Dec. 8, 1959 J. B. BURNELL ET AL 2,915,914

IDLE SPEED CONTROL DEVICE

Filed Feb. 10, 1958 2 Sheets-Sheet 1

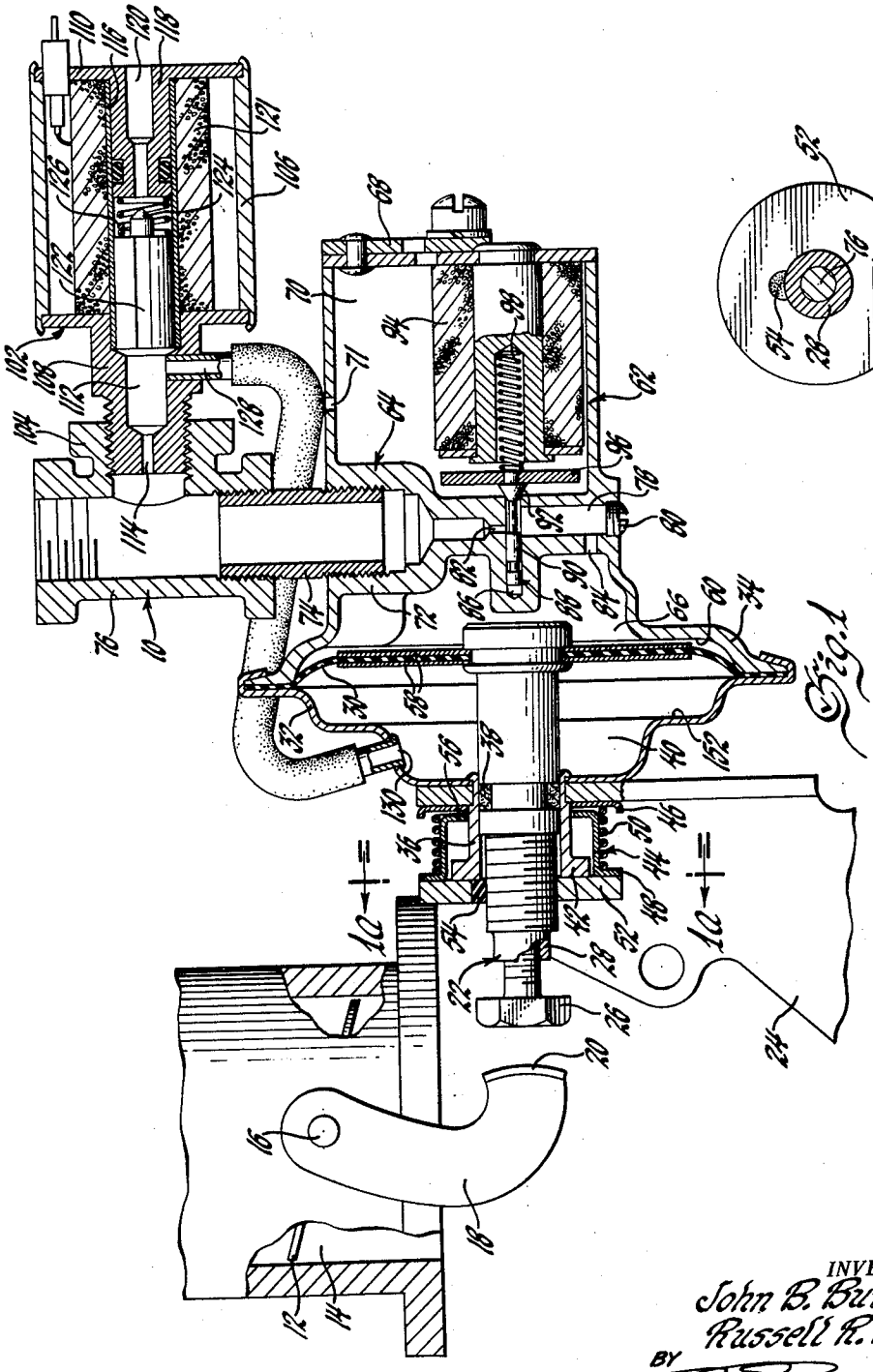


Fig. 1

Fig. 10

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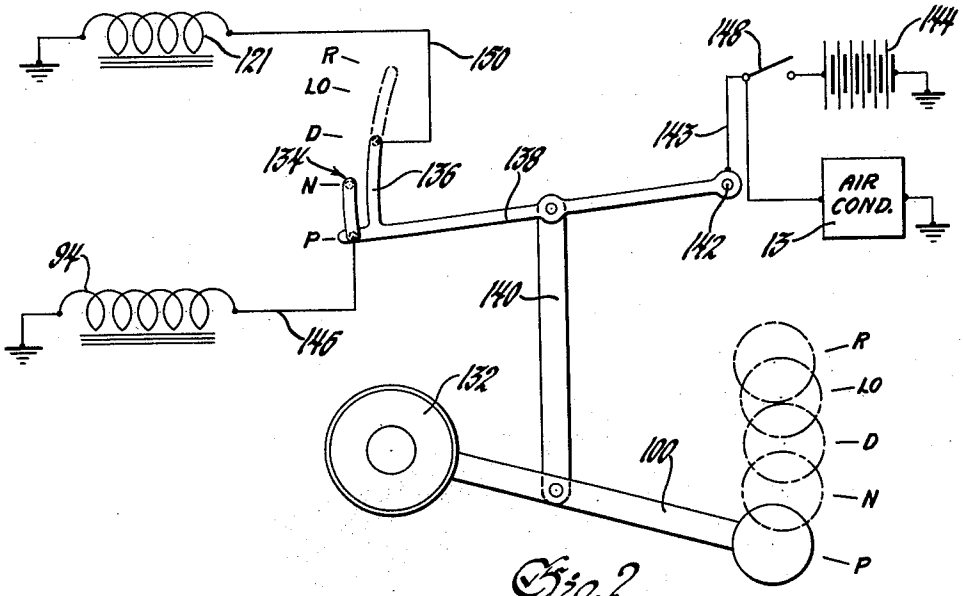


Fig. 2

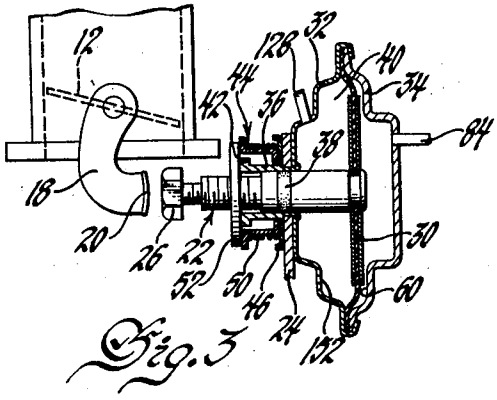


Fig. 3

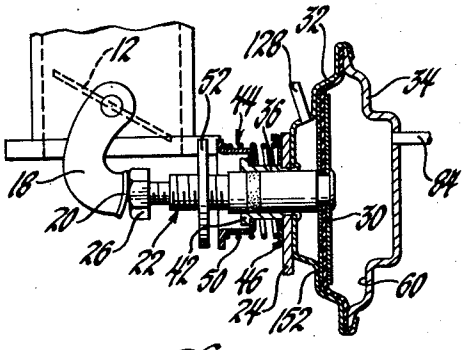


Fig. 5

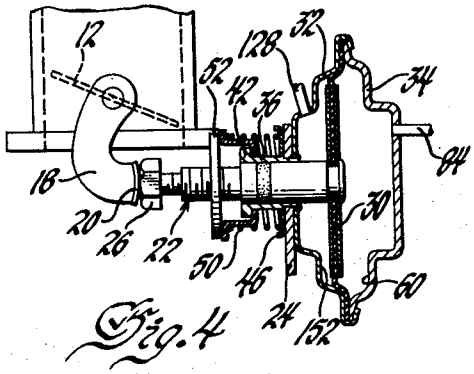


Fig. 4

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IDLE SPEED CONTROL DEVICE

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Application February 10, 1958, Serial No. 714,282

7 Claims. (Cl. 74—472)

The present invention relates to an idle speed control device for use with vehicles having high accessory loads and which loads are intermittently applied to the engine. The subject device may be applied to a vehicle having any type of accessory load which renders it necessary to control the carburetor in such a way as to either maintain a constant engine idling speed whether the load is on or off or which accessory load increase may require an increase in engine idling speed depending on certain conditions which will subsequently be discussed.

