

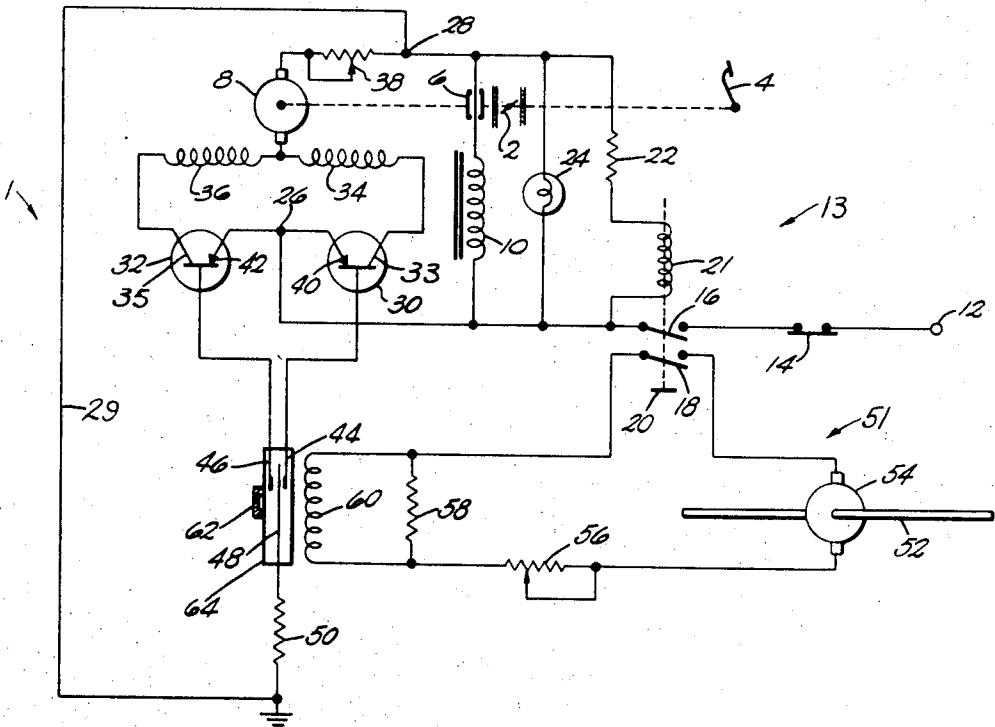
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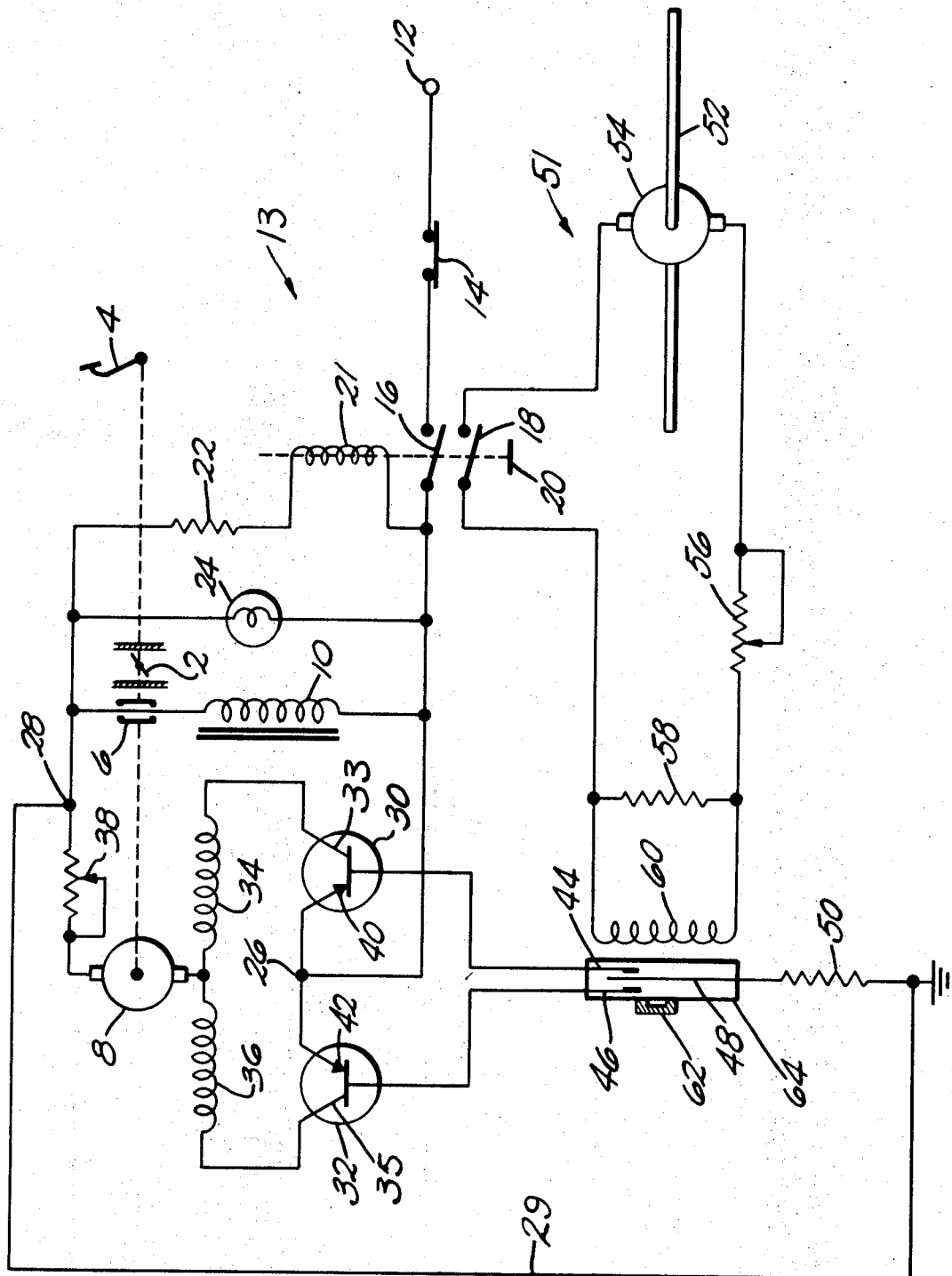
[56] **References Cited**
UNITED STATES PATENTS
3,070,185 12/1962 Fales 180/82.1
3,249,175 5/1966 Baxter 180/108
3,344,880 10/1967 Iwashita 123/102X
3,392,799 7/1968 Ishikawa 123/102X

