

[54] **TRAFFIC CYCLE SPLIT SELECTORS**

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abandoned, which is a continuation of Ser. No.
742,160, June 16, 1958, abandoned.
[52] U.S. Cl. **340/35, 235/150.24**
[51] Int. Cl. **G08j 1/00**
[58] Field of Search **340/35, 36, 40**

[56] **References Cited**

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2,542,978 2/1951 Barker 340/35

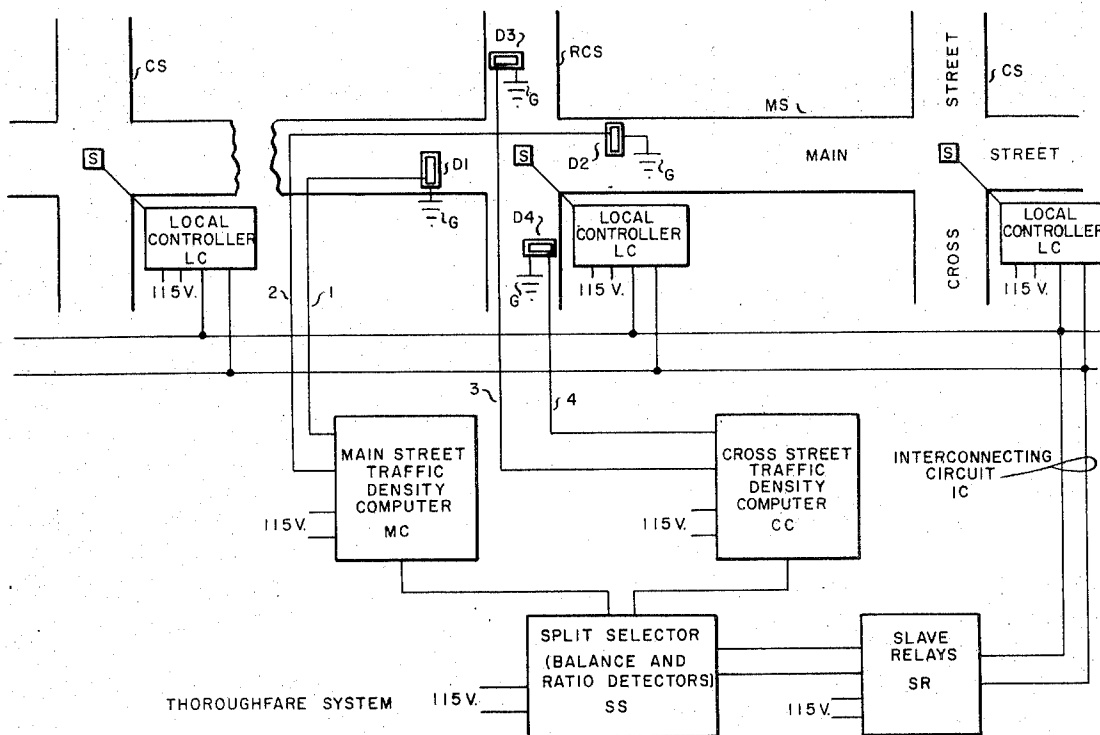
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EXEMPLARY CLAIM

1. In a traffic cycle split control system for two inter-

secting highways, traffic detector means for said high-
ways for detecting the passage of substantially all ve-
hicular traffic thereon, main highway traffic density
computer means to which all said detector means for
the main highway are connected, cross highway traffic
density computer means to which all said detector
means for the cross highway are connected, the out-
puts of said computer means being proportional to
traffic density on their respective highways, balance
detector means for receiving and comparing the out-
puts of said computer means to determine the higher
output, a plurality of adjustable impedances, a plural-
ity of ratio detector means connected to said imped-
ances, said balance detector means applying the
higher output of said computer means through said
impedances to said plurality of ratio detector means,
said balance detector means applying the lower output
of said computer means directly to said ratio detector
means, said plurality of ratio detector means being re-
sponsive to said computer outputs to represent a ratio
of main highway traffic to cross highway traffic, a plu-
rality of local controllers, and a control circuit be-
tween said controllers and said ratio detector means
for actuating one of a group of presettable traffic
cycle splits dependent on said represented ratio.