The present idle speed control device is particularly adapted for use with air conditioned vehicles in which the air conditioning mechanism varies considerably the type of carburetor operation required.

Devices are known which are adapted to vary the engine idling speed in accordance with changes in engine loading brought about by intermittently utilized accessories such as air conditioning. Such devices are shown in Patent Number 2,762,235 Berninger et al. as well as in copending application Serial No. 436,872 Olson et al., filed June 15, 1954, now Patent No. 2,822,701. These and similar devices, however, have been found not to be sufficiently versatile to comprehend all the various accessory load conditions under which the engine might be idling.

In general the prior devices will increase the engine idling speed over its normal value or maintain it constant if the air conditioning unit is energized with the engine being returned to its normal idling speed or normal throttle setting when the air conditioning system is shut off. In practice, however, there are found to be actually three distinct idling conditions which must be accommodated with such a device if it is to function properly. Under the first condition, with the air conditioning unit off the throttle setting must be such as to accommodate normal engine idling which for illustrative purposes might be 450 r.p.m.

In the case of a vehicle utilizing an automatic transmission, a second situation obtains when the transmission selector lever is in its drive range and the air conditioning unit on. Under these circumstances it is desirable to maintain the engine idling speed at 450 r.p.m. In this case, it is necessary to provide means for increasing the throttle opening to overcome the increased engine load represented by the frictional resistance or drag in the transmission whereby the engine idling speed will be maintained constant at the suggested 450 r.p.m. In general the prior art devices are capable of accommodating the first two conditions of operation. However, there is a third condition which has not been achievable, in combination with the other two, by previous devices.

This third condition obtains when the transmission selector lever is in the park condition with the air conditioning unit on. Under these conditions, that is, the vehicle idling at the curb, there is a high rate of under the hood heat rejection. It is imperative that the engine idling speed be increased in order that the air conditioning mechanism may compensate for the high underhood heat rejection rate. If the prior art devices are adjusted so as to cover this type of operation it will be apparent that under the second condition of operation, that is with the transmission selector lever in the drive range and the air conditioning unit on, that the engine idling speed will be unnecessarily high increasing the tendency of the vehicle to creep.

It is, therefore, the purpose of the present device to provide an idle speed control device which is capable of three-position operation corresponding to the three conditions of accessory-transmission operation set forth above. The subject device enables the engine idling speed to be more closely tailored to the load conditions to which the engine is subjected and which, therefore, insures engine idling operation which is more compatible with engine load requirements.

Other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

Figure 1 is a sectional elevational view of the throttle control mechanism;

Figure 1*a* is a view along line **1***a*—**1***a* of Figure 1;

Figure 2 is a schematic representation of the electrical control circuit for the throttle control mechanism; and

Figures 3 through 5 represent the various operative positions of the throttle control mechanism.

Referring to the drawings, the idle speed control device is indicated generally at **10**. Inasmuch as device **10** may be utilized with any type fuel system, no effort will be made to illustrate the fuel system beyond disclosing a throttle valve **12** rotatably mounted within an induction passage **14**. Thus it is apparent that the quantity of combustible mixture supplied to the engine will be varied by rotating the throttle valve **12** to variably restrict the induction passage **14**.

The throttle valve **12** is suitably fixed to a shaft **16** to which an operating arm **18** is also fixed. Throttle arm **18** terminates in a stop portion or projection **20** which, under conditions to be subsequently described, is adapted to coact with an adjustable stop member **22** which forms a part of the idle speed control mechanism.

