Sept. 11, 1934. H. M. FRIENDLY 1,973,691

HIGHWAY CROSSING SIGNAL SYSTEM

Filed Oct. 20, 1922 2 Sheets-Sheet 1

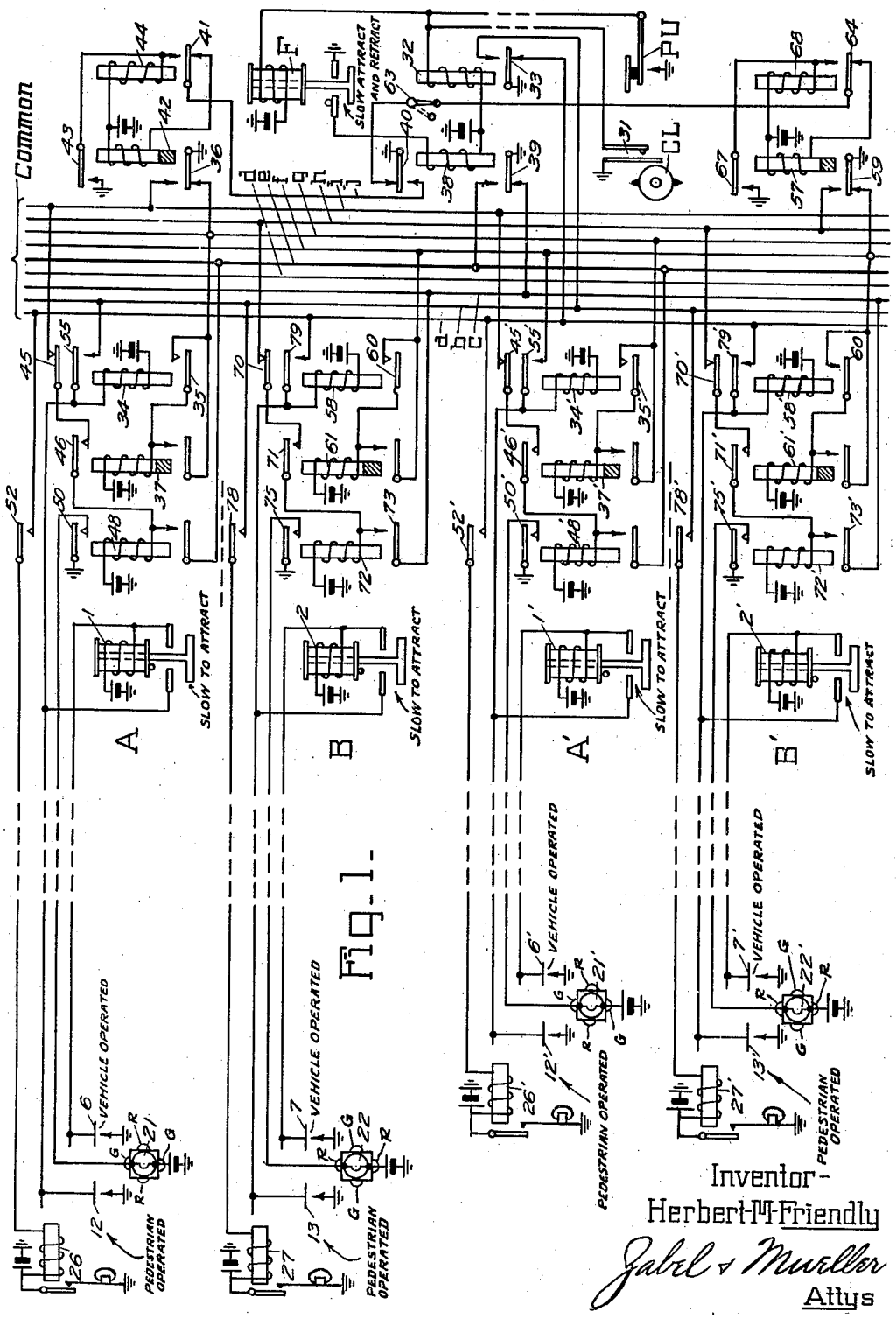


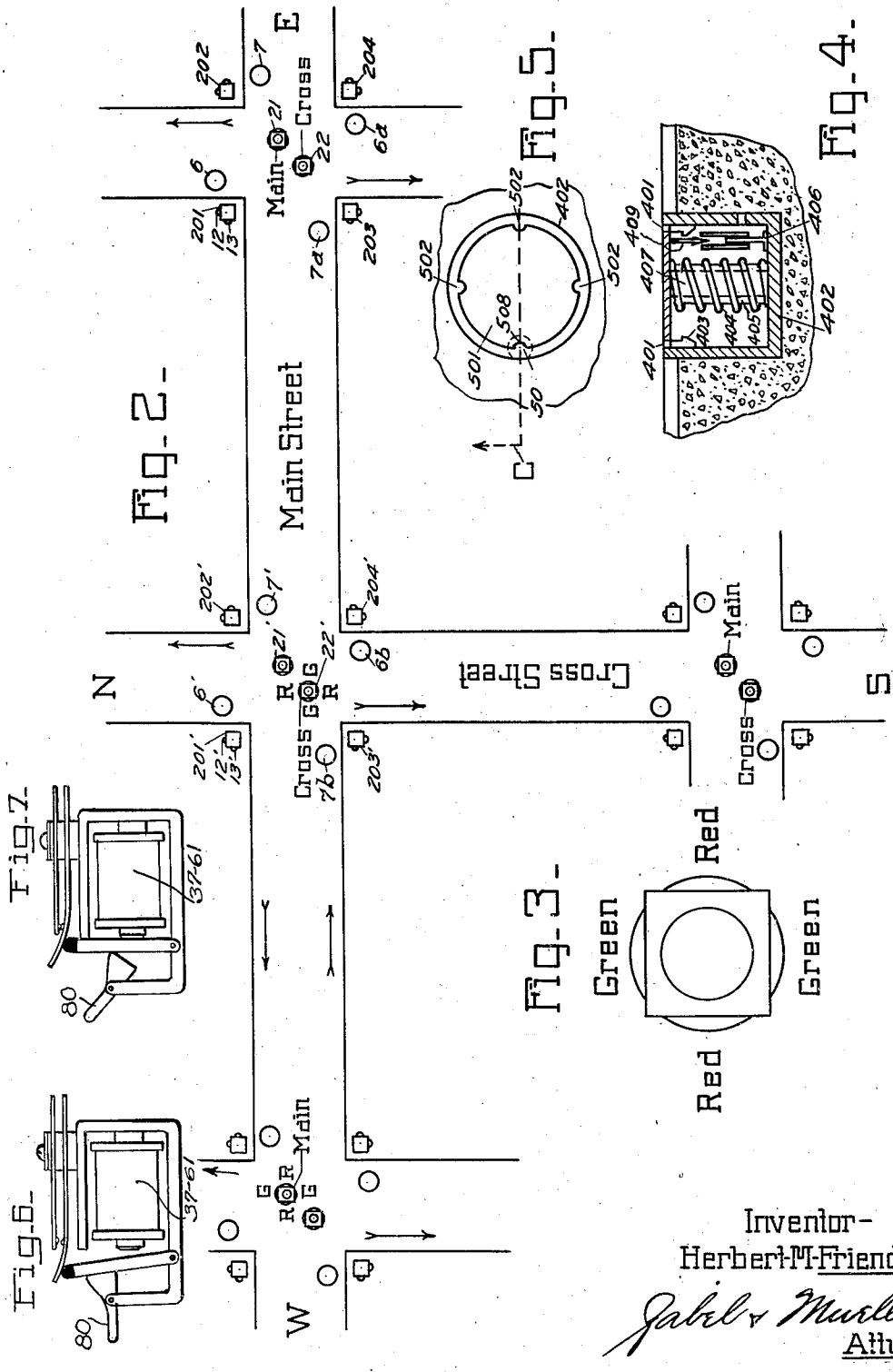
Fig. 1.

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HIGHWAY CROSSING SIGNAL SYSTEM

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Application October 20, 1922, Serial No. 595,831

22 Claims. (Cl. 177—337)

The present invention refers to highway traffic stop signals; more particularly traffic signals at street intersections or other crossings which are periodically controlled by clock mechanism or other timing device.

I am aware that clock-controlled and manually-controlled stop signals for controlling traffic along streets whereby the traffic will be halted on one street while permitting the traffic on a cross street to proceed, and vice versa, is not new. Moreover, it is not new to control a plurality of said stop signals from a central point simultaneously, as for example, to halt the traffic along a main stret at a plurality of cross highways while permitting the traffic on the said cross streets to proceed, and vice versa. Under this latter arrangement the traffic along a main street, for example, is halted at each of a plurality of cross streets coincidently, and then sent forward coincidently, while exercising the converse control of the cross traffic at each said cross street. The said traffic refers to vehicular and pedestrian.

However, the mechanism of the present invention is directed towards a plan of operation of signal systems of the stated general class, but having the novel provision of a secondary control of the signals, subject to the primary control. That is, while the primary control will determine the operation of the signal or signals at an intersection, this latter control will depend upon a secondary manual control (or possibly an independent clock control) at each cross street, or predetermined cross streets. In the commercial embodiment of the invention, the detailed organization will be modified or adapted to the traffic condition involved. Thus, a central control station may, for example, primarily govern signal devices at a plurality of street crossings, or a signal device at a single one only. In the case of controlling a plurality of the signal devices at a corresponding plurality of street crossings, a manually controlled circuit-closer (single or in multiple plurality) will be provided