

[54] **PORTABLE TRAFFIC CONTROL SYSTEM WITH TELEVISION MONITORING**

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[51] Int. Cl. **G08g 1/095**

[58] Field of Search 340/31 R, 31 A, 35, 340/38 R, 40, 41, 22; 178/DIG. 1, DIG. 38; 116/63 R, 63 P

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[57] **ABSTRACT**

A portable, electronic, vehicular traffic control system consisting of a central control console, telemetry links and numerous, remote flagging units. The remote flagging units are located at the traffic thresholds to a restricted zone and relay traffic entrance orders from the central control console thereby allowing the remote control of the ingress and egress of vehicles into that zone. The remote flagging units contain remotely operated traffic signal lights, a communications system, mechanical and electrical traffic passage sensors and a closed circuit television camera. The system is primarily adapted for the control of vehicular traffic within a control zone where portions are visually obscured.

1 Claim, 5 Drawing Figures

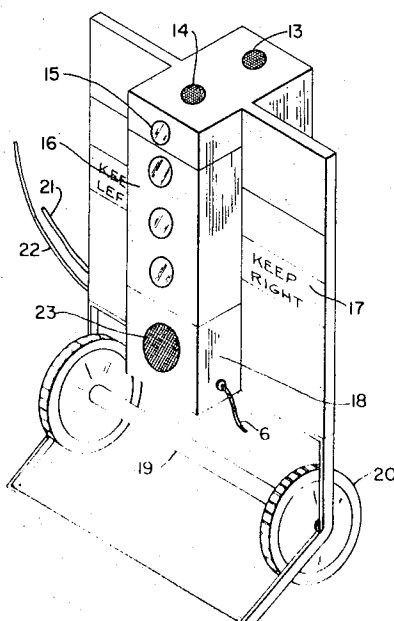


FIG_1

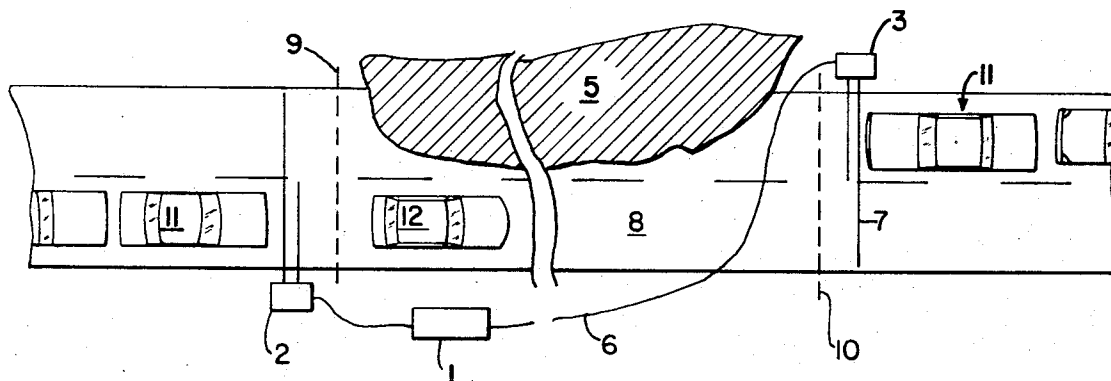


FIG_2

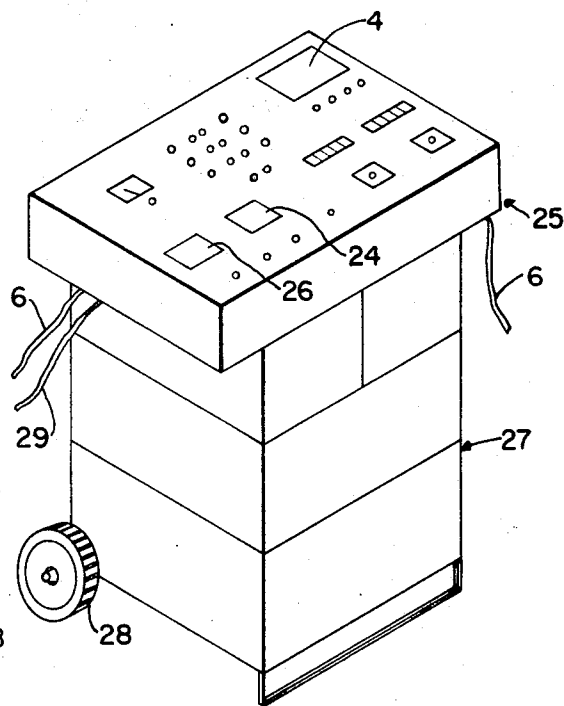
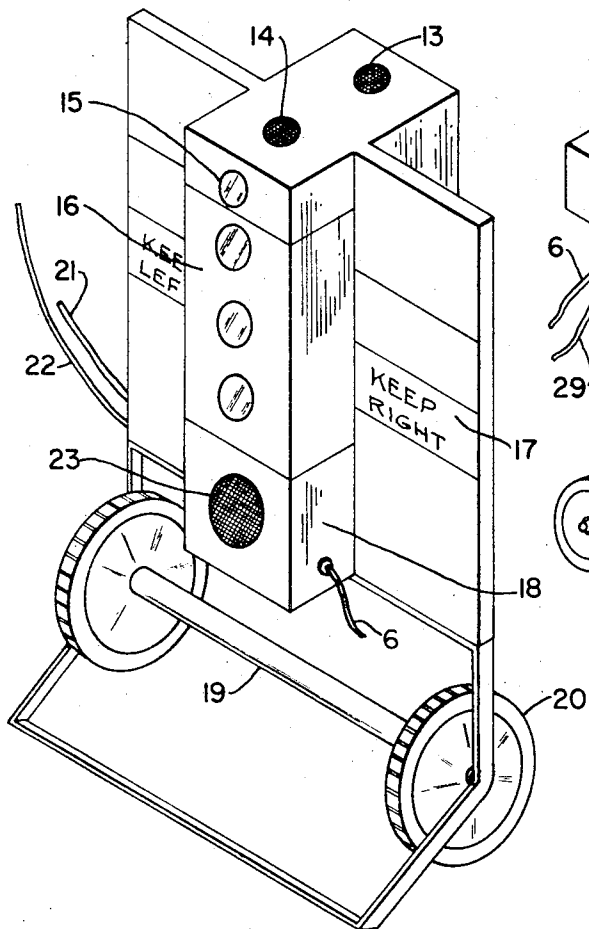
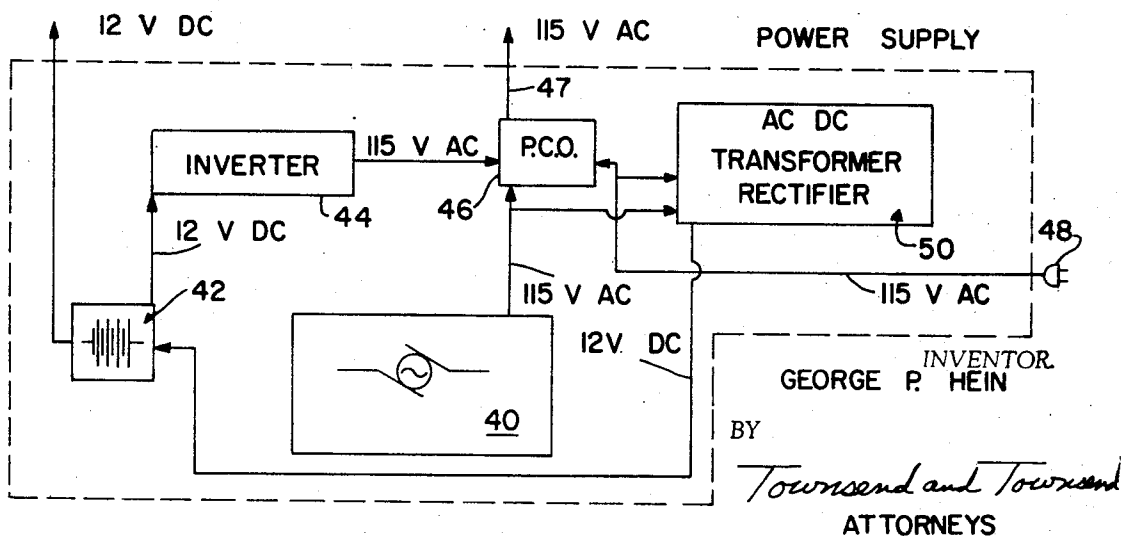
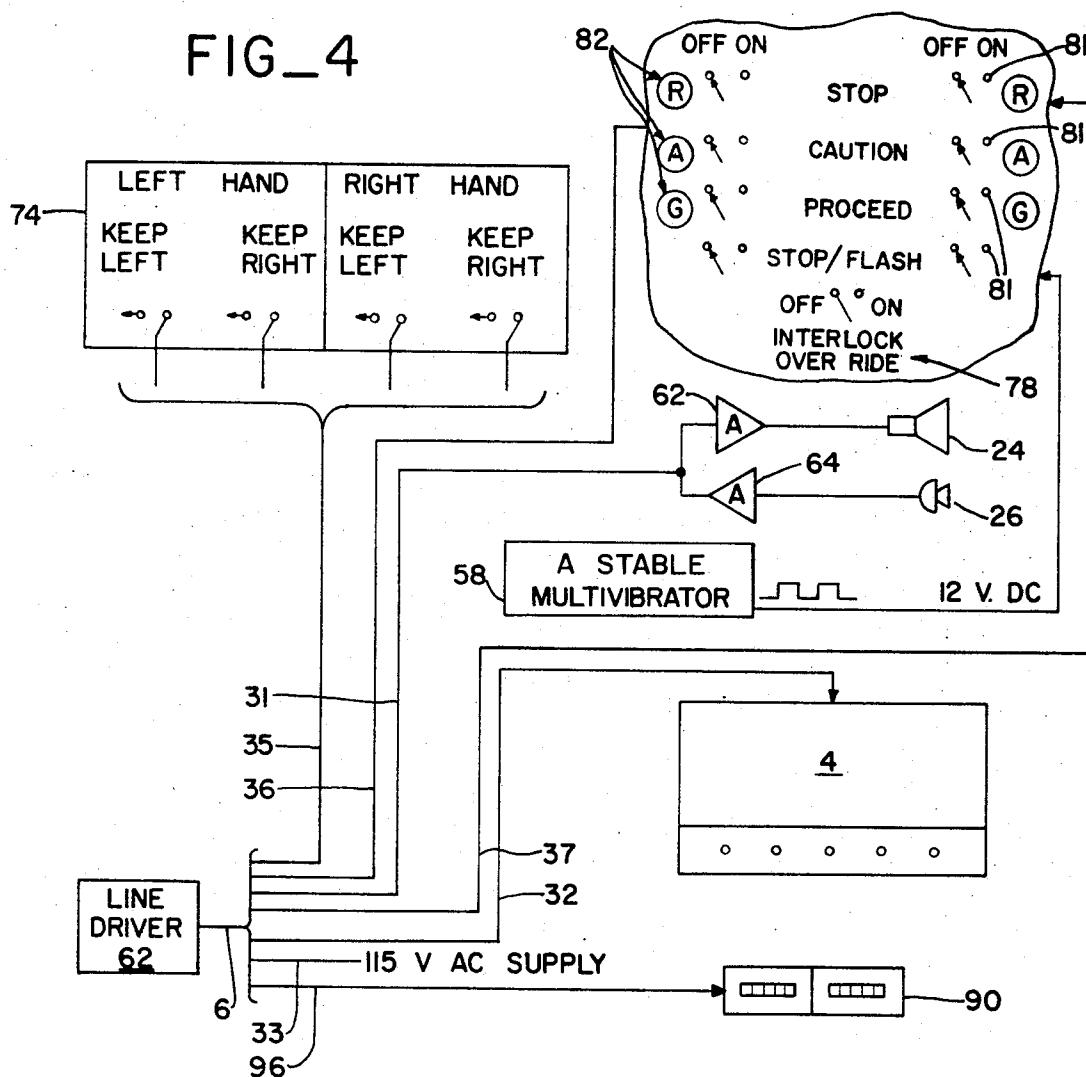


