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(54) Vehicle turn detection apparatus

(57) An electrical circuit detects the initiation and termination of a lane change or turn of a motorcycle, automobile, boat or other like vehicle. Linear acceleration sensors e.g. mercury switches 20, 21 detect the lateral movement of a vehicle commencing a lane change or turn and produce a signal responsive to same. The output of the sensor assembly is translated into a detectable signal and input as a reset signal to memory units 31, 33 which have stored an electrical signal equivalent to the manually selected direction of the turn. An appropriate change in signal level from the sensor assembly is processed to eliminate a response to false turn indications. Upon the completion of the turn or lane change, the memory unit indicating the direction of change will be reset by the acceleration sensors terminating the illumination of the vehicle's directional signal lights 16.

Fig. 3.

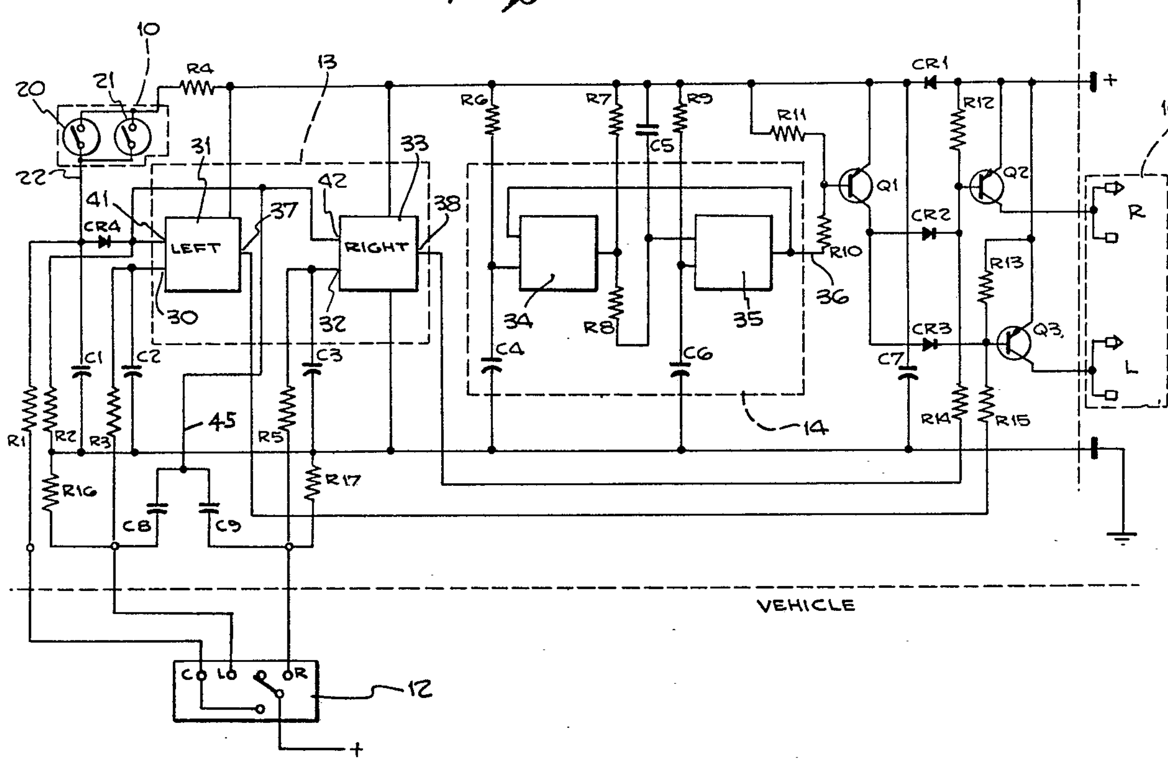

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Fig. 1.