10 Claims, 9 Drawing Figures



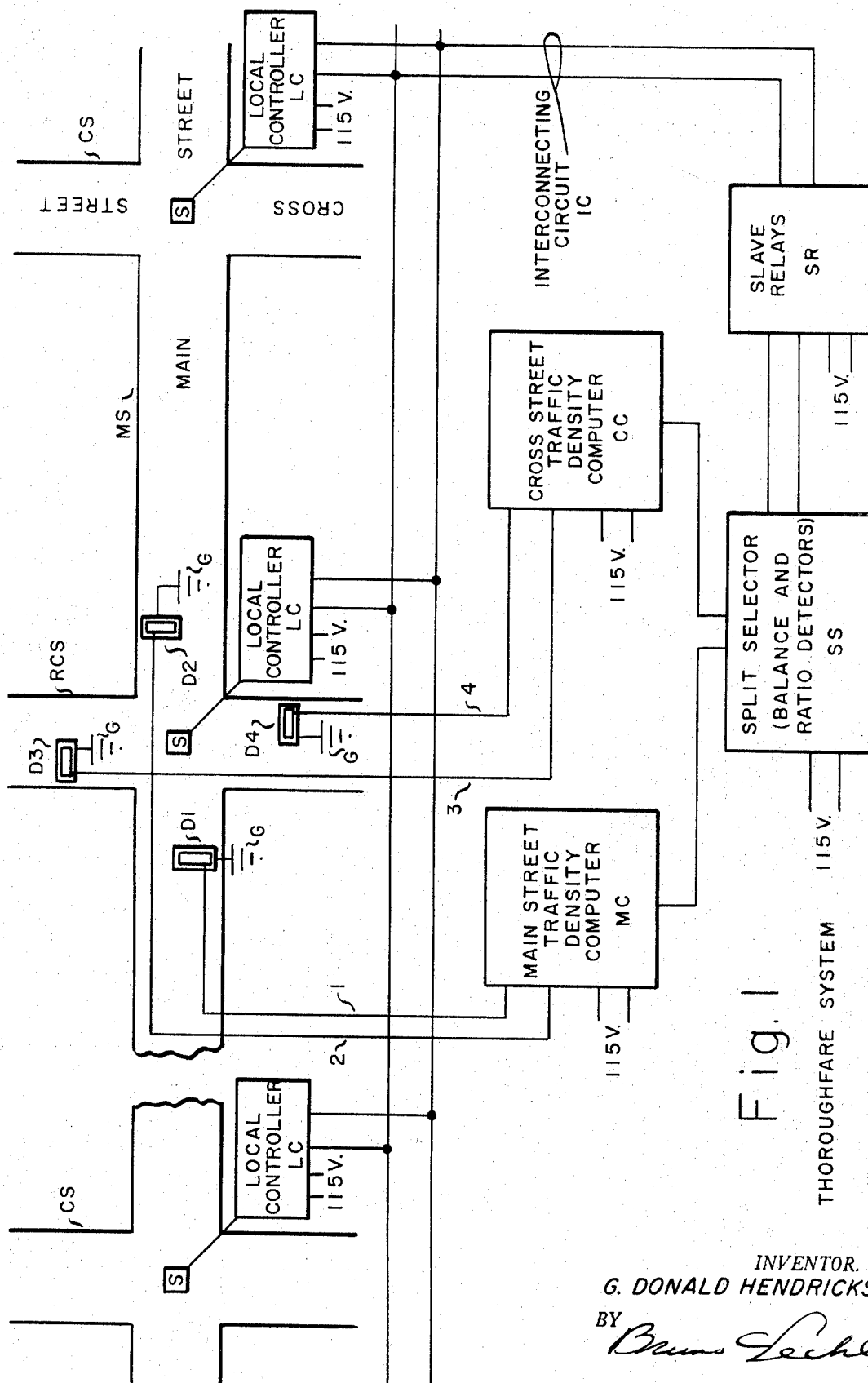
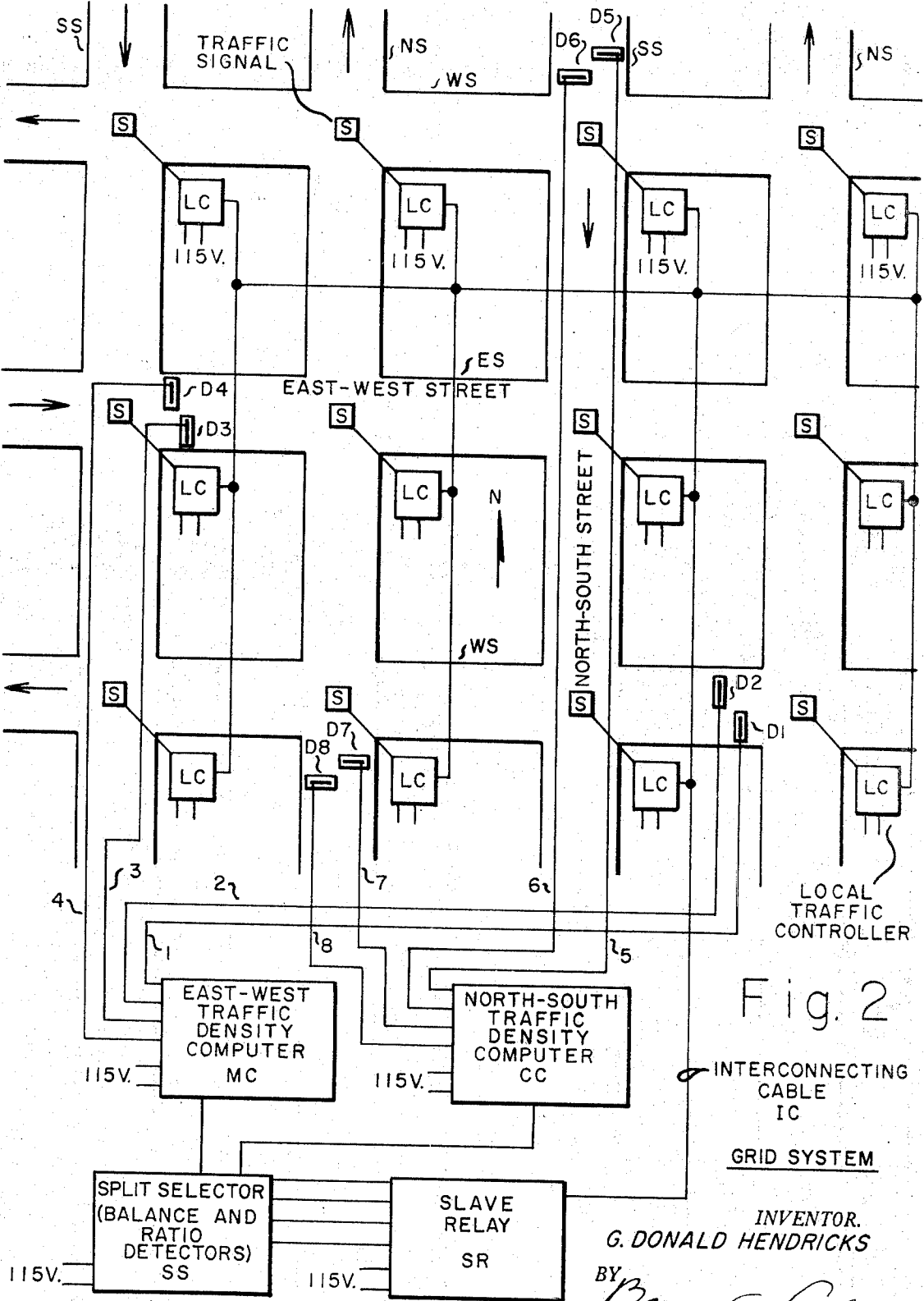
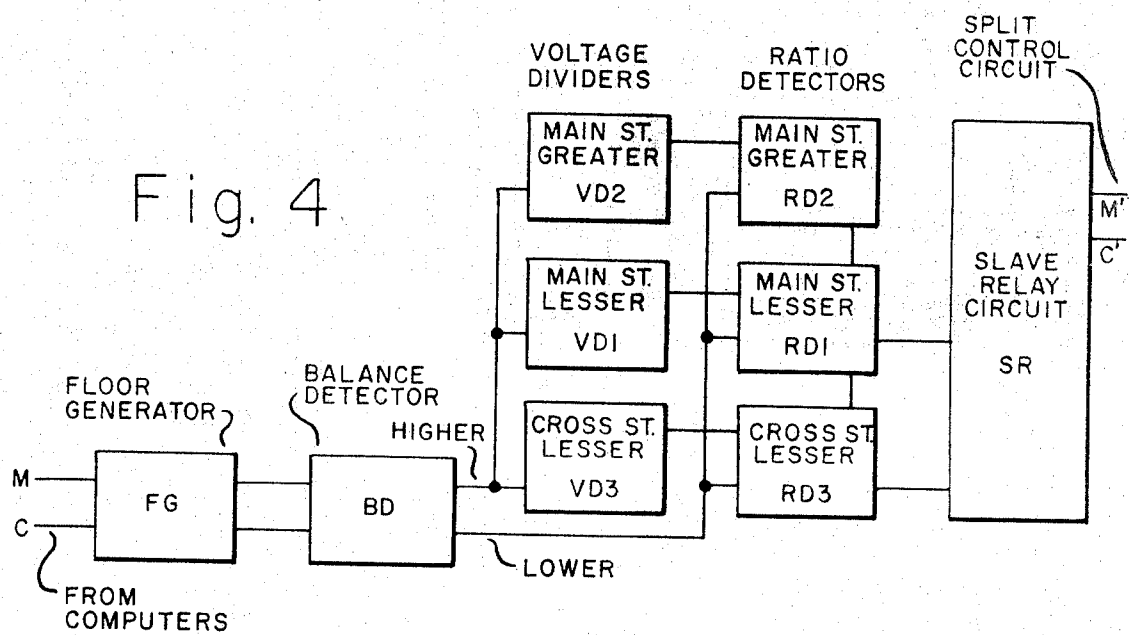
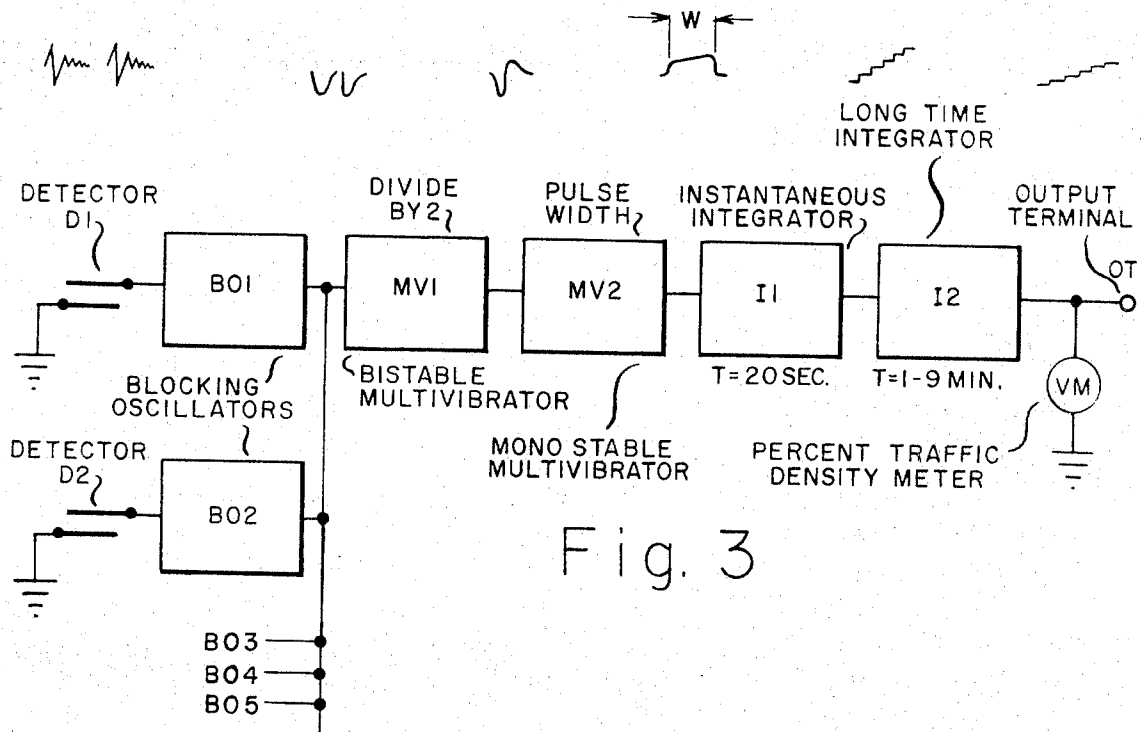


Fig. 1

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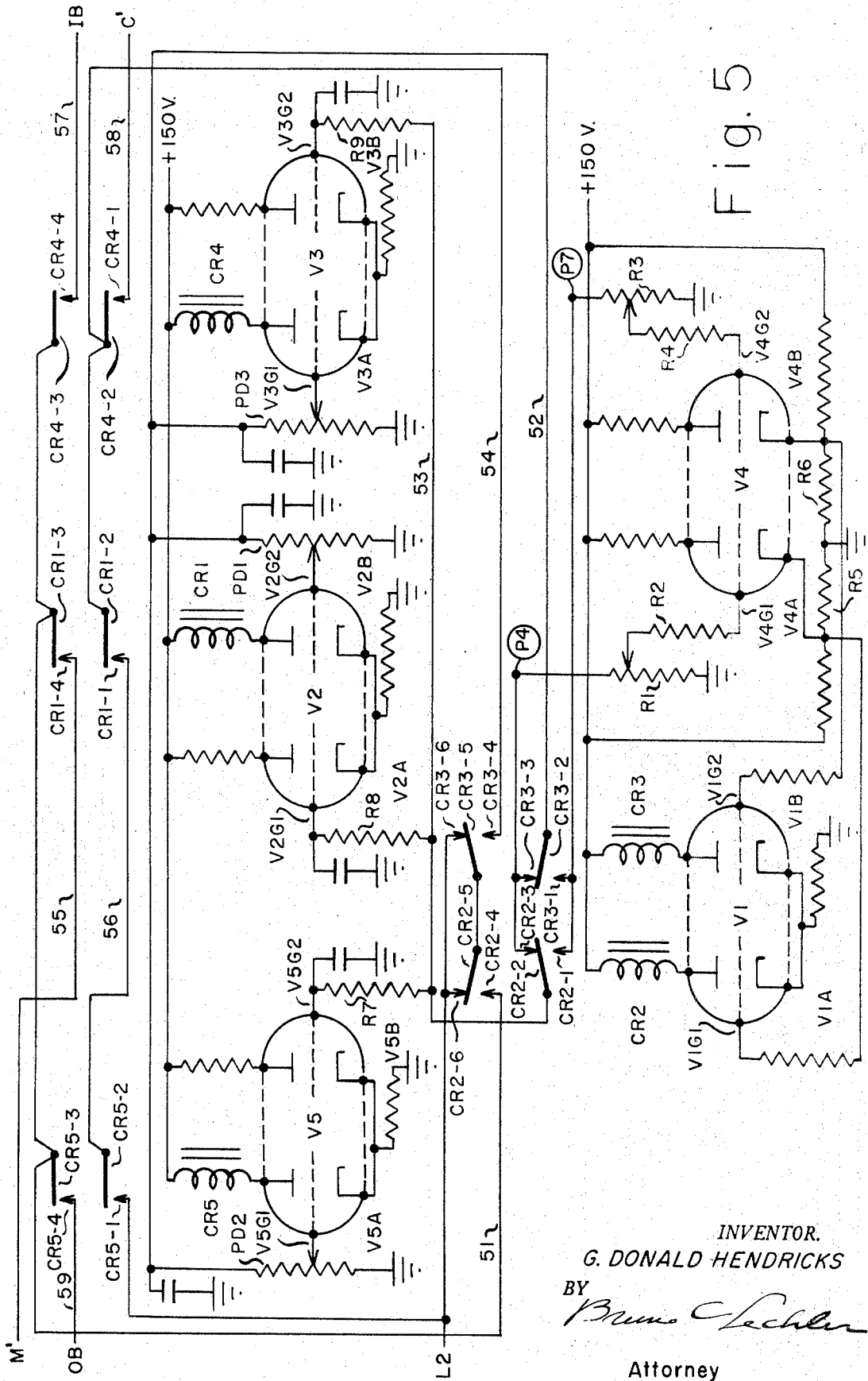