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[54] **VEHICLE SPEED CONTROL SYSTEM**
9 Claims, 1 Drawing Fig.
[52] U.S. Cl. **123/102,**
318/297
[51] Int. Cl. **F02d 11/10**
[50] Field of Search **123/102;**
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ABSTRACT: A system for controlling the speed of an engine driven vehicle in which a voltage proportional to vehicle speed is utilized to control the throttle of the vehicle engine.





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VEHICLE SPEED CONTROL SYSTEM

BACKGROUND OF THE INVENTION

1. Field of Invention

The minimum of cross traffic on modern limited access highways permits constant speed driving with the maximum of safety. The driver of the vehicle, however, must watch his speedometer and constantly increase and decrease pressure on the foot accelerator as he goes up and down the slight inclines and declines to maintain that constant speed. This leads to less than full attention to driving and to leg fatigue.

The safety and comfort of turnpike driving can be immeasurably improved by using a device that is manually set to a desired speed and maintains this preset speed constant regardless of road incline or decline. That is, a device that would do exactly what a driver must do, namely, vary the throttle to compensate for any changes in road conditions and thereby maintain the vehicle at constant speed.

2. Description of the Prior Art

The prior art shows pulse generating control devices for vehicle engines; for example, U.S. Pats. Nos. 3,207,255 and 3,249,175. The prior art also shows d.c. motor controls in which the direction and speed of a motor is determined by the amplitude of a d.c. signal; for example, U.S. Pat. No. 2,875,391. The use of square waves or other pulse type signals requires complicated and refined circuits and are subject to electrical transients which may cause radio interference if not properly shielded.

SUMMARY OF THE INVENTION

The present invention utilizes a direct current generator, whose output voltage is proportional to speed. This generator is attached to the speedometer cable to thereby produce a voltage that is proportional to vehicle speed. This output voltage of the generator is modified by a variable resistor so that a predetermined voltage is produced across an induction coil to control the operation of a magnetically actuated reed switch. This predetermined voltage is produced at the speed for which the variable resistor is set.