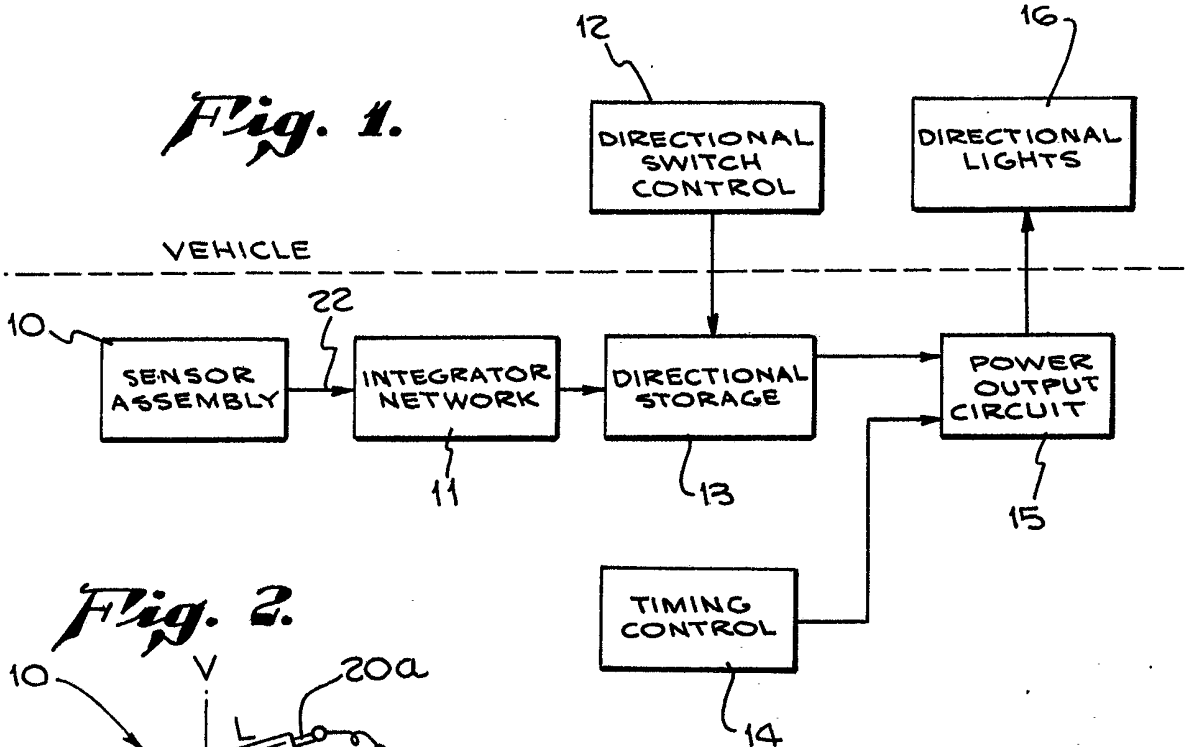
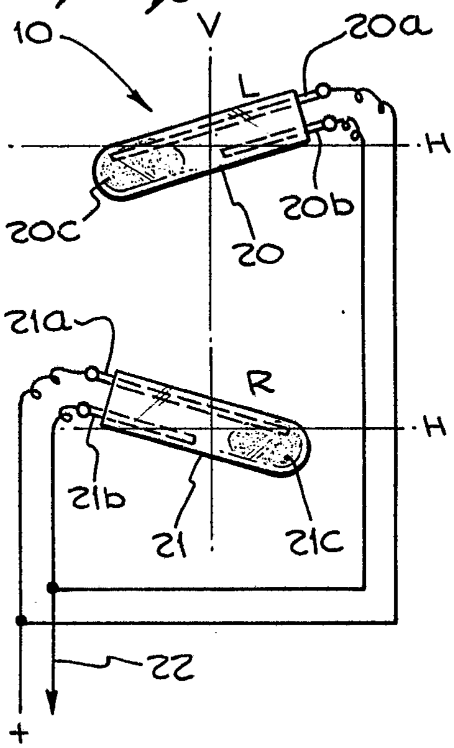


Fig. 2.



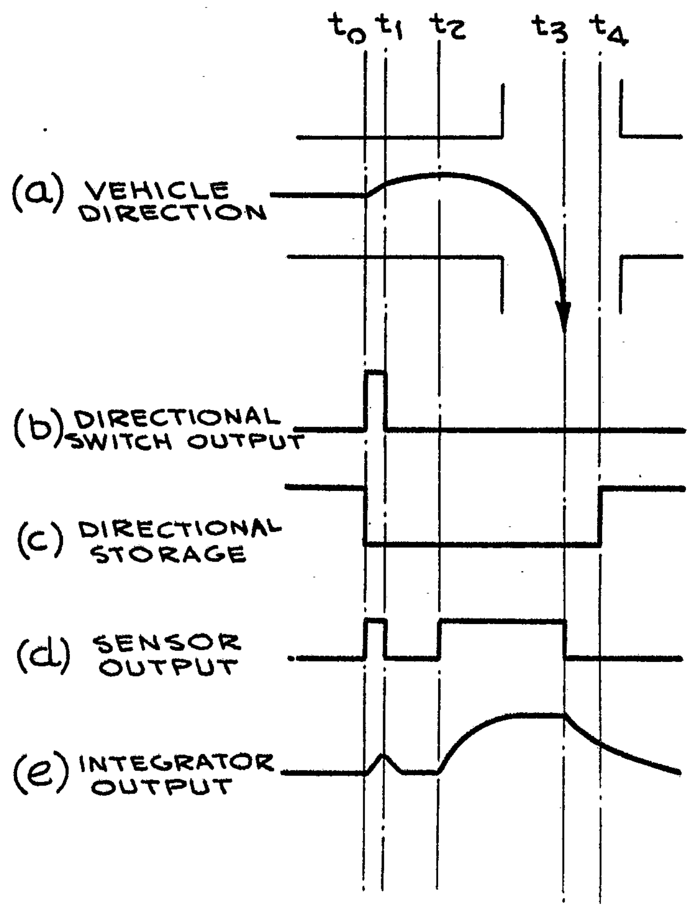
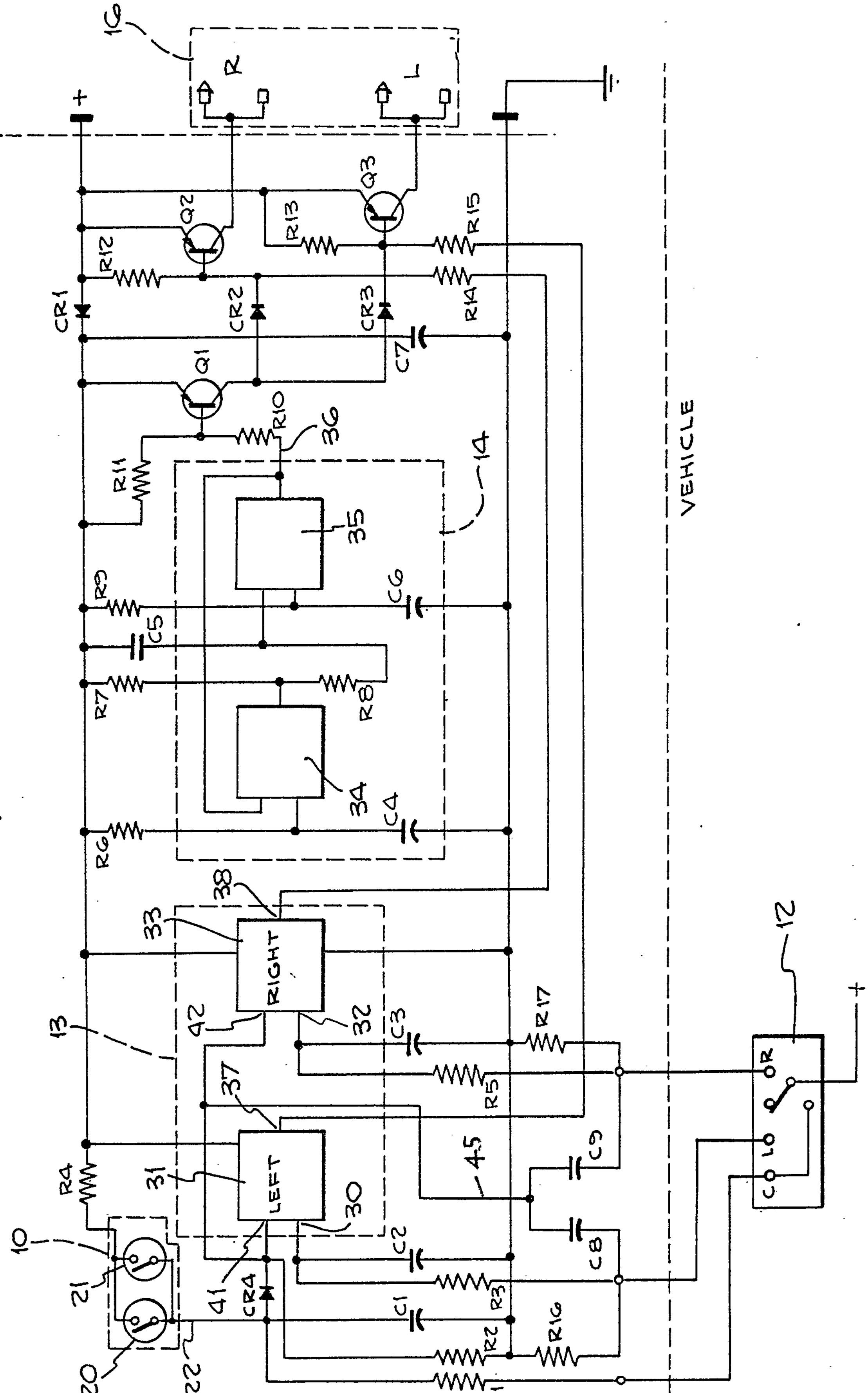