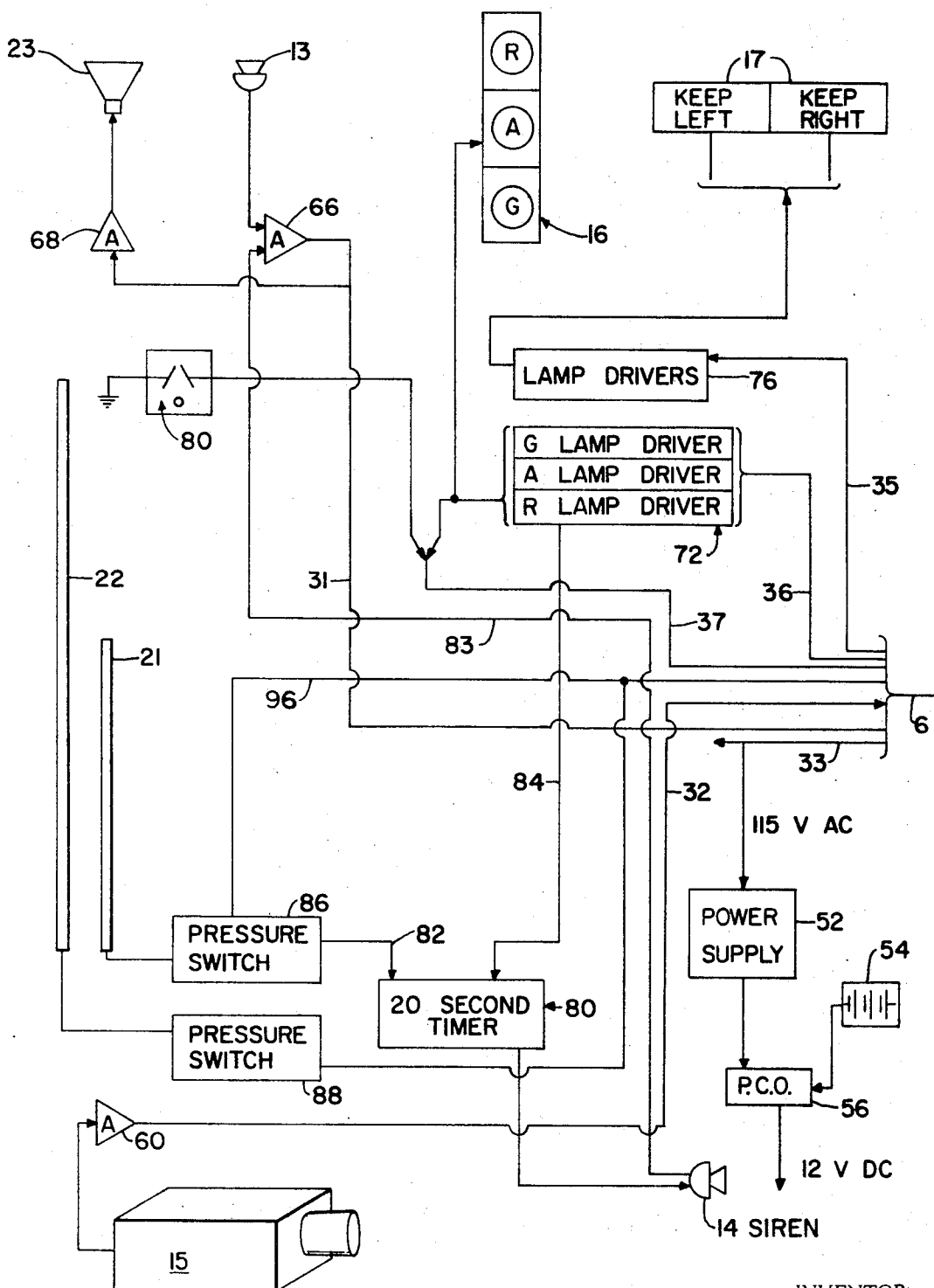
FIG_3

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FIG_4





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FIG_5

PORTABLE TRAFFIC CONTROL SYSTEM WITH TELEVISION MONITORING

BACKGROUND OF THE INVENTION

This invention relates to vehicular traffic control devices, more specifically to those devices operated near highway construction or repair projects.

The control of vehicular traffic along the highways which intersect repair and construction projects has always been a severe and dangerous problem. In the past it was customary for flagmen to be stationed at the thresholds of these zones to direct the passage of vehicles so as to avoid the interference with heavy equipment operations within and to effect the safe transit of foreign vehicles through the area.

The problems that have arisen in this situation have never been adequately solved. Basically, the flagmen must expose themselves without protection on the roadway in order to be seen by the approaching drivers and in order to properly control traffic. Consequently, these flagmen are continually exposed to the hazards of traffic accidents caused by non-observant drivers. Another problem is the uncertainty of control which occurs when the thresholds cannot be simultaneously observed by the flagmen stationed at them. Because neither flagman can observe the other flagman, neither is positive of the other's actions. Consequently, neither is positive of how many vehicles the other has allowed into the zone because they cannot directly communicate with each other.

SUMMARY OF THE INVENTION

An object of this invention is to provide facilities for the remote control of vehicular traffic through a restricted area. This object is achieved by prominently placing the remote flagger units at the ingress and egress thresholds to the control area where they can visually and audibly relay orders to the waiting vehicles from the central control console. Consequently, the flagmen who now operate the units can remain in a protective shelter and not be exposed to roadway hazards. The number of flagmen can be reduced because a flagman is no longer required to be stationed at every threshold. Conflicting or crossed signals between the flagmen are positively eliminated because regulation is now centralized.