at each crossing, which may be operated by depressing a corresponding push-button, whereby the signal device at the corresponding crossing will be thereby enabled to operate under the primary control of the central or master control station. That is to say, the master control station will not cause the operation of any of the signal devices unless a specific setting with respect to the concerned signal device has first occurred. Of course, some of the signal devices may be set to operate responsive to the master control station directly automatically, while oher signal devices may only operate when specifically set manually by a circuit closer, for example, and in the latter case, will operate but a single time and be thereafter disabled until again enabled by the said manual operation of its corresponding circuit-closer.

One contemplated organization of the invention which will be described, and which is illustrated by the accompanying drawings, is a master control station in primary control of main and cross street stop signal lamps located in pairs at each street crossing. A push-button is placed at each corner of the crossing for each of the said two signal devices, being eight push-buttons at each crossing. The said buttons will be in two groups of four, multipled. One push-button of each group is conveniently mounted on a post or flush with the sidewalk at each corner curb. Thus, there will be a push-button at each curb corner for each of the two stop signal lamps. In addition to the said push-buttons, a vehicle wheel operated push-button will be set flush with the street surface in the line of traffic contiguous to each curb corner. The wheel push-button will become operatively depressed upon a vehicle wheel or other weight bearing upon it.

The master control station, which it will be remembered is adapted to be controlled by a time mechanism at stated intervals, which latter may vary alternatively as well as with respect to the time of day, has auxiliary control mechanism responsive to the push-buttons located at the various street corners, so that if a push-button is depressed for an instant, a relay at the master control station will be caused to operate effective to cause the corresponding stop signal lamp to be directly controlled by the master control mechanism for one time only at the next normal operative period of the said master control station, but not thereafter, unless the push-button is again operated.

