

[54] AUTOMATIC VEHICLE DRIVER AID SYSTEM

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[58] Field of Search **340/31 R, 32, 33, 340/34, 62, 52 R**

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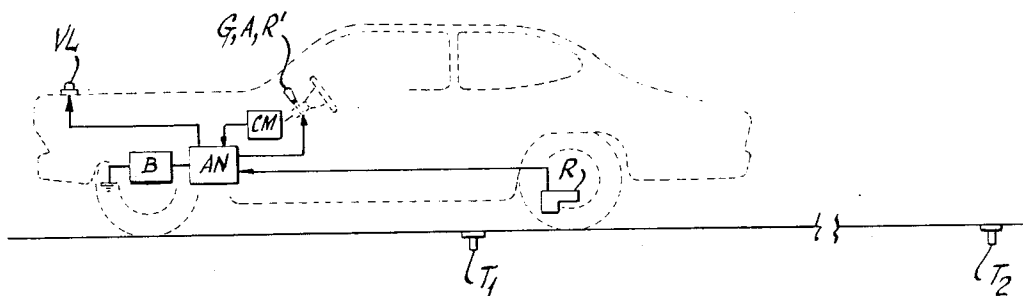
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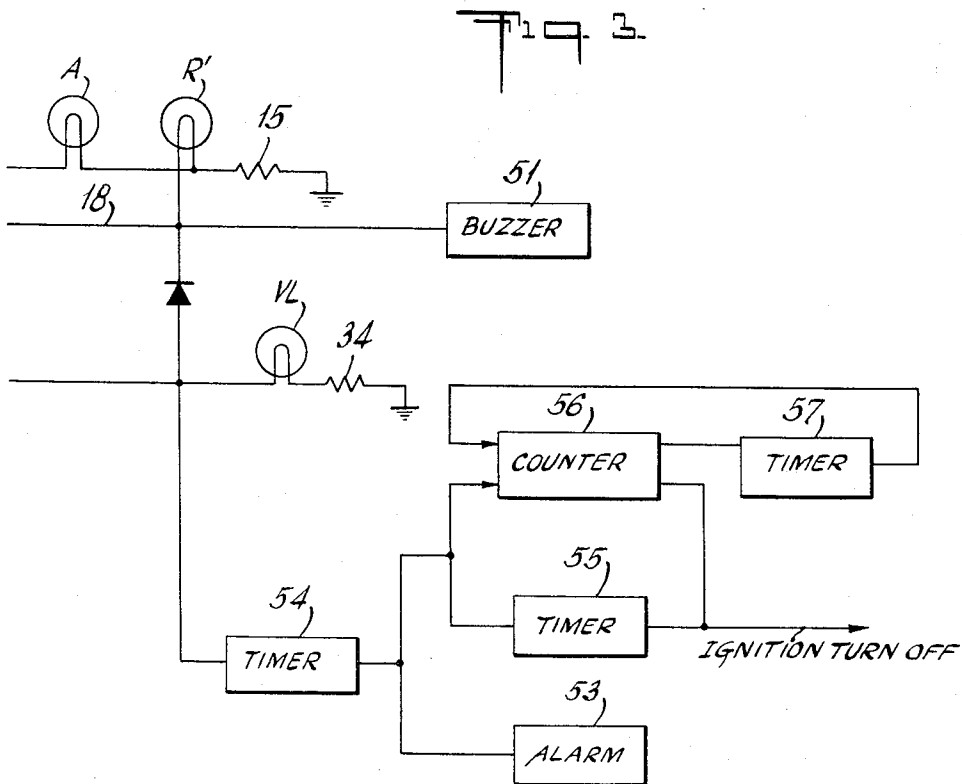
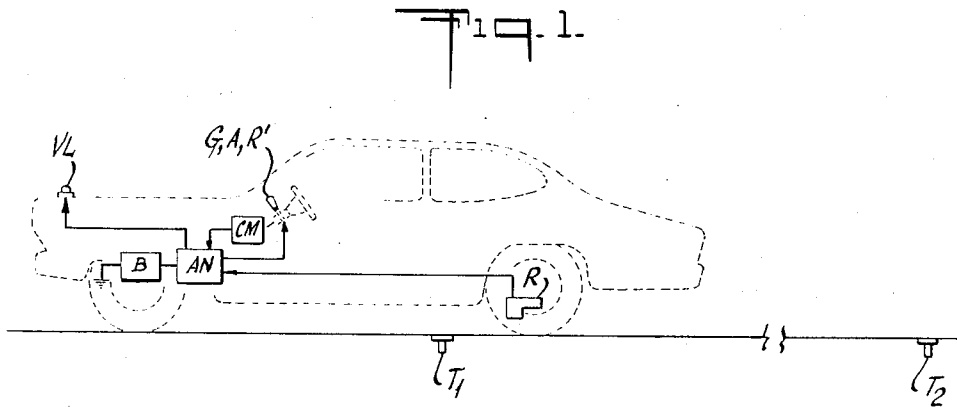
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ABSTRACT

