Fig. 2.
This invention relates to new and useful improvements in highway traffic controlling systems and its object is to regulate vehicle traffic on highways so as to speed up the rate of travel with the least hindrance to intersecting traffic and eliminate, as far as possible, the necessity of prolonged stoppage. With this object in view, I divide the two lanes of traffic moving on a highway into platoons or sections of predetermined lengths and spacing, and gradually and periodically advance the platoons in the direction of travel. Assuming, for instance, a highway running north-south, I divide the northbound traffic into platoons of two hundred feet, the end of one platoon being spaced from the head of the succeeding platoon by a distance of two hundred feet. The southbound traffic is broken up in the same manner. Within a predetermined period of time traffic in both directions is advanced by two hundred feet each occupying now those stretches of the highway on which traffic was interdicted during the preceding period. However, the spacing of the platoons remains the same. Intersecting traffic is similarly controlled in such a manner that its freely moving platoons are given access to those areas of the highway on which north-south traffic is interdicted.

By means of this method of traffic control, if the speed of the vehicles is gauged in accordance with the shifting of the platoons, traffic need never be stopped and will not interfere with the movement of vehicles on lateral streets.

In order more clearly to explain the nature of the present invention, specific embodiments thereof will be described in conjunction with the drawings in which Fig. 1 is a diagrammatic view of traffic conditions on a highway at successive periods of time; Fig. 2 illustrates traffic conditions on a plurality of parallel highways and intersecting streets; Figs. 3, 3a, 3b and 3c traffic conditions at various periods of time at a street intersection; Fig. 4 a circuit arrangement for controlling signals to direct traffic in accordance with the present invention; Fig. 5 another circuit arrangement for signal control, and Fig. 6 is a view showing the combination of the relay circuit arrangement of Fig. 5 with the commutator control circuit of Fig. 4.

Referring now to Fig. 1, the arrows indicate the direction in which traffic is moving, the length of the arrows indicating platoons, i.e., areas within which vehicles are free to move. The blank spaces indicate areas within which traffic is prohibited. The drawing represents traffic conditions at various periods of time on a north-south avenue. The Roman numerals indicate time periods and the Arabic numerals indicate east-west cross streets. In the example here assumed, traffic is controlled on the avenue in such a manner that vehicles are permitted to move only within areas equivalent to four blocks and these free areas are spaced by stretches of the same length within which north-southbound traffic is prohibited. By any suitable means, such as the electrical signal system to be hereinafter described more in detail, the open and closed stretches of the avenue are shifted for traffic in both directions during successive periods of time. The length of these periods may be determined to suit traffic conditions in the particular locality and at the particular time. Similarly, the length and spacing of the open and closed stretches on the avenue may be varied to suit traffic conditions.

During the first period of time traffic may move on the avenue from north to south from 23rd to 19th Streets, from 15th to 11th Streets, and from 7th to 3rd Streets. During the second period of time traffic may move on this avenue from north to south from 22nd to 15th Streets, from 14th to 10th Streets, and from 6th to 2nd Streets.

During the third period of time the free blocks are bounded by 21st and 17th Streets, 13th and 9th Streets, and 3rd and 1st Streets. Similarly, during the successive periods of time the north-south-bound platoons will be shifted by one block towards the south. A vehicle which proceeds along this avenue at such speed that is covers one block during the period predetermined for the shifting of the open and closed stretches, will be permitted to travel without being forced to stop, and notwithstanding this, traffic moving from west to east on the lateral streets will have at all times access to as long stretches of the avenue as is given for north-south traffic.

South-north traffic is permitted on the avenue during the first period of time in the stretches in which north-south traffic is interdicted.

During the second period of time the head of the south-bound traffic will overlap the head of the north-bound traffic by two blocks. During the third period of time traffic in the two directions will be running parallel. During the fourth period of time the end of the south-bound platoons will overlap the end of the north-bound platoons by two blocks, and during the fifth period of time the conditions that prevailed during the first period will be reestablished. However, the north-bound traffic will be moving within the blocks that were interdicted during the first period. During the sixth period of time south-bound platoons will again overlap the heads of the north-bound platoons by two blocks. During the seventh period of time traffic in the two directions will be running parallel, but in the blocks in which during the third period traffic was interdicted. During the eighth period of time the conditions that prevailed during the fourth pe-
period will be repeated but traffic will be moving within the blocks intersected during the fourth period. During the ninth period of time (not illustrated in the drawings) conditions that prevailed during the first period will be exactly duplicated.

