Oct. 24, 1967 J. KATES 3,349,368

COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 1

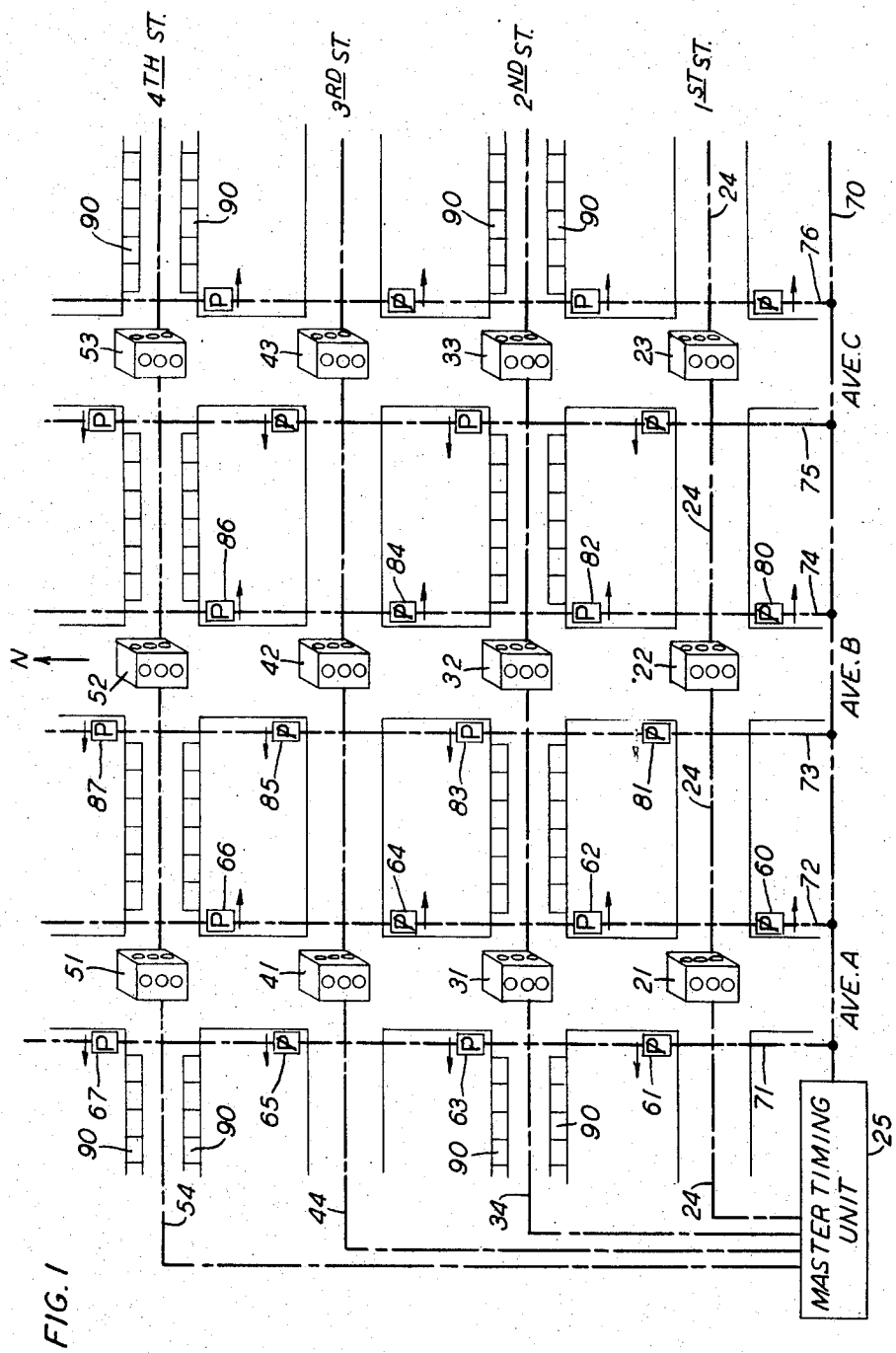

FIG. 1

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COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 2

FIG. 9

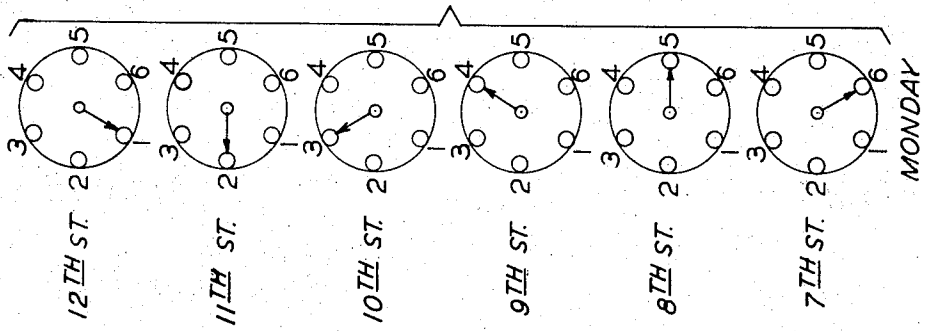
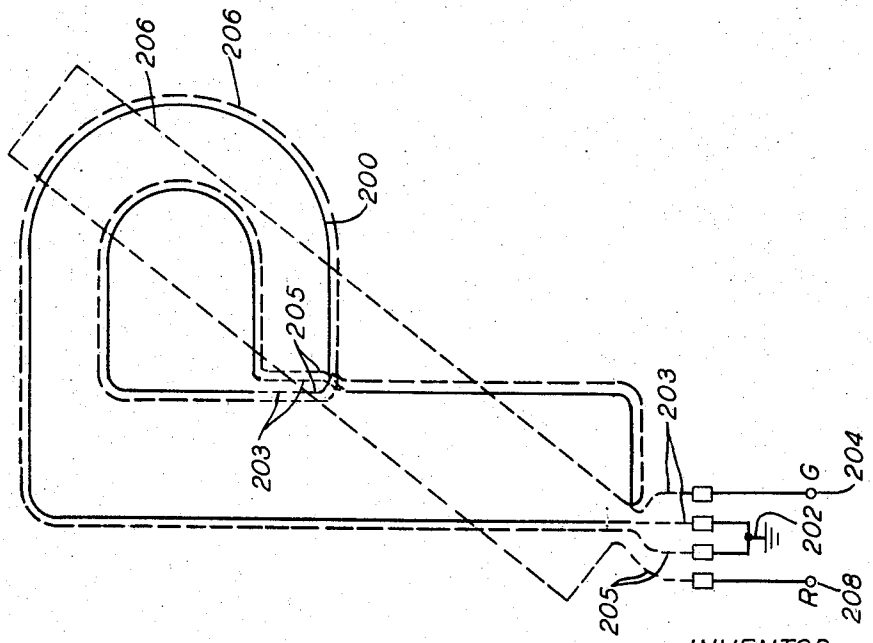


FIG. 2



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COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 3