Where all of a plurality of lamp signals located at corresponding cross-streets are coincidently operated under positive control of the master station, but not dependent upon secondary push-buttons, as is contemplated in the present invention, it means that when the master control station operates to close the lamp circuit, lamps at all cross streets will glow as a stop signal to halt the traffic in the corresponding direction, regardless of the fact that there may not be traffic at one or more crossings awaiting the cessation of the halted traffic. This causes a needless delay of traffic under the condition, and this condition will be met at various times. Again, where there may be little vehicular cross

traffic with respect to a busy main street, pedestrians will frequently find the traffic so dense that crossing the main street traffic will be impossible or hazardous. The said cross street traffic may not be of such volume that a definite stop at predetermined periods is warranted, or at least required to be of such duration as parallel cross streets. Under this condition of traffic it will obviously unduly hinder the main street traffic were it halted by predetermined rule regardless of the present requirement or exigency, having in mind that while pedestrians may be awaiting an opportunity to cross, the density of traffic on the main street may not be great enough to warrant halting the traffic precipitately. Of course, the hour of the day will perhaps alter the relative traffic on the streets crossing the main street, as well as the traffic on the main street. In any event, it is quite impossible to predetermine the regulation of the traffic over a plurality of streets crossing a main street without favoring certain cross streets at times and prejudicing the traffic on the main street correspondingly.

Having the last foregoing in mind, should a pedestrian desire to cross the main street, he will press the push-button on the curb of the corner he occupies, corresponding to the main street. This will lock a relay at the master control station so that at the next potential halting period on the main street, the traffic on the main street at the cross street at which the push button was depressed will be halted due to the glowing of the lamp at the specific crossing of the main street. The latter said lamp will show red to the traffic on the main street to indicate that the traffic thereon must halt, or that the cross traffic of every kind has the right-of-way, depending upon the rules laid down. The said lamp will show green to the traffic on the cross street to indicate that the traffic thereon has the right-of-way across the main street. In this connection, it will be understood that the glowing of the said lamp will be coincident with the glowing of corresponding other cross street lamps, provided a pedestrian has set the master control station mechanism by depressing a button or a permanent setting has been made. If the push-button has been depressed during a potential halting period on the main street, the signal lamp will not be effective until the next said halting period. To make a setting to cause the stop lamp to glow, a momentary pressing of the push button is all that is required.

A separate lamp is provided for halting cross traffic controlled by setting the mechanism at the master control station through the agency of one of the alternative push-buttons mentioned, in the same manner as halting the traffic on the main street, having in mind that the halting periods for the main street and the cross streets alternate. In the latter case, the red discs of the lamp will indicate to the cross traffic that it must halt, or that the main street traffic of every kind has the right-of-way, depending upon the rules laid down.

Two lamps are shown at each intersection, though it will be understood that one lamp may suffice, for example, the glowing of the lamp may mean to halt the traffic on the main street, while it will be understood that all traffic along the direction of the cross street (vehicular and pedestrian) has the right-of-way over the main street traffic. Under this condition there would not be the requirement for the set of push-buttons (and corresponding lamp) for halting the cross street traffic with reference to the main street.

The push-buttons with respect to the street surface mentioned will be operated by the driver of a vehicle desiring to halt the cross traffic with respect to the street he is traversing. The front wheel of the waiting vehicle, for example, will be run upon the push-button, and after a predetermined interval the master control station mechanism will be caused to set itself to halt the traffic as if the corresponding curb push-button had been momentarily pressed. In the case of the street push-button, a retarding relay is interposed to prevent the mechanism from being set due to a vehicle crossing the push-button under motion.

A signal device is provided associated with each lamp which will operate in advance of the lamp extinguishing, to indicate the condition, so that those concerned will know the halted or the right-of-way condition of the concerned street will terminate in a short predetermined interval.

It will be clear, presently, that while the system may be directively operated by manual means through the agency of the push-buttons located on the corners, governing the clock means, the said manual means may be disabled at certain periods of the day at any or all crossings, and furthermore, the automatic means may be made to predominate at certain hours of the day, so that the cross traffic and main traffic will be halted at any or all streets in a predetermined manner by the clock (or other timing means), regardless of the push-buttons. Moreover, the primary clock control may be displaced by or supplemented by a manual key control, operated by the foot of a traffic officer, for example.

Having set forth the general operative functions of the invention, its operation, as well as other functions will be now described.

Referring to the drawings:—

Fig. 1 shows a schematic wiring arrangement of the master control station, together with the schematic representation of the push-buttons and signal devices at two street intersections.

Fig. 2 shows east and west main streets with three north and south cross streets, together with the push buttons and lamps indicated in Fig. 1 located thereon as correspondingly designated.

Fig. 3 shows a schematic detail of a lantern containing a lamp as shown in Fig. 1.

Fig. 4 shows a vertical sectional view of a street surface push-button adapted to be operated by a vehicle wheel, for example. The section is along line C in Fig. 5.

Fig. 5 shows a plan view of the surface push-button shown in Fig. 4.

Fig. 6 shows a locking means for one of the relays with the relay in deenergized condition.

Fig. 7 shows the same relay with the armature held in energized position by the locking means.

With further reference to Fig. 1, the relays 1, 2, 1′ and 2′ are dash-pot relays which have a retarded actuating characteristic of their respective plunger-arms, so that they will not effect a circuit closure until a predetermined period after the respective winding has become energized. The push-buttons 6, 7, 6′ and 7′ (shown in detail in Figs. 4 and 5) are set flush with the street surfacing, being located where indicated in Fig. 2. It will be understood that a plurality of the latter said push-buttons may be grouped as a gang, in lieu of employing a single one, as indicated in Figs. 1 and 2. The push buttons 12,

13, 12′ and 13′ (and multipled buttons thereof) are on posts 201 to 204 and 201′ to 204′ located on the curb where indicated in Fig. 2, having in mind that buttons 13 and 13′ are on the west sides of the posts 201 and 201′, respectively, and that buttons 12 and 12′ are on the north sides of the posts 201 and 201′, respectively. The buttons 12 and 12′ are to halt traffic along the main street and the buttons 13 and 13′ are to halt traffic along the cross streets at the points concerned. Each of the said posts 201 to 204 and 201′ to 204′ will have two push-buttons for halting traffic. For example, post 202′ will have two buttons in multiple relation with buttons 12′ and 13′ on the north and east sides thereof, respectively; post 203′ will have two buttons in multiple relation with buttons 12′ and 13′ on the south and west sides thereof, respectively; post 204′ will have two buttons in multiple relation with buttons 12′ and 13′ on the south and east sides thereof, respectively. The same relation as the last described will relate to the posts 202 to 204, respective to the buttons on post 201. That is to say, at the cross street intersection, there will be a button on each of the four corner posts for halting traffic on the main street and for halting traffic on the cross street independently; eight buttons in all. It will be understood that the invention contemplates the installation of street surface push-buttons at the crossings, located as indicated by 6*a* and 7*a* connected in indirect multiple relation with push-buttons 6 and 7, respectively, for example, to halt the traffic on the main and cross streets, respectively.