An automatic driver aid system for a vehicle which includes means to alert the driver of approaching conditions and regulations requiring his caution, such as stop signs, school caution zones, dangerous intersections, etc., and means to warn the driver upon violation of certain traffic regulations such as speed limits, emergencies, etc.

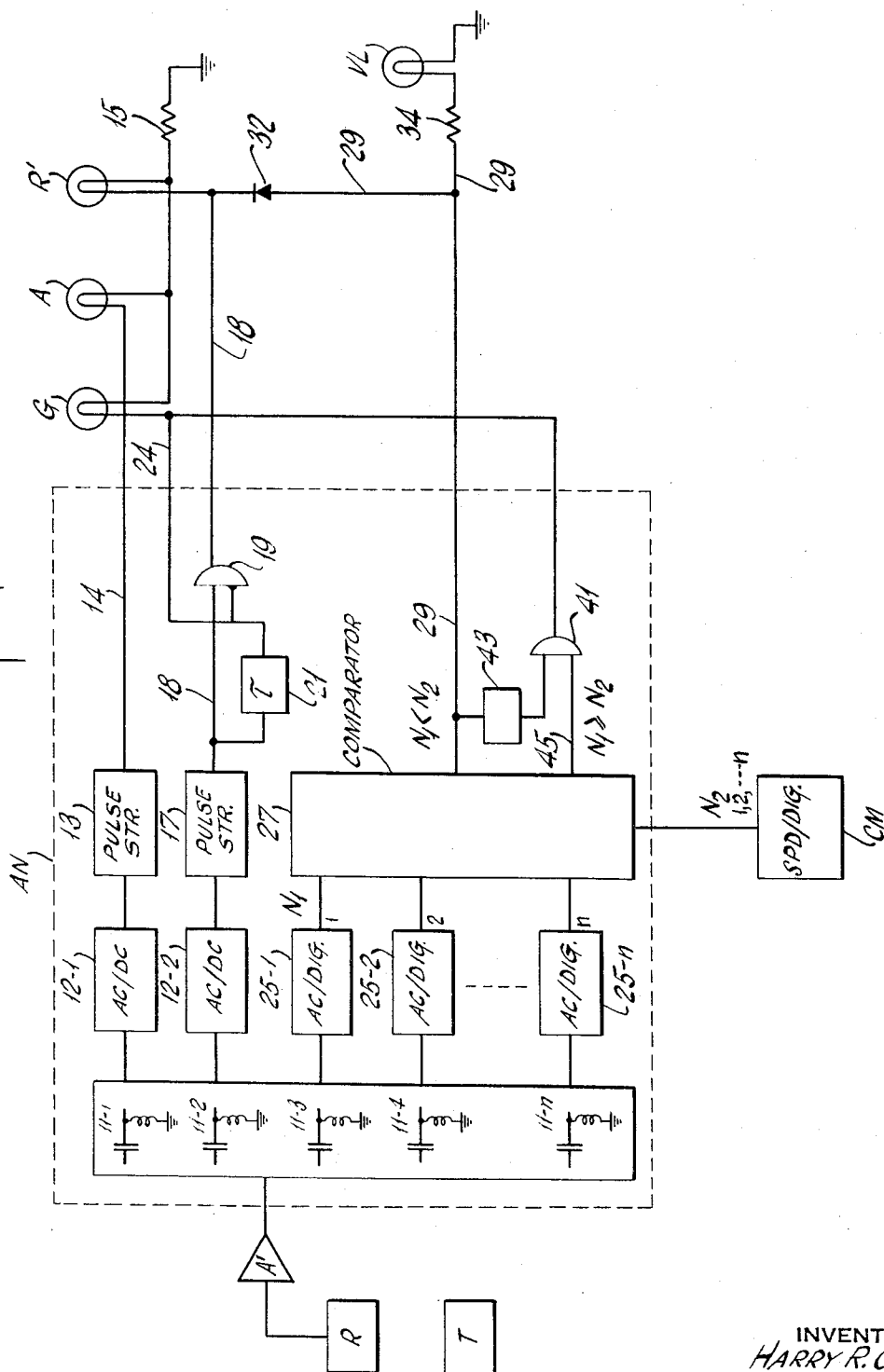
8 Claims, 3 Drawing Figures





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FIG. 2.