FIG. 3

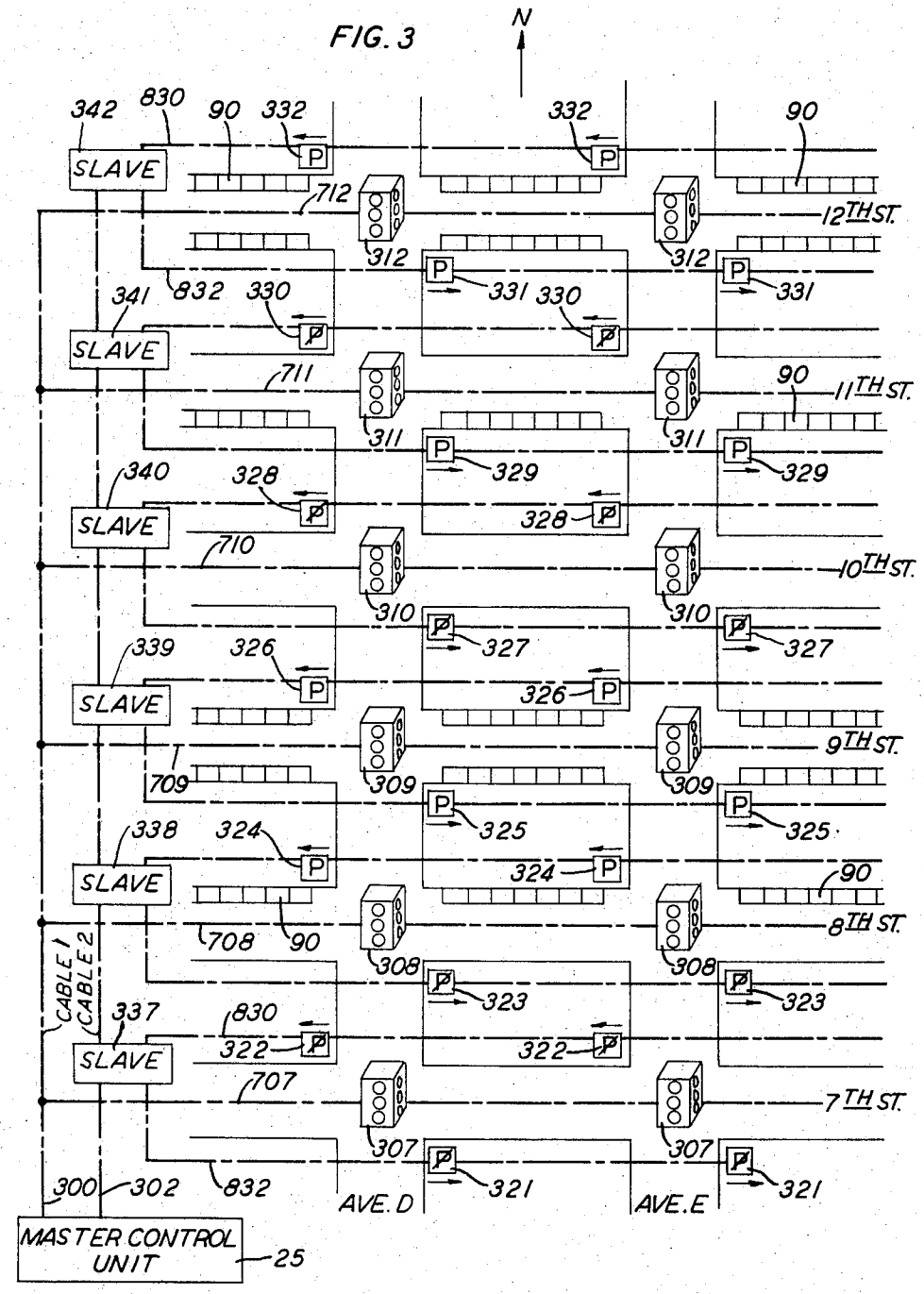

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FIG. 4

STREET	MON.	TUES.	WED.	THURS.	FRI.	SAT.
12TH	BOTH	S	NO	BOTH	N	NO
11TH	S	NO	BOTH	N	NO	BOTH
10TH	NO	BOTH	N	NO	BOTH	S
9TH	BOTH	N	NO	BOTH	S	NO
8TH	N	NO	BOTH	S	NO	BOTH
7TH	NO	BOTH	S	NO	BOTH	N

FIG. 5

	321	328	326	331	324	329	322	327	325	332	323	330
MON.	R		G		G		R		G		R	
TUES.	G		G		R		G		R		R	
WED.	G		R		G		R		R		G	
THURS.	R		G		R		R		G		G	
FRI.	G		R		R		G		G		R	
SAT.	R		R		G		G		R		G	

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COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 5