East-west traffic on the lateral streets will be given access to the avenue in a manner not to interfere with the north-south movement of vehicles. This phase of the control is best shown in Fig. 2. Vehicles proceeding in an easterly or westerly direction will be always permitted to take a right-hand turn on the avenue because this does not interfere with traffic on the avenue.

One of the important features of the present invention resides in that left-hand turns may be permitted on the avenue without the usual traffic confusion. During the first period of time vehicles moving from west to east on 18th, 17th, 16th, 15th, etc., 8th and 7th Streets may turn to the left, i.e., to the north on the avenue and join the north-bound traffic without the least hindrance. This would, of course, permit a vehicle to travel on the avenue for one or more blocks and then take a right-hand turn to the east and continue its travel. Wherever the rear ends of oppositely moving adjacent platoons are drawing apart, through traffic across the avenue may be permitted. During the first period of time the avenue may be crossed in an easterly or westerly direction at 7th and 16th Streets.

The second period of time the avenue may be crossed at 6th, 7th, 8th, 14th, 15th, 16th, 22nd, 23rd and 24th Streets.

A vehicle proceeding on a lateral street at a rate in accordance with the shifting of the light will be able to advance without stoppage. Not only this, but since left-hand turns may be freely taken, a vehicle located east of the avenue on 8th Street during the first period of time and the destination of which is 8th Street to the west of the avenue, may take a right-hand turn on the avenue, go with the traffic as far as 9th Street, gravitating all the time towards the center of the street, and then take a left-hand turn down the avenue or on the next avenue to the west and take a right-hand turn to 8th Street and continue its way west on 8th Street. It will be understood, of course, that within blocks traffic is always permitted on the avenue; that is to say, even during the first period of time a vehicle may go from 18th to 17th Street, but may not cross these two streets going from north to south on the avenue.

Preferably, traffic on the intersecting streets is so directed that it moves away from the heads of platoons on the avenue. In the arrangement shown in Fig. 2, for instance, on Avenue A a south-bound platoon extends from 7th to 3rd Streets, the end of a north-bound platoon is at 7th Street and the head of the following north-bound platoon is at 3rd Street. On Avenue B north and south-bound traffic conditions are just the reverse and on Avenue C traffic is moving in the same manner as on Avenue A.

Each block is approximately three times as long as the north-south blocks. Since it takes almost as long to go from A to B Avenue as it takes to go from 7th to 3rd Street, traffic on the lateral streets will be moved at a speed only slightly below that practicable on the avenues.

In Figs. 3, 3a, 3b and 3c, traffic conditions are illustrated at and near the intersection of highways H and S during four successive periods of time. H and S are assumed to be two highways running through open country where the control of traffic is necessary only at the intersection of congested roads. Traffic may be permitted to proceed on these highways in an uninterrupted stream until it comes, say, within a thousand feet of the intersection. Then the traffic is broken up into platoons as illustrated by the arrows in the drawings. In the scale indicated in Fig. 3 in the drawings, each unit represents 50 feet. The platoons are 200 feet long spaced by closed stretches of 400 feet. During the first period of time (Fig. 3) on S road, the head of a platoon moving to the left will have just reached H road, and the end of the platoon ahead of this will be 400 feet removed from the intersection. Similarly, there will be a platoon moving to the right of S road with its head at the intersection. On H road the end of a platoon will be just leaving the intersection in both directions.

Upon the termination of the first period of time (Fig. 3a) the platoons will be advanced in all directions by 100 feet. This will bring the heads of the two platoons on S road to overlap and will remove the ends of the two platoons shown in Fig. 3 by 100 feet on H road.

Upon the beginning of the third period of time the platoons will be advanced by a further 100 feet, bringing them into the positions illustrated in Fig. 3b.