At the outset it should be noted that the idle speed control device **10** is intended only to control the idle speed and thus the position of throttle **12** under conditions when the air conditioning system **13** is operative. Otherwise the normal carburetor hot and cold idle stops are p;rovided for controlling the idling position of the throttle valve **12**. Since the hot and cold idle stop members constitute no part of the present invention they have been eliminated from the drawings only to simplify the illustration of the present invention.

Referring now to control device **10**, a bracket **24** is provided to permit the device to be suitably mounted on the engine with which it is to be associated. The adjustable stop member **22** comprises the stud member **26** which is adjustably screwed into a sleeve **28**, the other end of which is centrally clamped to a diaphragm member **30**. The diaphragm **30** is peripherally clamped between casing members **32** and **34**. Thus by rotatably adjusting stud member **26** with relation to sleeve **28** the maximum idle speed of control device **10** may be established.

A sleeve or supporting tube **36** is centrally mounted to casing **32** and is adapted to slidably support the sleeve member **28** therewithin. For reasons which will be apparent subsequently, sleeve **28** is provided with a seal **38** which slidably cooperates with supporting tube **36** to maintain the chamber **40** defined by casing **32** and diaphragm **30** substantially airtight. The supporting tube **36** is fixed to casing **32** by bending or spinning over the

inner ends thereof so as to fixedly mount the tube to the casing. As shown in Figure 1 the control device supporting bracket **24** is fixed to tube **36** and therethrough supports the remainder of control device **10**.

A radial flange **42** is formed at the other end of tube **36** and provides an outer stop for a dished shape spring seat member **44** slidably mounted on the tube. A washer-like seat member **46** is provided on tube member **36** and abuttingly engages bracket **24**. Spring seat **44** includes a radial flange **48** against which one end of a spring element **50** abuts while the other end of the spring abuts against the other seat member **46** to bias the slidable seat to the left or extended position in which it abuts tube flange **42**.

A disc member **52** is fixed to sleeve **28** in a manner so as to be axially adjustable with respect thereto but which is normally retained against axial movement by a nylon insert **54**. Thus once the axial position of the disc **52** is established it will not vary therefrom unless an adjustment is made for reasons which will subsequently be considered. Disc **52** and spring seat **44** are so related that upon the axial movement of sleeve **28** to the right, or idle speed decreasing direction, the disc will engage the seat. Continued rightward movement of the sleeve and disc will cause spring **50** to be compressed until such time as the inner end **56** of seat **44** abuts against the spring seat **46** which ends the movement of adjustable stop **22**.

Reinforcing washers **58** are provided on either side of the diaphragm **30** in order to protect the diaphragm and also to provide a rigid surface adapted to coact with an annular ridge **60** formed on casing member **34**. Ridge **60** provides a stop limiting the leftward or throttle opening position of adjustable stop **22**.

The means for controlling the actuation of diaphragm **30** will now be described. The diaphragm supporting casing **34** is elongated, or otherwise formed, to provide a cylindrical portion **62** adapted to house control devices which will subsequently be described. Casing portion **62** is divided by a wall section **64** which cooperates with diaphragm **30** to provide a control chamber **66**. Wall **64** and the remainder of casing **62** in combination with a cover plate **68** define an additional chamber **70** vented to atmosphere through vent port **71**. Casing **62** and more particularly wall **64** are formed to provide an enlarged boss portion **72** which threadably receives a pipe section **74** adapted to communicate through a T-plug **76** with a source of vacuum. A passage **78** is drilled through wall **64** and communicates at one end with the boss **72** and pipe **74** and is closed at its other end by plug **80**. Passage **78** includes a restriction or orifice **82** therein which reduces the vacuum force adapted to act on diaphragm **30**. Passage **78** communicates through an opening or passage **84** with diaphragm chamber **66**.

Casing wall **64** also includes a transverse passage **86** intersecting passage **78** and open at its inner end to communicate with chamber **70**. A spindle type valve member **88** is slidably mounted in transverse passage **86** and includes a cylindrical land portion **90** and a frustro-conical land portion **92**. The frustro-conical land portion **92** is disposed mainly exteriorly of transverse passage **86** and is adapted to control the degree of communication between the transverse passage and chamber **70**. Cylindrical land **90**, on the other hand, controls the vacuum which may be introduced into chamber **66**.