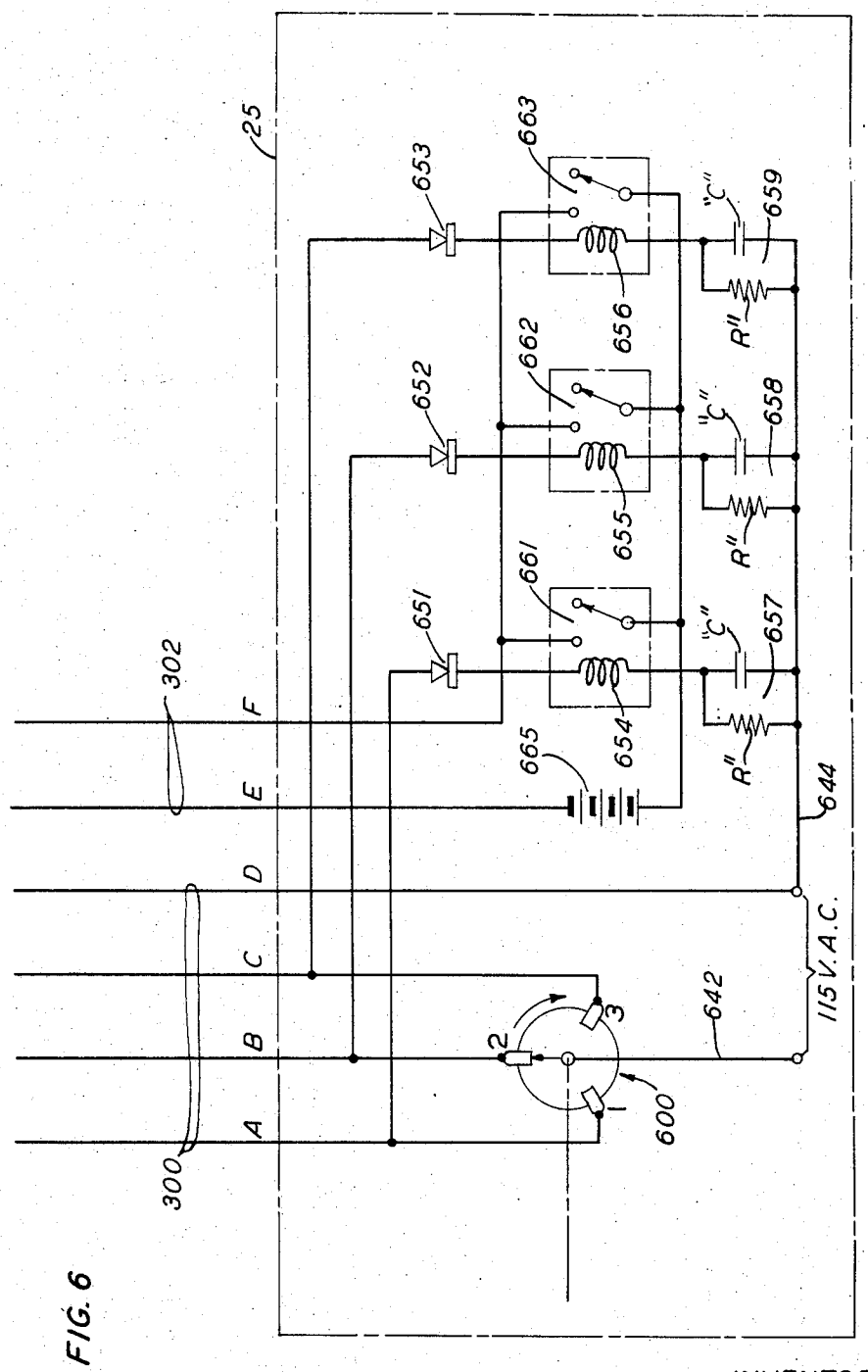

FIG. 6

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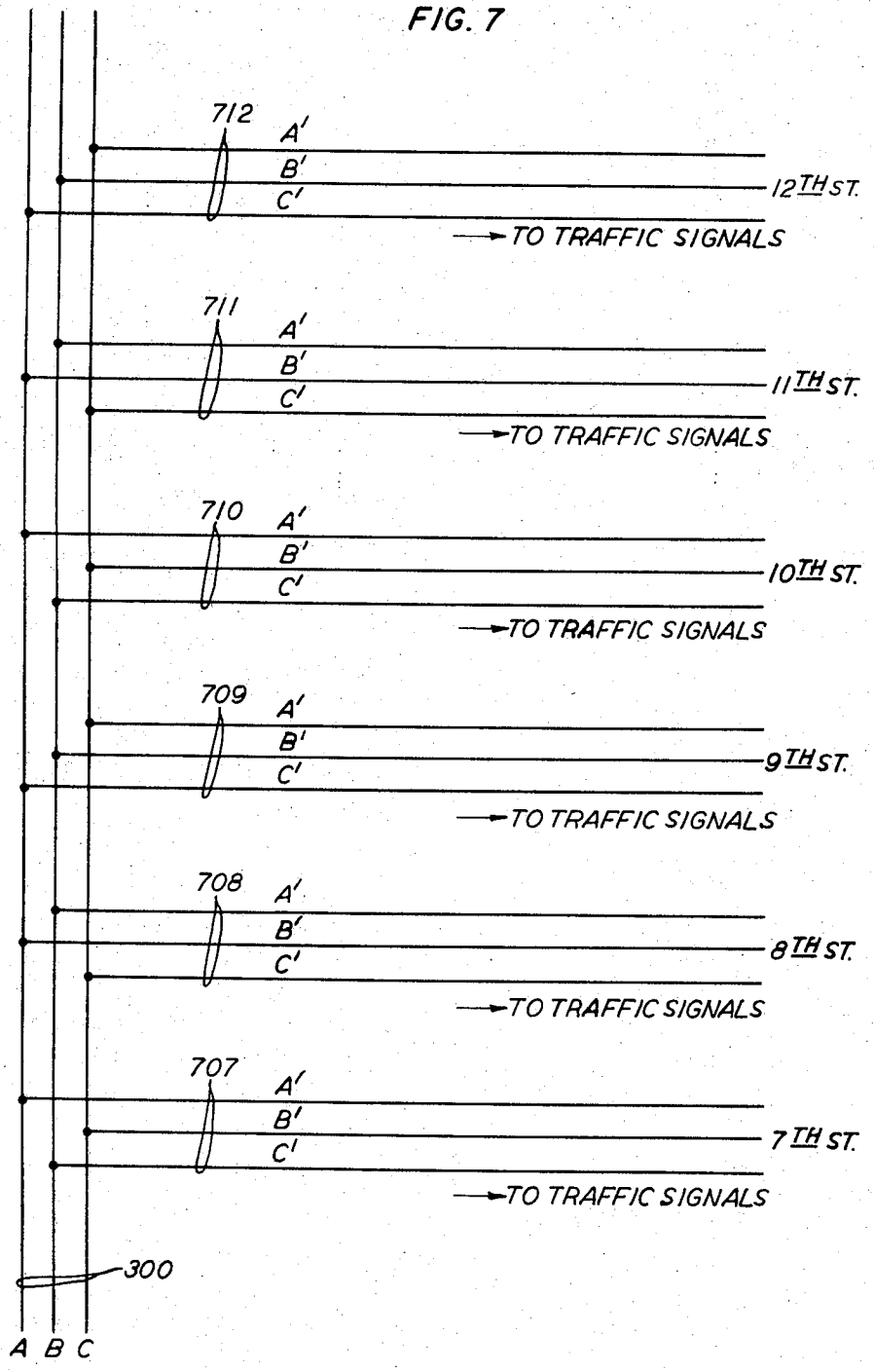
COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 6

FIG. 7



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COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

Filed June 30, 1964 8 Sheets-Sheet 7

FIG. 8

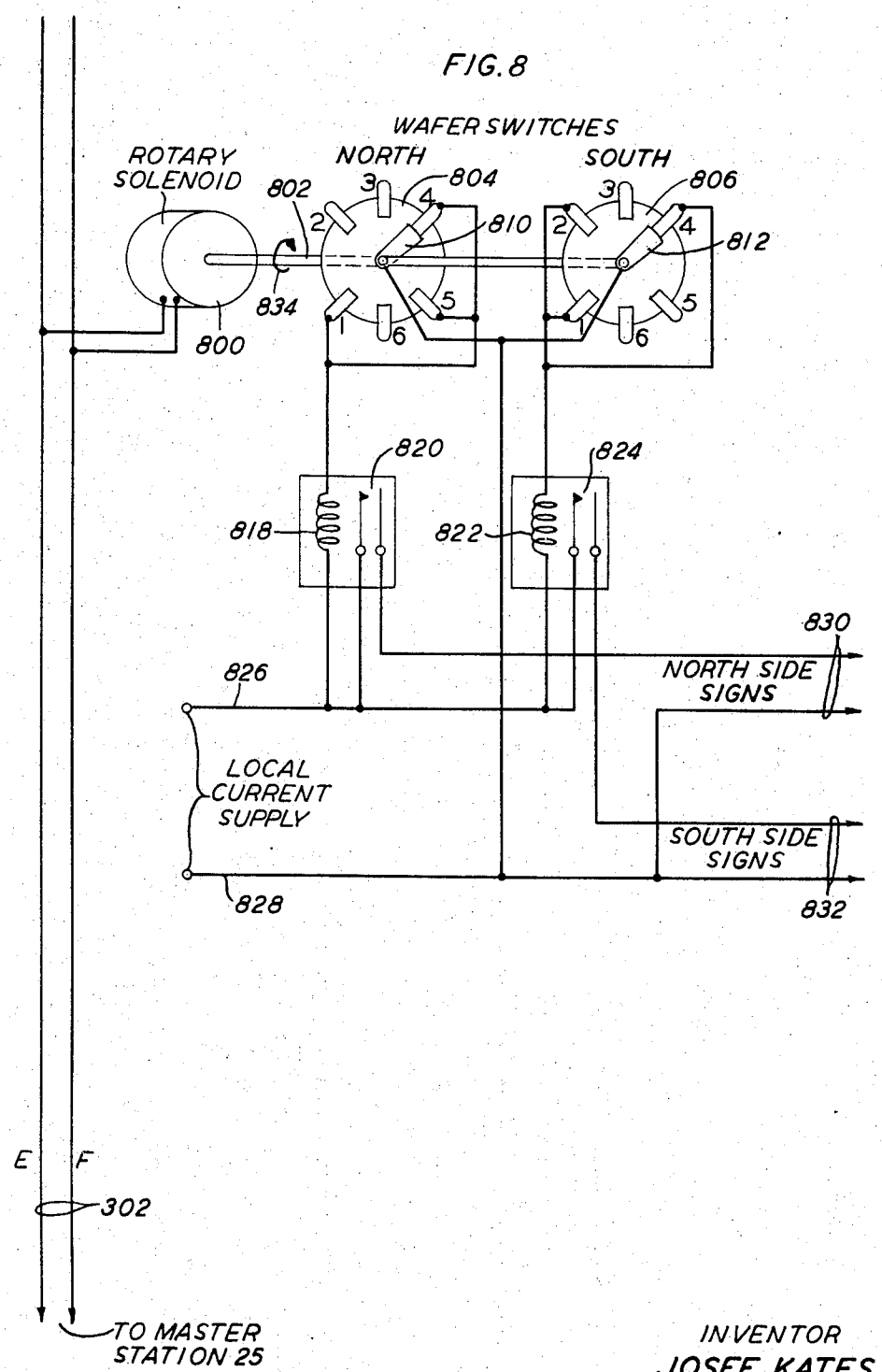

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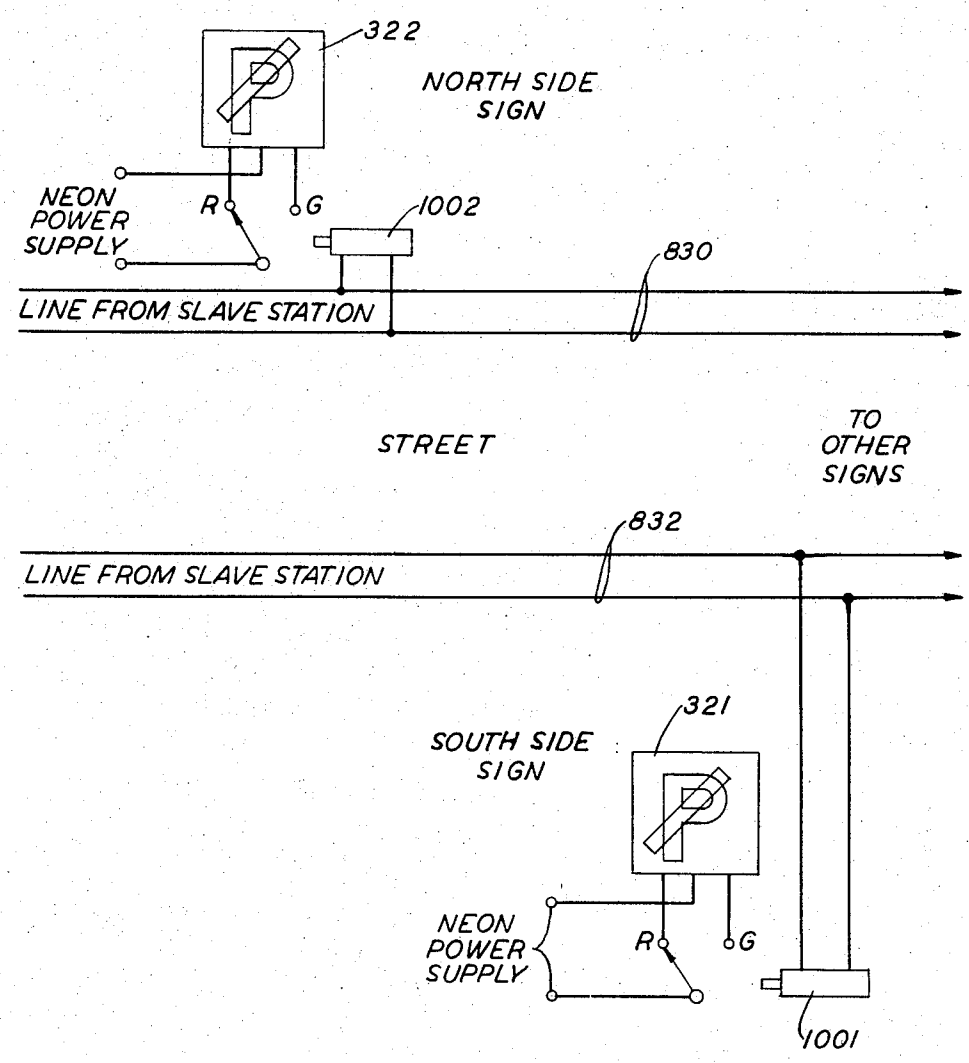
FIG. 10



