July 16, 1968 TOSHIO ISHIKAWA 3,392,799

SPEED CONTROL DEVICE FOR AN AUTOMOTIVE VEHICLE

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Fig. 1

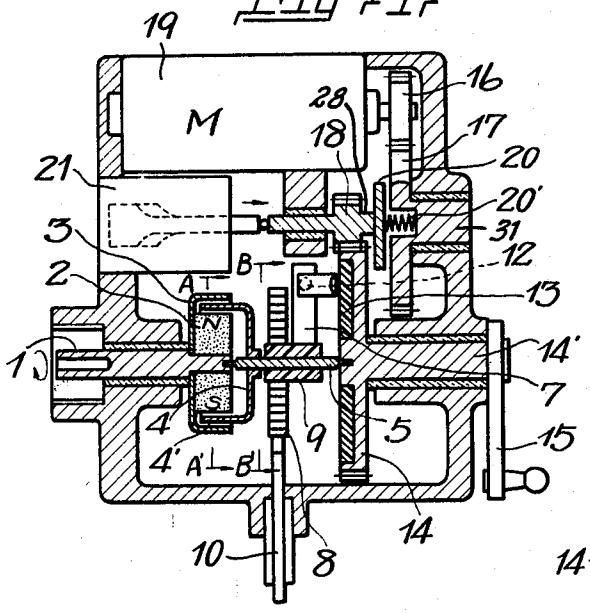


Fig. 2

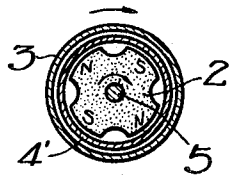


Fig. 3

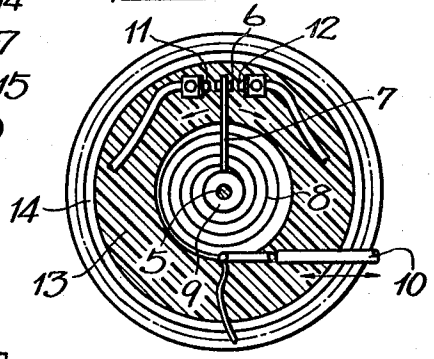
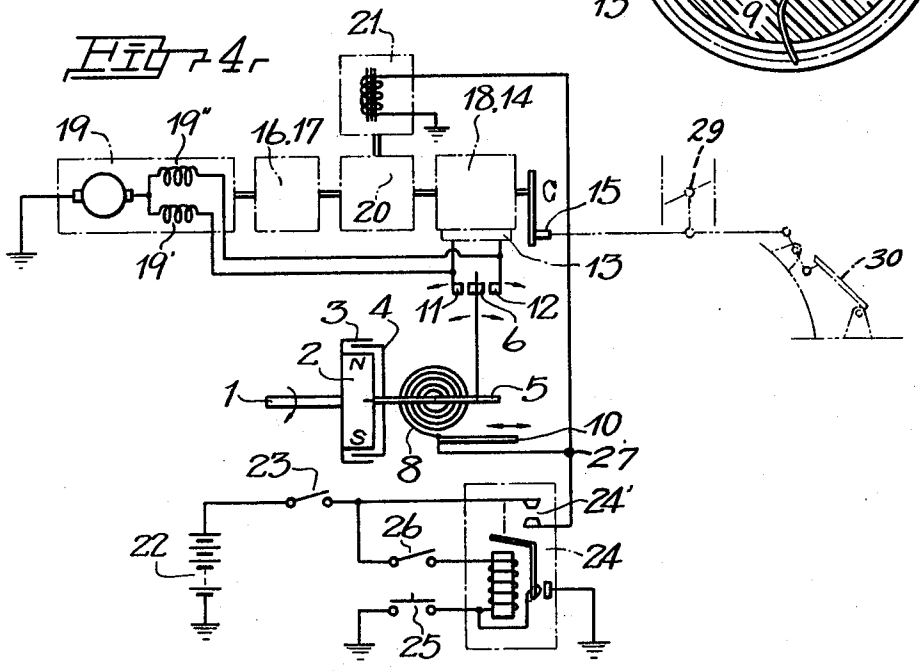


Fig. 4



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SPEED CONTROL DEVICE FOR AN AUTOMOTIVE VEHICLE

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3 Claims. (Cl. 180—105)