Fig. 4.

Fig. 3.


16
R
L
+
Q1
Q2
Q3
CR1
CR2
CR3
CR4
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
C1
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C3
C4
C5
C6
C7
C8
C9
36
14
35
34
13
33
38
RIGHT
42
32
37
LEFT
31
30
41
45
10
21
20
22
VEHICLE
12
R
LO
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SPECIFICATION

Vehicle turn detection apparatus

The present invention generally relates to vehicle control circuits, and more particularly to apparatus for controlling the termination of directional turn signals.

With the increased mobility of the world's population due to vehicular travel, it has become more and more evident that advances are necessary to provide for improved vehicle safety features. In particular, the need to provide improved directional signal control apparatus for vehicles in general, and motorcycles specifically, is of prime importance. Although the present invention is applicable to automobiles, boats and like vehicles which employ rotating steering columns which can easily employ directional signal shafts, the present invention will be discussed in terms of its primary application for motor driven cycles which shall be understood to include motorcycles, and mopeds. The latter type of vehicles are unique in the sense that there is no full rotation of the steering mechanism to execute a lane change or turn, but on the contrary, such changes in directions are often, if not always, accomplished through the use of weight allocation. The result of the change in weight allocation will cause a deflection of the motor driven cycle from its quiescent vertical orientation with very little movement of the handle bars or other like steering apparatus.

The prior art discloses several rudimentary types of devices which are used to control the duration of the directional signal used on motor driven cycles. The simplest of these devices is merely a manual switch operated by the user to indicate the start and stop of a left or right hand lane change or turn. Another type of device disclosed by the prior art is based on time and distance. The operator of the motor driven cycle initiates a manual switch to start the directional flashers. Detectors which combine input signals based on time and distance will reset the directional signal irrespective of the dynamics of the operation of the motor driven cycle.

The inadequacies of the above devices are obvious. The elementary manual switch is clearly deficient since the operator may totally neglect to reset the switch after he has completed the lane change or turn. With respect to the circuit based on time and distance, since there is no input which is based on the actual dynamics of the cycle, the directional signals can be reset even though the operator has not completed and possibly not even started the lane change or turn.