One of the main objects of the invention is to establish a control and telemetry link between the remote flaggers and the central control console. This object can be achieved by using either multi-lead connection cables or electromagnetic signals. With this link the operator at the control console can remotely operate the traffic control indicators and signs from his control panel, he can survey the waiting traffic at each threshold on the television monitors, he can be notified of a malfunctioning flagger, and he can be immediately warned of erring vehicles entering the zone without permission. Microphones and speakers on every flagger and on the central control console allow verbal communication through the link.

A further object of this invention is to regulate traffic in visually obscured areas and between visually obscured thresholds. The traffic flagger units contain closed circuit television cameras and traffic passage sensors whose information is displayed at the central control console so the operator can survey local traffic

status and be notified of vehicular entrance or exit at the flaggers located at each threshold.

Another object of this invention is to display to the operator the current traffic status within the zone. The traffic passage sensors which are on the remote flagging units transmit each vehicle's entry and exit to the zone through the telemetry link to a memory unit located within central control console.

Another object of this invention is to increase the communication between the flagman located at the control console and the equipment operators within the zone. With the telemetry link the control console can be optimally located so as to view as much of the zone as possible, typically on a nearby hill, and to easily receive traffic control orders from the nearby construction supervisors.

A further object of this invention is to control many thresholds over a large area with numerous simultaneous traffic patterns within the zone. This can be achieved by remote control of the flagger units and by the telemetry and control link which allows communications and traffic data to be passed between the operator and the thresholds.

Another object of this invention is to eliminate operator error by inadvertent cross-signaling; that is directing oncoming traffic streams into one another. This object is achieved by electrically interlocking the control console so only one-way traffic can be ordered at one time.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a typical traffic control situation in which only one-way traffic can be permitted;

FIG. 2 is a perspective view of one of the remote traffic flagger units;

FIG. 3 is a perspective view of a central control console;

FIG. 4 is a signal flow diagram within a central control console; and

FIG. 5 is a signal flow diagram within a remote flagger.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings, in FIG. 1 a travelable vehicular roadway 8 is intersected by or contains a major interference area 5. This area is one where the transit of vehicles around or through must be controlled to avoid mutual interference. Typically, area 5 could be a highway construction project where heavy equipment is operating and transiting vehicles foreign to the project must be regulated to avoid collisions. In order to regulate the transiting vehicles, a controlled zone is established exterior to the major interference area 5. This control zone is defined by a pair of thresholds 9 and 10 over which the entering and exiting traffic to the zone must pass and is bounded by the limits of the travelable sections of the roadway. Beyond these thresholds the traffic 11 waiting to transit can safely remain and not interfere with operations within the major interference area.

Traffic is regulated within the control zone by a pair of remote traffic flagger units 2 and 3 which relay traffic orders from and provide information to an operator (not shown) stationed at a central control console 1.

He controls vehicle passage. The flagger units 2 and 3 are located beyond the thresholds 9 and 10 respectively and are usually adjacent to the roadway 8 so that traffic approaching the control zone may easily see their signals and have time to react to the orders before entering the zone. All flaggers are connected to the control console 1 by a command and telemetry link 6 which conveys orders and information between the various units. Here the link is a multi-lead co-axial cable.

Referring to FIG. 2, a remote traffic flagger is an erect structure housing an assemblage of various traffic control devices. All flagger units are identical and interchangeable. Typically, the flaggers are mobile having either wheels 20 or suitable portable standards which support the assemblage. The primary traffic control device is a set of traffic signal lights 16, typically red, amber and green lights, which are visible to the approaching traffic and signal orders to enter or to remain outside the control zone. These orders originate from the operator at the control console, are transmitted by the command and telemetry link 6, are received by the flagger, and are displayed by the signal lights thereon. The flagger also contains a closed circuit television camera 15 to observe the traffic approaching the flagger. In its customary use the television camera scans the roadway approaching the threshold and records the traffic volume for ultimate use by the operator.

The flagger also contains a pair of traffic passage sensors, 21 and 22, which record the passage of vehicles across the thresholds. In this embodiment the sensors are pneumatic tubes connected to a pressure switch in the flagger, an installation typical to gasoline station approach aprons. Sensor 21 is shorter and measures only the traffic in one particular lane of the threshold, specifically only that portion of the total traffic entering the control zone. Sensor 22 is longer than sensor 21 and measures all the traffic passing over the adjacent threshold, i.e., both the entering and exiting traffic. The sensors are stored along with part of the command and telemetry link cables on a spool 19 between wheels 20.

The individual flagger contains an audio communication system 18 consisting of a microphone 13, speaker 23, and the associated circuitry. The audio communication system permits the operator at the central control console via the link 6 to talk with persons at the flagger or to verbally order the traffic into the zone.