Fig. 5

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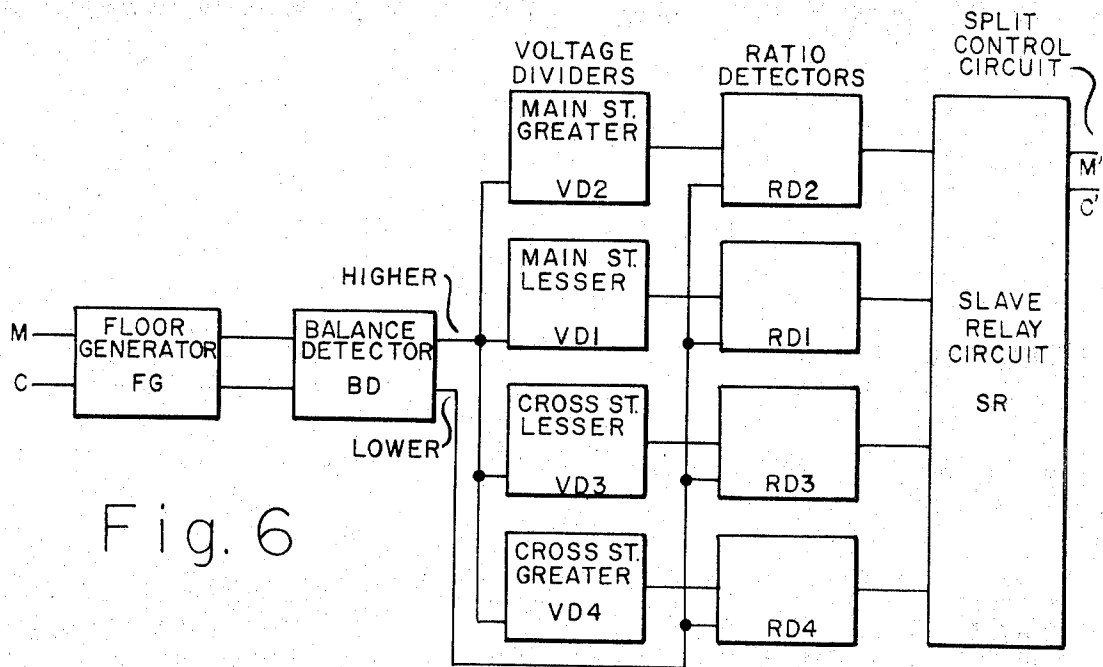


Fig. 6

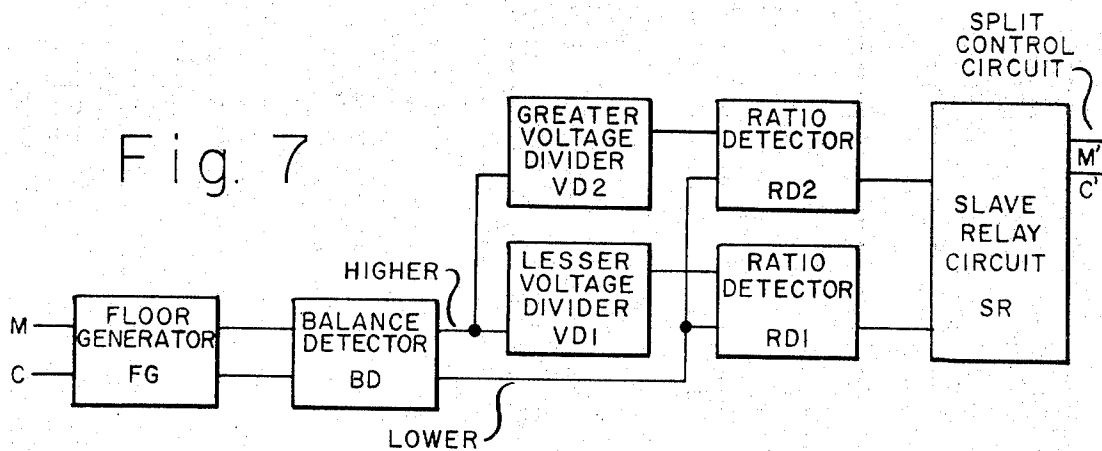


Fig. 7

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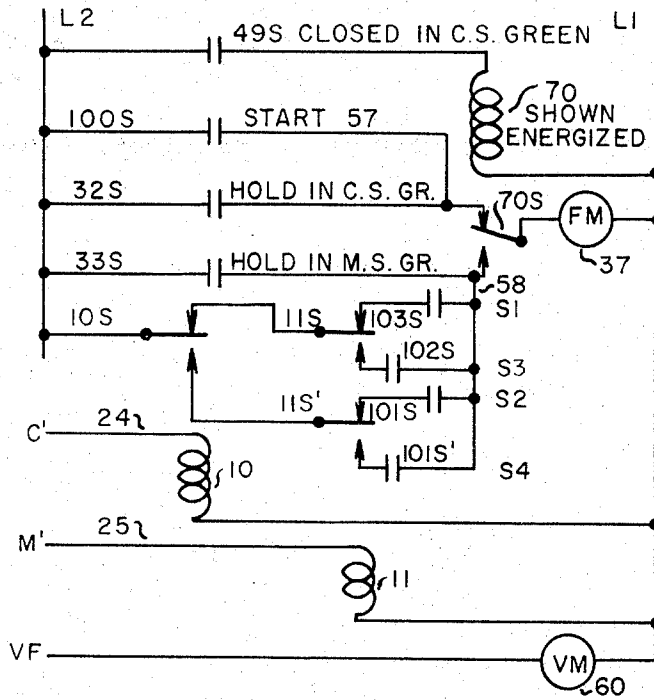
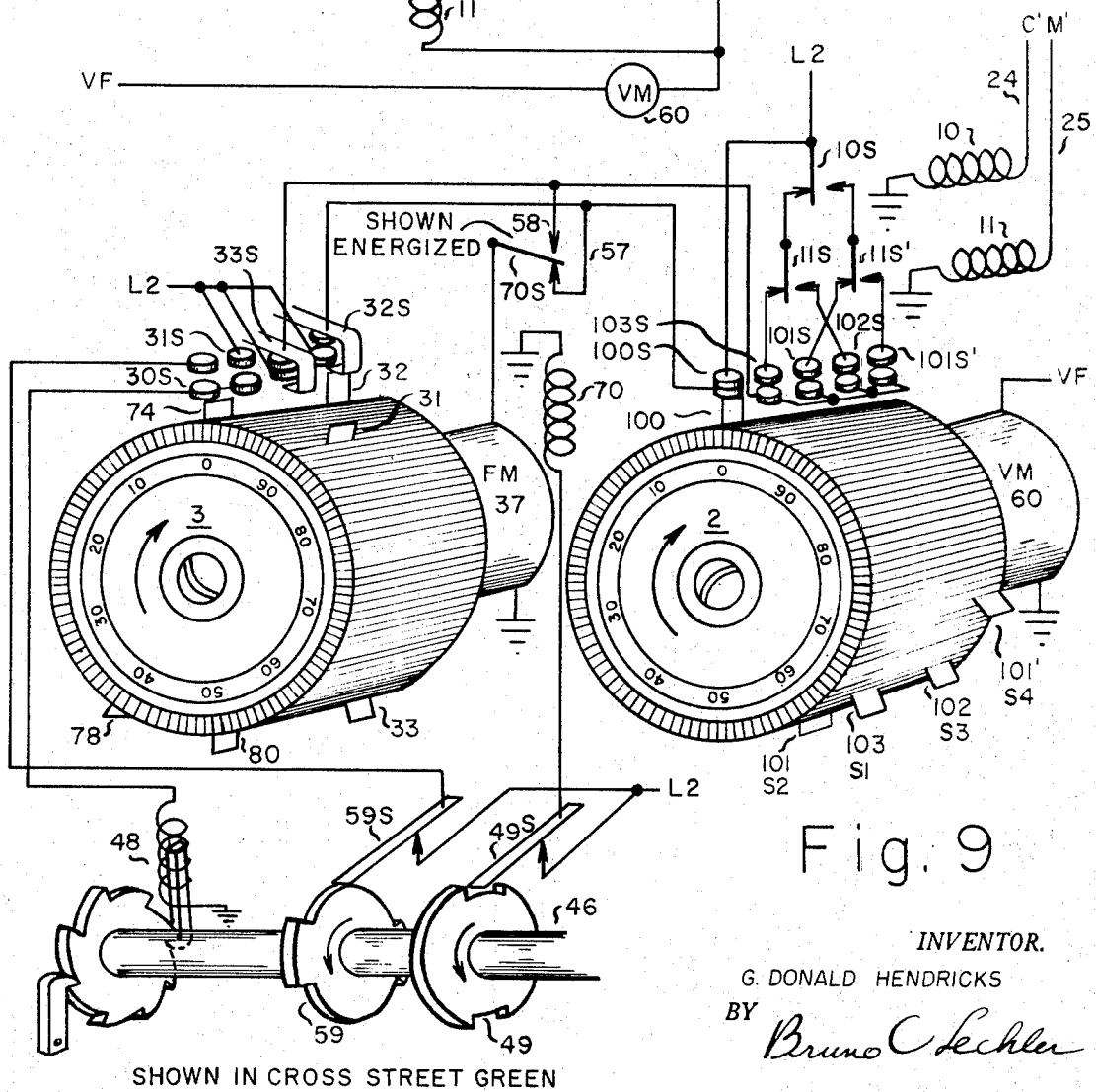


Fig. 8



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TRAFFIC CYCLE SPLIT SELECTORS

This application is a continuation application of my copending application, Ser. No. 343,182, now abandoned filed Feb. 3, 1964, which is a continuation of my application, Ser. No. 742,160, now abandoned filed June 16, 1958.