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United States Patent Office

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COORDINATED CONTROL OF TRAFFIC FLOW AND PARKING

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Filed June 30, 1964, Ser. No. 379,215

7 Claims. (Cl. 340—41)

This invention relates to means and methods for the control of vehicular street traffic both as to regulation of traffic flow and regulation of parking.

An object of the invention is to aid the vehicle driver in finding a parking space.

Another object to enable a driver to easily locate areas where parking is permitted at a given time.

A further object is to coordinate the method of traffic signal control in effect on a given street at a given time with the kind of parking regulation then in effect on that street.

Another object is to obtain the benefits of uninterrupted traffic flow free of the presence of parked vehicles in a given street for at least a part of the time.

Another object is to obtain maximum benefit from the absence of parked vehicles in a given street during a given period by so controlling traffic signals in that period as to promote free flow of vehicles.

If vehicles are prevented from parking on a street, the flow of traffic on the street is greatly aided. However, it is not generally possible to prohibit parking altogether, for reasons such as need for access to commercial or residential establishments. It may nevertheless be feasible to prohibit parking at certain times, and to allow parking at certain other times, so that the benefits of unimpeded traffic flow are made available for at least part of the time.

The invention provides for automatic control of parking on a network of streets, in such a way that each street in turn can be freed of parked vehicles, for a predetermined time of the day or week, thus always assuring that a proportion of the streets allow free flow of traffic, the remaining streets meanwhile providing parking facilities.

The invention also provides means for automatic signalling of when a street is free for parking. Drivers of vehicles can thus easily locate the particular streets on which they may park their vehicles at any given time.

The invention further provides for coordination between parking control and control of the flow of vehicles in the streets on which parking is controlled. By suitable operation of traffic stop-go signals on a street, by methods which are well known, it is possible to facilitate travel on that street. Streets which have no parking, being relatively unimpeded, allow freer travel than streets in which parking exists. The traffic stop-go signals on a street which has no parking, therefore should be set to facilitate freer movement than the signals on a street in which parking is permitted.

Increased freedom of movement of vehicles in a street tends to increase the number of vehicles which can pass through the street in a given time, as well as to decrease the time required by a vehicle to travel a given distance in that street, thereby promoting more efficient and more satisfactory use of the street.

In terms of the average safe speed of vehicles, in general, higher speeds are possible in streets where there is no parking as compared to streets where cars are parked on both sides of the street, and intermediate speeds are possible in streets where there is parking on one side only.

In conventional traffic signal systems such as are generally used to control the signals on a network of streets, there is a master timing unit which determines at which

time of the day changes are made in the traffic signal system in the area. In accordance with the invention, the master timing unit is made to control changeable or convertible park-no park signs so that the parking signs will automatically show no parking on certain streets, parking on one side only on other streets, and parking on both sides of still other streets, and at the same time, by means of control of traffic signals, to permit freer movement on the streets with no parking, and less free movement on other streets.

The parking control may be used alone if desired, but to obtain the maximum benefit from the system of controlled parking signs it is essential that the traffic light signal timing be coordinated with the timing of the parking signs.

In a preferred arrangement, parking is prohibited in a certain proportion of the streets, for example, every third street, at any given time. In a street in which parking is prohibited, the traffic light signals can be remotely controlled by methods well known to establish what is known as a progression in that street. This means that vehicles travelling in the right direction at the correct speed on that street always meet green lights, thus facilitating rapid movement. It is generally only possible to have a satisfactory progression on a street if there is little congestion. Parking is known to cause congestion, to a large extent preventing progressions. This preferred arrangement allows good progressions, for example, on every third street. When there are progressions, the volume of traffic moved is high, thus increasing street efficiency. On streets where parking is allowed on one side only, or on both sides, it will generally not be possible to make progressions, and the efficiency of these streets in moving traffic will be reduced. The overall efficiency of the network of streets, with every third street free to move traffic rapidly, will however be greatly improved compared with a street system which allows parking on all streets. At the same time, there are as many parking spaces available as in a street system where every street allows parking on one side only. Thus, with such an arrangement for parking, combined with progressions on the streets free of parking, it is possible to increase the rapidity of overall traffic flow without sacrificing any parking spaces.

A feature of the invention is an extension of the use of changing or convertible signs from traffic directing usages such as for stop-go, left turn or no, one-way or two-way traffic, etc., to usages that facilitates the temporary disposal of the vehicle when not in motion, such as for parking and no-parking signs.

Another feature is the use of a single master unit for control of parking and control of traffic signals.

A further feature is the automatic signaling of when a given street is free for parking.

Another feature is a rotation within a group of streets whereby each street in turn becomes free of parked vehicles during certain parts of the day or week.

Another feature is a rotation of a given street through conditions of parking on both sides, parking on one side only, and no-parking on either side, in that order, so that the change from parking to no-parking is made less abrupt.

Still another feature is that traffic signals in streets in which parking is not allowed are so controlled as to facilitate rapid movement of vehicles.

A more specific feature is the coupling of a particular type of control of vehicle movement as effected by a particular method of operating the traffic signals with the indication of changeable parking signs, to provide a type of vehicle movement control appropriate to the kind of parking restriction or absence thereof which is in effect at the time.

A still more specific feature is the coupling of the type of vehicle movement control which establishes a progression with a parking regulation prohibiting parking.

Other objects, features and advantages will appear from the following more detailed description of illustrative embodiments of the invention, which will now be given in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is an illustrative map of a network of streets equipped in accordance with an embodiment of the invention, showing, in schematic form, parking signs, traffic signals, master timing unit, and interconnecting cables;

FIGURE 2 is a diagrammatic representation of an illustrative form of changeable parking sign;

FIGURE 3 is a map similar to FIGURE 1, illustrating another embodiment of the invention;

FIGURES 4 and 5 are tables useful in explaining the operation of one embodiment of the invention;

FIGURE 6 is a schematic diagram of a master control unit suitable for use in systems embodying the invention;

FIGURE 7 is a wiring diagram showing means for interconnecting the master control unit of FIGURE 6 with cables controlling traffic signals in various streets in a network of streets to be served;

FIGURE 8 is a schematic diagram of a slave control system suitable for use in the systems embodying the invention;

FIGURE 9 is a schematic diagram showing illustrative relative settings of wafer switches in slave stations for different streets; and

FIGURE 10 is a schematic diagram showing illustrative relay controls for individual changeable parking signs.

Referring to FIGURE 1, there is shown therein a network of intersecting streets, designated individually for convenience as Avenues A, B and C, and 1st, 2nd, 3rd and 4th streets, respectively. In 1st St. there is shown a set of traffic signals **21, 22, 23**, connected to a common timing control cable **24** from a master timing unit **25**. The unit **25** may be located at any convenient place with reference to the network of streets so that the unit may control the timing of traffic signals in a plurality of streets in the network. The traffic signals **21, 22, 23** may be of conventional type, with stop and go indicators visible at the intersections from both the street and the avenue involved, and may have intermediate cautionary indicators of amber color appearing between the usual red stop indicator and the usual green go indicator. In the figure, a traffic signal is shown at each intersection, but in practice of course signals may be omitted at some intersections as desired. On 2nd St. there are shown traffic signals **31, 32, 33**, connected by a common control cable **34** to the master timing unit **25**. Similarly, traffic signals **41, 42, 43**, on 3rd St. are connected by a cable **44** to unit **25**, and traffic signals **51, 52, 53** are connected by a cable **54** to unit **25**.