According to the present invention a vehicle turn detection apparatus for use with a vehicle having directional signals comprises:

(a) a manual directional turn switch control having at least first and second switch positions;

(b) linear motion acceleration sensor means for detecting lateral movement of the vehicle, the said linear motion acceleration detection means being adapted for mounting upon the vehicle;

(c) first and second memory storage elements having set and reset signal inputs, each having an output which comprises a signal responsive to the first or second position respectively of the manual directional turn switch control, the set input of the said first and second memory storage elements being coupled to the first and second positions respectively of the manual directional turn switch control;

(d) integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the said linear motion acceleration sensor means and the reset inputs of the said first and second memory storage elements;

(e) timing control means for producing an output electrical signal which alternates between a high and a low signal level; and

(f) first and second combining means for combining the output signals of the said first and second memory storage elements respectively with the output electrical signal of the said timing control means, the said first and second means being connected to the directional signals.

The said linear motion acceleration sensor means may comprise first and second mercury switches, each of the said switches having a pair or normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the contacts of the said first and second mercury switches being electrically connected in parallel to each other, the said mercury switches being adapted to be secured to the vehicle, with the central axis of each being transverse, e.g. perpendicular, to the path of travel of the vehicle whereby a lateral rate of change of velocity of the vehicle may be sensed.

In a preferred form of the invention a motorcycle turn detection apparatus for use with a motorcycle having right and left directional signals comprises:

(a) a manual directional turn switch control having at least first and second switch positions;

(b) right and left linear motion acceleration sensors comprising a pair of mercury switches, each of the said switches having a pair of normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the said contacts of the said mercury switches being connected in parallel to each other, the said mercury switches being adapted to be secured to the motorcycle with the central axis of each being transverse to the path of travel of the motorcycle and being equally and oppositely deflected at a predetermined angle from a horizontal plane whereby a lateral rate of change of velocity of the motorcycle may be detected;

(c) first and second bistable memory units having set and reset signal inputs, each of the said bistable memory units having an output which comprises an electrical signal responsive to one of the switch positions of the manual directional turn switch control, each of the set inputs of the said first and second bistable memory units being connected to one of the switch positions of the said manual directional turn switch control;

(d) integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the connected contacts of the said mercury switches and the reset inputs of the said bistable memory units;

(e) an astable multivibrator having an output electrical signal which periodically alternates between high and low electrical states; and

(f) first and second means for combining the output signals of the said first and second bistable memory units respectively with the output electrical signal of the said astable multivibrator, the said first and second means being adapted to be connected to the right and left directional signals of the motorcycle.

The central axis of each of the said first and second mercury switches is preferably equally and oppositely deflected from a horizontal plane at a predetermined angle e.g. in the range 0° — 15°. The said timing control means may comprise an astable multivibrator having a duty cycle which periodically alternates the high and low states of the output electrical signal.

The said first and second combining means may comprise first and second current valves, e.g. diodes, each having an anode and cathode, the anode of each of the said diodes being coupled to the output of the timing control means, e.g. the astable multivibrator, the cathode of the said first diode being connected to the output of the said first memory storage element, e.g. bistable memory unit, the cathode of the said second diode being connected to the output of the said second memory storage element, e.g. bistable memory unit.

The said manual directional turn switch control may include a momentary switch having left, right and clear contacts, and clearing means for resetting one of the said first or second memory storage elements, the said clearing means being connected intermediate the left and right momentary switch contacts and the reset signal inputs of the said first and second memory storage elements respectively.

The invention also extends to a vehicle provided with vehicle turn detection apparatus as defined herein.

More particularly the invention extends to a motorcycle provided with vehicle turn detection apparatus, the motorcycle having right and left directional signals, a manual directional turn switch control having at least first and second switch positions, right and left linear motion acceleration sensors comprising a pair of mercury switches, each of the said switches having a pair of normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the said contacts of the said mercury switches being connected in parallel to each other, the said mercury switches being secured to the motorcycle, the central axis of each being perpendicular to the path of travel of the motorcycle and being equally and oppositely deflected at a predetermined angle from a horizontal plane whereby a lateral rate of change of velocity of the motorcycle may be detected,

first and second bistable memory units having set and reset signal inputs, each of the said bistable memory units having an output which comprises an electrical signal responsive to one of the switch positions of the manual directional turn switch control, each of the set inputs of the said first and second bistable memory units being connected to one of the switch positions of the said manual directional turn switch control,

integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the connected contacts of the said mercury switches and the reset inputs of the said bistable memory units,

an astable multivibrator having an output electrical signal which periodically alternates between high and low electrical states and

first and second means for combining the output signals of the said first and second bistable memory units respectively with the output electrical signal of the said astable multivibrator, the said first and second means being connected to the right and left directional signals of the motorcycle.

The present invention substantially resolves the problems which are inherent in those devices disclosed in the prior art. A sensor assembly detects the lateral change in direction of the vehicle e.g. a motor driven cycle and translates the same into an electrical signal responsive to same. The output signal from the sensor assembly is integrated to desensitize the present invention to ignore false or unintentional turning movements. The processed signal is used to reset storage media which have been previously set responsive to a manual switching circuit activated by the user to indicate a left or right lane change or turn. When the sensor assembly detects the completion of a lane change or turn, the directional lights, which are flashing in response to the manual operation of the user, are reset without any action by the user and in full response to the turning dynamics of the vehicle e.g. a motor driven cycle.