This invention relates to a traffic control system and more particularly to a traffic control system of the computer type able to select the most expeditious balance between main street and cross street use of a group of intersections.

The invention comprises part of a traffic control system which changes the traffic signals at various intersections according to a pattern. The pattern includes a right-of-way interval, a caution interval, and a stop interval for each street and is called a cycle. The invention provides means for apportioning the cycle between two or more intersecting directions. The division of the cycle between the intersecting directions of travel is here referred to as the split. When expressed as a percent division of the cycle between main street and cross street it is defined as a percentage split.

Heretofore, the percentage split of time available to main street and to cross street has been preset by hand or by time clock. Single dial pretimed controllers are normally set by hand to allow the most efficient flow of traffic across the intersection. An interconnected group on single dial controllers, all with the same cycle length, usually employed the same cycle split to allow most efficient progression along the main thoroughfare. Little flexibility was possible with this type of equipment.

Multiple dial pretimed controllers were developed to overcome this lack of flexibility. With the usual three dials, three different percentage splits were available, set in many cases to favor cross street traffic on one dial, to favor main street traffic on another dial, and balanced traffic on a third dial. Other common settings favored both streets equally on one dial, main street on a second dial, and main street more on a third dial. Dial changes were made at predetermined times usually by a time clock arrangement energizing control conductors and effecting remote dial change.

Another form of split change device in use today is shown in U.S. Pat. No. 2,815,410 and consists of a number of contact assemblies associated with and positioned above a dial unit. Keys are positioned around the dial periphery, one key for each split percent desired. A remotely controlled transfer device makes one contact assembly and key effective at one time and another contact assembly and key effective at another time. The number of split percentages available is limited by the size of the contact assemblies to three or four splits. A master programming device determines which split is effective at various hours of the day.

Still another form of split change device is incorporated in and made a part of a cycle length change device and disclosed in U.S. Pat. No. 2,761,119. Two adjustable frequencies are employed to vary the main street and cross street right-of-way periods. By increasing one frequency the right-of-way period for the street is lengthened. In order not to change the total cycle length the other frequency must be decreased to shorten the right-of-way period on the opposite street. This system is costly to produce and maintain because in addition to the normal amount of equipment required, two variable frequency generators are required

at the master, an amplifier is required at each local controller, and a three conductor cable is required to connect the master with each local controller.

The invention does not require variable frequency generators or amplifiers and does not need more than two conductors to each controller.

Traffic actuated controllers are not concerned with percentage split except under certain circumstances. A two street controller with traffic detectors in the cross street normally dwells in main street green and goes to cross street green only on call. If cross street traffic is heavy or if the recall switch is closed, the controller will operate as a cyclic controller with the cross street green interval being timed by its maximum timer and the main street green interval being timed by its minimum timer. The setting of these timers determines the split at one intersection.

A two street controller with traffic detectors in both streets may likewise time as a cyclic controller if traffic from both directions is heavy or if both recall switches are closed. Isolated actuated controllers find their own best solution to the split problem, and are not primarily concerned with this invention.

The full value of the invention is most evident when used in conjunction with a system of pretimed controllers. However, the invention operates equally well when used with a system containing both pretimed and traffic actuated controllers.

The principal feature of the invention is automatic control of the traffic cycle split at a group of intersection traffic signal controllers on a grid or along a thoroughfare according to the density of traffic in intersecting directions as measured at one or more representative intersections. Methods have been described above to remotely change the split at a number of intersections but none makes use of traffic density in the two intersecting directions as measured at one or representative intersections during a number of traffic signal cycles.

What is believed to be new is a traffic density comparator device able to compare the ratio of measured traffic volumes in two intersecting directions against a plurality of preset, adjustable ratios and select one of a plurality of splits for the heavier direction of traffic dependent upon which of the present ratios the measured ratio exceeds. The invention selects the most efficient split of the cycle without varying the overall duration of the cycle. The duration of the cycle may be determined by factors other than the ratio of traffic densities in intersecting directions.

Traffic density is here defined as the number of vehicles passing a given point during a predetermined interval. Control of traffic cycle split according to traffic density has a decided advantage over preset controls because the former system is related to actual rather than predicted traffic conditions. For this use a novel traffic density computer has been designed. The system for computing traffic density, herein described, is considered superior to known systems.

One traffic computer and control system known in the prior art determines traffic density during a discrete interval, then selects the cycle length at the end of the interval, and operates on that cycle length for at least one interval. At the end of each interval the count is erased. Actuations are then totaled during the ensuing interval. The density thus computed is referred to as a discrete density or average. A device for determining

such a discrete average is disclosed in U.S. Pats. Nos. 2,288,601 and 2,834,001.

A computer device is herein described which appears to be more accurate for control work than any known device. It consists of a traffic density computer which integrates traffic actuations over a running interval so that the most recent actuations are given more weight than past actuations. The count is not erased all at once but is allowed to drain off as time transpires. This count approximates actual traffic conditions as nearly as is practical. An integrator and controller which approximates traffic conditions more closely than this would tend to over control or to hunt.

Since the running average of traffic density is based on signals originating from passing vehicles it is essential that the signals created by each passing vehicle be modified to be identical regardless of the speed of the vehicle or the condition of individual detectors in different lanes. One of the features of the invention is a novel circuit which converts the signals received from several detectors into uniform signals. The uniform signals are applied to the traffic density computers which consist of a capacitor charging circuit which permits the running average of traffic density in each direction to be represented by electrical potentials.

The potentials indicative of traffic in intersecting directions are applied to a balance detector. Here the higher potential determines which direction of traffic is to be favored. A potential divider reduces the high potential by several preset ratios and then compares these reduced values with the lower potential. This comparison determines the extent to which the direction of traffic selected by the balance detector is to be favored in the split.

The present invention, in accordance with one aspect, is directed toward a traffic control apparatus for controlling traffic flow in at least two directions and comprises: means for providing signals representative of a characteristic of traffic in each of two directions; means for fixing a reference ratio; means for developing a signal when a given ratio relationship of the characteristic signals is different from the reference ratio; and, traffic signal control means coupled to the developing means and responsive to a developed signal for controlling traffic flow in the two directions.

The principal object of the invention is to provide a system for the control of traffic cycle split at a plurality of intersections according to relative traffic densities measured at one or more representative intersections.

It is another object of the invention to provide traffic density computers for main street and for cross street, and a cycle split selector consisting of a balance detector to determine which street is to be favored, and a group of ratio detectors to determine the ratio of traffic in the two directions.

It is another object of the invention to provide a local split selector device able to select four splits at each intersection and operable over a two conductor cable.

It is another object of the invention to provide a split selector apparatus able to select various splits relative to traffic density on two intersecting roadways.

It is another object of the invention to select one of a series of splits to obtain most expeditious traffic flow on both the cross street and the main thoroughfare.

It is another object of the invention to provide a split selector device compatible for use with other devices of similar design which select cycle lengths and offsets.

The apparatus will be explained in detail with reference to the following figures, in which like symbols are carried throughout the drawings:

FIG. 1 is a diagram showing a series of intersections along a thoroughfare, traffic detectors in each street at one intersection, a main street computer, a cross street computer, a split selector, slave relays, and an interconnecting circuit to local controllers;

FIG. 2 is a diagram showing a grid of intersecting traffic lanes, traffic detectors in representative lanes, a north-south traffic density computer, an east-west density computer, a split selector, traffic signals at each intersection, and local traffic signal controllers connected to the split selector by slave relays and an electrical cable;

FIG. 3 is a block diagram of a computer showing a number of blocking oscillators, a bistable multivibrator, a monostable multivibrator, an instantaneous integrator, a long time integrator, percent traffic density meter, and an output terminal, approximate wave shape at each stage is shown;

FIG. 4 is a block diagram of a balance detector and ratio detectors for the thoroughfare system shown in FIG. 1;

FIG. 5 is a wiring diagram of the apparatus shown in FIG. 4;

FIG. 6 is a block diagram of a balance detector and ratio detectors for a grid system;

FIG. 7 is a block diagram of a balance detector and ratio detectors for a balanced grid system as shown in FIG. 2;

FIG. 8 is a wiring diagram of a split selector apparatus in a local controller; and,

FIG. 9 is an isometric view of a two dial local controller.

GENERAL DESCRIPTION

The main street and cross street traffic density computers are disclosed fully in U.S. Patent application, Serial No. 738,327, filed May 28, 1958, now abandoned, entitled "Traffic Lane Control," but will be described here in block diagram form for the sake of completeness. In the application named above, the computers are associated with detectors in the inbound and the outbound lanes of main thoroughfare for detecting characteristics of traffic, such as traffic density, and are used to compute inbound and outbound traffic density. Here, the computers are associated with main street and a cross street and are used to compute traffic density in the two intersecting directions.

Each traffic density computer develops a direct current output potential substantially proportional to the running average of traffic density on that street. Each computer contains an integrator circuit which averages traffic flow over a running interval of time. Heretofore, computers counted the traffic flow over a discrete interval, totaled the count after a fixed time, and erased the total at the end of the interval. This invention utilizes a running average which appears to approximate average traffic conditions more accurately, and leads to more accurate control of traffic.

The output of each computer, a DC potential substantially proportional to traffic density on that street, is fed to a comparator device which consists of a balance detector and a group of ratio detectors. A stage of preamplification may be inserted ahead of the bal-

ance detector to reduce the back effect on the computers.

