality of right of way transferring mechanisms therefor, and a plurality of timers, each timer when activated operable thru a time cycle and connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting upon actuation of such traffic actuated means to cause accord of right of way to such lane by the transferring mechanism thru the signalling means in a part of such cycle and interlocking means for said plurality of right of way transferring mechanisms whereby accord of right of way to any one lane causes interruption of right of way in the other lanes, and means forming a part of each timer and operable at a predetermined point in the time cycle of the same to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence.

7. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, right of way signalling means for the lanes, right of way transferring mechanism therefor, and a plurality of individual unit timers one for each lane, each timer when activated operable thru a time cycle and connected to its associated traffic actuated means and to the right of way transferring mechanism, each timer including control means operable in one part of its time cycle to cause right of way transferring mechanism to accord right of way to the lane associated with such timer in response to

actuation of the traffic actuated means in such lane, and means operable in a further part of its cycle to activate another unit timer whereby successive operation of the unit timers in sequence occurs and means associated with said right of way transferring mechanism for maintaining it in the position to which it was last operated by one control means until operated by another control means whereby through said signalling means right of way will be maintained on any lane to which it is accorded until the control means in the timer of another lane is operated.

8. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, and one for and individual to each lane of a plurality of right of way signalling means for according and interrupting right of way therein, a plurality of right of way transferring mechanisms therefor, and a plurality of unit timers, each right of way transferring mechanism having an element movable from a normal position in which right of way is interrupted in its associated lane to an operated position in which right of way is accorded to its associated lane, each timer connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting only when its unit timer is operative and upon actuation of the traffic actuated means to operate such transferring mechanism and its movable element to cause accord of right of way to such lane for a time period, means interconnecting the several timers for rendering them individually so operative in sequential order, and latching means mechanically interlocking the movable elements of the plurality of such mechanisms to maintain any such element so operated to continue accord of right of way to its lane beyond said time period and until corresponding operation of another such element and to cause by such operation by any such movable element in according right of way to one lane the concurrent restoration of the movable element of any other mechanism of the other lanes to normal whereby right of way is maintained by any one element in its associated lane only and until it is interrupted by accord of right of way to another lane by another such element.

9. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, and one for and individual to each lane of a plurality of right of way signalling means, for according and interrupting right of way thereon, a plurality of right of way transferring mechanisms therefor, and a plurality of unit timers each right of way transferring mechanism having electro-magnetic means including an armature movable from a normal position in which it causes interruption of right of way in its associated lane to an operated position in which it causes accord of right of way to its associated lane, each timer connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting only when its unit timer is operative and upon actuation of the last named traffic actuated means to operate such transferring mechanism and its movable armature to cause accord of right of way to such lane for a time period, means interconnecting the several timers for rendering them individually so operative in sequential order, and latching means mechanically interlocking the movable armatures of the plurality of such mechanisms to maintain any such armature so operated to continue accord of right of way to its lane beyond said time period until corresponding operation of another such armature and to cause by such operation of any such movable armature in according right of way to one lane the concurrent restoration of the movable armature of any other mechanism of the other lanes to normal whereby right of way is maintained by any one armature in its associated lane only and until it is interrupted by accord of right of way to another lane by another such armature.

10. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, and one for and individual to each lane of a plurality of right of way signalling means adapted to accord and interrupt right of way, a plurality of right of way transferring mechanisms therefor and each adapted when operative to cause accord of right of way to its respective lane and to maintain such right of way until interrupted by transfer of right of way to another lane by the transferring mechanism of the latter lane, and a plurality of timers, each timer when activated operable through a time cycle and connected to the right of way transferring mechanism and to the traffic actuated means for its lane and including means acting only in a predetermined part of the time cycle of said timer upon actuation of such traffic actuated means to accord right of way to such lane through its connected transferring mechanism, means interconnecting said plurality of mechanisms to cause interruption of right of way in the other lanes upon such accord of right of way to any one such lane, and means forming a part of each timer and operable at a predetermined point in the time cycle of the same to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence.

11. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, and one for and individual to each lane of a plurality of right of way signalling means adapted to accord and interrupt right of way, a plurality of right of way transferring mechanisms therefor and each adapted when operated to cause accord of right of way to its respective lane and to maintain such right of way until interrupted by transfer of right of way to another lane by the transferring mechanism of the latter lane, and a plurality of timers, each timer when activated operable through a time cycle and having a circuit for connecting it to the right of way transferring mechanism and to the traffic actuated means for its lane and including means operable in one part of the time cycle of said timer to partially complete said circuit for effecting operation of the right of way transferring mechanism, and means operable responsive to actuation of said traffic actuated means to complete said circuit, whereby said right of way transferring mechanism will be operated to transfer right of way to its corresponding lane through its connected transferring mechanism, means interconnecting said plurality of mechanisms to cause interruption of right of way in the other lanes upon such accord of right of way to any one such lane, and means forming a part of each timer and operable at a

predetermined point in the time cycle of the same to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence.

12. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means, a plurality of right of way transferring mechanisms therefor, and a plurality of timers, each timer when activated operable thru a time cycle and having a circuit for connecting it to the right of way transferring mechanism and to the traffic actuated means for its lane and including means operable in one part of the time cycle of said timer to prepare said circuit for effecting operation of the right of way transferring mechanism, and means operable responsive to actuation of said traffic actuated means to complete said circuit whereby said right of way transferring mechanism will be operated to transfer right of way to its corresponding lane during such part of such cycle, means forming a part of said timer and operating in a further part of the time cycle to activate another of said timers whereby successive operation of the timers occurs in a predetermined sequence.

13. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means, a plurality of right of way transferring mechanisms therefor and each adapted when operated to cause accord of right of way to its respective lane and to maintain such right of way until interrupted by transfer of right of way to another lane by the transferring mechanism of the latter lane, and a plurality of timers, each timer when activated operable thru a time cycle and having a circuit for connecting it to the right of way transferring mechanism and to the traffic actuated means for its lane and including means operable in one part of the time cycle of said timer to prepare said circuit for effecting operation of the right of way transferring mechanism, and means operable responsive to actuation of said traffic actuated means to complete said circuit whereby said right of way transferring mechanism will be operated to transfer right of way to its corresponding lane during such part of such time cycle, means forming a part of said timer and operating in a further part of the time cycle to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence, means associated with the said timer and operable upon such actuation of the traffic actuated means of its lane to delay operation of said activating means for a time period whereby right of way will be maintained on such lane for at least a minimum period before transfer of right of way by another timer and associated right of way transferring mechanism to the lane of the latter, can correspondingly be effected.

14. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signaling means, a plurality of right of way transferring mechanisms therefor and each adapted when operated to cause accord of right of way to its respective lane and to maintain such right of way until interrupted by transfer of right of way to another lane by the transferring mechanism of the latter lane, and a plurality of timers, each timer when activated operable thru a time cycle and having a circuit for connecting it to the right of way transferring mechanism and to the traffic actuated means for its lane and including means operable in one part of the time cycle of said timer to prepare said circuit for effecting operation of the right of way transferring mechanism, and means operable responsive to actuation of said traffic actuated means occurring prior to said one part of the cycle to complete said circuit in said one part whereby said right of way transferring mechanism will thereupon be operated to transfer right of way to its corresponding lane, means forming a part of said timer and operating in a further part of the time cycle to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence, means associated with said timer and operable upon further actuation of the traffic actuated means of its lane while right of way is accorded to such lane to delay operation of said activating means whereby the maintaining of right of way on said lane will be prolonged, and further means associated with each timer to provide a maximum limit to such prolongation by a plurality of such further actuations.

15. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with and individual to each lane, and one for each lane of a plurality of right of way signalling means, a plurality of right of way transferring mechanisms therefor, and a plurality of timers, each timer when activated operable thru a time cycle and having a circuit for connecting it to the right of way transferring mechanism and to the traffic actuated means for its lane and including means operable in one part of the time cycle of said timer to prepare said circuit for effecting operation of the right of way transferring mechanism, and means operable responsive to actuation of said traffic actuated means occurring prior to said one part of the cycle to complete said circuit in said one part whereby said right of way transferring mechanism will thereupon be operated to transfer right of way to its corresponding lane, means forming a part of said timer and operating in a further part of the time cycle to activate another of said timers whereby successive operation of the timers occurs in predetermined sequence, means associated with each said timer and operable upon further actuation of the traffic actuated means of its lane while right of way is accorded to such lane to delay operation of said activating means whereby the right of way on said lane will be prolonged before transfer can be effected to another lane in response to actuation in the latter, and further means associated with said timer to cause activation of another timer after a maximum period of such delay by a plurality of such actuations and independently of said delaying means.

16. A traffic control system for a plurality of mutually interfering traffic lanes including in combination, traffic actuated means associated with each lane, right of way signalling means for the lanes, right of way transferring mechanism therefor, and a plurality of individual unit timers one for each lane, each timer when activated operable thru a time cycle and connected

to its associated traffic actuated means and to the right of way transferring mechanism, each timer including control means operable in one part of its time cycle to cause said right of way transferring mechanism to accord right of way to the lane associated with such timer in response to actuation of the traffic actuated means in such lane, and means operable in a further part of its cycle whose time relation to said one part of such cycle depends on further actuations during such cycle to activate another unit timer whereby successive operation of the unit timers in sequence occurs.

17. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and interrupt right of way in the lanes, traffic actuated means for each lane, and a plurality of individual unit timers, one for each lane, and each connected to the traffic actuated means for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by said cams, camshaft driving means, and relay means operated from an unoperated position to an operated position by one of said switches in a predetermined part of the cycle of said camshaft upon actuation of the corresponding traffic actuated means to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic actuated means and means operated by said relay means in its unoperated position and in cooperation with operation of another of said switches in a further part of the camshaft cycle to activate another of said timers whereby successive operation of the plurality of timers in sequence occurs.

18. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and interrupt right of way in the lanes, traffic actuated means for each lane, and a plurality of individual unit timers, one for each lane, and each connected to the traffic actuated means for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by said cams, camshaft driving means, and relay means operated from an unoperated position to an operated position by one of said switches in a predetermined part of the cycle of said camshaft upon actuation of the corresponding traffic actuated means to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic actuated means and means operated by said relay means in its unoperated position and in cooperation with operation of another of said switches in a further part of the camshaft cycle to activate another of said timers whereby successive operation of the plurality of timers in sequence occurs and means operated by further actuation of said traffic actuated means when said relay is operated to maintain it in operated position whereby said action of said activating means is delayed and right of way prolonged on the lane of said traffic actuated means.

19. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and interrupt right of way in the lanes, traffic actuated means for each lane, and a plurality of individual unit timers, one for each lane, and each connected to the traffic actuated means for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by said cams, camshaft driving means, and relay means operated from an unoperated position to an operated position by one of said switches in a predetermined part of the cycle of said camshaft upon actuation of the corresponding traffic actuated means to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic actuated means at least as long as said relay means is in its operated position, and means operated by said relay means in its unoperated position and in cooperation with operation of another of said switches in a further part of the camshaft cycle to activate another timer whereby successive operation of the plurality of timers in sequence occurs, means operated by actuation of said traffic actuated means when said relay means is operated to maintain it in operated position for a time period whereby said action of said activating means is delayed and right of way prolonged on the lane of said traffic actuated means and means including a third one of said switches for preventing said relay means from remaining in its operated position for more than a predetermined maximum portion of the camshaft cycle.

20. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and interrupt right of way in the lanes, traffic actuated means for each lane, and a plurality of individual unit timers, one for each lane, and each connected to the traffic actuated means for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by said cams, camshaft driving means, and relay means operated from an unoperated position to an operated position by one of said switches during a predetermined portion of the cycle of said camshaft upon actuation of the corresponding traffic actuated means to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic actuated means at least as long as said relay means is operated, means operated by said relay means in its unoperated position and in cooperation with operation of another of said switches in a further part of the camshaft cycle to activate another timer whereby successive operation of the plurality of timers occurs in sequence, means including another cam-operated switch operated upon actuation of said corresponding traffic actuated means while said relay means is in operated position to maintain it therein and thus extend its period of operation and consequently the right of way period on the lane of said corresponding traffic actuated means for a further predetermined part of said cam shaft cycle, and means including a third cam-operated switch to prevent said relay means from being maintained in operated position for more than a predetermined maximum portion of the camshaft cycle.

21. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and

interrupt right of way in the lanes, traffic actuated means for each lane, and a plurality of individual unit timers, one for each lane, and each connected to the traffic actuated means for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by said cams, camshaft driving means, relay means operated from an unoperated position to an operated position by one of said switches during a predetermined part of the cycle of said camshaft upon actuation of the corresponding traffic actuated means to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic actuated means at least as long as said relay means is in its operated position, means including a second cam-operated switch to store the effect of actuation of the traffic actuated means in certain further parts of said camshaft cycle, means including a third cam-operated switch to maintain said relay means in operated condition longer than for said predetermined part of the camshaft cycle in response to operation of said last recited means including the second switch, and means activated by said relay means in its unoperated position and in cooperation with operation of a fourth cam-operated switch in a still further part of the camshaft cycle to initiate activation of another timer whereby successive activation of the plurality of timers in sequence is effected.

22. Traffic signal control apparatus for mutually interfering traffic lanes including in combination, right of way transferring mechanism for controlling right of way signals to accord and interrupt right of way in the lanes, means including relays individual to the several lanes and operated responsive to traffic approaching in the respective lanes, and a plurality of unit timers, one for each lane, and each connected to the traffic responsive relay for its lane and connected to said mechanism, each timer comprising a camshaft when activated operable thru a cycle, cams mounted on said camshaft, switches operated by the cams, camshaft driving means, relay means operated from an unoperated condition to an operated condition by one of said switches during a predetermined part of the camshaft cycle upon actuation of the corresponding traffic responsive relay to operate said transferring mechanism to accord right of way to the lane of such corresponding traffic responsive relay at least as long as said relay means is in its operated position, means including a second of said switches to lock-in the traffic responsive relay upon actuation thereof by traffic in certain positions of the camshaft cycle and to maintain said relay means in operated condition in such positions, means including a third of said switches to maintain said relay means in operated condition in other than said certain positions of said cycle after the last named means has locked it in a preceding certain position, said cams arranged to render said last two named means operative alternately, and means operated by said relay means in its unoperated position and in cooperation with a fourth of said switches in a further part of said camshaft cycle to initiate activation of another timer whereby successive activation of the plurality of timers in sequence is effected.

WILLIAM C. NEIN.
THOMAS W. VARLEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,114,968. April 19, 1938.

WILLIAM C. NEIN, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, first column, line 59, claim 3, strike out the words "by the latter" and insert the same after "way" in line 60, same claim; page 9, second column, line 22, claim 14, before "timer" insert each; and line 28, same claim, before "each" insert said; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of November, A. D. 1938.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.

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