The present invention comprises a vehicle turn detection apparatus which is responsive to the dynamics of a vehicle in general, and a motor driven cycle in particular. As stated previously, a change of direction of a motor driven cycle is made by a shift in weight allocation. There is little movement of the steering apparatus for the cycle thereby precluding use of the conventional type of directional controls used on automobiles, trucks or other vehicles using fully rotating steering columns. Although the present invention can be used on vehicles employing steering columns, the invention will be described with reference to motor driven cycles only. A sensor assembly in the form of a linear motion accelerometer is laterally mounted perpendicular to the general orientation of the motorcycle when it is in motion. The linear motion accelerometer will detect lateral movements of the cycle to either side of its straight path by monitoring a net difference between the force of gravity and the force created by the rate of change of the velocity in that lateral direction. The accelerometer outputs a signal responsive to the directional change, the signal being processed by a network to negate any false or inadvertent lateral movements of the cycle while in preparation or at the initiation of a full turn or lane change.

As stated hereinabove, the present invention is to be used to control the reset function of the directional signals of the cycle in response to the dynamics of the cycle as opposed to inflexible parameters of time and distance. Memory storage units, having been previously set into a condition which reflect the user's anticipated turning direction, monitor the output of the translated sensor output. When an appropriate signal from the sensor assembly is received by the latched memory storage unit, the previously set storage unit will be reset. By resetting the storage unit which has been responsive to the selected direction of the turn, the cycle's flashing signals will be turned off.

It is an object of the present invention to provide an improved vehicle turn detection apparatus.

It is another object of the present invention to provide a vehicle turn detection apparatus which is responsive to the dynamics of a moving vehicle.

It is yet another advantage of the present invention to provide a vehicle turn detection apparatus which will cancel an erroneous direction selection.

It is still another object of the present invention to provide a vehicle turn detection apparatus which operates independent of the time and distance travelled by a vehicle.

It is still yet another object of the present invention to provide a vehicle turn detection apparatus which is simple and inexpensive to fabricate.

The invention may be put into practice in various ways and one specific embodiment will be described by way of example to illustrate the invention with reference to the accompanying drawings in which:

Figure 1 is a schematic, block diagram of vehicle turn detection apparatus in accordance with the present invention;

Figure 2 is a schematic view of a preferred form of the sensor assembly for use in the apparatus shown in Figure 1 and shown mounted in relation to the vertical and horizontal orientation of a motor driven cycle;

Figure 3 is a schematic circuit diagram of the apparatus shown in Figure 1; and

Figure 4 is a timing diagram of a portion of the elements of the circuits shown in Figure 3 in relationship to the direction of a moving vehicle.

The present invention comprises a vehicle turn detection apparatus responsive to the dynamics of a motor driven cycle. Figure 1 shows a schematic block diagram of the present invention and its interface with a vehicle. As stated, the discussion of the present invention is related to a motor driven cycle although it is equally applicable to vehicles employing fully rotational steering columns. A sensor assembly 10 detects the lateral change in direction of the motor driven cycle. A preferred form of the present invention utilizes a linear motion accelerometer for the implementation of the sensor assembly 10. When using a linear motion accelerometer, a net difference between the force of gravity and the force created by the rate of change of the velocity in the monitored direction will result in a signal. As will be discussed in detail hereinbelow, although the preferred form of the present invention utilizes a pair of mercury switches to implement the sensor assembly 10, other conventional linear motion accelerometers such as those employing gyroscopes, pendulums, moving slugs, or magnets could be used.

The sensor assembly 10 produces an output signal responsive to the lateral change of direction of the cycle. The output signal of the sensor assembly 10 is translated by an integrator network 11 which sensitizes the remainder of the system to true changes in direction as opposed to inadvertent movements which were unintentional. As stated hereinabove, the user of the cycle had previously utilized a directional switch control 12 to indicate the desired lane change or turn of the cycle. Typical directional switches used on motor driven cycles are momentary switches which produce a signal responsive to the switch activation. A directional storage 13 provides memory to store the user's selection of the directional change. The state of the directional storage 13 will be maintained until the output of the integrator network 11 produces an output signal responsive to the termination of the selected lane change or turn. The timing control 14 produces an electrical output signal which will produce an electrical signal having an alternating duty cycle which will determine the rate at which the cycle's directional lights will flash. When the directional storage 13 has been activated to indicate a selected lane change or turn, power output circuits 15 will electrically drive right and left directional lights 16 at a rate set by a timing control 14.

The preferred embodiment of the sensor assembly 10 is shown in Figure 2. As stated previously, the present invention is particularly applicable for use with motor driven cycles which are deflected from a vertical plane during turns or lane changes. The schematic depiction of the sensor assembly 10 as shown in Figure 2 utilizes a pair of conventional mercury switches 20 and 21. The vertical and horizontal axis of the cycle are schematically designated respectively by the letters V and H. As will be described hereinbelow, for small or no deflections from a vertical plane, the mercury switch 20 will detect movement of the cycle to the left, mercury switch 21 detecting a turn to the right. For large deflections from a vertical plane, the net difference between the force of gravity and the rate of change of velocity in the later direction of movement will cause a reversal of switch closures because the force vectors due to gravitational acceleration will overcome the inertia of the mercury mass. The mercury switch 20 employs a pair of contacts 20a and 20b, the quiescent state of which is a normally open condition. It is understood that the mercury switch 20 could be utilized with the contacts in a normally closed state, the selection merely being one of choice. By definition, the normally open state of the mercury switch 20 occurs when there is no electrical continuity between contacts 20a and 20b. A mass of mercury 20c makes electrical contact between the contacts 20a and 20b upon the occurrence of appropriate conditions. For small deflections, when there is a rate of change of the velocity of the cycle corresponding to movement to the left, the mass of mercury 20c will move to the right responsive to the detected acceleration. As will be described, for large deflection angles, the resultant force of gravity and the rate of change in the direction of movement will cause the mercury mass 20c to make electrical contact between contacts 20a and 20b. In operation, the mercury switch 20 is positioned and fitted to the cycle at an angle to the horizontal plane, the angle depending on the dynamics of the vehicle. A deflection of 10° is approximately equal to a force of one-tenth the force of gravity. The deflection of the mercury switch 20 is used to avoid the effect of spurious or unwanted closures of the contacts 20a and 20b. In a preferred embodiment of the present invention, the mercury switch 20 is deflected from the horizontal plane at an angle in the range of 0° — 15°.