For convenience of reference, the direction toward the top of the sheet in FIGURE 1 is designated as north.

Each of the traffic signals **21, 22, 23, 31, 32**, etc., as well as other similar traffic signals **307, 308**, etc. shown in FIGURE 3, is assumed to be of conventional type such as is capable of automatic variation of signals to accomplish control of movement of vehicles along the streets to be regulated. It is further assumed that each of the traffic signals can be remotely controlled, as by selectively applying electrical power to one of a plurality of control wires leading to the signal to make the signal execute a particular program of changes which is designed to effect a particular type of control of vehicle movement. Such types of control are effected in general by regulating the relative lengths of time during which a signal remains in a "go" indicating state, in a cautionary state and in a "stop" indicating state. It is further assumed that the control wires leading to a plurality of signals can provide suitable offsets to correlate the changes in a plurality of signals in a given street to establish a progression, or to operate all the signals in unison, or to execute other types of control of vehicle movement.

At street intersections in the figures there are shown schematically, changeable or convertible, preferably electrically operated visual devices which can display alternately one or the other of two possible signs. One of these signs indicates parking is not allowed, the other that parking is permitted. When it is desired to indicate parking is not allowed, appropriate electrical devices cause certain symbols on the face of the sign to be illuminated in some way, for example, so as to outline the symbols in red. When parking is to be allowed, the electrical devices causes certain distinguishable symbols to be illuminated in another way, for example, so as to outline the symbols in green.

In FIGURE 1, the changeable parking-no-parking visual display means or signs are shown at the street intersections in position to be visible mainly from the avenues. The figure shows an illustrative appearance or complexion of the group of parking-no-parking signs at a given time. A sign indicating No Parking visible in Avenue A, is shown at **60** at the south-east corner of Avenue A and 1st St. to indicate to a driver on Avenue A that no-parking is permitted at the time on 1st St. east of Avenue A. A similar sign **61** is shown at the north-west corner of Avenue A and 1st St. to indicate that no-parking is permitted at the time on 1st St. west of Avenue A. The signs **60** and **61** may be visible to drivers moving in either direction on Avenue A. No-Parking signs **64** and **65** are shown for like purposes at the south-east corner of Avenue A and 3rd St. and at the north-west corner respectively. At the intersection of Avenue A and 2nd St. signs **62** and **63** are shown indicating that parking is permitted in 2nd St. at the time. Similarly, signs **66** and **67** at the intersection of Avenue A and 4th St. indicate that parking is permitted in 4th St. at the time. A common control line **70** from the master timing unit **25** connects through a branch line **71** to parking signs **61, 63, 65** and **67**; and through a branch line **72** to parking signs **60, 62, 64** and **66**. A similar array of signs is arranged to be visible in Avenue B and another array in Avenue C. Of the signs visible in Avenue B, signs **80** and **81** indicate no-parking in 1st St., signs **84** and **85** indicate no-parking in 3rd St., signs **82** and **83** show that parking is allowed in 2nd St., and signs **86** and **87** show that parking is allowed in 4th St. Branch control line **73** is connected to signs **81, 83, 85** and **87**, while branch control line **74** is connected to signs **80, 82, 84** and **86**. Branch control lines **75** and **76** are connected to signs visible in Avenue C.

Parking sign control lines **71, 72, 73, 74, 75** and **76**, together with line **70**, form a network of lines such that each intersection is connected to the master timing unit **25**. Similarly, traffic signal control lines **24, 34, 44** and **54** form a network such that each intersection is connected to the master timing unit **25**. These two networks are shown as taking different routes, mainly for the sake of clarity in the drawing. In practice, it may be more convenient to have the two networks follow the same route.

A plurality of parking spaces are represented schematically by rectangles **90** in 2nd St. and in 4th St. where parking is permitted at the time represented in FIGURE 1. It will be understood that in general, parking spaces will be marked on the pavement of all streets where parking is permitted at designated times. For clarity in the drawing and to emphasize the absence of parking at a given time, no parking spaces **90** are shown in the drawing on 1st St. nor on 3rd St. It is preferable that there be no parking at any time on certain streets, such as Avenue A, Avenue B, and Avenue C. As shown in FIGURE 1, each parkng sign may have an arrow displayed upon or near it to indicate the direction toward available parking blocks so that a driver looking for a parking space is immediately informed at what corners and in which directions he may turn off from the Avenue for parking in the neighborhood in which he wishes to stop.

Arrows associated with signs indicating No-Parking will clearly indicate the blocks where parking is prohibited at the given time. The convertible Parking-No-Parking portions of the signs are preferably illuminated, while the directional arrows associated therewith are not necessarily illuminated. Conventional signs, not convertible nor electrically operated, may be placed along each street in the conventional manner, to list the hours or days on which parking is allowed. The direction of the arrow associated with any sign may be reversed as required, without altering the general purpose of the sign.

FIGURE 2 shows schematically an illustrative form of changeable or convertible sign for indicating at any given time whether parking is allowed or is prohibited. To indicate that parking is allowed, a letter "P" is outlined upon the sign in known manner, as by a bent glass tube constituting a neon sign tube containing the necessary gas or gasses to give a green light when electrically energized. This neon tube, which will be called the "green tube" is shown having full line exposed portions at **200** and dotted darkened portions at **203** in FIGURE 2. One end of the green tube is electrically connected to a ground terminal **202** and the other end to a terminal **204** marked G in the drawing. To indicate that no-parking is allowed, a figure comprising the letter "P" with a diagonal bar through it is outlined by a similar bent glass tube arranged to give red light when energized. This tube, which will be called the "red tube" is shown in dashed line at **206** with dotted darkened portions at **205**. The red tube has one end connected to ground at **202** and the other end connected to a terminal **208** marked R in the figure. The green tube may be lighted by impressing a suitable electrical potential between terminal **204** and ground and the red tube may be lighted by impressing such a potential between terminal **208** and ground. Each of the signs **60**, **64**, **80**, **84**, etc. may be of the type shown in FIGURE 2, although any other suitable device may be used instead to accomplish the same purpose, namely to automatically change the information content of a visual display means.

In the operation of the system of FIGURE 1, the master timing unit **25** performs two principal functions. One of these functions is the control of the changeable or convertible Parking-No-Parking signs. For this purpose, the unit **25** sends control signals over control line **70** and branch control lines **71** through **76**. Either one of two signal conditions may prevail at any given time. One condition maintains the signs in the configuration shown in the figure with some signs showing Parking and others showing No-Parking. In the other condition, the indication of each sign is changed so that the signs showing No-Parking when the unit **25** acts to make the change will then show Parking and the signs that were showing Parking will then show No-Parking.

The second function of the unit **25** is to control the traffic flow regulating effect of the traffic lights. For this purpose, the unit **25** sends control signals in conventional manner over the control cables **24**, **34**, **44**, and **54**.

At the time shown in FIGURE 1, it is preferable that the signals sent out by the unit **25** over the control cables **24** and **44** be such as to establish what are known as progressions on 1st St. and on 3rd St. A progression is the timing of traffic signals in such a way as to cause vehicles which are travelling in the right direction, at the right speed, to always meet green lights. The combined effect of Prohibition of parking on 1st and 3rd Sts. and of establishment of progressions in these streets, is such as to greatly improve traffic flow in the street system as a whole, well above what could be done by application of either principle singly.

In general, it is only possible to establish progressions in one direction on a street. However, this difficulty may be overcome by making streets one-way, but this is not essential to the application of the system.

It is to be noted that the number of parking spaces available in the area, is the same as there would be if parking were allowed on one side of all streets.

The type of traffic signal control to be used on streets such as 2nd and 4th where parking is allowed, will in general be governed by other factors not under consideration here. It is sufficient to say that there is one type of control, a progression, on 1st and 3rd Sts., and another type of control, not specified, on 2nd and 4th Sts. In any event, the master timing unit **25** so controls the system that progressions are established on streets on which at the time, there is no-parking.