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AUTOMATIC VEHICLE DRIVER AID SYSTEM

The present invention relates to an automatic driver aid system generally and more particularly to a system mountable on a vehicle for alerting the driver of traffic conditions generally encountered that require caution and provide a warning upon violation of certain traffic regulations or the existence of emergency conditions.

With an ever increasing number of vehicles on the public roads and highways, traffic safety and the high rate of accidents and fatalities continue to be serious problems yet to be resolved.

Causes for the accidents and fatalities are often traceable to the surrounding environment, such as road and weather conditions and defects in the vehicle itself or the acts of the driver, whether intentional or unintentional or any combination of these factors. In terms of the acts of the driver, however, a significant amount of accidents can be traced to unintentional acts and negligence in observing the traffic rules and regulations or to poor habits, fatigue and other physiological and mental conditions. Thus any means that can assist the driver in overcoming these adverse factors by warning or alerting him of traffic conditions is highly desirable in minimizing vehicle accidents and improving traffic safety.

The U.S. Pat. No. 2,640,979, issued on June 2, 1953, to applicant herein discloses an automatic warning system which includes means to alert the driver when he violates certain traffic rules such as speed limits. While the system is satisfactory in many ways it does not alert the driver to various conditions or traffic regulations frequently encountered on the roads that require his caution.

Therefore, one object of the present invention resides automatically of various traffic conditions or emergencies which require his caution.

Another object of the present invention resides in the provision of an improved system that can warn the driver upon the violation of certain traffic rules and regulations.

Still another object of the present invention resides in the provision of an improved automatic driver aid system that will immobilize the vehicle upon a repeated or continued violation.

Still another object of the present invention resides in the provision of a highly improved dependable driver aid system.

The above and other objects of the present invention are achieved by providing a receiver mounted on a vehicle for receiving a.c. signals of different frequencies indicating of the various traffic regulations and conditions requiring the driver's caution, transmitters positioned along the roadway or embedded in the road surface, an analyzing network responsive to the output of the receiver, and means responsive to the output of the analyzing network for alerting the driver to the conditions requiring his caution.

One feature of the present invention involves the use of an analyzing network which includes a plurality of filters of predetermined frequency ranges for detecting the presence of a.c. signals of different frequencies indicating various traffic regulations and conditions.

Still another feature of the present invention concerns the use of converting means which generates electrical signals indicative of an actual condition such as the speed of the vehicle, means in the analyzing network to compare the detected a.c. signals indicating

certain traffic rules with electrical signals indicating actual conditions and actuate the indicating means upon detection of the violation of certain traffic rules.

Still a further feature of the present invention includes the provision of means for immobilizing the vehicle upon repeated or continuing violations of traffic rules.

The aforementioned and other objects and features of the present invention will become more apparent from the following detailed description of the preferred embodiment of the present invention and the accompanying drawings.

In the drawings:

FIG. 1 schematically illustrates the automatic driver aid system of the present invention mounted on a vehicle;

FIG. 2 is a schematic circuit diagram of the driver aid system in accordance with the present invention; and

FIG. 3 is a schematic drawing showing additional indicating means that may be used in conjunction with the automatic driver aid system shown in FIG. 2.

Broadly stated, the driver aid system in accordance with the invention utilizes transmitters stationed along the roads or embedded in the road surfaces for transmitting a.c. signals of different frequencies indicative of various traffic conditions and regulations. Thus, for example, the transmitted signals may indicate a stop sign or caution light, school zone, reduced speed zone, no passing zone, dangerous curve or intersection or merging traffic, emergency situations or other kinds of conditions ordinarily encountered along the roads and highways.

The present driver aid system includes means to detect and analyze these signals and use them to alert the presence of the aforementioned various conditions to the driver and means to warn the driver upon he violation of certain traffic rules.