When the balance detector senses an unbalanced condition it energizes a relay that switches the input potentials to a group of ratio detectors. The higher potential is reduced by a plurality of potential dividers and the resulting reduced potentials compared with the lower input potential.

Each ratio detector, when unbalanced by the higher potential representing a certain ratio of main street to cross street traffic, energizes a split selector device representing the best percentage split for that ratio of traffic. The split selector in turn energizes a control conductor leading to each local intersection controller to effect the proper split at each intersection.

MAIN THOROUGHFARE CONTROLLED SYSTEM

One application of the invention is shown by FIG. 1. A series of street or highway intersections are shown along a main thoroughfare. The local traffic signal controllers at each intersection are electrically interconnected with a control circuit to permit control of the cycle split for most efficient flow of traffic on both the main thoroughfare and on the cross streets.

At one representative intersection traffic actuated detector devices are located in, on, above, or along the lanes in both streets. In this description pressure sensitive traffic detectors are used because they are easy to represent and describe. However, any of the well known types of detectors may be used without departing from the spirit of the invention.

A representative intersection is chosen for most efficient operation of the system. The intersection may not be the one along the controlled thoroughfare which has the most traffic; it would preferably be the intersection where traffic conditions most nearly approximate those at other intersections during most intervals of the day.

It is important to the accuracy of the system that detectors be located in all heavily traveled lanes at the representative intersection and preferably in any other lanes frequently used. Lanes not detected reduce the accuracy of the traffic density computers.

As shown in FIG. 1, the main street MS is provided with detectors D1, D2, and the representative cross street RCS is provided with detectors D3, D4. Each detector D1 to D4 consists of two plates mounted in the pavement, the bottom plate being electrically and mechanically grounded, and the upper plate insulated from ground. Upon passage of a vehicle over the upper plate of detector D1, for example, a circuit is established to ground over conductor 1. Passage of a vehicle over either main street detector D1, D2 grounds a circuit in the main street traffic density computer MC through conductors 1, 2. Passage of a vehicle over either cross street detector D3, D4 grounds a circuit in the cross street traffic density computer CC through conductors 3, 4.

Both traffic density computers MC, CC receive signals from their respective detectors, amplify the signals, reduce the number of signals by a factor of two, give the remaining signals a definite duration, integrate the number of signals over a short interval, again integrate the number of signals over a long interval, and develop a direct current potential proportional to the running average of traffic density on that street. The function of the integrators is explained more fully in another section.

The output of the traffic density computers is available for a variety of purposes. In the present invention, the outputs are used to select the proper division of traffic cycle time to main street and to cross street. In another system the outputs might be used to determine traffic cycle length; in another application they might be used to provide a progression; or any combination of these functions.

In this invention the computer outputs are applied to a split selector SS comprised of balance and ratio detectors which compare the values of the potentials and permit the higher potential to energize a switching device. The switching device routes the higher potential to the ratio detectors through one or more potential dividers. It also routes the lower potential to the other side of the ratio detectors. The ratio detectors compare the higher potential, reduced by the potential dividers, with the lower potential to determine the ratio of main street to cross street traffic density.

A ratio detector will become energized if the reduced higher potential is greater than the lower potential. The ratio detector carries contacts which switch power to slave relays SR which translate the information received over three or four conductors to information capable of being sent over two conductors IC to the local controllers LC. It is necessary to reduce the number of control conductors required so that the cost of interconnecting cable will be kept to a minimum. In most installations a cable already interconnects the various local controllers with a master controller located at a central station. The split control function is assigned to two of the conductors or its control signal is superimposed on one or more of the conductors being used by a non-interfering control function. A radio or other link might be employed to transmit the information to the local controller.

GRID SYSTEM

The usual layout of a city may include a number of streets lying in an east-west direction with a number of intersecting streets lying in a north-south direction. To adjust the traffic cycle split at all the intersections to the average densities of traffic at all of the many intersections, a few intersections that seem most typical are selected. Vehicular traffic moving east and west at these few intersections is used to determine one density. Vehicular traffic moving north and south at these few intersections is used to determine the other density.

In FIG. 2 any street bearing eastbound traffic is designated ES; any street bearing westbound traffic is designated WS. Streets normal to ES and WS streets are designated NS and SS. The streets are shown as one-way thoroughfares but may be the more common two-way streets or any combination thereof.

Each signalized intersections is equipped with a local traffic signal controller LC which may be either pre-timed or traffic actuated or any combination thereof. For purposes of illustration, pre-timed controllers are used. To simplify nomenclature, streets running one direction will be termed east-west streets and those running at right angles will be termed north-south streets.

On one or more representative streets in each direction traffic actuated detector devices D1 to D8 are located in, on, above, or along the lanes of travel. Pressure sensitive traffic detectors are used by way of illustration but any of the well known types of detectors may be used.

The streets chosen for traffic sampling purposes must preferably be representative of the major portion of streets running in that direction. In FIG. 2, one-way streets are illustrated with traffic detectors in each lane of eastbound ES, westbound WS, northbound NS, and southbound SS streets. To count most accurately and to anticipate changing traffic conditions it is preferred that the traffic detectors be located at the entry points to the grid.

Each of the east-west traffic detectors D1 to D4 feed into individual circuits of the east-west traffic density computer MC. Each of the north-south traffic detectors D5 to D8 feed into individual circuits of the north-south traffic density computer CC. It is important to the accuracy of the system that detectors be located in all heavily traveled lanes and preferably in all other lanes frequently used in the representative streets. Lanes not detected reduce the accuracy of the traffic density computers.

Passage of a vehicle over any east-west street detector D1 to D4 grounds a circuit in the east-west traffic density computer MC over conductor 1 to 4. Passage of a vehicle over any north-south street detector D5 to D8 grounds a circuit in the north-south traffic density computer CC over conductor 5 to 8.

The function of the traffic density computers MC, CC is identical to that described above. The output of each computer is substantially proportional to traffic density for that direction of travel averaged over the integrating interval.

In this form of the invention, the balance and ratio detectors may be designed to include one or more split selections for each main direction of travel. For instance, two splits may be available favoring east-west travel and two splits may also be available favoring north-south travel. One balanced split would favor each direction equally. In the first form of the invention, as shown in FIG. 1, two splits are available favoring main street traffic and one balanced split is available favoring each direction equally. In the first form of the invention the cross sections are of only secondary importance, and no split is provided to favor them. The design and layout of the ratio detector circuits is slightly different for the two forms of the invention.

Likewise, the design of the split selector slave relay circuit is slightly different in that it must select one of two splits for each direction of traffic, or a total of four splits. If traffic density is relatively balanced, a fifth split favoring each direction equally is selected. Information received over four conductors is translated to information transmittable over two conductors and an existing ground conductor to local controllers.

TRAFFIC DENSITY COMPUTER

In both forms of the invention a traffic density computer is provided for each direction of traffic. That is, one computer is provided to measure traffic density on main street and another is used to measure traffic density on cross street, as in FIG. 1. Or, one may be provided to measure traffic density on two one-way east-west streets, and another to measure density on two one-way north-south streets, as in FIG. 2. Or, any combination may be used so long as density in the two intersecting directions is measured.

A block diagram of the units associated with each traffic density computer is shown in FIG. 3. A plurality of detectors D1, D2 are installed in the highway, one

in each lane of traffic. The detectors may be placed at the approaches to the intersection as shown in FIG. 1, or in the various lanes of one-way streets as shown in FIG. 2, or in any configuration to count all the traffic in that direction.

To assure maximum accuracy of the counter, each detector feeds into a respective blocking oscillator circuit as indicated by BO1-BO5, which receives the signal from the detector and emits a pulse of uniform wave shape and substantially uniform amplitude.

The noisy output of the detectors, which has been noted on a cathode ray oscilloscope to include up to 14 impulses per actuation, is fed into the block oscillators, which accept the first pulse and block out the remaining signal for 6 to 7 milliseconds. This wipes out the chatter.

The signal is next fed into a bistable multi-vibrator MV1 whose purpose it is to reduce two pulses to one. Each vehicle passing over a pressure sensitive detector puts out two pulses, one for each set of wheels. Since the purpose of the computer is to count vehicles per unit of time, it is desirable it reduce the two pulses to one so that the count will be accurate.

Another reason for supplying both the blocking oscillators BO1 to BO5 and the bistable multi-vibrator MV1 is to reduce each actuation to as short a pulse as possible for preventing loss of one by overlapping of two pulses arriving almost simultaneously from different detectors.

The bistable multi-vibrator puts out a sharp pulse of short duration. This pulse is fed into a monostable multi-vibrator MV2 for which it emerges with a constant duration or width. It is desirable to send to the integrator 11 pulses of uniform duration so that the integrator will give each pulse equal weight.

Pulses of uniform duration, one for each two axle vehicle, are fed into the next stage, an instantaneous integrator 11. The time constant of the RC combination is 20 seconds, which is instantaneous only by comparison to the long time integrator 12. The incoming pulses charge a capacitor which is allowed to drain off through a high resistance. The potential of the capacitor is applied to the grid of a triode. A cathode follower provides a potential across its cathode resistor proportional to the running average of the number of vehicles counted during the previous 20 seconds.

The short time integrator is provided for at least three reasons. First, a linear charging circuit is more easily applied to a short time integrator than a long time integrator. Second, a RC circuit with a short time constant is more accurately charged from a short duration pulse than is an RC circuit with a long time constant. Third, in some types of traffic control application it is desired to know the instantaneous density. An example of this application is a single intersection traffic control.

The potential from the short term integrator is applied to the long time integrator 12 which is an RC circuit with a longer time constant. One novel feature of this circuit is that its charging circuit is different from and independent of its discharge circuit and each may be set with a different time constant. In this embodiment its charging circuit may be set from 1 to 9 minutes in 1 minute increments.