During the fourth period illustrated in Fig. 3c, the ends of two platoons will be just leaving the intersection on S road and the heads of two platoons on H road will just reach the intersection; that is to say, the reverse of the conditions illustrated in Fig. 3 will exist.

During the following period of time (not shown) the two platoons on H road will overlap in the same manner as the platoons on S road during the second period of time (Fig. 3a) and the two platoons on S road will be leaving the intersection in the same way as was the case with the platoons on H road during the second period.

During the sixth period of time the conditions illustrated in Fig. 3b will be repeated with the exception that the platoons will be moving on S road in the reverse direction as compared on H road during the third period, and vice versa.

During the seventh period the conditions illustrated in Fig. 3 will be reestablished.

Depending on the length of the platoons, their spacing, and the duration of the periods, traffic may be moved at and near this intersection at a speed of 20 miles per hour without necessitating the stopping of the flow. Furthermore, left-hand turns at the intersection may be performed with a lesser hindrance to traffic than is usually the case.

For instance, during the first period of time (Fig. 3) cars in the platoons on S road approaching the intersection may turn to the left on H road without interfering with traffic on either road. During the second and third periods of time (Figs. 3a and 3b), cars in the platoons on S road crossing the intersection may stop until the ends of the platoon passes and then turn to the left. Left or right cars in either platoon may join the end of the platoon moving in the opposite direction and then turn to the right.

Fig. 4 illustrates a suitable circuit arrangement whereby signals at various street intersections may be actuated to control traffic in the manner explained with reference to Figs. 1 and 2. The control is accomplished by means of a commutator 1 adapted to cooperate with commutator brushes 2 to 9. The commutator is provided with 150
a conducting segment 10 rotated in the direction of the arrow and adapted to bridge four of the brushes. In accordance with this embodiment of the invention, four lights are provided at each street intersection. Two of these lights are marked "G", indicating, respectively, "go" for north and south-bound traffic, and "S", indicating, respectively, "stop" for the east and west-bound traffic. With the interrupter in the position illustrated in the drawings, circuits are closed from one pole of the battery 11 through the conducting segment 10, brush 9, conductor 12, the "go" light 13 at the intersection of 2nd Street, and thence through the return conductor 14 back to the other pole of the battery.

In parallel with this circuit another circuit is closed through brush 8, conductor 15, the "go" light 16 at the intersection of 3rd Street and through the return wire 14 back to the other pole of the battery.

Another parallel circuit is closed through brush 7, conductor 17, the north "go" light 18 and the return conductor 14. A fourth parallel circuit is closed through brush 6, conductor 19, north "go" light 20 at the intersection of 5th Street, and back to the battery through wire 14.

Since the stop lights 21, 22, 23 and 24 at the intersections of 6th, 7th, 8th and 9th Streets are connected in parallel with the "go" lights 13, 16, 18 and 20, respectively, within these four blocks north-bound traffic on Avenue I will be halted. The "go" light 25 at the intersection of 10th Street is in parallel with the "go" light 13, indicating that from 10th Street north traffic may proceed on the avenue. Similarly, the "go" lights in the next three blocks will be connected in parallel with the lights 15, 19 and 22, and thence for each block the "stop" lights will be connected in parallel. On the south side of the avenue the "stop" light 26 at the intersection of 1st Street will be lighted by current flowing from one pole of the battery 11, through the conducting segment 10, brush 6, the "stop" light 26 and the return conductor 17 back to the other pole of the battery. The "stop" light 26 at the intersection of 2nd Street will be lighted by current supplied by brush 7, the "stop" light 27 at 3rd Street, by current supplied through brush 8 and the "stop" light 30, by current supplied through brush 9, indicating that south-bound traffic may not proceed along the avenue within these four blocks. The "go" lights 31, 32, 33 and 34 at the intersections of 5th, 6th, 7th and 8th Streets being in parallel with the "stop" lights 28, 29 and 30 indicate that traffic may proceed within these four blocks. At 9th and 10th Streets the "stop" lights 35 and 36 will again be connected in circuit as well as the "stop" lights of the next two blocks. In the arrangement disclosed in Fig. 2, the lights on the avenues give the opposite signal to vehicles moving on the lateral streets. At 4th Street, for instance, the light 18 will warn east-bound traffic against crossing the avenue and will serve at the same time as an indication that vehicles may turn to the right on the avenue. Traffic going east on 4th Street will be warned by the simultaneous lighting of the 18 and 30 that while traffic may not entirely cross the avenue, since south-bound traffic on the avenue is at a standstill, turns may be taken either to the left or to the right.