Referring to the drawings, FIG. 1 schematically represents the driver aid system of the present invention. T_1 and T_2 denote various transmitters that may be embedded along the road surface for transmitting certain predetermined a.c. signals of different frequencies indicating certain traffic rules such as speed limits. Various other transmitters generally denoted symbolically by T may be positioned along the road for generating a.c. signals indicating various caution or emergency conditions. Preferably, each of the transmitters is designed to generate an a.c. signal of a particular frequency to represent one or more of the predetermined conditions requiring the attention and caution of the driver. Thus, for example, the transmitter T_1 may generate an a.c. signal of a frequency indicating a speed limit of 30 miles per hour, and T_2 an a.c. signal of another frequency indicating another speed limit and transmitter T may generate an a.c. signal of still another frequency representing various conditions such as an approaching stop sign, caution light, school zone, reduced speed zone, no passing zone, approaching emergency conditions such as dangerous curves or other dangerous conditions, merging traffic and the like which require the driver's caution. In the like manner various other transmitters may be used to generate a.c. signals of particular frequencies to represent corresponding conditions.

The vehicle driver aid system includes a receiver R which receives the a.c. signals of various frequencies representing various conditions discussed above as the vehicle passes the transmitters. The detected and re-

ceived a.c. signals may then be amplified and applied to the analyzing network AN having a plurality of filters each tuned to a particular frequency.

The system includes suitable means such as green G, amber A, and red R' lights that may be mounted on the dashboard in front of the steering wheel to alert the driver of the detected conditions. The system may also include as an optional, a violation indicating light VL mounted in the front of the vehicle above the front wheel to be visible to the driver and others including traffic law enforcers. These indicating lights are connected to the analyzing network and selected lights are illuminated depending upon the nature of the conditions detected.

The system also includes suitable converting means CM equipped to read the speedometer and generate a plurality of different signals, each representing the speed of a moving vehicle.

The analyzing network is provided with means to receive the a.c. signals from the transmitters and ordinarily will be required to handle only one or two signals at a time.

However, the analyzing network includes means for receiving and analyzing one or more signals of different frequency characteristics at a time. The output of the analyzing network is then applied to light the amber A or the red lamp R' depending upon whether or not the signal is to alert the driver of conditions requiring his caution or to warn him that he is facing certain emergencies or dangerous conditions. The analyzing network is also provided with means to receive an electrical signal from the converting means CM and compare it to a signal received from the transmitter and generate an output to light the red lamp R' and the violation light VL when the analyzing network detects that the driver is violating certain traffic rules.

FIG. 2 illustrates a preferred embodiment of the automatic driver aid system in accordance with the principles of the present invention described above. The analyzing network is provided with a plurality of filters 11-1, 11-2, 11-3, 11-4, . . . 11-n, each tuned to an a.c. signal of a particular frequency. The filter 11-1 is designed to detect an a.c. signal of a given frequency which represents conditions such as an approaching stop sign, caution light, school zone, etc., generated by transmitters positioned along the roadside or highway. The output of the filter is then converted into a d.c. signal by an a.c. to d.c. converter 12-1. The d.c. output of the converter 12-1 is then used to light an amber lamp A and thus alert the driver.

Ordinarily a moving vehicle passes by a transmitter within a matter of seconds, and thus the amber lamp would not remain energized for a sufficient period to enable the driver to observe the light and react accordingly. The problem is overcome by interposing a pulse stretcher 13 to stretch the d.c. signal from the converter 12-1 to prolong for a predetermined time period as it is applied to the amber lamp A via a conductor 14. If necessary, a resistor 15 may be used to limit the magnitude of the current being applied to the amber lamp A. Similarly, the filter 11-2 detects an a.c. signal of another frequency from another transmitter located along a road representing the presence of an emergency or dangerous condition ahead. The detected a.c. signal is then converted into a d.c. signal and stretched by another a.c. to d.c. converter 12-2 and a pulse stretcher 17 and then applied to light the red lamp R' through

the conductor 18, the INHIBIT gate 19, and the resistor 15 and ground and thereby alert the driver of the dangerous or emergency condition.

In the case of emergency or dangerous situations, the driver may stay near the transmitter and the red lamp R' would continue to stay lit. However, having noticed and attended to the emergency or dangerous condition, the driver would wish to have the red lamp R' turned off. This is accomplished by using a timing circuit 21 which times the stretched d.c. output from the stretcher 17 for a predetermined given period of time, for example, one minute, and generate an output to turn off the INHIBIT gate 19.