The mercury switch 21 operates identically to the mercury switch 20. The contacts 21a and 21b will be in a normally open condition in the quiescent state. When the mercury mass 21c creates electrical continuity between the contacts 21a and 21b as a result of a change of velocity, the contacts will appear closed and produce a responsive signal on the line designated by the reference numeral 22. The deflection of the mercury switch 21 from a horizontal plane follows the same conditions as described in connection with the mercury switch 20. As shown in Figure 2, the mercury switches 20 and 21 are connected in parallel so that the closure of either set of contacts will produce a "high" signal on the signal line 22 which provides an input to the integrator network 11. By connecting the outputs of the mercury switches 20 and 21, a signal responsive to the dynamics of the turn will be produced irrespective of the magnitude of the deflection angle.

The operation of the present invention can be best understood by reference to trace (a) shown in Figure 4. The ultimate directional movement of the motorcycle is shown as being a turn to the right with four pertinent time occurrences which are related to the dynamics of the cycle. In the operation of a motor driven cycle, the operator will, in substantially all cases, make a countermovement of the cycle prior to making the actual lane change or turn. As can be seen in trace (a) of Figure 4, the interval between t_0 and t_1 constitutes a false turn which occurs only as a result of the balancing movement employed by the user. As will be described hereinbelow, the countering weight movement shown in trace (a) of Figure 4 will produce a signal of short duration which will be ignored as a control signal by the directional storage 13 as a result of the integrator network 11. The right turn which is reflected by trace (a) of Figure 4 commences at time t_2 and terminates at time t_3. The discussion with respect to the circuit shown in Figure 3 as well as the traces (b) — (e), inclusive, will reflect the dynamics of the cycle from t_0 to t_4.

Figure 3 is a circuit diagram of the present invention showing its relationship to the directional switch control 12 and the directional lights 16. The directional switch control 12 employs a conventional momentary switch used with motorcycles which will produce an output signal responsive to a manually selected position or the clearance of a previously set position. The contact L of the switch control 12 is connected to a set input 30 of a latching memory unit 31 using a resistor R3 and a capacitor C2 as the biasing network. In a like manner, the contact R of the directional switch control 12 is connected to a set input 32 of a latching memory unit 33 through signal biasing resistor R5 and capacitor C3. The contact C of the switch control 12 is connected to reset inputs 41 and 42 of the memory units 31 and 32 respectively through diodes CR4 and resistor R1. Diode CR4 isolates the capacitor C1 from the remainder of the circuit used to cancel previously selected direction information. The contact C is used to permit the user to manually reset a previously selected direction. As described hereinabove, the operator of the cycle will manually activate the directional switch 12 to set the memory latch 31 or 33 respectively, to commence the flashing of a directional light 16. Circuit elements 34 and 35 and the related inner-connecting elements shown comprise an astable multivibrator which is well known in the art. Although the preferred form of the present invention uses an astable multivibrator to provide the timing control 14, other conventional alternatives can be used to generate the required periodic signal, e.g., a crystal oscillator. The astable multi-vibrator defined as the timing control 14 will produce an output signal on a line 36 which will alternate between the selected high and low signal levels utilizing the optimum duty cycle pertinent to visual operation of the directional signals 16. In a form of the present invention, the output of the astable multivibrator appearing on line 36 will typically have a duty cycle whereby the output thereof will be in a low state for one-third of the duty cycle and in a high state for two-thirds thereof, the period being one of choice. The output of the timing control 14 is input to an amplifier Q1. If the latching memory unit 31 has been activated indicating a left turn or lane change, the output of Q1 will invert the timing control signal levels output on line 36 and drive a power amplifier Q3 to energize the left directional signal L. As can be seen from trace (c) of Figure 4, the output 37 of the memory latching unit 31 will be in a low signal state when a left turn or lane change is to be indicated. The output of the amplifier Q1, through diode CR3, will cause the alternating signal to be applied to the left directional signal L causing the same to flash at the duty cycle established by the timing control 14. Since the diode CR3 will isolate the signal input to the amplifier Q3 from that input to the amplifier Q2, the right directional signal R will not operate. In a like manner, when the output 38 of the latching memory unit 33 is in a low state as a result of its selection by the operator, the amplifier Q2 will be energized causing the right directional signal R to flash at the duty cycle established by the astable multivibrator comprising the timing control 14. As in the prior case, the diode CR2 will isolate the signal applied to the amplifier Q2 from the input of amplifier Q3. The latching memory units 31 and 33 can be any one of a number of conventional bistable memory units, either solid state or electromagnetic, whereby the output thereof can be made responsive to an input triggering signal. In a preferred form of the present invention, the components designated by the latching memory units 31 and 33 as well as the memory elements 34 and 35 comprising the astable multivibrator can be incorporated on a single commercially available component marketed by Signetics as its Model No. NE558N.