A solenoid **94** is mounted on end plate **68** so as to be disposed within chamber **70** in axial alignment with the spindle valve **88**. A disc-like armature member **96** is fixedly mounted to the spindle valve **88** proximate the frustro-conical land **92**. A spring member **98** is seated within the core of the solenoid **94** and is adapted to bias armature **96** and the spindle valve **88** to the left when the solenoid is not energized. In this way the frustro-conical land **92** will block the transverse passage **86** from communicating with the chamber **70**. At the same time, cylindrical land **90** will permit the vacuum introduced from

pipe **74** to communicate with the diaphragm chamber **66**. By means to be subsequently discussed, solenoid **94** is adapted to be energized when the vehicle gearshift lever **100** is in its park position.

An additional solenoid device **102** is provided for superimposing a control force on the device **10** which reflects the operative condition of the air conditioning unit. Solenoid device **102** will now be described. The T-plug **76** mounted on pipe **74** provides a boss **104** which threadably supports solenoid casing **106**. A solenoid coil is disposed within casing **106** which is enclosed by end plates **108** and **110**. End plate **108** includes a passage **112** which communicates through a restricted portion **114** with the T-plug and hence the source of vacuum.

A tube **116** is adapted to seat within an enlarged portion of end plate **108** and is supported at its other end upon a boss **118** extending inwardly from end plate **110**. Casing boss **118** includes a longitudinally extending passage **120** therethrough which communicates the interior of tube **116** with the atmosphere.

An axially fluted armature-valve member **122** is slidably supported within tube **116** and includes a tapered end portion **124** adapted to coact with the longitudinally extending boss passage **120** to block the flow therethrough when solenoid **121** is energized. However, a spring member **126** disposed between boss **118** and the slidable valve member **122** urges the valve member to the left which communicates the end casing passage **112** with the atmosphere.

A conduit **128** communicates with end casing passage **112** and at its other end with an opening **130** in diaphragm casing **32**. Thus with the solenoid controlled fluted valve **122** in the position shown in Figure 1 the diaphragm control chamber **40** is vented to the atmosphere.

The means for controlling the solenoids **94** and **121** is shown schematically in Figure 2 and will now be described. Transmission selector lever **100** is rotatable about its pivot point **132** to the varying positions indicated by the letters P, N, D, L*o* and R signifying the various operating conditions of the transmission. A transmission selector lever controlled switch is indicated generally at **134** and includes a movable contact member **136** articulated through a lever **138** and a link **140** to the transmission selector lever. The movable contact lever **138** is pivoted at **142** and is connected through a lead **143** with the vehicle battery **144**. Switch **134** includes the fixed terminals indicated at N and P which correspond to the transmission selector lever positions represented by neutral and park. The fixed terminals N and P connect through a lead **146** with solenoid **94**.

A switch **148** controlled by the air conditioning actuating mechanism is interposed in lead **143** between the battery **144** and the movable contact **136** of switch **134**. The movable contact **136**, through a lead **150**, energizes solenoid **121** whenever the air conditioning switch **148** is closed. With the air conditioning switch closed and the transmission selector lever in either the neutral or park positions, both solenoids **94** and **121** will be energized.

Referring especially to Figures 3, 4 and 5 in conjunction with Figure 2, the operation of the control device **10** is as follows. With the air conditioning switch **148** off or open both solenoids **91** and **121** will be deenergized as shown in Figure 2. Under this condition diaphragm chamber **40** will be vented to the atmosphere through conduits **120**, **112** and **128**. With the solenoid **121** deenergized, restricted passage **114** will provide a limited atmospheric bleed in vacuum pipe **74**. However, the vacuum force in the pipe and hence the remainder of the system is not seriously affected by such bleed. Further, inasmuch as solenoid **94** is also deenergized, spindle valve land **92** will block the communication of transverse passage **86** with atmospherically vented chamber **70** and at the same time will permit the vacuum force in passage **78** to be communicated to diaphragm chamber **66** which will cause the diaphragm to be moved to the right as

seen in Figures 1 and 3. Under these conditions sleeve disc **52** will engage flange **48** of spring seat **44** compressing spring **50** and moving the adjustable stop **22** to its rightmost position. As a result, throttle valve **12** is positioned by its normal stop members to provide an appropriate idling speed which for illustrative purposes may be 450 r.p.m.