As an optional feature, the system may include a green light G connected in the manner shown which is turned on by the output of the timing circuit 21 when the INHIBIT gate 19 turns off the red lamp R'.

Of the various traffic rules and regulations, the speed limit is the more serious one in terms of the consequences when it is violated. Close study indicates that the speed limits ordinarily encountered are generally of the order of 20, 25, 30, 35, . . . 70 miles per hour. The present system takes advantage of this factor. In accordance with the present invention such speed limits are indicated by a.c. signals of particular frequencies respectively generated by transmitters which may be embedded in the road surface and are designed so that when a vehicle traverses them, the weight thereof actuates them and causes the generation of a.c. signals. These a.c. signals are detected by the receiver R and amplified by the amplifier A'. The analyzing network is provided with a plurality of filters 11-3, 11-4, . . . 11-n, tuned to the a.c. signals of the aforementioned particular frequencies. The analyzing network includes a.c.-to-digital signal converters 25-1, 25-2, . . . , 25-n which convert the detected and filtered a.c. signals into digital signals of a binary nature.

The converting means CM of the automatic driver aid system translates the actual speed of the vehicle into quantitative numbers, for example, digits 1, 2, . . . n, wherein the numbers generated by the converting means and the a.c.-to-digital converters represent the same speeds. Thus, for example, the digits 1, 2, 3, . . . n, generated by the converting means CM and the a.c.-to-digital converters may represent 20, 25, 30, . . . , etc., miles per hour or the actual speed of the vehicle and the maximum speed limit along the roadway as indicated by the transmitted a.c. signals. The analyzing network includes a comparator 27 which compares the output N_1 of the a.c.-to-digital converters with the digital output N_2 of the converting means CM. The comparator is provided with suitable conventional digital circuitry which generates an output at the conductor 29, if N_2 is greater than N_1 , to indicate that the vehicle is exceeding the maximum speed limit. The comparator output at the conductor 29 may turn on the violation indicating lamp VL, thereby indicating that the driver is exceeding the speed limit.

The comparator output is also applied to turn on the red lamp R' to warn the driver of the violation of the speed limit by connecting the output conductor 29 to the red lamp R' as shown. In this connection, a diode 32 may be preferably interposed in the manner shown to prevent the current from the output of the pulse stretcher 17 indicative of the emergency or danger conditions from reaching and lighting the violation light VL.

The present system includes means to automatically turn off the red lamp R' and the violation lamp VL when the driver take corrective measures. Thus, for example, the driver may exceed a speed limit for a short period in order to pass a slow vehicle and then reduce his speed below the allowable speed limit after passing the slow vehicle. This is accomplished by applying the output indicative of $N_2 > N_1$ to an AND gate 41 via a pulse stretcher circuit 43 which provides a suitable predetermined interval of time delay such as 5, 10, or 15 seconds. The comparator is also provided with another output terminal 45 to apply an output signal when the speed of the vehicle is equal to or less than the maximum speed limit, i.e., $N_1 \geq N_2$. Coincident application of the delayed output from the circuit 43 and the output from another output terminal 45 switches the AND gate 41 and enables it to generate an output which is applied to turn on the green light G at the time when the red lamp R' and the violation light VL are turned off.

FIG. 3 shows additional optional features in the indicating means which alert or warn the driver of danger, emergency conditions and traffic violation conditions, and which turns off the ignition system and thereby immobilizes the vehicle, if the violation is repeated or continued despite the warning. Thus, for example, the system may include a buzzer 51 which generates a warning sound of suitable character, such as sharp beep sounds, when the red lamp R' is lighted. The sharp audible sound will have an added impact in making the driver aware of an emergency or dangerous condition or a speed violation. The system also includes an alarm bell 53 connected to the output of the comparator 27 via a timing circuit 54. Preferably the alarm bell 53 is designed to generate a sharp siren sound as opposed to the beep sound to indicate that the driver is violating a traffic regulation and does not correct it within a given time as determined by the timing circuit 54.

There are instances when the driver may become physically incapacitated or fatigued so that he is unable to heed to the warning signals, or that he may be unwilling to respond to the audible alarm signals. For such contingencies, the present system includes a second timing circuit 54 to generate an output if the duration of the violation exceeds a certain predetermined time interval beyond the time interval set by the timing circuit 54. In such case, the output of the timing circuit 55 turns off the ignition system of the vehicle and thus immobilizes it.