The commutator 11 may be rotated manually or by means of a suitable motor mechanism simultaneously to bridge with its conducting segment 10 another set of four brushes. Obviously, the timing of this commutator will be determined by the traffic conditions. When the conducting segment bridges brushes 5, 6, 7 and 8, then the "go" lamp 13 at the corner of 2nd Street is extinguished and the "stop" light 37 illuminated. Through a circuit including brush 5, the "go" light 38 at the corner of 6th Street is lighted and the circuit of "stop" light 21 at the corner of this street being open at brush 9, this light will be extinguished. Similarly, the "go" light 25 at the corner of 10th Street is extinguished and the "stop" light 39 illuminated. It will be seen, therefore, that the traffic in a northward direction will be displaced one block. It will be clear from an inspection of the drawing that the same thing will hold good for the actuation of the lights directing the southward traffic and that during the rotation of the interrupter, both the southward and northward traffic will be continuously displaced by one block at a time. Depending on the speed at which the interrupter is rotated, the fluctuation of the traffic may be controlled at varying rates. This may be changed during various periods of the day. Variations in the traffic control may also be introduced by changing the number of blocks within which vehicles may move freely. In the present embodiment of the invention this may, for instance, be readily accomplished by simultaneously bridging a larger or lesser number of brushes. It will be obvious also to those skilled in the art that the interrupter here illustrated may be used for controlling any desired number of lights simply by increasing the number of brush sets and cooperating conducting segments that are mounted on the shaft of the interrupter. The same interrupter may, of course, be used for controlling all the lights on one avenue or on any number of avenues, or in a whole section of a city.

Fig. 5 illustrates diagrammatically a circuit arrangement by means of which a more comprehensive signaling system may be automatically operated under the control of the interrupter illustrated in Fig. 4. The lamps provided at the intersection of one side street and the avenue are shown in the drawings, the controlling contacts of the interrupter being indicated at 100 and 101, it being assumed that these contacts are opened and closed at certain time intervals in the manner hereinafter explained more in detail. In the present embodiment of the invention ten lamps are provided at the intersection of the street with the avenue. Lamps 102 and 103 are the "go" and "stop" signals, respectively, for the south-bound traffic. Lamps 104 and 105 are the "go" and "stop" signals for the north-bound traffic. The east and west-bound traffic are signaled by lamps 106, 107, 108, 109, 110 and 111, respectively. These lamps when lighted indicate "go", "cautious" and "stop." The caution signals 107 and 110 convey the meaning that left-hand turns may be taken on the avenue. It will be obvious to those skilled in the art that the number of lamps may be reduced by providing differently colored lenses for different directions. For the sake of simplicity in the present case, it is assumed that a separate light is used for each traffic signal in each direction. The circuits of the lamps are controlled by relays A and B. Each relay is provided with two armatures 112, 113 and 114, 115, respectively, which, depending on the energized or deenergized condition of the relay, engage back contacts 116, 117, 118, 119, or front contacts 120, 121, 122, 123. Let us assume that the interrupter closes contact 100 and opens contact 101. A circuit is es-
established from the grounded battery 124 through contact 100 and the winding of relay B, to ground. The relay B becomes energized and closes a circuit from grounded battery 123 through its armature 115, front contact 120, and then in parallel through "stop" light 106 and "go" light 102, to ground. Another circuit is closed from grounded battery 123 (which may be the same as the one indicated at 125), through the armature 114 and front contact 121 of relay B, and through the "Caution" signal 110, to ground. The relay A being in a deenergized condition, the circuit of "stop" light 105 is completed in its back contact 119 and armature 112. The signals indicate that the avenue traffic may proceed southward, but is stopped at this intersection in a northerly direction. The light 108 stops east-bound traffic on the lateral street, and the light 109 indicates that traffic may proceed west to the middle of the avenue and then turn to the left, with the south-bound traffic.