As discussed hereinabove, the operator of the motor driven cycle will initiate the storage of information in either the latching memory unit 31 or the latching memory unit 33 to designate a left or right lane change or turn. As stated, an erroneous selection can be reset by the contact C. In addition, if a memory unit 31 or 32 had been previously selected by switch control 12 and a new, but opposite direction selected, a pulse of short duration is output on the line 45 by capacitors C8 or C9 which will be applied at reset inputs 41 and 42 and thereby reset the previously selected memory unit 31 or 33. The pulse appearing on the line 45 will not be applied to the set inputs 30 or 32 because of the time constant created by the resistor R3 and the capacitor C2, the resistor R5 and the capacitor C3 respectively. The manually selected signal that remains will be integrated by R3 and C2, or R5 and C3 respectively, the processed signal activating the appropriate input 30 or 32. C8 and C9 are discharged by R16, R17, R2 and 45 when the directional switch has returned to its off position. The combination of the stored information along with the output of the astable multivibrator comprising the timing control 14 will initiate the flashing of one of the directional lights 16. The essential objective of the present invention is proper termination of the directional signal.

Referring again to trace (a) of Figure 4, the direction of the vehicle is ultimately to be a right turn. As stated hereinabove, operation of a two-wheeled cycle will generally require a counterturn such as that shown between times t_0 and t_1. As stated hereinabove, the force vector created by the lateral movement of the cycle will cause a component of acceleration which will cause closure of one of the mercury switches which forms a part of sensor assembly 10. It is understood that for illustration only, the description below relates to a small deflection turn which will dictate which of the two mercury switches 20 or 21 will produce the reset signal. As shown in Figure 2, the lateral movement of the cycle to the left in preparation for the right turn will cause the mercury mass 20c to create electrical continuity between the contacts 20a and 20b. The mercury switches 20 and 21 are desensitized to small lateral movements as a result of the discrete angle between the central axis of the switches 20 and 21 and the horizontal plane. As can be seen in trace (d) of Figure 4, the minor closure of the mercury switch 20 between the times t_0 and t_1 will result in a "high" signal level indicating a closed contact. As stated previously, the output of the mercury switches 20 and 21 are connected in parallel so that the output of both switches, as processed by the integrator network 11, will appear on line 22 (Figure 3). Resistors R2 and R4 along with a capacitor C1 comprise the integrator network 11 which sorts real turns and lane changes from false movements and processes the information to reset the memory units 31 or 33. The application of the integrated switching signal on the reset input 41 of the latching memory unit 31 and the reset input 42 of the latching memory unit 33 will comprise a pulse whose characteristics are based upon the integrator network 11. As can be seen in trace (e) of Figure 4, the pulse will terminate at time t_1 when the premature switch closure returns to the normally open condition. At time t_2, the lateral movement of the motor driven cycle to the right will cause the mercury switch 21 to close. As can be seen from traces (d) and (e) of Figure 4, the signals applied to the reset inputs 41 and 42 of the latching memory units 31 and 33 respectively will cause the latching memory unit 33 to be reset at t_4 [trace (c) of Figure 4] when the triggering requirement of the latch being used are met. A conventional solid state latching unit is utilized and requires triggering in the form of an input signal which rises above a predetermined level and then falls below a second predetermined level which will then initiate the reset function. In the preferred form of the present invention, the electrical signal appearing on the reset inputs 41 or 42 must exceed 1.5 volts DC and then fall below the predetermined lower voltage level in order to reset the memory element. In the form of the present invention shown in

Figure 3, the signals on reset inputs 41 and 42 will reach a level of at least 1.6 volts DC at time t_3 and fall below 1.4 volts at time t_4. Since trace (a) of Figure 4 indicates a right turn, the latching memory unit 33 will be reset shutting off the power amplifier Q2 and halting the flashing of the right directional signal. In the preferred form of the present invention, the components shown in Figure 3 have the following representative values:

COMPONENT VALUES

R1 = 3.3K ohms	R10 = 10.0K ohms	CR1—4 = 1N658
R2 = 24.0K ohms	R11 = 10.0K ohms	Q1 = 2N3702
R3 = 100K ohms	R12 = 1.0K ohms	Q2, Q3 = TIP 125
R4 = 3.3K ohms	R13 = 1.0K ohms	
R5 = 100K ohms	R14 = 2.2K ohms	
R6 = 0.22M ohms	R15 = 2.2K ohms	
R7 = 10.0K ohms	R16 = 1.0K ohms	
R8 = 10.0K ohms	R17 = 100K ohms	
R9 = 0.43M ohms		

C1 = 8 μfarads	C6 = 1 μfarad
C2 = 1 μfarad	C7 = 10 μfarads
C3 = 1 μfarad	C8 = .001 μfarads
C4 = 1 μfarad	C9 = .001 μfarads
C5 = .001 μfarads	

It can therefore be seen that the present invention utilizes linear motion accelerometers to monitor the dynamics of a motor driven cycle in order to terminate directional turn signals in response thereto. The sensor assembly used to detect true lane changes and turns will respond only to actual turning movements and is capable of filtering out any extraneous information which would arise from inadvertent movement of the cycle or the instinctive counter movement inherent in the operation of a motor driven cycle. By monitoring the dynamics of the motor driven cycle, the present invention provides a safe and economical manner to implement directional signals on motor driven cycles without dependency on the inflexible parameters of time and distance.