The system also includes means to immobilize the vehicle, if the driver commits willfully or unintentionally a predetermined number of violations in a given period of time. Thus a counter 56 is connected to the output of the timing circuit 54 and is set to generate an output if the number of violations exceeds a predetermined number during a predetermined time period set by another timer 57 connected in the manner as shown. The output so generated can also be used to turn off the ignition system to immobilize the vehicle. The timer 57 is triggered into operation by an output of the counter 56, and after a given period of time, for example, 10 minutes, its output is applied to reset the counter 56 as shown. Thus the counter 56 accumulates the violations only during the given period of time set by the timer 57 and if the count exceeds the number set by the connector 56 during the time period, an output will be generated to turn off the ignition system. Otherwise the timer

57 will reset the counter. An advantageous consequence of the aforescribed feature would be to eliminate or minimize the necessity for a high speed chase of traffic violators or getaway cars of law breakers beyond a set period of time as determined by the timer 55 or the number of violations as determined by the counter 56 during the time period set by the timer 57.

Various other modifications may be made without departing from the spirit and scope of the teachings of the present invention described above. Thus, for example, while a preferred embodiment of the present invention utilizes a.c. signals, it could easily be adapted to handle pulse or digital signals from the transmitters.

What is claimed is:

1. An automatic vehicle driver aid system comprising a receiver mounted on said vehicle for receiving related sets of electrical signals from transmitters located along roadways, said related sets of signals each representing caution and danger indications for road conditions and regulations, means including an AC to DC converter interconnected with said receiver for analyzing said electrical signals and selectively producing caution signals and danger signals, first indicating means mounted on said vehicle and responsive to said caution signals for alerting the driver to conditions requiring caution, and second indicating means mounted on said vehicle and responsive to said danger signals for alerting the driver of the need for immediate corrective action, said electrical signals being in the form of AC signals of different frequencies, a first selected frequency signal representing said caution condition and a second selected frequency signal representing said danger condition, said analyzing means including a first circuit having a first filter tuned to said first selected frequency signal, and a second circuit having a second filter tuned to said second selected frequency signal, and analyzing means further including a first AC to DC converter and a first pulse stretcher connected in series and interposed between said first filter and said first indicating means, a second AC to DC converter and a second pulse stretcher connected in series with and interposed between said second filter and said second indicating means, said first and second indicating means including an amber and a red lamp respectively, and said system further includes third indicating means having a green lamp, said analyzing means further includes an INHIBIT gate interposed between said second stretcher and said red lamp, and a time delay circuit interposed between said second stretcher and said INHIBIT gate for turning off said red lamp after a predetermined time period set by said time delay circuit and lighting said green lamp.

2. The driver aid system according to claim 1 which further includes an additional plurality of filters, each detecting a particular frequency signal received from a transmitter disposed along the roadside representing a particular maximum speed limit, a plurality of means for converting particular frequency signals into a first corresponding digital electrical signal N_1 , means for generating a second digital signal N_2 representing the actual speed of the vehicle, means for comparing said first and second digital signals and generating a violation signal when the condition $N_2 > N_1$ exists, and fourth indicating means actuated by said violation signal.

3. The driver aid system according to claim 2 including means for turning off said red lamp when the condi-

tion N_2 N_1 exists within a predetermined time period after said violation indicating means is first actuated.

4. The driver aid system according to claim 3 wherein said turning off means includes pulse stretching means for producing a first output signal for said predetermined time period when $N_1 < N_2$, said comparing means generates a second output signal indicative of $N_1 \leq N_2$, a coincidence gate responsive to the simultaneous presence of said output signals and connected to turn on said green lamp.

5. The driver aid system according to claim 4 including a first buzzer connected to generate an audible sound having a selected characteristic when said red lamp is energized.

6. The driver aid system according to claim 5 including a first timer and second buzzer connected to gener-

ate an audible signal having a second selected characteristic actuable after said red lamp is actuated for a period of time beyond a period of time set by said first timer.

7. The driver aid system according to claim 6, including means for generating an electrical signal to turn off the ignition system of the vehicle when said violation lamp is continuously actuated for a predetermined time period beyond the time period provided by said first timer.

8. The driver aid system according to claim 7, including means for generating said ignition turn off signal when the number of actuations of said violation lamp exceeds a predetermined number during a predetermined time period.

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