The potential from the long-time integrator is applied to the grid of a triode. A cathode follower circuit provides a potential across its cathode resistor propor-

tional to the running average of the number of vehicles counted during the running interval. It will be understood that no definitely timed interval, as such, is used here; the average is a running average. As time transpires, new counts are added and old counts allowed to drain off so that the most current average is used. This is a distinct improvement over present equipment.

The long time integrator is required for control of a system of intersections. A sufficient number of vehicles must be included in the sample to obtain an accurate picture of traffic conditions. Short time changes must not be allowed to effect a split change. But short time changes must still be allowed to exert their influence on the long time total. Density from the long time integrator is useful in determining cycle length, split, and offset.

The output potential from the long time integrator is applied to a "Percent Traffic Density" meter VM which registers traffic density as a percent of the setting on an adjustment dial entitled "Vehicles per hour per lane at 100%". This latter adjustment permits the computer to be used on highways with widely different traffic densities.

Output is provided at output terminal OT for use by the split selector, or by a cycle length selector, an offset selector, a lane selector, or any of a variety of purposes.

A more detailed disclosure of the traffic density computer will be found in U.S. Patent application, Ser. No. 738,327, entitled "Traffic Lane Control," filed May 28, 1958.

BLOCK DIAGRAM OF RATIO DETECTOR

The potential from the two computers is applied to a balance and ratio detector shown in block diagram in FIG. 4. The output potentials of the main street and cross street traffic density computers MC, CC are applied to the input terminals M, C of the generator FG. The potentials from the generator are then applied to the balance detector BD where the higher potential may energize a relay to switch said higher potential to a plurality of voltage dividers. The lower potential is switched to one side of each ratio detector RD1 to RD3.

Voltage dividers VD1 to VD3 reduce the higher potential by three differently reduced adjustable ratios. Each different potential is applied to the grid of a ratio detector tube, the lower potential having been applied to the other grid in each ratio detector tube. If any reduced higher potential is sufficiently high to outbalance the lower potential it energizes a relay which switches power to a control conductor. The control conductor in turn energizes the proper relay in the slave relay circuit SR.

The relative position of the three ratio detector relays determines which of four splits is energized at the local controller. Power to select the proper split at the local controllers flows over lines M', C' from slave relay circuit SR.

The purpose of the slave relay circuit is to permit energization of the split selector relays in a number of local controllers. The slave relays act as current amplification devices to reduce the load on the ratio detector relays which are necessarily small because they are plate circuit relays.

A plurality of contact assembly and keys on a cycle timing dial at each local controller effects the cycle split. A split selector relay makes effective the proper

contact assembly and dial key. A more detailed explanation of the local split selector is found in another section.

BALANCE AND RATIO DETECTOR

A circuit diagram of the balance and ratio detector shown in block diagram in FIG. 4 is shown in FIG. 5. A five tube unit is employed in this embodiment with three of the tubes used as ratio detectors. In another embodiment more or fewer ratio detectors may be employed without departing from the spirit of the invention.

One ratio detector stage is employed for each independently adjustable ratio desired. For instance, tube V3 detects the ratio of cross street to main street traffic. When traffic exceeds the preset ratio, tube V3 energizes relay CR4. Contacts on relay CR4 actuate a control function — in this case, a 50-50 split favoring cross street equally with main street.

A second ratio detector V2 is employed to detect the ratio of main street to cross street traffic. When traffic exceeds the preset ratio, tube V2 energizes relay CR1 which actuates a control function, here a 60-40 split favoring main street.

A third ratio detector V5 is utilized to detect a higher ratio of main street to cross street traffic. When traffic exceeds a second, greater preset ratio, tube V5 energizes relay CR5 which actuates another control function, here a 70-30 split favoring main street.

Thus the unit serves two functions: it discerns which direction of traffic is heavier, and it compares the ratio of heavy to light flow against one or two adjustable ratios to determine how much of the traffic cycle shall be allocated to main street traffic.

Referring to FIG. 5 in greater detail, the output of the main street traffic density computer MC is fed in on pin P4, through potentiometer R1 and resistor R2 to the grid V4G1 of tube V4A. The output of the cross street traffic density computer CC is fed in on pin P7, through potentiometer R3 and resistor R4 to the grid V4G2 of the tube V4B.

Tube V4 serves as a generator. The tube half which has the higher potential impressed on its grid conducts more heavily. The cathode to plate current flowing through tube V4A increases the voltage rise across resistor R5 and increases the bias voltage on grid V1G1 of tube V1A. The current flowing through tube V4B increases the voltage rise across resistor R6 and increases the bias voltage on grid V1G2 of tube V1B.

The tube half V1A, V1B which has the higher positive potential impressed on its grid conducts more heavily and pull in relay CR2 or CR3 in its plate circuit. If traffic is sufficiently heavier on main street than cross street, for example, relay CR2 will pull in closing contacts CR2-1 and -2 and contacts CR2-4 and -5. L2 power is fed in on pin L2, through the contacts CR3-6 and -5, through contacts CR2-5 and -4, through line 51 to contacts CR5-3, CR1-3, CR4-3. Now closed contacts CR2-1 and -2 apply the potential arriving from the cross street computer CC through pin P7 to the grids V5G2, V2G1, and V3G2 of the ratio detector tubes through grid resistors R7, R8, R9 associated with tubes V5B, V2A, V3B, respectively.

The output of the main street computer MC arriving through pin P4 is now being fed through contacts CR3-3 and -2, through conductor 52 to the potential dividers PD2, PD1 and PD3 associated with tubes

V5A, V2B, V3A, respectively. The tap on each potential divider applies a reduced voltage to the grids V5G1, V2G2, V3G1, respectively. The taps may be set for the various ratios desired for split change. To illustrate further conditions enumerated in the first part of this section, potential divider PD1 associated with tube V2 may be set for any ratio between 1 to 1 and 2.5 to 1. When the ratio of the main street to cross street traffic exceeds the ratio set on potential divider PD1, relay CR1 is energized pulling in split 60/40, for example. Note that the ratio set on the potential divider need not be the same as the split.

Potential divider PD3 associated with tube V3 may also be set for any ratio between 1 to 1 and 2.5 to 1. When the ratio of cross street to main street traffic exceeds the ratio set on potential divider PD3, relay CR4 is energized pulling in split 50/50, for example. That is, even though cross street traffic is heavier than main, the split is awarded evenly, which actually gives main street an advantage and allows main street traffic free movement.

Potential divider PD2 associated with tube V5 may be set for any ratio between 1.5 to 1 and 2.5 to 1. When the ratio of main street to cross street traffic exceeds the ratio set on potential divider PD2, relay CR5 is energized pulling in split 70/30, for example.

Assume now that traffic is relatively heavy and that main street traffic exceeds cross street traffic by the ratio 1.25 to 1, for instance. The left half of balance detector tube V1 conducts pulling in relay CR2. Contacts CR2-1 and -2 close and apply across street computer potential to grids of V5G2, V2G1, V3G2, of ratio detector tubes V5, V2, V3. Contacts CR3-2 and -3 apply main street computer potential through potential dividers PD2, PD1, PD3 to the other grids V5G1, V2G2, V3G1 of tubes V5, V2, V3, respectively, where the resultant ratios are compared. Tube halves V2B and V3A will both conduct sufficiently to energize relays CR1 and CR4, respectively, because the ratios of higher to lower potential are within the ratios set on potential dividers PD1, PD3. With the energization of relay CR1, contacts CR1-3 and -4 close feeding L2 power through conductor 55 onto output terminal M' associated with the 60/40 split selector. Closure of contacts CR1-1 and -2 has no effect because contacts CR5-1 and -2 and contacts CR3-4 and -5 are open preventing L2 power from reaching output terminal C' on conductor 58.

Since relay CR4 is also energized, contacts CR4-3 and -4 are closed feeding L2 power through conductor 57 onto terminal IB which is vacant in this application. Closure of contacts CR4-1 and -2 has no effect because line 56 is not energized because contacts CR5-1 and -2 are open, and because line 54 is not energized because contacts CR3-4 and -5 are open. Thus, no power is fed over line 58 to terminal C'. No power is fed over line 59 to terminal OB because contacts CR5-3 and -4 are also open. Terminals IB, OB are used for inbound and outbound favoring offsets in another application.

If cross street traffic had exceeded main street traffic, output terminal C' and not M' would have been energized. Contacts CR3-4 and -5 would have been closed allowing L2 power to energize output terminal C' over conductor 58. Also, output terminal M' would not have been energized because contacts CR2-4 and -5 would have been open.

If now main street traffic builds up heavier than cross street traffic until the ratio of main to cross street traf-

fic reaches 2 to 1, for example, relay CR5 will also be energized. Conduction through tube half V5A will result from the increased potential developed by the main street computer and fed in on pin P4, and applied through contacts CR3-3 and -2, conductor 52, and potential divider PD2, to grid V5G1. The increase in potential causes tube half V5A to conduct, energizing relay CR5.

Relays CR1 and CR4, and therefore M', were already energized as traffic increased so that now all three ratio detector relays are energized.

With relays CR5, CR1, and CR4 energized, power is fed from line L2, through contacts CR5-1 and -2, conductor 56, contacts CR1-1 and -2, contacts CR4-2 and -1, conductor 58, to output terminal C'. With both terminals C' and M' thus energized, they make the fourth split effective at the local controllers. This split may be set 70/30 in favor of main street.

Output terminals IB and OB are also energized but they are vacant in this application.

OTHER BALANCE AND RATIO DETECTOR CIRCUITS

Various combinations of balance and ratio detectors may be assembled by one skilled in the art of electronics. For example, two combinations are shown in FIGS. 6 and 7. The type designed depends on highway requirements and the number of splits required for each direction of traffic.

FIG. 6 illustrates a type of balance and ratio detector for a grid system. Two adjustable split changes are provided for each direction of traffic in addition to a balanced split favoring each direction equally. An independently adjustable greater and lesser voltage divider and ratio detector is provided for each direction of traffic. With only slight change in wiring, three of the adjustable ratios could be used for one street, and one for the other street.