CLAIMS

1. A vehicle turn detection apparatus for use with a vehicle having directional signals comprising:

(a) a manual directional turn switch control having at least first and second switch positions;

(b) linear motion acceleration sensor means for detecting lateral movement of the vehicle, the said linear motion acceleration detection means being adapted for mounting upon the vehicle;

(c) first and second memory storage elements having set and reset signal inputs, each having an output which comprises a signal responsive to the first or second position respectively of the manual directional turn switch control, the set input of the said first and second memory storage elements being coupled to the first and second positions respectively of the manual directional turn switch control;

(d) integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the said linear motion acceleration sensor means and the reset inputs of the said first and second memory storage elements;

(e) timing control means for producing an output electrical signal which alternates between a high and a low signal level; and

(f) first and second combining means for combining the output signals of the said first and second memory storage elements respectively with the output electrical signal of the said timing control means, the said first and second means being connected to the directional signals.

2. A vehicle turn detection apparatus as claimed in Claim 1 in which the said linear motion acceleration sensor means comprises first and second mercury switches, each of the said switches having a pair of normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the contacts of the said first and second mercury switches being electrically connected in parallel to each other, the said mercury switches being adapted to be secured to the vehicle, with the central axis of each being transverse to the path of travel of the vehicle whereby a lateral rate of change of velocity of the vehicle may be sensed.

3. A motorcycle turn detection apparatus for use with a motorcycle having right and left directional signals comprising:

(a) a manual directional turn switch control having at least first and second switch positions;

(b) right and left linear motion acceleration sensors comprising a pair of mercury switches, each of the said switches having a pair of normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the said contacts of the said mercury switches being connected in parallel to each other, the said mercury switches being adapted to be secured to the motorcycle with the central axis of each being transverse to the path of travel of the motorcycle and being equally and oppositely deflected at a predetermined angle from a horizontal plane whereby a lateral rate of change of velocity of the motorcycle may be detected;

(c) first and second bistable memory units having set and reset signal inputs, each of the said bistable memory units having an output which comprises an electrical signal responsive to one of the switch positions of the manual directional turn switch control, each of the set inputs of the said first and second bistable memory units being connected to one of the switch positions of the said manual directional turn switch control;

(d) integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the connected contacts of the said mercury switches and the reset inputs of the said bistable memory units;

(e) an astable multivibrator having an output electrical signal which periodically alternates between high and low electrical states; and

(f) first and second means for combining the output signals of the said first and second bistable memory units respectively with the output electrical signal of the said astable multivibrator, the said first and second means being adapted to be connected to the right and left directional signals of the motorcycle.

4. A vehicle turn detection apparatus as claimed in Claim 2 or Claim 3 in which the central axis of each of the said first and second mercury switches is equally and oppositely deflected from a horizontal plane at a predetermined angle.

5. A vehicle turn detection apparatus as claimed in Claim 4 in which the central axis of each of the said first and second mercury switches is deflected at an angle from a horizontal plane in the range of 0° — 15°.

6. A vehicle turn detection apparatus as defined in any one of Claims 1 to 5 in which the said timing control means comprises an astable multivibrator having a duty cycle which periodically alternates the high and low states of the output electrical signal.

7. A vehicle turn detection apparatus as claimed in any one of Claims 1 to 6 in which the said first and second combining means comprises first and second current valves e.g. diodes each having an anode and cathode, the anode of each of the said diodes being coupled to the output of the timing control means, e.g. the astable multivibrator, the cathode of the said first diode being connected to the output of the said first memory storage element, e.g. bistable memory unit, the cathode of the said second diode being connected to the output of the said second memory storage element, e.g. bistable memory unit.

8. A vehicle turn detection apparatus as claimed in any one of Claims 1 to 7 in which the said manual directional turn switch control includes a momentary switch having left, right and clear contacts, and clearing means for resetting one of the said first or second memory storage elements, the said clearing means being connected intermediate the left and right momentary switch contacts and the reset signal inputs of the said first and second memory storage elements respectively.

9. Vehicle turn detection apparatus as claimed in Claim 1 substantially as specifically described herein with reference to the accompanying drawings.

10. A vehicle provided with vehicle turn detection apparatus as claimed in any one of claims 1 to 9.

11. A motorcycle provided with vehicle turn detection apparatus, the motorcycle having right and left directional signals, a manual directional turn switch control having at least first and second switch positions, right and left linear motion acceleration sensors comprising a pair of mercury switches, each of the said switches having a pair of normally open contacts and a mercury mass for closure of the same, each of the said first and second mercury switches having a central axis which defines the relative movement between the mercury mass and the said contacts, the said contacts of the said mercury switches being connected in parallel to each other, the said mercury switches being secured to the motorcycle, the central axis of each being perpendicular to the path of travel of the motorcycle and being equally and oppositely deflected at a predetermined angle from a horizontal plane whereby a lateral rate of change of velocity of the motorcycle may be detected, first and second bistable memory units having set and reset signal inputs, each of the said bistable memory units having an output which comprises an electrical signal responsive to one of the switch positions of the manual directional turn switch control, each of the set inputs of the said first and second bistable memory units being connected to one of the switch positions of the said manual directional turn switch control, integrator means for processing the value of an electrical signal, the said integrator means being connected intermediate the connected contacts of the said mercury switches and the reset inputs of the said bistable memory units, an astable multivibrator having an output electrical signal which periodically alternates between high and low electrical states and first and second means for combining the output

signals of the said first and second bistable memory units respectively with the output electrical signal of the said astable multivibrator, the said first and second means being connected to the right and left directional signals of the motorcycle.

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