It will be understood that in some instances the traffic on the cross streets will be relatively light at all hours, so that it will not be necessary to halt it, the main street traffic having the right-of-way over it at all times. Under such condition this cross street traffic will be ignored, so far as signal lamps and push-buttons are concerned. That is, push-buttons and signal lamps for halting the said cross traffic will not be provided for.

The lamps 21 and 22, for example, will be mounted on a convenient corner post at the concerned corner, or otherwise suspended or placed visual to the main and cross traffic. As shown in Fig. 3, the lamps will show red and green to right angles as indicated in Fig. 3, so that if a lantern presents a red light to the north and south traffic, it will at the same time present a green light to the east and west traffic. The red light will indicate that traffic must halt, or that its right-of-way is subordinated to the right-ang e traffic, depending upon the traffic rules in force. All north and south stop lamps at all intersections will light simultaneously, if at all, and the east and west stop lamps will operate similarly at the alternative period. That is to say, the north and south, and the east and west stop lamps will not glow simultaneously.

The lamps indicated at the extreme left and the extreme lower portion in Fig. 2 are not shown in the wiring diagram of Fig. 1. The designated "common" conductors in Fig. 1 at the master control station may have groups of relays attached, depending upon how many crossings are to be operated from the master control station; wiring for two crossings only being shown in the circuit diagram in Fig. 1. Also, if cross traffic with relation to the main street is to be ignored, then the relay sets B and B′ will be omitted, and relay sets A and A′ only used with relation to the two crossings concerned. In that event, the corresponding push-buttons, indicators and lamps will be omitted from the installation.

The indicators, as 26 and 27, and 26′ and 27′ may be buzzers or bells, or other electromagnetic auditory, or in fact visual signals, or they may be lamp signals. It will be remembered that the latter signals are to apprise the traffic in advance of a signal being effaced, so that traffic will prepare for the changed condition to ensue.

The clock or motor driven circuit changer CL periodically closes the contacts 31 to operatively energize the relays 32 and F. The push-button PU may be operated by a traffic officer, for example, at arbitrary periods, to halt the traffic on the main street, while giving the cross street traffic the right-of-way. Slow actuating and releasing relay F will operatively actuate; energized in multiple with relay 32.

Assume that it is desired to halt the traffic on the main street through the agency of lamp 21, contacts 31 being open at said instant. The push-button 12 (or any of its multiplied buttons on posts 202 to 204), will be momentarily depressed by a pedestrian or officer. This will operatively energize relay 34 while push-button 12 is held down. Armature 35 will apply ground from armature 36 to actuate slow-releasing relay 37 and lock it to grounded armature 36. Nothing else happens now and lamp 21 does not light until the next operation of the timer CL. Upon the contacts 31 being closed (or the push-button PU being depressed), relays 32 and F will actuate. Upon relay F actuating (following the actuation of relay 32), relay 38 will actuate, whereby grounded armature 39 will ground conductor *e*, and ground will be applied from armature 40 through armature 41 to the winding of slow-releasing relay 42, the latter said relay actuating. The armature 36 will unlock relay 37 consistent with its slow-releasing period and will ground conductor *i*. Armature 43 will operatively energize relay 44 and lock it through armature 41 to armature 40. Relay 42 will become deenergized and will subsequently deactuate after relay 37 (relay 42 being somewhat more slow-releasing than relay 37), and relay 44 will be maintained actuated dependent upon the attracted condition of armature 40. However, before relays 37 and 42 retract their armatures, said relay 34 having only momentarily operated and restored to normal, the push-button 12 being assumed (for the present) released promptly after depressing it before relays 32 and F actuate, and relays 37 and 42 not yet having retracted their armatures, a circuit can be traced from the grounded armature 36, conductor *i*, armatures 45 and 46 to the winding of relay 48. The latter relay will actuate and lock to conductor *e*, so that when armature 46 retracts, the relay 48 will be sustained actuated dependent upon the attracted condition of armature 39. A circuit can be traced from the lamp 21 to grounded armature 50, the latter said lamp glowing to halt the traffic on the main street and to indicate through the green disc to the cross street concerned that its traffic (the cross street) has the right-of-way. When the contacts 31 disengage (or the push button PU is released), relay 32 will deactuate, followed by relay F at a predetermined period thereafter, it being understood that the relay F has a retarded actuation and deactuation characteristic, as distinct from the retarded actuating characteristic of relays 1, 2, 1′ and 2′ shown in Fig. 1.

Relay 32 will, upon being deenergized, retract its armature before the relay F will open its local

circuit to deenergize relay 38. Thus, at the time armature 33 retracts, a circuit path can be traced from the latter said armature, conductor *a*, armature 52 to the winding of the indicator 26 to render a signal to indicate that the lamp 21 will be extinguished in a predetermined period thereafter, as will appear. Upon relay F deactuating, following the deactuation of relay 32, relay 38 will deactuate, whereupon the locking circuit for relay 48 is opened so that armatures 50 and 52 will retract to deenergize the indicator 26 and extinguish the lamp 21.