ABSTRACT OF THE DISCLOSURE

A compact speed control device is provided for a motor vehicle to maintain constant speed and is magnetically controlled. The desired speed can be set, and the throttle will be opened or closed as required upon departure from the desired speed. The speed control device has a control shaft which is driven by the main drive shaft of the car. A permanent magnet is mounted on this control shaft. A reversible motor has two opposed windings and is connected to a double throw switch which selectively determines the direction of rotation of the motor. The rotation of the motor in one direction or the other transmits selectively actuating force to cause opening or closing of the throttle. An auxiliary shaft acted on by a spiral spring is coaxial with the control shaft and carries a magnetic element which is rotatable in the magnetic field of the permanent magnet on the control shaft, and the auxiliary shaft controls movement of the double throw switch. When the engine is rotating with the main drive shaft at the desired set speed, the switch blade is in a neutral position, and when the main drive shaft rotates at a speed which is too high or too low, the switch blade is deflected in the required direction. A foot brake switch is provided to release the automatic speed control in case of emergency.

This invention relates to improvements in keeping motorcar running at a constant speed and a control means therefor.

It is well known that, in order to bring an automatic means for keeping a motorcar running at a constant speed into active operation, it is required that an accelerator pedal be stepped on to push it down into an active operation, and an electric switch button is pushed in so as to operate a dog clutch electromagnetically. However, these operations are inconvenient for the driver. There is a serious drawback that, when an emergency occurs, even if it is tried to release the car from the constant speed maintaining means for sudden deceleration, it may occur accidentally that it becomes impossible to disengage the electromagnetic clutch, ending in failure of deceleration.

A good many of well known means of the class described are provided with a simply constructed mechanical governor for measuring the speed of a car, due to which the control means required becomes a large-sized one. In addition, there is involved a defect that, due to the fact that the centrifugal force in the mechanical governor is directly proportional to the square of the speed of the car, in order to obtain a stroke which is linearly proportional to the speed, a particular kind of specified spring having a square characteristic as to force and displacement must be provided. For such prior art devices, it is necessary to be precisely careful for the design of such a specified spring.

One object of this present invention is to provide a method of keeping a motorcar running at a constant speed and a means therefor, in which the above-stated drawbacks are overcome.

Another object of this present invention is to provide a method of keeping the motorcar running at a constant speed and a means therefor, in which only a simple operation is required for a sudden release of the car from such control in case of an emergency.

Still another object of this present invention is to provide a means for keeping the motorcar running at a constant speed, which is compact and small-sized in comparison with those in accordance with the prior art.

Further objects of this present invention are to generally simplify and improve the method and provide means of the class described whereby they may be cheaply produced and reliably operated for a very considerable length of time without requiring any repairs or attention.

In accordance with the present general features of the invention, there is provided a permanent magnet member which is continuously rotated at a speed proportional to that of the car by a shaft driven by the drive shaft of the car, and a torque induced by cutting the magnetic flux of this magnet is balanced against the adjustable action of a spring. There is a reversible electric driving motor which is energized when balance of the torque against the spring is upset, whereby a throttle valve is actuated mechanically in such a way as to recover the balance, and the motor is deenergized when the balance is recovered, so as to restore the throttle valve to original position. In addition, there is provided an electromagnetic clutch adapted to interrupt the mechanical transmission of power from the motor to the throttle valve.

The present invention will be better understood and other objects and additional advantages of the present invention will become apparent upon perusal of the following description taken in connection with the drawings, in which:

FIG. 1 is an axial sectional view of a control means for keeping a motorcar at a constant speed embodying the principles of this present invention;

FIG. 2 is a cross-sectional view taken along the line A—A in FIG. 1; showing the permanent magnet and its enclosing yoke and the magnetically cooperative flanged disk;

FIG. 3 is a cross-sectional view taken along the line B—B in FIG. 1 showing the independent drive spindle carrying a switch blade and a spiral spring and an insulating plate; and

FIG. 4 is an electrical diagram of the speed controlling means.

Referring to the drawings, the preferred embodiment of this invention will now be described; however, this description will be understood to be illustrative of the present invention and not as limiting it to the particular arrangements shown and described.

A principal rotary shaft **1** is provided in a casing (not shown) and adapted to be rotated continuously at a speed proportional to the speed of the car. A quadruple-pole clover-leaf permanent magnet member **2** (FIG. 2) and an enclosing yoke **3** are fixedly secured on and to the rotary shaft **1**. Another rotary spindle **5** is mounted coaxially with the rotary shaft **1** and is not fixedly attached to shaft **1**. A rotary flanged enclosing disk **4** is secured on and to the rotary spindle **5** and the flange **4'** of the rotary flanged disk **4** is arranged concentrically with and between the quadruple-pole clover-leaf magnet **2** and the yoke **3**, cutting the magnetic flux of the magnetic circuit composed thereof, so that a torque exists in the same direction as the rotation of the yoke **3** by the action of the eddy current while the shaft **1** is rotated with respect to the spindle **5**, which is proportional to the rotating velocity. An insulating boss **9** is also fixed on and to the spindle **5**. A movable contactor switch blade **7** is secured to the boss **9** and extended radially. The extremity of the extended contactor blade **7** is provided with