If traffic and geographic conditions are such that the same setting could be used for both streets, a simplified version of the ratio detectors could be assembled as shown in FIG. 7. Only two adjustable settings are provided and are used for both streets. That is, if the lesser voltage divider is set to effect a split change when the ratio of traffic density on the two streets is 1.25 to 1, the split change will favor main street when its traffic is 1.25 times heavier than cross street, or the split change will favor cross street when its traffic is 1.25 times heavier than main street. Likewise, when the greater voltage divider is set to effect a second split change when the ratio of traffic density on the two streets is 1.75 to 1, the split change will favor the busier street when its traffic is 1.75 times greater than the less busy street. This simplified system could be used advantageously with a grid system when the two groups of intersecting streets are of equal dignity.

LOCAL CYCLE SPLIT CONTROLLERS

The split selector disclosed in this invention is designed for use in traffic control systems using local traffic signal controllers of the type described in pending U.S. Patent application, Ser. No. 642,469, filed Feb. 26, 1957, entitled "Multiple Program Traffic Control Systems." However, the selector is not limited to use with one specific type of local traffic signal controller but may be used with any type which allows for the utilization of information or electrical energy furnished by

the selector. Many controllers now in use may be adapted to permit the master controller to vary their cycle split.

In one version of a split control mechanism, power is fed out on terminals M' and/or C' of the split selector shown in FIG. 5. In the slave relay circuit SR shown in FIGS. 1 and 2 the current may be amplified so that a large number of local controllers may be controlled. Power flows over one or more conductors in the interconnecting cable IC to each local controller LC connected into the system. The relay circuit SR is employed also to permit the transmission of four items of information over a two conductor cable. The table below shows which conductors are energized for the following conditions:

Con- di- tion	Split Desig- nation	Condition of Traffic	Split, per- cent Main/ Cross	Con- ductor energi- zed
1	S1	Cross street less than main st.	60/40	None
1	S1	Cross st. equal with main st.	60/40	None
2	S2	Cross street more than main st.	50/50	C'
3	S3	Main st. 1.25 times cross st.	60/40	M'
4	S4	Main st. 1.5 times cross st.	65/35	C' and M'

Within each local controller is a decoding network which utilizes the information received on two conductors to energize the selected cycle split. The relative position of two relay armatures and contacts determines which split is effective. A wiring diagram of one such relay circuit is shown in FIG. 8. FIG. 8 is a reproduction of part of FIG. 7 of application, Ser. No. 642,469 noted above. Relay positions will be explained with reference to conditions shown in the table above and with reference to FIGS. 5 and 8.

Under condition 1 when cross street traffic is equal to or less than main street traffic, neither control relay CR2 nor CR3 is energized and neither conductor C' nor M' is energized. Power is fed in on conductor L2, through contacts 108, 118, 103S, conductor 58, switch 70S, to motor 37 making split S1 effective.

In condition 2 when cross street traffic exceeds main street traffic by a ratio greater than that preset on adjustable potential divider PD3, as previously explained, power is fed onto conductor C', which at the local controller is wire 24, energizing local relay coil 10. This switches local power from line L2 through contacts 10S, 11S', 101S, conductor 58, switch 70S, to motor 37 making split S2 effective.

Under condition 3 when main street traffic exceeds cross street traffic by a ratio greater than that present on adjustable potential divider PD1, but not as great as that preset on potential divider PD2, control relays CR2, CR1, and possibly CR4 are energized. (CR4 has no effect under this condition because CR3 is de-energized preventing L2 power from reaching the movable contact member, CR4-2.) Power is fed onto conductor M', which at the local controller is wire 25, energizing local relay coil 11. This switches local power from line L2 through contacts 10S, 11S, 102S, conductor 58, switch 70S, to motor 37 making split S3 effective.

In condition 4 when main street traffic exceeds cross street traffic by a ratio greater than that preset on adjustable potential divider PD2, control relays CR2, CR1, CR4 and CR5 are energized. Power is fed onto

conductors C' and M', which at the local controller are designated 24, 25, energizing local relay coils 10 and 11. This switches local power from line L2 through contacts 10S, 11S', 101S', conductor 58, switch 70S, to motor 37 making split S4 effective.

The above description shows how the master cycle split selector chooses and energizes the proper split at the local controllers. A typical local controller will be explained more fully in the following section to illustrate its complete split function. The remainder of the circuit shown in FIG. 8 will also be described.

TWO DIAL CONTROLLER

A very thorough description of a local split selector will be found in U.S. Pat. application, Ser. No. 642,469, noted above. A short explanation will be made here to supplement the teaching of the present invention.

FIG. 9 represents part of a two dial local traffic signal controller and is identical in function to the device shown in FIG. 1 of application, Ser. No. 642,469 noted above. The same numerical designations are used to avoid confusion. Dial 3 is the amber timing dial and is driven by synchronous motor 37 which is powered directly from 60 cycle alternating current. Dial 3 carries on its surface 100 slots each representing 1 percent of the periphery and 1 percent of a revolution of the dial. Dial 3 is geared to motor 37 so that it makes half a revolution in less time than the shortest split of the shortest cycle for which the equipment is designed.

Into the slots in the face of dial 3 fit keys which may be displaced at any percent point in the cycle. Four types of keys are available, each with a projection located at one of four different locations measured from the front of the slot. Four contact pairs are located above the dial, each pair operated by only one of the four key projections. When the front contact pair is to be closed, for example, a key with a projection in the front position is used. The table below shows the function of each dial key, its designation, and a sample dial setting.

DIAL 3

Key	Setting Percent	Function
32	2	Stops Dial 3 in Cross Street Green.
78	40	Begins Cross Street Amber. Ends C.S. Green.
80	50	Begins Main Street Green. Ends C. S. Amber.
33	52	Stops Dial 3 in Main Street Green.
31	90	Begins Main Street Amber. Ends M.S. Green.
74	0	Begins Cross Street Green. Ends M.S. Amber.

In the example illustrated in FIG. 9, six keys are fitted into slots on dial 3, four keys having projections near the front of the dial, and two keys having projections near the rear of the dial. The former keys are located at percentage times in the cycle at which it is desired to step the step switch and change the traffic signal indications. The keys carry projections which close contacts which step the step switch once for each contact closure. The three keys 74, 78, 80, with projections in the front position are impulse keys. The key 31 with a projection in the second position is a release key. Their interaction is explained in greater detail below.

Two keys, 32, 33, with projections located near the rear of dial 3 serve to open motor control contacts 32S, 33S. As soon as the projection on key 33, for example, opens contacts 33S, motor 37 is deenergized, dial drum

3 stalls, and contacts 33S remain open. Closure of one of contact pairs 101S, 101S', 102S, or 103S on dial 2 is required to energize the motor 37 momentarily to rotate dial drum 3 and cause the motor control contacts 33S to close, energizing motor 37 for another half revolution of the dial 3.

In like manner, the projection on key 32 opens the contact pair 32S, deenergizing motor 37, which stalls dial drum 3 allowing contacts 32S to remain open. Dial 2 must then rotate until the projection on key 100 momentarily closes the contact pair 100S energizing motor 37 through line 57 and now-closed contacts 70S. When motor 37 rotates dial 3 a few degrees contacts 32S again close permitting motor 37 to be energized directly from line L2 for another half revolution of dial 3. Contacts 70S are closed at the proper time by relay 70 being energized from line L2 through contacts 49S closed by cam 49.

As noted above, two types of keys have projections near the front of the dial: impulse and release keys. Although neither is important to the present invention, they are included in the description. Impulse keys 74, 78, 80, are developed around the dial at each point in the cycle at which the step switch is to be stepped to change the traffic signal indication. The front contact 30S is closed by impulse keys 74, 78, 80 to cause such stepping action.

To keep the camshaft 46 in step with dial 3 a release key 31 is used. Release key 31 closes contact pair 31S located adjacent to impulse contacts 30S. The release key's projection is to the rear of the impulse key's projection. Release key 31 closes contacts 31S energizing ratchet solenoid 48 which rotates camshaft 46 out of the main street green interval. The release key is used to terminate the main street green interval so that if camshaft 46 and dial 3 get out of step camshaft 46 will remain in the main street green interval until dial 3 makes up to one revolution to again step the camshaft.

The camshaft 46 shown in part in FIG. 9, carries cams 49, 59, and additional cams (not shown) to operate switches to energize traffic signal lights S, as in FIGS. 1 and 2.

Cam 59 allows closure of contacts 59S admitting L2 power to one contact of front contact pair 30S. Closure of contacts 30S thus energizes the ratchet solenoid 48 only when contacts 59S are closed. Contacts 59S are controlled by the action of cam 59 and are closed by the low section on cam 59. The low section of cam 59 corresponds to all of the cycle except the main street green interval. During the main street green interval the high portion of cam 59 opens contacts 59S and makes impulse contacts 30S ineffective. Closure of release contacts 31S by key 31 energizes ratchet solenoid 48 because one contact of contact pair 31S is continuously connected to L2 power. The dial 2 and camshaft 46 are thus kept in step.

SPLIT DIAL

Dial 2 is constructed similarly to dial 3. Five keys 100, 101, 101', 102, 103, have projections located in unique positions from front to rear, one projection on each key. Key 100 located in slot 0 may momentarily energize motor 37 out of its stalled condition during the cross street green interval. Any one of the keys 101, 101', 102, 103 may momentarily energize motor 37 out of its stalled position during the main street green interval. Which of the latter keys is made effective depends

upon which contact 101S, 101S', 102S, 103S is energized which in turn depends upon the position of relay contacts 10S, 11S, and 11S'.

Relay contact is maintained in the position shown by its own spring pressure and is urged into its other position when coil 10 is energized through conductor 24 from interconnecting conductor C'. Relay contacts 11S, 11S', are maintained in the position shown by their own spring pressure and are urged into their other position when coil 11 is energized through conductor 25 from interconnecting conductor M'.