As soon as the contact 100 of the interrupter is opened the relay B becomes deenergized and the lamps are extinguished. As long as both contacts 100 and 101 remain open, the "stop" lights 105 and 106 are energized through the armatures and back contacts of relays A and B, respectively, carrying north and south-bound traffic on the avenue. On the other hand, the "go" lights 106 and 109 for the east and west-bound traffic are lighted, the circuit extending from ground through light 106, the back contact 118 and armature 113 of relay A, and the back contact 116 and armature 115 of relay B, to grounded battery. The circuit for lamp 108 may be traced from the back contact 117 and armature 114 of relay B, and the back contact 119 and armature 112 of relay A, to grounded battery. As soon as the circuit of relay A is closed it will open the circuit of the "stop" light 105 and also of the "go" lights 109 and 106. In its front contact 123 the relay will close a circuit for the "go" light 104 and in its front contact 122 close a circuit for the "caution" light 107, permitting eastward traffic to take a left turn on the avenue. The "stop" light 111 will be lighted in parallel with the "go" light 104.

In Fig. 6 the same reference numerals are used to indicate the same parts as in Figs. 4 and 5 and the manner of operation of the control circuits is exactly the same as described in the preceding paragraph. The two contacts which were represented by reference numerals 100 and 101 in Fig. 5 are now shown as forming part of the commutator mechanism of Fig. 4. The street shown equipped with the cross-town traffic control lights is 4th Street of Fig. 4 and the contacts 100 and 101 are the same contacts which control the "go" lights at 4th Street in the figure referred to. It is not necessary to use the "stop" light connections of that figure. While the circuit connections for the lamps at a single street intersection only are explained it will be understood that the connections for other street crossings will be made in the same manner as the control contacts for the relays should be the same as those used for the "go" lights at those intersections in Fig. 4. The battery 11 of Figs. 4 and 6 takes the place of the battery 124 shown in Fig. 5.

What I claim is:

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1. In a traffic control system, a highway, a cross street intersecting said highway, a plurality of control signals at spaced intervals along said highway, means for causing each of two separate series of signals along said highway to give "go" and "stop" indications in a series of successive groups, means for causing said series of groups progressively to advance said indications in opposite directions to regulate traffic flow, and means for indicating at said cross street at one side of said highway "go left" simultaneously with the indication of "stop" to traffic on said side of said highway.

2. In a system for controlling traffic along a highway having an intersecting street, means for causing "go" and "stop" indications to move in successive alternate groups in both directions on said highway, means responsive to an indication of "stop" to highway traffic moving in one direction at a street intersection, for indicating "caution" to traffic on said street approaching said highway from the side adjacent to that on which said highway traffic is stopped.

3. In a system for controlling traffic along a highway having an intersecting street, means for causing "go" and "stop" indications to move in successive alternate groups in both directions on said highway, means responsive to an indication of "stop" to highway traffic moving in both directions at the street intersection for indicating "go" to traffic on said street approaching said highway from both sides.

4. A traffic signal control mechanism for changing signal indications directing a traffic at a street intersection, comprising means for controlling a traffic signal for traffic from one direction, independent means for controlling a traffic signal for traffic from another direction, and means under the control of the first two means for controlling a traffic signal for traffic from a third direction.

5. In a traffic signal system for regulating traffic on a highway intersected by a plurality of cross streets, electric signal means for each intersection including go-stop signals for the highway and cross streets respectively, a central control station, separate connections between each of said signal means and said central control station, commutator mechanism in said central control station, and means to operate said commutator mechanism to change the signals progressively in opposite directions along the highway and to give signals to traffic in both directions on said cross streets.

6. In a traffic signal system for regulating traffic on a highway intersected by a plurality of cross streets, electric signal means for each intersection including go-stop signals for the highway and for the cross streets respectively, a central control station, a conductor extending from each of said signal means to the central control station and terminating in contact means thereat, commutator mechanism in said central control station in operative relation to said contact means, operating means for moving said commutator mechanism and said contact members with respect to each other to change the signals progressively in opposite directions along the highway, and to give signals to traffic in both directions on said cross streets.

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