The induction coil, when the voltage is below the predetermined voltage, allows the magnetically biased reed switch to operate a power switching circuit which energizes a servo motor to rotate in a direction to open the engine throttle valve, thereby causing the engine to speed up and increase vehicle speed. When the voltage across this coil is greater than the predetermined voltage, the magnetic bias is overcome and the switch is operated in the other direction to energize the servo motor to rotate in an opposite direction tending to close the engine throttle valve. Another adjustable resistance is placed in the servo motor circuit to give the desired speed of response of the servo motor, which receives electrical energy from the 12-volt automobile battery power supply.

There are therefore two electrical sources utilized: one is the power source which is normally the electric battery for the automobile, and the other is a voltage produced by a speedometer cable driven generator, the amplitude of this voltage being proportional to vehicle speed. The automobile battery furnishes power to actuate the throttle, and the vehicle speed responsive generator furnishes a control voltage to operate the switch controlling the electrical power to the throttle actuating servo motor. In such a control apparatus the vehicle speed is indicated by a voltage produced by the d.c. generator driven by the vehicle. This d.c. voltage is then reduced by a potentiometer to produce a predetermined fixed voltage at the desired vehicle speed to control the throttle.

It is an object of the present invention, therefore, to provide an improved vehicle speed control system.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims, and the accompanying drawing which is a schematic circuit diagram showing the speed control system of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawing, the system of this invention, indicated generally at 1, is shown in controlling relation with a conventional throttle 2 for an automotive vehicle gasoline engine. The throttle 2 can be manually actuated by a throttle pedal 4 or automatically actuated through a clutch 6 by a reversible electric servo motor 8. A coil 10 is connected to the clutch 6 so that when the coil 10 is energized, the clutch 6 is engaged and the throttle 2 is controlled by the servo motor 8, and when the coil 10 is deenergized the clutch 6 is disengaged so that the servo motor 8 has no control over the throttle 2.

The system 1 includes a power circuit, indicated generally at 13, in which a normally closed brake switch 14, which is opened only when the vehicle brake pedal is depressed, is located. The switch 14 is connected to a source of electrical power, indicated generally at 12, usually the vehicle battery. A manually operable switch 16, connected in series with the brake switch 14, is mounted on a common support with a switch 18. An actuating button 20 can be depressed to simultaneously close the normally open switches 16 and 18.

When the switches 14 and 16 are closed, electric power from the source 12 is impressed across a switch holding coil 21 and voltage dropping resistor 22 to hold the switch 16 in engagement. Electric power is also then impressed across an electric indicating light 24, to indicate that the circuit 13 is energized, and across the coil 10 to engage the clutch 6. The power circuit 13 also includes a pair of transistors 30 and 32 connected through their emitter electrodes 40 and 42, respectively, at point 26 to the current source 12. The collector electrode 33 in the transistor 30 is connected to a "retard" winding 34 for the servo motor 8 which is arranged so that when the winding 34 is energized, the motor 8 will rotate in a direction tending to close the throttle 2 so as to decrease the vehicle speed. The collector terminal 35 in the transistor 32 is connected to an "advance" winding 36 for the motor 8, which, when energized, provides for operation of the motor in a direction to open the throttle 2 so as to increase the vehicle speed. The motor 8 is connected in circuit with a throttle control rate adjustment resistor 38 which is in turn connected at point 28 to a ground conductor 29.

The transistors 30 and 32 have their base terminals connected to stationary switch elements 44 and 46, respectively. A movable reed switch element 48, connected to the conductor 29 and to ground through a biasing resistor 50 is movable between three positions. In one position, the switch element 48 engages the switch element 44, in a second position the switch element 48 engages the switch element 46, and in a third position illustrated in the drawing, the switch element 48 is positioned between and out of engagement with the switch elements 44 and 46.

A control voltage circuit, indicated generally at 51, is provided for actuating the reed switch element 48. The circuit 51 includes a direct current generator 54 connected in a driven relation with the vehicle speedometer cable, indicated at 52, which rotates at a speed proportional to vehicle speed so that the voltage generated by generator 54 is in turn proportional to vehicle speed. The control voltage circuit 51 also includes the manually closable switch 18, an induction coil 60, a coil regulating shunt resistor 58 connected in parallel with the coil 60, and a variable resistor or potentiometer 56.