A traffic violation alarm 14, usually a siren, warns erring drivers who cross the nearby threshold against the orders displayed by the traffic signal lights 16. The violation alarm signal also is communicated to the operator at the control console via the audio link so that he can take appropriate action. The sensor 21, which measures only entering traffic, keys the alarm when the traffic control indicator 16 is selected to display a red "stop" signal to prohibit entrance. Attached to the flagger and visible from the approaching roadway are various traffic information signs 17. These signs warn drivers of conditions within the upcoming control zone. They can be designated by lights as being applicable or not applicable to the drivers. Typically, they are made of bright plastic, are easily changed, and are of such nature as KEEP LEFT or SPEED LIMIT 10 M.P.H..

The command and telemetry link 6 connects all of the remote flaggers with the central control console. Typically, it is a multi-lead coaxial cable, but it can be a modulated or digitalized electromagnetic radiation conveying the same information. The control console may also be connected by other communication links 29 to slave flaggers which mimic the functions sent to the remote flaggers described above. The slave flaggers are used interior to the control zone to repeat the orders sent from the control console to that respective end of the control zone to remind forgetful drivers.

Referring to FIGS. 2, 3 and 4, the central control console is an erect, rectangular shaped, mobile equipment housing containing a display and operating panel 25, the system's power supplies 27, and the ancillary electronics. The primary power supply is a small displacement gasoline engine driven alternator; the auxiliary is typically a lead acid storage battery. There are also facilities for receiving exterior 115 Vac 60 cycle power and 12Vdc power. The system is designed so that if the primary power supply fails, the auxiliary will then automatically take over. This insures a constant, reliable source of power for traffic control. The control console is mobile, having either wheels 28 or suitable portable standards which support the unit.

The power supplies 27 are surmounted by a rectangular shaped, display and operating panel 25 from which the operator runs the system. On the exposed, upper horizontal face of the panel 25 is located a television monitor 4. On this monitor are displayed the traffic pictures taken by a television camera 15 located in one of the remote flagger units. On this face of the display and operating panel 25 are a speaker 24 and a microphone 26 for the operator. They comprise the other end of the audio-communication system with the flaggers (13, 18, 23). The operator may selectively talk with any or all of the flaggers. Also on this face of the panel 25 are two sets of switches 81 and two sets of indicating lights 82 which operate the traffic signal lights 16 and a set of switches 74 to operate the information signs 17 on the two remote flaggers. The panel also contains a diagnostic circuit (not shown) which when used with the indicating lights 82 and audio alert circuit (not shown) which supplies an audible tone to the amplifier 62 will allow the operator to be warned of a malfunctioning flagger or a broken command and telemetry link.

On the exposed, upper, horizontal face of the control panel 25 are also two memory units 90 to receive and to record inputs from the traffic passage sensors 21 and 22. The units indicate the sum traffic passages across each threshold. Typically, the memory units are resettable, mechanical, digital counters.

Referring to FIGS. 4 and 5, the traffic passage sensors 21 and 22 are connected respectively to pressure switches 86 and 88. Every vehicle crossing a sensor causes the pressure switch to generate a voltage pulse. These transit pulses are sent through wire 96 of the link 6 to the appropriate memory unit 90 located on the central control console.

The power supply 27 within the central control console contains a small displacement gasoline engine coupled to a 115 volt alternator 40. This alternator is the primary power supply for the whole system. The power supply also contains a 12 volt lead acid storage battery

42. The output of this storage battery supplies the transistor circuits and also leads a dc to ac inverter 44. Both the alternator 40 and the inverter 44 are connected at a power changeover switch 46. The power changeover switch is an automatic bus transferring relay which senses the output of the alternator. When its output is lost, this switch automatically transfers to the inverter. Consequently, the 115 volt ac output 47 of the power supply is automatically maintained even if the gasoline engine stops. The power supply also has facilities to accept standard 115 volt ac exterior power 48. This exterior power 48 besides providing 115 volts ac for the output 47 of the power supply also provides an input to an ac to dc transformer-rectifier 50 which is used to charge the battery 42. The alternator 40 can also be connected to the transformer-rectifier to provide an alternate charging path for the battery. A second source of external emergency power may be supplied from an external 12Vdc source 48A (such as a construction vehicle). Essentially the external 12Vdc takes the place of the internal lead acid battery (typical) 42.