It will be noted that should the push-button 12 have been depressed while contacts 31 are closed, that is, during a potential halting period for the main street, the relay 34 alone operates and would become locked through its armature 55, conductor *b* to attracted grounded armature 33. Having in mind that relay 42 actuates responsive to relay F and relay 38, and then deactuates responsive to the actuation of relay 44, it will be manifest that in a brief period (at most) after relay 34 locks while relay 42 is reactuated the relay 37 will be locked to armature 36. Then, the next time relay 42 actuates (relay 34 having deactuated), ground will be applied from its armature 36, conductor *i*, armatures 45 and 46 to the winding of relay 48, the latter said relay actuating and locking to conductor *e* grounded at armature 39, as before described, to cause the lamp 21 to glow. It is thus clear that if the push-button 12 is momentarily depressed at an off potential halting period for the main street while contacts 31 are open with relays F, 32, 38, 42, and 44 normal or de-energized, a condition will be set-up at the master control station which will cause the lamp 21 to glow at the next potential halting period for the main street, and if the said push-button 12 is depressed during the potential halting period for the main street, that is, with timer contacts 31 closed and relays F, 32, 38, 42, and 44 actuated, a condition will be set-up which will prevent the lamp 21 from glowing during the said ensuing potential halting period, but which will operate to set-up a condition which will endure during the present said halting period and over the alternative cross street halting period, so that it will operate to cause the lamp 21 to glow at the next potential halting period for the main street, after which the set-up condition will be effaced, unless the push-button 12 is again depressed to set-up a new condition as before described, wherein the relay 37 will be caused to actuate and lock.

The street surface push-button shown in Figs. 4 and 5 consists of a top plate 501 having four semi-circular notches 502 spaced ninety degrees apart at the periphery and which notches register with four projections 401 (only two of which are shown), respectively, cast integral with the box 402. The said projections 401 have shoulders 403 to limit the distance the top plate can be depressed, which distance in practice will preferably be less than one-fourth inch. A coil compression spring 404 encircles a sleeve 405 at the center of the box. The sleeve 405 is hollow so as to allow a support spindle 407, which is integral with the cover and concentric with its center point, to slidably fit into the hollow portion of the sleeve. A pair of insulated electrical contacts on springs is mounted on a standard 406 attached to the box 402. A plunger 409 is rigidly attached to the cover 501 so an electrical path will be closed including the latter said contact springs when the cover is depressed. The said contact springs may be considered the springs of the push button 13.

When the top plate 501 is depressed by the weight of a vehicle wheel, for example, the said plate 501 will depress against the resilience of spring 404 to close the contacts carried by the standard 406. The plate 501 is prevented from rising above a flush position by reason of the heads of round-head machine screws (not shown) indicated by the dotted circle 503. The latter said screws are placed in threaded holes in the four projections 401 and extended over the plate so as to retain the latter from rising above the flush position. Of course, the mechanical and electrical detail of the said street surface push-button can be varied in mechanical design without departing from the present invention. For example, the contact springs carried by the standard 406 may be enclosed in a water-tight compartment and operated through the agency of a packed piston from the plunger 409 properly adapted.

Assume that the push-button 6 is depressed by a vehicle wheel stopping upon it. After a predetermined period the relay 1 will operate to energize relay 34 for the objects set forth, the relay 1 retarding the effect of the primary closing of the push-button 6 in order to insure that brief closures of the button 6 (as by a wheel passing over it without pausing) will not set-up an operative condition in the relays at the master control station.

Assume that push button 13 is momentarily depressed while the contacts 31 are closed and after relay 38 has actuated and slow-releasing relay 57 is normal, that is, as illustrated in its deactuated condition. Relay 58 will actuate and apply ground from armature 59, conductor *f*, armature 60 to the winding of slow-releasing relay 61, the latter said relay actuating and locking to grounded conductor *f*. When the push-button 13 is released, relay 58 deactuates resultant therefrom, the relay 61 remaining locked. When the contacts 31 open at the potential halting period of the cross street traffic, relays 32 and F will deactuate; relay F deactuating last, followed by relay 38. A circuit path can now be traced from grounded armature 40, switch arm 63, armature 64 to the winding of relay 57, the latter said relay actuating. Armature 67 will apply ground to actuate relay 68, whereupon armature 64 will lock its relay 68 to grounded armature 40, relay 57 deactuating consistent with its slow-releasing characteristic. At the time armature 59 attracted it applied its ground over conductor *h*, armatures 70 and 71 to the winding of relay 72, the latter said relay actuating and locking through its armature 73, conductor *c* to the grounded armature 39. A circuit path can be traced from the lamp 22 to grounded armature 75, the latter said lamp glowing as a halting signal to the cross street traffic. The relay 72 will remain locked as long as armature 39 remains retracted. If the contacts 31 now close, relays 32 and 38 will actuate, as has been described. When armature 33 attracts, it applies its ground over conductor *b*, armature 78 to the winding of the indicator 27 to indicate that the lamp 22 will extinguish in a predetermined time thereafter. Then, when relay 38 actuates, relay 72 will unlock and lamp 22 will extinguish and the circuit energizing indicator 27 will be opened.

Had the push-button 13 been depressed while the contacts 31 were open, as drawn, and while the relays 32 and 38 are normal, and armature 59 is retracted, conductor *a* will be grounded at ar-

mature 33 so that the relay 58 will lock through armature 79 to armature 33 when it is caused to actuate from push button 13, and remain so until the contacts 31 close and again open. The relay 61 will also be actuated, locked to armature 59, it being remembered that the armature 59 retracts a short period after it is caused to attract. When the contacts 31 close thereafter, relays 32 and 38 actuate and relay 68 will unlock, the relay 61 remaining locked to armature 59. When the contacts 31 open at the next potential halting period for the cross street traffic, the relay 57 will momentarily actuate to unlock relay 61 and to apply ground from armature 59, conductor *h*, armatures 70, 71 to the winding of relay 72 before the armature 71 will retract, due to the slow-release characteristic of relay 61. Relay 72 will thus actuate and lock through its armature 73, conductor *c* to armature 39, causing the lamp 22 to glow. The relay 72 will remain locked until the contacts 31 close to cause armature 39 to attract, and the indicator 27 will operate in advance of the unlocking of relay 72 due to armature 33 applying ground over conductor *b* and armature 78.