By a mode of operation of this type, the flow of vehicular traffic is greatly improved on those streets that are free from parking, and moreover the entire group of streets so equipped and operated becomes better able to move traffic. After a certain period of time, the streets which formerly allowed parking will no longer allow parking, while simultaneously with this change, streets formerly not allowing parking will then allow parking. In this way all streets will have at least a portion of time in which parking is allowed, and therefore in which ready access by vehicles may be had to the establishments, residential or business, on the street.

The times at which a street is changed from one in which parking is allowed to one in which it is not allowed, or vice versa, may be chosen at will, preferably in accordance with a plan calculated to promote best flow of traffic consistent with requirements of local establishments for parking.

The system shown in FIGURE 1 is to be considered as illustrative and not as limiting the use of the invention. Many variations will suggest themselves that are within the scope of the invention. For instance, streets may be taken in groups of three or more and the ratio of the number of parking streets to no-parking streets may be chosen as desired. Also, the succession of parking and no-parking streets may be varied as desired. Furthermore, schemes in accordance with the invention may be extended to any desired number of streets or avenues.

A variety of different schedules may be used in apportioning the time sharing among the several streets in a group. For example, one regulation may hold in the morning and another in the afternoon. Or, one regulation may hold on Monday, Wednesday and Friday and another on Tuesday, Thursday and Saturday.

It will be understood that the invention is applicable to one-way streets as well as to two-way streets, and that at any given intersection both intersecting streets may be two-way, or one or both may be one-way.

An abrupt transition from parking to no-parking may be avoided by introducing a period in which parking is allowed on only one side of the street. For this purpose the streets may be controlled in groups of three, with one street having no-parking allowed, a second street having parking allowed on one side only, and a third street in which parking is allowed on both sides. Each street is then given its turn in each of the three parking conditions.

To introduce alternate side parking into the scheme, a group of four or more streets may be controlled as a unit.

A particularly advantageous arrangement is one in which six streets form a group with six separate periods of parking control. Beginning with the period when parking is allowed on both sides of a given street, the second period allows parking on only one side, say the north side. In a third period, parking is prohibited on both sides, and free flow of traffic is promoted. In the fourth period, parking is again allowed on both sides. In the fifth period, parking is allowed on the one side on which it was prohibited in the second period, in this case the south side. In the sixth period, parking is again prohibited on both sides.

FIGURE 3 shows such a group of six streets, designated 7th St. through 12th St., intersecting avenues designated Avenue D and Avenue E. As in FIGURE 1, the

direction toward the top of the sheet is designated as north. Traffic signals are shown in each street at the intersections with the avenues, for example, traffic signals **307** in 7th St., **308** in 8th St., etc., through **312** in 12th St. Convertible parking-no-parking signs **321** through **332** are shown at the intersections in generally similar positions to those shown in FIGURE 1. Parking sign control slave sets designated **337** through **342** are shown in block diagram form, one for each numbered street, 7th through 12th, respectively. A first control cable **300** is connected through branch cables **707** through **712**, as shown, to the traffic signals in the respective streets. A second control cable **302** is connected to all the slave sets **337** through **342**. Each slave set for a given street is connected through a control cable **830** to the parking signs on the north side of the street, and through a control cable **832** to the parking signs on the south side of the street. All the control cables are to be understood as being extended as desired to other streets and other intersections in a network of streets to be controlled.

An illustrative appearance or complexion of the parking-no-parking signs at a given time is shown in FIGURE 3. Signs **321**, **322**, **323**, **327**, **328** and **330** indicating "No Parking" are shown, respectively, at the southeast and northwest corners of 7th St. and the avenues, at the southeast corners of 8th St., the southeast and northwest corners of 10th St., and at the northwest corners of 11th St. Signs **324**, **325**, **326**, **329**, **331** and **332**, indicating that parking is allowed are shown, respectively, at the northwest corners of 8th St., at the southeast and northwest corners of 9th St., at the southeast corners of 11th St., and at the southeast and northwest corners of 12th St. Available parking spaces are indicated by small rectangles **90** as in FIGURE 1. As shown, parking is allowed at the time represented by FIGURE 3, on both sides of 12th St. and 9th St.; on the south side only, in 11th St.; and on the north side only, in 8th St.

Examination of the arrangement of parking signs in FIGURE 3 shows that parking on one side only, in a given cross street is indicated to a driver on the avenue by either a Parking sign on his left and a No Parking sign on his right at the intersection, or by a Parking sign on his right and a No Parking sign on his left, depending upon which side of the street the parking is allowed. For example, in the scheme shown in FIGURE 3, a driver facing north on Avenue D and approaching the intersection of Avenue D with a street in which parking is allowed on the north side only, as in 8th St., sees a Parking sign at his left and a No Parking sign at his right, and is thereby advised to turn left into 8th St. if he wishes to find allowable parking. A driver facing south and approaching this intersection sees a Parking sign at his right and a No Parking sign at his left, and is thereby advised to turn right into 8th St. to find allowable parking.

Conversely, to find allowable parking in a street in which parking is allowed on the south side only, such as 11th St., a driver facing north on Avenue D is advised to turn right and not left into 11th St. A driver facing south on Avenue D is advised to turn left and not right into 11th St.

A driver approaching in either direction a street in which parking is allowed on both sides sees Parking signs on both sides of the avenue as he approaches the intersection, and if he is approaching a street in which no-parking is allowed on either side he sees No Parking signs on both sides of the avenue.

In the operation of the system of FIGURE 3, the parking signs are converted at predetermined time intervals to insure a desired rotation among the group of six streets through successive states of no-parking, parking on both sides, and parking on one side only, with alternate side parking in successive cycles of the parking changes.

An illustrative time division for a group of six streets controlled according to the above mentioned six-period scheme is to allow one of the streets to have parking on the north side on Monday, Thursday and Friday, and on the south side on Monday, Tuesday and Thursday. This street would be free of parking on Wednesday and Saturday. Another street in the group would allow parking on the north side on Wednesday, Thursday and Saturday, and on the south side on Monday, Wednesday and Saturday. This street would be free of parking on Tuesday and Friday. Each of the other four streets in the group would have a different schedule, under which in the example selected two streets would be free of parking on Wednesday and Saturday, two on Tuesday and Friday, and the remaining two on Monday and Thursday.

FIGURE 4 shows in tabular form such an illustrative schedule of rotation of the states of different degrees of parking as applied to the respective streets in the network shown in FIGURE 3 for the weekdays Monday through Saturday. For Monday, as indicated in the second column of the table, the parking signs are set as shown in FIGURE 3, so that 9th St. and 12th St. have parking on both sides, 7th St. and 10th St. have no-parking, 8th St. has parking on the north side only, and 11th St. has parking on the south side only. For Tuesday, as indicated in the third column of the table, 12th St. which on Monday had parking on both sides, now has parking on the south side only. On 11th St. which had parking on the south side only, there is now no parking. On 10th St. which had no parking, there is now parking on both sides, a change which constitutes no inconvenience to drivers wishing to park. On 9th St. which had parking on both sides, there is now parking on the north side only. On 8th St. the change is from parking on the north side only, to no-parking, and on 7th St. the change is from no-parking to parking on both sides.

As shown by the table, the progression of the parking states is the same for each street, while the phase of the progression is different in each street. It will be noted that each street in the group of six streets receives equivalent treatment but with different schedule of daily changes in each street.

FIGURE 5 shows, in tabular form, for each of the twelve convertible parking signs of FIGURE 3, the color of the sign for each day of the week, the symbol R indicating a no-parking indication in red light and the symbol G indicating a parking-permitted indication in green light. It will be noted that the schedule of sign changes shown in FIGURE 5 will result in the program of parking changes on the various streets of the group as shown in FIGURE 4. It will be noted further that the parking signs fall into a group of six pairs in which the indication of the signs in a given pair is the same. These pairs, in the arrangement shown in FIGURE 3, comprise signs **321** and **328**, **326** and **331**, **324** and **329**, **322** and **327**, **325** and **332**, **323** and **330**. All twelve signs go through the same series of change RGGRGR from day to day but each in a different phase as shown in the table.

At the time shown in FIGURE 3, it is preferable that the signals sent out by the unit **25** over the cable **300** be such as to establish progressions on 7th St. and on 10th St., wherein parking is prohibited. The combined effect of the prohibition of parking on 7th St. and on 10th St. and of the establishment of progressions in these streets is such as to greatly improve traffic flow in the street system as a whole, well above what could be done by application of either principle singly.