two opposite contacts studs 6. A spiral spring 8 is secured to the insulating boss 9 and electrically connected with the contactor blade 7. The outer end of the spiral spring 8 is held by an adjustable controlling rod 10 so as to adjust the position of rest of the action of the spiral spring 8 against the torque due to the yoke, that is, the load setting characteristic of the spiral spring 8 may be adjusted by means of the adjustable controlling rod 10.

There is provided a reversible electric motor 19 inside the casing (not shown). A pinion 16 is fixedly mounted on the shaft 28 of the reversible electric motor 19 and in mesh with a gear disc 17 mounted on a stub shaft 31 so as to form a reduction pair. A clutch plate 20 is mounted co-axially with the disc gear 17 so as to engage therewith compressing a coil spring 20' therebetween when the clutch plate 20 is axially displaced towards the disc gear 17. The clutch plate 20 is fixed on and to a pinion shaft 28 arranged coaxially with the gear 17 and its stub shaft 31 and adapted to be shifted axially between an engagement position and a disengagement position by means of an electromagnet 21 mounted on the side of pinion 18 remote from clutch plate 20. The pinion 18 is in mesh with a throttle arm driving gear 14 forming a reduction pair. The throttle arm driving gear 14 is secured on and to an end of a throttle arm driving shaft 14' arranged also coaxially with the rotary shaft 1 and spindle 5. A throttle driving arm 15 is fixed radially on and to the other end of the throttle arm driving shaft 14' and is linked with a shaft of a throttle valve 29 of a carburetor of the car.

An insulating plate 13 is mounted on a face of the gear 14, on which two contacts 11 and 12 are mounted in such a manner that the two contacts, that is, an accelerating contact 11 and a decelerating contact points 12, face the two contacts 6 on blade 7 providing a suitable clearances therebetween, respectively. The accelerating contact 11 and the decelerating contact 12 are electrically connected with the respective windings 19' and 19'' of reversible motor 19 in such a manner that, when either of the two contacts 11 and 12 is engaged by the contactor blade 7, the reversible motor 19 is energized in such a manner so as to be rotated in such a direction as for disconnecting the engaged contact 11 or 12 from the contactor blade 7, by electrically causing a change-over between the positive and negative exciting windings 19' and 19'' of the reversible motor 19. The mounting of the accelerating contact 11 and the decelerating contact 12 on the insulating plate mounted on the throttle arm driving shaft 14' is designed with the intention of maintaining stabilized operation by providing a feedback minor loop.

Referring now to FIG. 4, an electrical circuit connection of the present embodiment will be described. There is provided a storage battery 22 whence a circuit is extended through a key switch 23 and contact 24' of a relay 24 to a point 27 whence a rod is extended to the controlling rod 10. The connection is extended through the spiral spring 8, contactor blade 7, either one of the two fixed contacts 11 or 12, and either of the exciting windings 19' or 19'' of the reversing motor 19. From the point 27, another line is extended through the windings of electromagnet 21 which displaces the clutch plate 20 magnetically. A starter push button 25 is provided for controlling energization of the winding of the relay 24 whereby the means in accordance with this present invention is brought into operating condition by energizing the relay 24. A switch 26 may be mechanically connected with a foot brake 30 of the car so as to release the car from the constant speed maintaining condition by releasing the control means in accordance with this present invention into the inactive state when the car must be decelerated suddenly.

In operation, when the car is running at a normal speed and the adjustable controlling rod 10 has been set at a desired speed which may be indicated on a dial, it is merely necessary to push the starting push button 25 in order to bring the car into a constant speed maintaining condition, whereby the winding of relay 24 is energized and electromagnet 21 is energized and displaces shaft 28 and the clutch plate 20 is brought into engagement with gear 17. Now, if the car speed is lower than the set speed, the movable contactor switch blade 7 is brought into contact with the accelerating fixed contact 11 completing a circuit from the storage battery 22 to the positive driving exciting windings 19' of motor 19 through the key locking switch 23, contacts 24', spiral spring 8, and blade contact 6 and contact 11 and the motor 19 is rotated positively. This rotation is transmitted to the throttle driving arm 15 through the pinion 16, gear 17, clutch plate 20, pinion 18, gear 14, and the throttle arm driving shaft 14' so as to open the throttle valve 29 of the carburetor. When the car gets up to the set speed, the contact 6 of the movable contactor switch blade 7 is separated from the accelerating fixed contact 11 so that the car is not accelerated any more.