The operation of relay 2 corresponds to that of relay 1. It retards the functioning of relay 58 when controlled from push button 7 (or its multipled button 7*a*), in the manner described with relation to push button 6 and relay 34.

The groups of relays A' and B' (and attachments) correspond to the groups A and B, respectively, with relation to the equipments to the right of common conductor *i*. So in view of the designations of the relay groups A' and B' corresponding to the designations of the groups A and B, but with a prime (or letter *b* substituted for the letter *a* when combined with a digit) added, the operation of the lamps 21' and 22'; push-buttons 12', 6', 13' and 7'; indicators 26' and 27' will be manifest in view of the descriptions preceding. Each group of relays A, B, A' and B' operate independent of each other, having in mind that the lamps 21 and 22 and the indicators 26 and 27 operate at alternative potential halting periods for the traffic of the main and cross streets, respectively, and that the same holds for lamps 21' and 22' and the indicators 26' and 27'. That is, for example, lamps 21 and 21' may be caused to glow and extinguish simultaneously, if push buttons 12 and 12' have been set before the potential halting period of the traffic on the main street, but the lamps 21 and 22, and 21' and 22' will only glow alternatively with respect to each said pair.

It will be noted that normally relay 44 or relay 68 will be locked alternatively, depending upon the grounded or non-grounded condition of the free terminal of the winding of relay 38. If it is desired to operate the signal lamp at any crossing automatically at any period of the day, the relays 37 and 61 (or corresponding relays of other companion crossing relay groups), will be mechanically closed or blocked and then maintained so. Then, each time armature 36 attracts, relay 48 will actuate to glow lamp 21, locking to attracted armature 39, the indicator 26 actuating upon armature 33 retracting, and the relay 48 deactuating to extinguish the lamp 21 upon armature 39 retracting. Each time armature 59 attracts, relay 72 will actuate to glow lamp 22, locking to retracted armature 39, the indicator 27 actuating upon the armature 33 attracting, and the relay 48 deactuating to extinguish the lamp 22 upon armature 39 retracting.

In Figs. 6 and 7 I have illustrated a means for mechanically holding the relays such as 37 and 61 mechanically closed or blocked. In Fig. 6 the relay armature is shown in its normal unoperated position, and in Fig. 7 the armature is shown mechanically locked by the lever 80. Such a hand operated lever, or any other suitable locking means, may be applied to the various relay pairs 37–61 etc., and actuated when it is desired to effect the continuous automatic operation of any or all of the crossing signals.

In view of the foregoing descriptions, it will be clear that the present invention provides multiple stop signals for a corresponding plurality of mutual cross streets, and that the said signals are operated from a common master control station in which the circuits are interlinked. Further, that the main street traffic and the cross streets traffic may be halted at will at a potential halting period of the main street or the cross streets, having in mind that the potential halting period of all cross streets will be coincident, alternative with the potential halting period of the main street. It provides an automatically periodically controlled or variable manually controlled signal system wherein the signals at a plurality of street crossings of a main street or streets may be simultaneously operated, or only a part thereof operated, depending upon directive control from the various street crossings, independently, and it also provides for operating any or all the signals wholly automatically.

While the drawings show the wiring for a single main street and two cross streets thereto, it is to be understood that the system is applicable to any plurality of cross streets, by introducing a set of relays as A and B for each such cross street. Moreover, if a second main street parallels the designated main street, as shown in Fig. 2, and the cross streets shown as crossing the said second main street also, sets of relays corresponding to A and B, for example, may be attached to the common conductors *a* to *l*, as are sets A to B, respectively, and conductors extended therefrom to the push buttons, lamps and indicators in the manner shown in Fig. 1, bearing in mind that the push buttons, lamps and indicator devices from the added set will be installed relative to the latter said elements as they are shown attached to relay groups A and B. It will be understood in this connection that it is immaterial what street crossing the relay group is to refer to, since all main street groups are wired alike, and all cross street groups are wired alike. For example, the wires leading from a street crossing to group A' may be transferred to corresponding terminals on group A', and vice versa, without altering the practical operation of the system. However, the wires leading to said group A could not be transferred to corresponding terminals of group B', since the signals would then operate alternatively, as one group A refers to halting the main street traffic and the other group B' refers to halting the cross street traffic at an alternative period with respect to the main street. From this it is clear that a master control station may comprise a large plurality of pairs of relay groups, any said pair referring to any crossing, and connections made to the relay groups indiscriminately from all street crossing master control station equipments of a district involving a plurality of main and a plurality of cross streets thereto.

As adverted at the outset, in case it is not desired to affect the cross street traffic at any specific crossing, the relay group, as B, for example, may be disconnected, and perhaps corre-

spondingly connected with the push-buttons, lamp and indicator at some other cross street in the district served by the master control station.

While the push-buttons are referred to as mounted on posts on the corners of the crossing, it will be understood that the buttons or button may be placed convenient to a traffic officer who may be stationed in the street intersection, or at some other point.

Separate indicators, as 26 and 27, are shown located at a crossing, each specific to one of the intersecting streets. It will be understood that one of the said indicators may be disconnected and the conductor freed connected to the conductor of the retained indicator, so that the retained indicator will operate under the conditions both operated under independently.

Ground or grounded battery has been indicated at various terminals. It will be understood that in lieu of ground, a common conductor may be employed. Also, that lamps described may be displaced by another type of indicator without departing from the invention defined by the claims.