Dial 2 rotates continuously at a uniform speed determined by synchronous motor 60, energized by an alternating voltage VF which may vary in frequency from 40 to 120 cycles per second. The frequency is constant over a period and is varied by or from a master controller to effectively change the length of cycle of traffic signal change. This feature is covered in U.S. Patent application, Ser. No. 642,469, noted above.

The purpose of dial 2 is to time the termination of the cross street green interval near the zero point in the cycle, and to time the termination of the main street green interval at the percentage split in the cycle as selected by the Master Controller. Keys on dial 3 actually initiate and terminate the intervals while the keys on dial 2 time the start of dial 3. The table below shows the function of each key on dial 2, its designation, and a sample dial setting. The keys on dial 2 actually time the beginning of the end of their interval.

DIAL 2

Key	Setting Percent	Function
100	0	Releases Dial 3 in Cross Street Green.
101	50	Split S2. Releases Dial 3 in Main Street Green.
103	59	Split S1. Releases Dial 3 in Main Street Green.
102	60	Split S3. Releases Dial 3 in Main Street Green.
101'	70	Split S4. Releases Dial 3 in Main Street Green.

One rotation of dial 2 times one rotation of dial 3 and one complete change of traffic signals. The first key on dial 2, key 100, closes contacts 100S momentarily which energize motor 37 out of its deenergized condition caused by the opening of contacts 32S. The latter four keys on dial 2, keys 101, 101', 102, 103, close contacts 101S, 101S', 102S, 103S, momentarily, one of which energizes motor 37 out of its deenergized condition caused by the opening of contacts 33S. At any time, only one of the four latter contacts is energized and is effective to start dial 3 into the second half of its cycle. The effective contact determines how the cycle will be split and is energized through relay contacts controlled by the split control conductors C', M'.

If the cycle is to be split 50-50, for example, key 101 located in slot 50 must be effective. Key 101 is made effective when contact 101S is energized from an L2 source through contacts 10S and 11S'. This condition exists when relay coil 10 is energized and coil 11 is not energized. Thus, to make split S2 effective, control conductor C' must be energized causing the traffic cycle to be divided 50 percent to main street and 50 percent to cross street.

Energizing control conductor M' and not C' makes split S3 effective. Power flows from conductor L2 through contacts 10S, contacts 11S, contacts 102S, line 58, contacts 70S, to motor 37.

Solenoid coil 70 is energized only during the cross street green interval to close contacts 70S and make line 57 and contacts 100S effective. This circuit permits contacts 100S to start motor 37 out of its stalled condition during the cross street green interval.

Energizing control conductors C' and M' energizes both relay coils 10 and 11 and makes split S4 effective. Power flows from conductor L2, through contacts 10S, contacts 11S', through contacts 101S', line 58, contacts 70S, to motor 37.

Split S1 is effective with neither control conductor C' nor M' energized. Power flows from conductor L2, through contacts 10S, contacts 11S', through contacts 101S', line 58, contacts 70S, to motor 37.

Latch relays may be used instead of the normal relays 10, 11 used to energize one or another split contact. When the interconnecting conductors C' or M' are energized they energize the main coil of their associated relays 10, 11. Contacts 10S, 11S, or 11S' do not close until the release coils (not shown) are energized, pulling a latch away from the main armature, permitting the main armature to act on its contacts.

The release coils are energized during a portion of the cycle when a transfer in splits would be least disruptive of normal operation. The release coils may be energized by contacts 49S which are closed only during the cross street green interval. This prevents disruption of the traffic signal cycle during switching of the splits.

FUNCTION SELECTOR

Broadly, the invention provides means for selecting a particular mode of operation of an apparatus capable of operating in several different manners. The use of the balance and ratio detectors disclosed in this invention is not limited to split selection or to traffic control. As stated in a prior section, the output of the traffic density computers can be used for a variety of purposes such as split selection, offset selection, cycle length selection, lane control, or any other purpose. Likewise, the ability of the balance and ratio detectors to discern which of two potentials is higher and by what ratio is useful for split selection, offset selection, cycle length selection, lane control, or any other purpose. Therefore, the balance and ratio detector assembly may well serve as a function selector for a variety of apparatus.

Having described the invention in one or more forms or arrangements, it will be evident to one skilled in the art that modifications or changes may be made without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a traffic cycle split control system for two intersecting highways, traffic detector means for said highways for detecting the passage of substantially all vehicular traffic thereon, main highway traffic density computer means to which all said detector means for the main highway are connected, cross highway traffic density computer means to which all said detector means for the cross highway are connected, the outputs of said computer means being proportional to traffic density on their respective highways, balance detector means for receiving and comparing the outputs of said computer means to determine the higher output, a plurality of adjustable impedances, a plurality of ratio detector means connected to said impedances, said balance detector means applying the higher output of said computer means through said impedances to said plurality of ratio detector means, said balance detector means

applying the lower output of said computer means directly to said ratio detector means, said plurality of ratio detector means being responsive to said computer outputs to represent a ratio of main highway traffic to cross highway traffic, a plurality of local controllers, and a control circuit between said controllers and said ratio detector means for actuating one of a group of presettable traffic cycle splits dependent on said represented ratio.

2. In a traffic cycle split control system as in claim 1, a plurality of relays energizable by said ratio detector means, a plurality of local controllers, means within said local controllers for changing the traffic cycle split between said streets according to a plurality of splits, an interconnection between said relays and said local controllers, and means within said local controllers responsive to energization of said relays to change said splits.

3. In a split control system for a major street and a group of streets intersecting said major street, traffic detector means at at least one intersection, a main street traffic density computer means, an intersecting street traffic density computer means, balance detector means for receiving the out-puts of said computer means to discern which direction of traffic flow exhibits the heavier traffic density, ratio detector means coupled to said balanced detector means to discern the ratio of heavier to lighter traffic density, split selector means energized by said ratio detector means, a plurality of local street intersection controllers, an electric cable connecting said local controllers with said split selector means, traffic cycle timers in said local controllers, a plurality of cycle split means in said timers for dividing the cycle time between main street and cross street, and relays in said local controllers controlled by said cycle split selector for selection of one of said cycle split means.

4. In a split control system for a grid of intersecting streets, traffic signals at a plurality of intersections, local traffic signal controllers controlling said traffic signals, a timer within each said controller for timing a cycle of signal change, split control means on said timer for controlling allocation of a plurality of percentage splits of right-of-way time between the two intersecting directions; a master traffic controller including a split selector, a plurality of ratio detector means, balance detector means, an east-west traffic computer means, a north-south traffic computer means, traffic detector means for a plurality of streets in each direction, said detector means for all east-west streets connected to one computer means, said detector means for all north-south streets connected to the other computer means, each said computer means developing an output signal proportional to a characteristic of traffic in that direction, said balance detector means determining which output signal is higher, said ratio detector means determining by what ratio one output signal exceeds the other, said split selector means being controlled by said ratio detector means for in turn energizing one of said split control means at each said controller.

5. In a traffic control system, means for developing an electric potential for a first direction of traffic flow in accordance with a characteristic of traffic in said first direction, means for developing an electric potential for a second direction of traffic flow in accordance with a characteristic of traffic in said second direction, electrical potential balance detector means for determining the higher of said two potentials, ratio detector

relay means, a plurality of potential dividers having outputs connected to said ratio detector relays, and switching means controlled by said detector means for applying said higher potential across said potential dividers.

6. In a traffic control system, electric potential developing means for developing an electric potential for a first direction of traffic flow in accordance with a characteristic of traffic in said first direction, means for developing an electric potential for a second direction of traffic flow in accordance with a characteristic of traffic in said second direction, electric potential balance detector means for determining the higher and lower of said potentials, a plurality of voltage dividers, a plurality of ratio detector means each connected to one of said voltage dividers, a pair of balance detector relay means connected to said balance detector means for respectively applying said higher potential across said voltage dividers and said lower potential to said ratio detector means, and a function selector relay connected to each of said ratio detector means.

7. A traffic control apparatus for controlling traffic flow in at least two directions, means for providing output signals representative of a characteristic of traffic in each of said two directions, reference ratio means, means for comparing said output signals and applying on of said signals to said reference ratio means to attenuate said one signal by said reference ratio, second means for comparing said attenuate one signal to the other signal, and traffic control means coupled to and controlled by said second comprising means for controlling traffic flow in said two directions in accordance with said comparison.

8. A traffic cycle split selector apparatus for controlling allocation of traffic cycle splits to a roadway intersection having two intersecting directions of traffic flow, means for providing output signals representative of a characteristic of traffic in each of said two directions, means for fixing a reference ratio, means for

comparing said output signals and applying the greater to said reference ratio means to reduce said greater signal by said reference ratio, second means for comparing said reduced greater signal to the lesser signal, and traffic control means coupled to said second comparing means for controlling allocation of a particular traffic cycle split to said intersection.

9. A traffic cycle split selector apparatus for controlling allocation of traffic cycle splits to a roadway intersection having two intersecting directions of traffic flow, means for providing output signals representative of a characteristic of traffic in each of said two directions, means for fixing a reference ratio, means for comparing said output signals and applying the greater to said reference ratio means, second means for comparing said greater signal to the lesser signal, said reference ratio means coupled to said second comparing means, and traffic control means coupled to said second comparing means for controlling allocation of a particular traffic cycle split to said intersection.

10. A traffic cycle split selector apparatus for controlling allocation of traffic cycle splits to a roadway intersection having two intersecting directions of traffic flow, means for providing signals representative of a characteristic of traffic in each of said two directions, balance detector means responsive to said characteristic signals to determine which characteristic signal is representative of the greater characteristic of traffic, means for fixing a reference preset ratio representing a ratio of characteristics of traffic in said two directions, ratio detector means coupled to said balance detector means and said reference ratio means for detecting whether the ratio of the greater characteristic signal to the lesser characteristic signal is greater than said reference preset ratio, and traffic control means coupled to said ratio detector means for controlling allocation of a particular traffic cycle split to said intersection.

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