When the car is moving at a constant speed but the condition on the road has changed, the equilibrium maintained between the torque applied in the rotary flanged disk 4 and the action of the spiral spring 8 is upset so that the movable contactor blade 7 moves into contact with either the fixed accelerating contact 11 or the fixed decelerating contact 12 on the face of gear 14 as the case may be by the action of the spiral spring 8. Thus the reversible motor 19 is energized to rotate one in the other in direction whereby the throttle valve 29 is either opened or closed.

In emergency or voluntarily in order to release the car from the automatic constant speed maintaining condition, it is only necessary to step on the brake pedal. Then the foot brake switch 26 breaks the circuit so that the relay 24 is deenergized whereby overall mechanisms of this control means are deenergized and the car is brought into the usual steadily running condition at once.

A certain embodiment of the present invention has been illustrated for purposes of description, but it is to be understood that the present invention is not to be limited to this particular form but only by the scope of the appended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a compact speed control device for a motor vehicle, to maintain constant speed, a rotatably journalled principal shaft which is driven by the main shaft of said motor vehicle, a rotatably journalled spindle, mounted coaxially with said principal shaft, magnetic means magnetically coupling and applying torque to said spindle from said principal shaft, an adjustable spiral spring mounted to apply to said spindle torque in the direction opposed to the torque magnetically so applied to said spindle, a switch blade carried on said spindle, a pair of fixed contacts respectively mounted on opposite sides of said switch blade, a reversible motor having a forward drive winding and a backward drive winding, which are respectively connected to the respective contacts of said pair of fixed contacts, a throttle driving arm shaft, and gear transmission means mechanically connecting the drive shaft of said reversible motor to said throttle driving arm shaft for selectively increasing the opening of said throttle driving arm shaft when said motor is rotating in a first direction, and for decreasing the opening of said throttle driving arm shaft when said motor is rotating in the opposite direction. Said gear transmission means comprising a disc gear and a clutch plate coaxially mounted with reference to each other, and axial displacing means for axially displacing said clutch plate with reference to said disc gear, a foot switch operable by a driver of the car, and means connected to said axial displacing means whereby actuation of said foot switch causes actuation of said axial displacing means.

2. In a compact speed control device for a motor vehicle, to maintain constant speed, a rotatably journalled

principal shaft which is driven by the main shaft of said motor vehicle, a rotatably journalled spindle, mounted co-axially with said principal shaft, magnetic means magnetically coupling and applying torque to said spindle from said principal shaft, an adjustable spiral spring mounted to apply to said spindle torque in the direction opposed to the torque magnetically so applied to said spindle, a switch blade carried on said spindle, a pair of fixed contacts respectively mounted on opposite sides of said switch blade, a reversible motor having a forward drive winding and a backward drive winding, which are respectively connected to the respective contacts of said pair of fixed contacts, a throttle driving arm shaft, and gear transmission means mechanically connecting the drive shaft of said reversible motor to said throttle driving arm shaft for selectively increasing the opening of said throttle driving arm shaft when said motor is rotating in a first direction, and for decreasing the opening of said throttle driving arm shaft when said motor is rotating in the opposite direction, said magnetic means comprising a cloverleaf quadripole magnetic element.

3. In a compact speed control device for a motor vehicle, to maintain constant speed, a rotatably journalled principal shaft which is driven by the main shaft of said motor vehicle, a rotatably journalled spindle, mounted co-axially with said principal shaft, magnetic means magnetically coupling and applying torque to said spindle from said principal shaft, an adjustable spiral spring mounted to apply to said spindle torque in the direction opposed to the torque magnetically so applied to said

spindle, a switch blade carried on said spindle, a pair of fixed contacts respectively mounted on opposite sides of said switch blade, a reversible motor having a forward drive winding and a backward drive winding, which are respectively connected to the respective contacts of said pair of fixed contacts, a throttle driving arm shaft, and gear transmission means mechanically connecting the drive shaft of said reversible motor to said throttle driving arm shaft for selectively increasing the opening of said throttle driving arm shaft when said motor is rotating in a first direction, and for decreasing the opening of said throttle driving arm shaft when said motor is rotating in the opposite direction, said gear transmission means comprising a disc throttle arm driving gear and an insulating plate mounted on a face of said disc throttle arm driving gear, and said pair of fixed contacts engageable with said switch blade being mounted on said insulating plate.

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