I claim:—

1. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a main start circuit including a traffic controlled switch, an electro-magnetic device energized over the start circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, an electric timer switch including means for continuously opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic, and means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding interval operation of the timer switch after said control is applied to the start circuit for closing said signal circuit to operate the signal for halting the main street traffic.

2. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device over the start circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, a locking means controlled responsive to the energization of said device to maintain said device energized independent of the start circuit, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic, and means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said control is applied to the start circuit for closing the signal circuit to operate the signal for halting the traffic along the street.

3. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device over the start circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, a locking means controlled responsive to the energization of said device to maintain said device energized independent of the start circuit, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic, means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said control is applied to the start circuit for closing said signal circuit to operate the signal to halt traffic along the street, and means for unlocking said device for effacing the said assumed condition of the signal at the termination of a predetermined period following said next succeeding operation of the timer switch.

4. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device over the start circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic, means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said control is applied to the start circuit for closing the signal circuit to operate the signal to halt the traffic along the street, and means for restoring the signal to said condition normally existing a predetermined period after assuming its said condition for halting the traffic, so that the traffic will be halted only a predetermined time regardless of when the traffic effects said control.

5. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device over the start circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic, means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said control is applied to the start circuit for closing the signal circuit to operate the signal for halting the main street traffic, and circuit connections including a manual circuit controller for rendering said operating circuit immediately effective when said electro-magnetic device is in operated condition and in advance of the next predetermined interval.

6. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a main start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device over the start

circuit responsive to a momentary control applied to said switch by and at the will of traffic approaching the street, a locking means controlled responsive to the energization of said device to maintain said device energized independent of the start circuit, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical operating circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the main street traffic means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said control is applied to the start circuit for closing the signal circuit to operate the signal for halting the main street traffic, and circuit connections including a manual circuit controller for rendering said operating circuit immediately effective and in advance of the next predetermined interval.

7. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device responsive to control over said start circuit responsive to traffic approaching the street, a slow-acting means interposed in said start circuit for delaying the energization of the electro-magnetic device a predetermined time after the traffic has approached and maintained its approach for said predetermined time, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, and an electrical circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the street traffic, and means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only the one occurrence of the next succeeding operation of the timer switch after said device has become energized for closing said signal circuit to operate the signal to halt the traffic along the street.

8. In a street crossing signaling system, a signal having traffic directing means for traffic along a street, a start circuit including a traffic controlled switch, an electro-magnetic device, means for energizing said device responsive to control over said start circuit responsive to traffic approaching the street, a slow-acting means interposed in said start circuit for delaying the energization of the electro-magnetic device a predetermined time after the traffic has approached and maintained its approach for said predetermined time, a locking means controlled responsive to the energization of said device to maintain said device energized independent of the start circuit, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, an electrical circuit for said signal adapted to be closed to cause the signal to assume a condition for halting the street traffic and means jointly controlled by said operation of the electro-magnetic device and the timer and responsive to only one occurrence of the next succeeding operation of the timer switch after said device has become energized for closing said signal circuit to operate the signal for halting the traffic along the street.

9. In a traffic signal device, the combination with a signal adapted to be disposed at the intersection of two or more thoroughfares and having traffic directing means thereon adapted to be displayed alternately to allow traffic to proceed on one thoroughfare and restrain traffic on another thoroughfare of a traffic-operated device for each of said thoroughfares, an electric timer switch common to the traffic operated devices including means for intermittently operating said switch for predetermined periods, means including relay controlled circuits actuated by said device but controlled by operation of said timer switch for setting said signal to permit traffic to proceed on one of said thoroughfares for holding the signal so set for a certain determined period of time whereby traffic after operating said device will have time to pass the intersection before the signal can be again changed by the traffic operated means for the other thoroughfare.

10. In a traffic signal device the combination with a signal adapted to be disposed at the intersection of two thoroughfares and having traffic directing means thereon adapted to be displayed alternately to allow traffic to proceed on one thoroughfore and to restrain traffic on the other, of vehicle and pedestrian-operated devices for setting the signal for traffic to proceed on one thoroughfare and to restrain traffic on the other, means for holding the signal set for a definite period of time after operation of said vehicle or pedestrian-operated devices in one thoroughfare and vehicle and pedestrian-operated means on the other thoroughfare for setting the signal for traffic to proceed on said last mentioned thoroughfare, as soon as said period of time is ended.

11. In a traffic signal device for two intersecting thoroughfares, the combination with a signal adapted to be disposed at the intersection and having traffic directing means thereon adapted to alternately give the right of way to one of said thoroughfares while restraining traffic on the other thoroughfare, a traffic operated device for one thoroughfare, an electric timer switch common to the traffic operated devices including means for intermittently operating said switch for predetermined periods, means including a relay controlled circuit actuated by said device but controlled by operation of said timer switch for setting said signal to give the right of way to said thoroughfare and for holding the signal so set for a predetermined time, a traffic operated device in the other thoroughfare, and means including a relay controlled circuit having its operation initiated by the actuation of the last named traffic operated device within the said predetermined time but controlled by operation of said timer switch, to cause said signal to display the right of way to said other thoroughfare at the end of said predetermined time.

12. A traffic signal system including a plurality of signals adapted to be disposed at the intersections of a main and cross thoroughfares, said signals being normally inert to permit traffic along the main thoroughfare, a timer mechanism common to said signals, a control circuit for each signal, a traffic operated device in each cross thoroughfare for the corresponding signal and control circuit, and means for operating the control circuits responding to operation of the corresponding traffic operated device to effect an operation of the corresponding signal responsive to the timer to halt the traffic on the main highway and permit traffic to proceed from the cross highway.

13. In a traffic control signaling system com-

prising a signal on a street, the signal having a "stop" indication and an effaced condition of said indication, a start conductor, a traffic actuated device, means operated over the start conductor by operation of the traffic actuated device for causing the signal to display its "stop" indication, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods for causing the "stop" indications to endure for a predetermined time, and thereupon efface, a change circuit, a manually controlled switch, and means for operating the change circuit responsive to momentary closure of the manual switch a single time for effacing the "stop" indication in advance of said predetermined time, but permitting a subsequent said display of the "stop" indication after said predetermined time.