The induction coil 60 is disposed adjacent one side of a housing 64 in which the stationary switch elements 44 and 46 and the reed switch element 48 are located. A permanent magnet 62 is positioned on the opposite side of the housing 64. The magnetic field of the coil 60 tends to deflect the reed switch element 48 toward the fixed switch element 44 and the field of the permanent magnet 62 tends to deflect the reed switch element 48 toward the fixed switch element 46. When the forces exerted on the reed element 48 by the coil 60 and the magnet 62 are substantially equal, the element 48 is moved to a dwell position in which it is spaced from both the

elements 44 and 46. The resistor 56 is set to determine the vehicle speed at which the current flowing through the coil 60 will generate a magnetic field of a magnitude to substantially equal the force exerted by the permanent magnet 62 on the reed switch element 48. Thus the variable resistor 56 functions in the system 1 as the speed selector, and in a practical embodiment of the invention is calibrated in terms of vehicle speed.

In the operation of the control system 1, assume that the button 20 has been depressed so that the switches 16 and 18 are closed and that the vehicle is traveling at a speed corresponding to the speed setting of the speed selector variable resistor 56. Under these circumstances, the force exerted on the switch element 48 by the magnetic field from the coil 60 is substantially equal to and in an opposite direction from the force exerted by the permanent magnet 62. Thus, the reed switch element 48 is in the intermediate position shown in the drawing, neither of the servo motor windings 34 and 36 are energized, and the setting of the throttle 2 will thus remain unchanged.

Now assume that the vehicle begins traveling up a hill so that the vehicle speed starts to decrease with the throttle 2 remaining in the same position. This reduction in vehicle speed will cause an immediate reduction in the voltage impressed across the coil 60 so that the magnetic force of the coil 60 on the element 48 will be reduced thereby permitting the magnet 62 to move the contact element 48 into engagement with the contact element 46. This will result in a base drive current to the transistor 32, so that the transistor 32 is turned on to thereby provide for a flow of current from point 26 through transistor emitter electrode 42 and collector electrode 35 and through the advance coil 36 causing the motor 8 to rotate in a direction to open the throttle 2 and increase the vehicle speed. The rate of rotation of the motor 8 is controlled by the setting of the variable rate adjustment resistor 38. The resistor 38 is adjusted so as to provide for as rapid an action of the motor 8 as is consistent with no hunting of the servo motor 8 in its operating range.

As soon as the throttle 2 is opened by the servo motor 8, the vehicle immediately speeds up with the result that the generator 54 produces a higher voltage. When this voltage has increased to a value at which the magnetic field of the coil 60 is sufficient to return the reed switch element 48 to its intermediate position shown in the drawing, the transistor 32 will be turned off to deenergize the coil 36 and thereby discontinue operation of the motor 8. Thus, the throttle 2 will remain in its new position to which it was moved by the motor 8 so that the engine output will remain fixed and the vehicle will continue to travel at its present speed.

Now assume that the vehicle starts down a hill so that the speed increases without a change in the position of the throttle 2. The speedometer cable 52 will drive the generator 54 at an increased speed so that an increased voltage will be impressed across the coil 60. This increased voltage increases the magnitude of the magnetic field at the coil 60 to an extent sufficient to move the reed switch element 48 to a position in which engages the fixed contact element 44. This results in a supply of base drive current to the transistor 30 turning it on and providing for flow of current through transistor emitter electrode 40 and collector electrode 33 and through the retard coil 34. Energizing of the coil 34 results operation of the motor 8 in a direction to decrease the setting of throttle 2 to thus provide for a corresponding decrease in engine speed. The speed of the vehicle will then be quickly reduced to a speed corresponding to the setting on the variable resistor 56 so that the voltage at the coil 60 will be reduced sufficiently to provide for return of the reed switch element 48 to its intermediate position illustrated in the drawing.

It can thus be seen that the driving of the generator 54 at a speed proportional to vehicle ground speed provides for a continuous control of the voltage across the coil 60 which will actuate the reed switch element 48 so as to signal the servo motor 8 to change the setting of throttle 2 thereby maintaining

a substantially constant ground speed regardless of road conditions causing a variable power requirement of the vehicle engine. The use of the transistors 30 and 32 as switch means to provide for selective energizing of the motor coils 34 and 36 prolongs the life of the system 1 and provides the desired quick reaction of the motor 8 to signals from the switch element 48. When the vehicle operator wants to discontinue operation of the speed control system 1 the actuating button 20 should be switched to the release side. This will interrupt power to the switch holding coil 21, returning switches 16 and 18 to their normally open positions.