Referring to FIG. 5, the flaggers receive 115 volts ac through wire 33 within the control and telemetry link 6 from the output of power supply 27 in the central control console. Besides providing the primary source of power, the wire 33 is also connected to power supply 52 which is a transformer-rectifier producing 12 volts dc. In addition, each flagger contains a standby 12 volt battery 54. The outputs of both the power supply 52 and the standby battery 54 are connected to a power changeover relay 56. This power changeover relay normally transmits the output from the power supply 52. However, if there is an interruption of power either in the power supply 52 or within the wire 33, the power changeover switch automatically transfers to the standby battery. The power changeover switch insures that if the cable is broken or if 115 volt ac service is lost to the flagger, the traffic signal lights 16 will indicate a command of STOP, STOP/FLASH or CAUTION which is determined by a switch (not shown).

Referring to FIGS. 4 and 5, the television camera 15 in each of the flaggers is connected to a video amplifier 60. The output of the video amplifier is transmitted via coaxial cable 32 in the link 6 to the television monitor 4 on the control console. If the distance between the flaggers and the control console is long, an intermediate video line driver 62 is used to amplify the video signals. Typically, there is one television monitor mounted on the display and operating panel 25 of the central control console. The operator has a switch (not shown) on that panel to select among the video signals coming from any of the flagger units.

The operator at the central control console can communicate with any of the flaggers through the audio communication link. The operator speaks into microphone 26 whose signal is amplified by a low level amplifier 64 into the console. From amplifier 64 the signal travels through the communications wire 31 of the control and telemetry link to a power amplifier 68 in the flagger which drives the remote speaker 23. Persons at the remote flagger may communicate with the operator at the control console by speaking into microphone 13. This signal is amplified by a low level amplifier 66 whose output travels through the commu-

nications wire 31 to a power amplifier 62 within the central control console and drives speaker 24. The operator may select with which flagger he wishes to communicate and between public address or an individual communication.

On the display and operating panel 25 there is a set of traffic control switches 81 and indicating lights 82 to operate the traffic lights 16 on each remote flagger. The pushbutton switches can select either the red "stop" light, the amber "caution" light, or the green "proceed" light, or the "stop-flash" flashing red light. When two flaggers are used, the traffic control switches consist of two sets of pushbutton switches mechanically interlocked to allow only one switch in a set to be depressed at a time. The switches are also electrically interlocked between the sets so that if any switch other than "stop" is depressed in one set, only the "stop" switch will operate in the other set. The electrical interlock prevents the operator from simultaneously ordering two conflicting streams of traffic into the zone.

On the display and operating panel 25 there is an interlock over ride switch 78, which allows the operator to bypass the aforementioned electrical interlocks on the control switches 81. When the interlock over ride switch is used, the operator is thereby permitted to operate any one switch in a set.

The power supply 27 is connected to an astable multivibrator 58. This multi-vibrator has a period of about two seconds and provides the flashing voltage for the red "stop-flash" traffic control switches and the information sign control switches.

The output of each control switch is transmitted through wire 36 of the link 6 to one of the individual lamp drivers 72. Each lamp driver circuit senses the voltage applied from its respective control switch. This voltage is applied to the base of a transistor, causing it to conduct and to power its respective traffic signal light 16. The voltage developed across a resistor in series with the now lighted lamp in the traffic light 16 is fed back through the circuit failure wire 37 to the main console. This feedback voltage is fed to the base of a transistor which conducts and powers its respective indicator light 82 and disables the audio alert circuit (not shown). As a result, an indicator light 82 on the control console only lights when its respective traffic light 16 on the flagger is lit. Consequently, these feedback circuits continuously appraise the operator of the condition of the traffic lights in the flaggers.

Also contained within each remote flagger is a tilt switch 80. Whenever a remote flagger is upset, this tilt switch grounds the lamp feedback circuit 37. The operator is immediately warned of the upset because when all feedback voltage is lost, none of the indicator lights 82 will light at the control console. The non-illumination of all the indicator lights for one flagger also may signal that the command and telemetry link is severed or damaged.

Whenever the red lamp driver in one of the remote flaggers is energized, it sends an entry prohibit signal 84 to a twenty second timer 80. If an encroaching vehicle violates the red "stop" light on the nearby flagger and crosses the traffic passage sensor 21, an entry count signal 82 is sent to the twenty second timer. When both the entry prohibit signal 84 and the encroaching entry signal 82 are present at the timer, it energizes the siren

14 to broadcast a twenty second warning signal to the erring driver. A signal 83 from the siren circuit is also sent to the low level amplifier 66 of the audio communications system. The illegal entry siren signal is then transmitted through circuit 31 to speaker 24 on the central control console. As a result, the operator at the central control console is warned of an illegal entry in violation of his "stop" order.