14. In a street crossing signal system for a plurality of intersections, a plurality of signals for each intersection having traffic directing means for traffic along a street past the signals respectively, a start circuit including a traffic controlled device for each signal, an electro-magnetic device for each starting circuit and signal energized responsive to a momentary control impulse applied over its corresponding start circuit by its device, a timing control circuit common to said signals having means for rendering the control circuit operative at predetermined periods, and means operative upon energization of said electro-magnetic devices and when said control circuit is operative for causing the respective signals to assume a condition for halting the street traffic predeterminately with respect to each other although the respective electro-magnetic devices are energized at random times.

15. In a signal system, a signal, a circuit path for said signal, a timer operating continuously to intermittently prepare said circuit path for operating the signal, a traffic operated device, means operated by the traffic device for causing the signal to subsequently operate responsive to the prepared circuit path effective to operate the signal only at the one next operation of the timer and next prepared circuit although the circuit path may be in prepared condition when the switch is operated.

16. In a signaling system for a highway, electrical lamp signaling means mounted on the highway having traffic directing means with a condition permitting movement of traffic along the highway and another condition for restraining movement along the highway, but permitting traffic across the highway, electro-magnetic means including a circuit normally disconnected from said signal for operating said signal to change from one condition to the other condition on closure of said circuit and back to its first condition on opening of said circuit, means for alternately energizing and deenergizing said circuit at regular periods, and means including a traffic operated switch actuated by traffic approaching the street for connecting said signal to said circuit for operation thereby upon energization thereof at the period next after the time of operation of said connecting means to restrain traffic movement along the highway and permit approaching traffic to cross the highway.

17. In a signaling system for a highway, electric lamp signaling means mounted on the highway having traffic directing means with a condition permitting movement of traffic along the highway and another condition for restraining movement along the highway but permitting traffic across the highway, electro-magnetic means including a circuit normally disconnected from said signal, for operating said signal to change from one condition to the other condition on closure of said circuit and back to its first condition on opening of said circuit, means for alternately energizing and de-energizing said circuit at regular periods, and means including a traffic operated switch actuated by traffic approaching the street for connecting said signal to said circuit for operation thereby upon energization thereof a single time only at the period next after the time of operation of said connecting means to restrain traffic movement along the highway and permit approaching traffic to cross the highway.

18. In a street signaling system, a lamp signal for stopping the traffic on a street, a traffic controlled device, relays and electrical connections between the relays and signal for causing the signal to operate to restrain the traffic along the street and thereafter efface its operation to remove the restraint, responsive to operation of the traffic device by traffic approaching the street, to permit approaching traffic to cross the street, and an electrical timer device electrically connected with the relays for insuring that the signal will be disabled by said relays from reoperating to restrain traffic along the street after its effacement within a minimum predetermined time in order that the street traffic will have a minimum predetermined time between operations of the signal in which it will be unrestrained although traffic has in the mean time approached the street.

19. In a street crossing signaling system, a pair of signals for a point on a street, one signal operating for imparting a specific restraint to traffic along the street at the point, and the other coming on to the street, traffic controlled switches, an electric timer switch including means for intermittently opening and closing said switch for predetermined periods, a relay controlled circuit for each signal, said circuits being alternately energized and de-energized by the timer without operating the signals, and means for rendering one of the relay controlled circuits operative responsive to traffic approaching the point on the street for operating one of the signals to cause it to assume a condition for restraining the flow of traffic along the street at the point but permitting traffic to pass on to the street.

20. In a traffic signal device the combination with a signal adapted to be disposed at the intersection of two thoroughfares and having traffic directing means thereon adapted to be displayed alternately to allow traffic to proceed on one thoroughfare and to restrain traffic on the other, of vehicle and pedestrian operated devices for each thoroughfare, a timer periodically having one condition of operation and a second condition of operation, means operating responsive to operation of one of the devices for one thoroughfare and one condition of said timer, to set the signal for traffic to proceed on said one thoroughfare and to restrain traffic on the other for a predetermined period of time after operation of the last said devices, and means operated responsive to operation of one of the devices for the other thoroughfare and the other condition of the timer, for setting the signal for traffic to proceed on said latter thoroughfare after the end of said period of time.

21. In a traffic control device for two intersecting streets, signal means which when opera-

tive restrains traffic on one street and permits traffic to proceed on the other street, means normally inoperative, for rendering said signal means in position to be operative; a traffic actuated device in one street, and means operated upon actuation of said device for making the normally inoperative means operative; a timer having successive periods of operation, a plurality of relays, means responsive to an operation of the timer to render said relays in a predetermined condition, and means acting when said normally inoperative means is operative and the predetermined condition of said relays has obtained for rendering said signal means operative.

22. In a traffic signal device for two intersecting thoroughfares, the combination with a signal adapted to be disposed at the intersection and having traffic directing means thereon adapted to alternately give the right of way to one of said thoroughfares while restraining traffic on the other thoroughfare, an electric timer switch including means for intermittently operating the switch for predetermined periods, interlocking relay circuits responsive to operations of the timer switch in the absence of traffic for continuously automatically operating the relay circuits to operate the signals to alternately give the right of way to one of said thoroughfares while restraining traffic on the other thoroughfare, manually controlled means for changing the relay circuits to remove the automatic continuous operation of the signals and effect a traffic control of the signals, a traffic operated device, and means for operating the changed relay circuits responsive to operation of the traffic device and timer switch to operate the signal to restrain traffic in one thoroughfare and permit passage of a vehicle in the intersecting thoroughfare within a predetermined time after arrival of such vehicle, but only for a predetermined period to permit passage of said vehicle.

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