The type of traffic signal control to be used on the other streets where parking is permitted will, as in the case of the system illustrated in FIGURE 1, in general be governed by other factors not under consideration here. It is sufficient to say that there is one type of control, a progression, on 7th St. and on 10th St., and other types of control not specified, on the other streets in the network. The method of control may be different in 8th St. and in 11th St. where parking is allowed on one

side only, from the method in 9th St. and 12th St., where parking is allowed on both sides of the street. In any event, the master timing unit **25** so controls the system that progressions are established on streets on which at the time, there is no parking, and other methods of control are established as desired in the other streets in accordance with known traffic control practices designed to facilitate flow of traffic.

FIGURE 6 shows suitable apparatus comprised in the master control unit **25** for coordinating the traffic signal controls and the parking sign controls. The control cable **300** for the traffic signals is shown in this figure as comprising conductors A, B, C and D, of which A, B and C are connected to three contact positions of a wafer switch **600** and the conductor D is a common return line for conductors A, B and C. The switch **600** may be either hand operated, for example once or twice a day, or it may be operated by an automatic timer. It may have three positions numbered 1, 2, and 3, as shown, and it may be shifted one position at a time, or it can be changed by steps from one setting to any other if desired, to alter an otherwise prearranged program according to circumstances.

The switch **600** is arranged to control the energization of the parking sign control cable **302** in such a way that whenever the switch **600** is advanced one step, a pulse is generated and impressed upon the cable **302**, which latter is shown as comprising conductors E and F.

To generate the requisite pulses, each of the conductors A, B and C is connected through a rectifier such as a semiconductor diode, a relay winding, and a parallel connected resistor-capacitor pair to the common conductor D. One side **642** of an alternating current supply line, such as a 115 volt line, is connected by conductor **642**, to the rotatable arm of the switch **600** and thence to one or another of the conductors A, B and C, according to the setting of the switch. The other side of the alternating current supply line is connected to conductor D. The rectifiers are designated **651**, **652** and **653** respectively; the relay windings **654**, **655** and **656** respectively, and the resistor-capacitor combinations, **657**, **658** and **659**, respectively. Each resistor-capacitor combination comprises resistance R'' and capacitance C''.

When switch **600** is moved from position No. 2 to position No. 3, power is suddenly applied to the rectifier **653** from the alternating current supply line. This causes direct current to flow through relay winding **656**, closing a relay contact **663**, at least until the condenser C'' of combination **659** becomes fully charged. As soon as capacitance C'' is charged, neglecting for the moment the effect of the resistance R'', the current stops, and the contact **663** re-opens. The closing of the contact **663** causes a pulse of direct current to flow in cable **302** from a direct current supply source, shown for purposes of illustration as a battery **665**.

The length of the pulse applied to the cable **302** may be controlled by proper selection of the value of the product R''C'' in known manner.

The purpose of the resistance R'' is as follows: When power is removed from one of the rectifiers, there is a charge left on the associated capacitor. The purpose of the resistor is to bleed this charge off, so that the capacitor will be ready the next time power is applied to its circuit. The value of R'' may be chosen low enough to bleed off the charge in a reasonable time, yet not so low as to cause a large, steady direct current to flow through the relay. If too large a steady current flowed, with power on the circuit in question, the relay would stay closed as long as power was applied to the circuit, and a pulse would not be produced.

It will be noted that the cable **302** will receive a pulse through one or another of the contacts **661**, **662** or **663** each time the switch **600** is advanced by one step.

FIGURE 7 shows illustrative electrical connections between the traffic signal control cable **300** and the traffic signal control branch cables **707** through **712** extending to the traffic signals in the respective streets of the network of streets to be served. The figure shows the conductors A, B, and C of the traffic signal control cable **300**; and it shows each branch cable having conductors A', B' and C'. In each street each conductor of the branch cable for that street is connected to a different one of the conductors of the cable **300** according to a pattern which will presently appear.

As shown in FIGURE 3, parking is not allowed in 7th St. and in 10th St. At the same time it is desired that the traffic signal control system on these streets be so operated as to establish progressions. At other times, it will be desired to establish progressions in other streets in turn. For the purpose of establishing these progressions when required, one of the conductors in the branch cable in each street, say conductor A', is connected to suitable apparatus in each traffic signal assembly so that, in known manner, offsets are provided so that the traffic signals are controlled in such a way as to establish the desired progression whenever power is supplied over the cable **300** to the conductor A' in that street.

As shown further in FIGURE 3, parking is allowed on one side only in 8th St. and in 11th St. At the same time some appropriate method of traffic control other than the establishment of progressions is desired in these streets. At other times, it will be desired to put into effect in other streets in turn the same method of traffic control as is required in 8th St. and in 11th St. at the time shown in FIGURE 3. For this purpose, another of the conductors in the branch cable in each street, say conductor B', is connected to suitable apparatus in each traffic signal assembly to effect the desired method of control whenever power is supplied over cable **300** to the conductor B' in any given street.

Similarly, for streets where parking is allowed on both sides, a third method of traffic control may be desirable. For this purpose, a third conductor in the branch cable in each street, say conductor C', is connected to suitable apparatus in each traffic signal assembly to effect the desired third method of control whenever power is supplied over cable **300** to the conductor C' in any given street.

The three types of traffic control above mentioned will be designated for convenience of reference as types A', B' and C', respectively. Type A' is the progression establishing type, while types B' and C' are not specified herein, because their selection involves considerations that do not affect the operation of the present invention. In any case, the purpose of the electrical connections, shown in FIGURE 7, is to provide a variety of types of traffic control on each street in succession, so that, for instance, in a first time period 7th St and 10th St. will have type A' control, 8th St. and 11th St. will have type B' control and 9th St. and 12th St. will have type C' control. In a second time period, 7th St. and 10th St. will have type C' control, 8th St. and 11th St. will have type A' control, and 9th St. and 12th St. will have type B' control. In general, in succesive time periods, each street will have each type of control in turn, in the order A', C', B'. As will appear below, the arrangements shown in FIGURE 7 through FIGURE 10 provide that when the progression type control, that is, type A', is in effect in a given street, there is no parking allowed in that street; when type B' control is in effect in a given street, parking is allowed on one side only in that street; and when type C' control is in effect in a given street, parking is allowed on both sides of that street.

Accordingly, in the illustrative wiring scheme shown in FIGURE 7, conductor A of cable **300** is permanently connected to conductor A' of cable **707** in 7th Street, to conductor B' of cable **708** in 8th St., to conductor C' of cable **709** in 9th St., to conductor A' of cable **710** in 10th St., to conductor B' of cable **711** in 11th St., and to conductor C' of cable **712** in 12th St. In the figure, conductor B of cable **300** is permanently connected to con-

ductor C' of cable **707**, A' of cable **708**, B' of cable **709**, C' of cable **710**, A' of cable **711**, and B' of cable **712**. Also in the figure, conductor C of cable **300** is permanently connected to conductor B' of cable **707**, C' of cable **708**, A' of cable **709**, B' of cable **710**, C' of cable **711**, and A' of cable **712**.

It will be noted that, while three methods of traffic control are provided in the schematic circuit of FIGURE 7, there are actually six separate parking periods illustrated in FIGURE 3. The six parking periods and their respective types of control are characterized in Table I:

TABLE I

Parking period:	Method of control
No-parking	A'
Parking north side only	B'
Parking both sides	C'
No-Parking	A'
Parking south side only	B'
Parking both sides	C'

The reason for providing a period for parking north side only and a period for parking south side only is not one to do with the essential principles of the invention, but rather to allow a fair division of parking time between the two sides of any given street.

In the operation of FIGURES 6 and 7, when switch **600** of FIGURE 6 is placed on position No. 1, alternating current power is supplied over conductors A and D of cable **300**. Accordingly, conductors A' in cables **707** and **710** are energized, thereby activating method A' of traffic control in 7th St. and in 10th St.. At the same time, conductors B' in cables **708** and **711** are energized, thereby activating method B' of traffic control in 8th St. and in 11th St. Similarly, at the same time, conductors C' in cables **709** and **712** are energized, thereby activating method C' of traffic control in 9th St. and in 12th St. In moving switch **600** to position No. 1, a pulse is sent out over cable **302** as above described, to set up the desired complexion of the indications of the parking signs in each street to correspond to the method of traffic control activated in the given street, as will be explained more fully below in connection with FIGURES 8, 9 and 10.