The astable multi-vibrator 58 also supplies flashing voltage to an informational sign control panel 74 which is part of the central console's display and operating panel 25. The sign control panel consists of pushbutton switches which allow the operator to select which information sign on the remote flagger he desires to flash. The information sign circuit 35 is connected to a set of lamp driver circuits 76 similar to the traffic light lamp drivers 72 but without feedback. The output of the lamp drivers 76 is connected to the informational signs 17.

Referring to FIGS. 1, 2 and 3, the operation of the system will be described. After the major interference area 5 has been specified and the thresholds 9 and 10 designated, the remote flagger units 2 and 3 and the control console 1 are placed, and the command and telemetry link 6 is established. During the setup both flaggers indicate that entry is prohibited by a red "stop" signal. After system checkout the operator at the control console looks at the television monitor 4 on the control console to survey the waiting traffic 11. If traffic transit is desired from the left-hand threshold 9 across the control zone to threshold 10 and out, the operator turns off the left-hand "stop" switch on the control panel 25 and turns on the left-hand flagger's "go" switch. The signals are sent along the command and telemetry link 6 and received by the left-hand flagger unit 2. The red traffic signal light 16 goes out and the green one comes on. At this command, the waiting traffic 11 crosses both left-hand traffic sensors 85 and 87 and enters the zone as transiting traffic 12. The shorter left-hand traffic passage sensor 87, which measures only entering traffic, sends a signal via the link to the memory unit within the control console for each entering vehicle. The signal from the longer left-hand sensor 85 is not used when traffic flows from left to right. From the control panel 25 the operator can see the traffic begin to enter the zone over the closed circuit television monitor and the entrance passage counter of the memory unit start to record. When transiting vehicles 12 leave the zone at threshold 10, they pass through the longer right-hand traffic sensor 91 which records total passages, both entering and exiting traffic. The exiting signal from this traffic passage sensor goes to the other memory unit on the control panel and indicates traffic 12 has left the zone. The shorter right-hand sensor 89 triggers the siren circuit 14 on an illegal entry. During the whole sequence the right-hand flagger 3 is holding its traffic with a red "stop" signal light. The operator then turns the left-hand flagger's green "go" light out by turning the appropriate switch on the central control panel and turns on the left-hand flagger's red "stop" light. At this

point, both flaggers have red "stop" lights on and the initial condition has returned. In order for the operator to reverse the traffic flow, the operational sequence of the flaggers' lights is just reversed. Every traffic flagger unit is mechanically identical, and hence, each is operated in the same manner.

It will be obvious that various adaptations and modifications of this invention can be made without departing from the true scope and spirit of the invention. For example, this remote traffic control system can be used to control the entrance and exit of vehicles from freeways. Slave traffic flagger units can be used within the zone to mimic the signals sent to the remote units. Automatic circuitry can be incorporated within the control console to speed the decision making and to increase the orderly flow of vehicles. The traffic passage sensors can be photoelectric devices, radar, or laser beams. Additionally, two or more control consoles and numerous flagger units can be connected together to control a large traffic situation containing numerous intersections with numerous traffic flow patterns occurring simultaneously.

I claim:

1. A traffic controller having a control console and a pair of traffic control units electrically connected to the console to enable the traffic control units to be temporarily mounted on opposite ends of a highway control area to allow the control of traffic from the console in situations in which the console is situated outside of the range of direct viewing of at least one of the control units comprising at least a pair of signal lights mounted on each of said control units, one of said signal lights indicating a go indication and the other of said signal lights a stop indication, panel light means mounted on said console for each said signal light on each of said control units, each panel light means being connected to provide on the console a positive indication of the light illumination condition of a signal light, switch means mounted on said console operative to illuminate and extinguish the respective signal lights individually, a television camera mounted on each of said units in a fixed position to encompass the same general field of view and facing in the same direction as said signal lights whereby the signal lights and the television camera as a unit are mountable to face in the direction of incoming traffic flow to the control zone, television monitoring receiver means mounted on said console and connected to said television camera to allow the console operator to simultaneously view said television monitoring receiver means and said panel light means while operating said control switches, audio warning means mounted on each of said control units, automobile actuated switch means mounted on the road area within the control zone, means operative to energize said audio warning signal upon the simultaneous energization of the signal light indicating a stop indication and of said automobile actuated switch means, and display means mounted on said console connected to said audio means to provide an indication on said console during activation of said warning means.

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