Any brake application while the speed control system 1 is in operation will open brake switch 14, interrupting power to the switch holding coil 21, releasing switches 16 and 18 to their normally open positions.

It will be understood that the speed control system which is herein disclosed and described is presented for purposes of explanation and illustration and is not intended to indicate limits of the invention, the scope of which is defined by the following claims.

We claim:

1. In a speed control system for a vehicle; the combination including electromagnetic coil means, direct current voltage generator means in circuit with said coil means for impressing a voltage across said coil means, means driving said generator means at a speed proportional to existing vehicle speed so that the magnitude of the voltage impressed across said coil means is proportional to existing vehicle speed, signal means responsive to the magnitude of the voltage impressed across said coil means for signaling an increase or a decrease in vehicle speed to provide for the maintenance of a predetermined voltage across said coil, and manually variable resistor means in circuit with said coil means settable to provide for said predetermined voltage across said coil means at a preselected vehicle speed.

2. In a speed control system for a vehicle; the combination including electromagnetic coil means, direct current voltage generator means in circuit with said coil means for impressing a voltage across said coil means, means driving said generator means at a speed proportional to existing vehicle speed so that the magnitude of the voltage impressed across said coil means is proportional to existing vehicle speed, and signal means responsive to the magnitude of the voltage impressed across said coil means for signaling an increase or a decrease in vehicle speed to provide for the maintenance of a predetermined voltage across said coil, said signal means including a switch having a pair of fixed contact elements and a movable contact element movable between positions engaged with each of said fixed contact elements and an intermediate position therebetween, a pair of transistors, each of which is connected to one of said fixed contact elements, a supply of current for said transistors, and means connecting said movable contact element to ground so that when said movable contact element is engaged with either one of said fixed contact elements, a base drive current is supplied to the one of said pair of transistors which is connected to the one of said fixed contact elements engaged with said movable contact element.

3. In a speed control system for a vehicle, the combination including:

three position switch means movable between a first position providing for increased vehicle speed, a second position providing for decreased vehicle speed and a third position intermediate said first and second positions providing for neither increased nor decreased vehicle speed;

magnetic means biasing said switch to said first position; electromagnetic coil means arranged relative to said switch means so that when a direct current voltage is impressed across said coil means the resulting electromagnetic field provides a force which urges said switch means toward said second position, with the magnitude of said force being proportional to the magnitude of said voltage;

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means for impressing a direct current voltage across said coil means which is proportional to existing vehicle speed; and

means in circuit with said coil means providing for a voltage across said coil means at a preselected vehicle speed sufficient to create a force on said switch means of a magnitude to move said switch means to said third position.

4. The combination as set forth in claim 3 wherein said last mentioned means is a manually variable resistor.

5. In a speed control system having the structure set forth in claim 3, servo motor means connected to said switch means operable to provide for increased speed of said vehicle in said first position of said switch means and provide for decreased speed of said vehicle in said second position of said switch means.

6. The combination as set forth in claim 5 wherein said switch means includes a pair of fixed contact elements and a movable contact element which engages one of said fixed contact elements in said first position of said switch means and engages the other one of said fixed contact elements in said second position of said switch means, and a pair of transistors each of which is connected in circuit with said servo motor

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means and one of said fixed contact elements so that in a position of said movable contact element engaged with one of said fixed contact elements, the one of said pair of transistors connected thereto is turned on to provide for flow of current to said servo motor means.

7. The combination as set forth in claim 3 wherein said means for impressing a voltage across said coil means is a direct current generator adapted to be driven by the vehicle speedometer cable.

8. The combination as set forth in claim 5 wherein said servo motor means is an electric motor having an advance winding and a retard winding connected in circuit with said switch means so that when said vehicle speed is to be increased said advance winding is energized and when said vehicle speed is to be decreased said retard winding is energized, and variable resistor means in circuit with said windings for varying the magnitude of the current flow therethrough.

9. The combination as set forth in claim 3 wherein said means biasing said switch to said first position is a permanent magnet.

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