When switch **600** is placed on position No. 2, conductor B is energized and alternating current power is supplied over conductors B and D of cable **300**, and another pulse is sent out over cable **302**. Accordingly, traffic control method A' is activated in 8th St. and in 11th St., method B' is activated in 9th St. and in 12th St., method C' in 7th St. and 10th St. and a different appropriate complexion of parking sign indications is automatically set up.

Similarly, when the switch **600** is placed on position No. 3, conductor C is energized, activating traffic control method A' in 9th St. and in 12th St., method B' in 7th St. and in 10th St., method C' in 8th St. and in 11th St., and setting up another appropriate complexion of parking sign indications.

Thus, it may be seen that, as the master switch **600** of FIGURE 6 is rotated, either manually or by a timing device, the correct desired types of traffic control appear on the different streets, at the correct times, according to a plan of the type illustrated in FIGURE 4.

FIGURE 8 shows one form of slave station apparatus which is suitable for effecting parking sign variations in an extended network of streets with economy of apparatus and standardization so that each street in a group of parallel streets can be equipped with substantially identical slave station units which may be differently adjusted according to the place of the individual street in the overall program.

A rotary solenoid **800** is shown having a shaft **802** connected to wafer switches **804** and **806**. Each of the wafer switches is provided with six fixed contactors numbered 1 through 6 and spaced at equal angular intervals about the circumference of the wafer. The shaft **802** carries contactors **810** and **812** which are rotatable with the shaft and which are arranged to contact corresponding fixed contactors on the respective wafers **804** and **806**. As shown in the figure, each of the rotatable contactors is in contact at the moment with fixed contactor No. 4 on the respective wafer. The cable **302** is connected to the solenoid **800** and to the corresponding solenoid in each of the other similar slave stations.

The wafer switch **804** has certain of its fixed contactors connected to a relay winding **818** which controls normally open contacts **820** which in turn control changeable parking signs on the north side of the street as shown in FIGURE 3. The wafer switch **806** has certain of its fixed contactors connected to another relay winding **822** which controls normally open contacts **824** which in turn control changeable parking signs on the south side of the street. The parking signs may be distributed all along both sides of the street as desired, with preferably at least one at each street intersection. Lines **826** and **828** connect to a local current supply which may be obtained at a convenient power outlet connected to power mains in the individual street. Line **828** is extended to one terminal of each of the parking signs on both sides of the street through cables **830** and **832**. The power connection to the other side of the parking signs on the north side of the street passes through the contacts **820** when these are closed and thence over cable **830**. The power connection to the other side of the parking signs on the south side of the street passes through the contacts **824** when these are closed and thence over cable **832**.

In the operation of the arrangement shown in FIGURE 8, whenever a change in signs is to be made, the master timing or programming unit **25** sends a pulse over the cable **302** as above described. This pulse when received by the rotary solenoid **800** turns the shaft **802** one-sixth of a revolution, in the direction indicated by an arrow **834** in FIGURE 8. At the same time, similar rotary solenoids in other streets are likewise turned each through one-sixth of a revolution. In the position of the shaft **802** shown in FIGURE 8, the movable contactors **810** and **812** are each on position No. 4 on the respective wafer switch. In this position, contactor **810** closes an energizing circuit path from line **826** through relay winding **818** to the common line **828**, resulting in the closing of the contacts **820**. Due to the closure of contacts **820**, current is sent over cable **830** to all the changeable parking signs on the north side of the street. It will be assumed that this current causes the parking signs to display a Parking indication. At the same time, the contactor **812** closes an energizing circuit path from line **826** through relay winding **822** to the common line **828**, resulting in the closing of the contacts **824**. Due to the closure of contacts **824**, current is sent over cable **832** to all the changeable parking signs on the south side of the street, causing these signs also to display a Parking indication. By this means, parking is shown to be permitted on both sides of the street.

When a pulse is received by the rotary solenoid **800** advancing the contactors on the wafer switches to position No. 5, relay winding **818** is energized but relay winding **822** is not. The result is that the parking signs on the north side of the street receive current which maintains them in the state of indicating Parking while the parking signs on the south side of the street do not receive current and are assumed to be arranged so that they revert to an indication of No-Parking. The effect is that the signs now show that parking is permitted only on the north side of the street.

When the wafer switches are in position No. 6, wafer switches do not connect power to either of the relay windings and all parking signs revert to the No-Parking indication, showing that parking is not permitted on either side of the street. When the wafer switches pass from position No. 6 to position No. 1, the parking signs are so

energized as to indicate parking permitted again on both sides of the street. Position No. 2 provides for parking on the south side only and position No. 3 provides again for permitting no-parking on either side of the street.

FIGURE 9 shows how the wafer switches in a group of streets are to be set at different phases to set up the rotation of parking conditions among the streets in the group. The figure pertains to a rotation scheme of six phases, such as is required to carry out the scheme of rotations illustrated in FIGURE 4. As shown in FIGURE 9, the switch positions No. 1 through No. 6 are set so that the switches for each street are one switch position advanced from the switch position in an adjacent street. Thus, as shown, 12th St. for Monday according to the schedule of FIGURE 4, has its switches set in position No. 1, 11th St. in No. 2, 10th St. in No. 3, 9th St. in No. 4, 8th St. in No. 5 and 7th St. in No. 6. After the initial setting, the switches are left in their same relative positions as long as the program of rotation is to remain unchanged. If the switches in 12th St. for example, are on position No. 1 at a given time, they will be on position No. 2 after the next change of signals. When the master control sends a pulse to change the signs, all the solenoid switches advance simultaneously, thus keeping each street exactly one switch position different from the next.

FIGURE 10 shows an illustrative circuit for utilizing pulses transmitted over the cables **830** and **832** to effect changes in individual convertible parking signs. The figure shows a typical parking sign **322** which is shown in FIGURE 3 as being located on the north side of 7th St., and another typical parking sign **321** which is shown in FIGURE 3 as being located on the south side of 7th St. A relay winding **1002** for the control of sign **822** is shown connected between the conductors of cable **830**. A similar relay winding **1001** for the control of sign **821** is shown connected between the conductors of cable **832**. Each of these relay windings controls a normally closed contact which is connected to the R terminal of the respective parking sign, and a normally open contact which is connected to the G terminal. Any suitable source of power for neon lights is connected between the movable contactor of the relay and the common conductor of the parking sign. Whenever there is no power on cable **830**, the relay winding **1002** is unenergized and the parking sign is activated to give a red indication of No-Parking. Whenever there is power on cable **830**, the relay winding is energized, causing the closure of the circuit to the G terminal of the sign, giving a green indication that parking is permitted. The sign **321** is similarly controlled by the cable **832** and the relay winding **1001**.

While illustrative forms of apparatus and methods in accordance with the invention have been described and shown herein, it will be understood that numerous changes may be made without departing from the general principles and scope of the invention.

What is claimed is:

1. In a coordinated street traffic control system, in combination, first changeable visual means displayed in a given street to indicate a given local regulation currently in effect in said street, traffic signal means displayed at spaced intervals along said street, means for controlling said traffic signal means to permit control of traffic flow along said street, and common means for changing said controlling means to effect a desired offset in said traffic signal means concurrently with a change in the information content of said first visual means, whereby the type of control of traffic flow and the local regulations currently in effect may be coordinated.

2. A system in accordance with claim **1**, in which said first visual means indicate parking prohibited or parking permitted.

3. A system in accordance with claim **2**, in which said common means couples an indication in said first visual means of parking prohibited with a type of control of traffic flow which promotes a maximum progression of traffic flow in said street.

4. A system in accordance with claim **2**, in which said common means couples an indication of parking permitted with a type of control of traffic flow other than one which promotes a maximum progression of traffic flow in said street.

5. In a street parking control system, in combination, a plurality of convertible signs each adapted to display information indicating alternatively a regulation of parking permitted and a regulation of parking prohibited, with reference to a specific street parking area controlled by the respective sign, electrically actuatable means for changing each said sign, said means determining which of said indications is displayed by said sign at a given time, and common means for substantially simultaneously actuating said respective indication determining means, whereby each said parking area may be rotated between regulations of parking permitted and parking prohibited.

6. Apparatus in accordance with claim **5**, in which said signs are posted on opposite sides of a given street to control parking regulations on the two sides of the street, whereby each side of the street may be rotated between regulations of parking permitted and parking prohibited.

7. Apparatus in accordance with claim **5**, in which said signs are posted in a plurality of streets to control parking regulations in each said street, whereby each said street may be rotated between regulations of parking permitted and parking prohibited.

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