Next with the air conditioning switch **148** on and the transmission selector lever **100** moved to any of the drive positions (D, Lo or R) it will be appreciated that it will be necessary to increase the degree of opening of throttle **12** to maintain a constant, e.g. 450 r.p.m., engine idling speed in view of the air conditioning load now imposed on the engine. Accordingly, the movable contact **136** is out of engagement with the fixed contacts N or P under which condition only the solenoid **121** is energized. Under this condition the solenoid controlled fluted valve **122** blocks the atmospheric bleed passage **120** which permits manifold vacuum to be communicated through passages **114**, **112** and **128** to diaphragm chamber **40**. In this way the vacuum forces in chambers **40** and **66** substantially neutralize each other. Spring **50**, therefore, will now expand and in so doing move the spring seat **44** and with it disc **52** to the left until flanged end **56** of spring seat **44** engages the annular flange **42** of tube **36** leaving the elements in the position shown in Figure 4. In this position the adjustable stop **22** engages the projection **20** of the throttle arm **18** and opens the throttle sufficiently to maintain the desired engine idling speed, e.g. 450 r.p.m.

In the event the vehicle is now parked at the curb with the engine running and the air conditioning unit on it has been found that the rate of heat rejection under the hood is considerably increased. To provide for proper functioning of the air conditioning system, it is necessary to increase the engine idling speed by an appreciable amount which again for illustrative purposes may be considered to be as much as to 900 r.p.m. Thus with the transmission selector lever now in either the neutral or park position, solenoid **94** will also be energized. Under this condition, the spindle valve **88** is moved to its rightmost position by the armature disc **96** causing the cylindrical land **90** to block the flow of vacuum to diaphragm chamber **66** and at the same time permitting the frustroconical land **92** to open said chamber to the atmospherically vented chamber **70**. Now manifold vacuum is acting only in diaphragm chamber **40** which causes the diaphragm to be moved still further to the left, as shown in Figure 5, until the left diaphragm reinforcing disc **58** abuts the annular shoulder **152** formed on diaphragm casing member **32**. This further leftward movement of the diaphragm **30** will cause the sleeve **28** and the disc **52** to move relative to the spring seat **44** and to move the throttle valve **12** to a more fully opened position which will cause the engine idling speed to be increased in the amount already suggested.

While the mechanism shown in the drawings is fully operative to provide the three throttle settings, as described, it is apparent that various structural modifications may be made in the subject device within the scope of the invention comprehended by the hereinafter appended claims.

We claim:

1. Apparatus for controlling the idling speed of the engine of an automotive vehicle comprising in combination an induction passage for supplying a combustible mixture to said engine, a throttle valve in said passage for controlling the quantity of flow therethrough, means for applying an accessory load to said engine, a transmission selector lever movable to a plurality of driving and non-driving positions, means for moving the throttle toward open position for increasing the idling speed of the engine, a first device controlled by said accessory load controlling means, a second device controlled by said transmission selector lever, said first and second devices

cooperating to maintain the throttle moving means in an inoperative position relative to the throttle valve when the accessory load is not applied and the transmission selector lever is in one of its driving positions whereby the throttle valve is disposed in its normal idle position, said first device being adapted to permit said throttle moving means to open said throttle valve to a second position when said accessory load is applied, and said second device being adapted to permit said throttle moving means to position said throttle valve in a third position more open than the second when said transmission selector lever is placed in one of its non-driving positions with the accessory load applied.

2. Apparatus for controlling the idling speed of the engine of an automotive vehicle comprising in combination an induction passage for supplying a combustible mixture to said engine, a throttle valve in said passage for controlling the quantity of flow therethrough, switch means for applying an accessory load to said engine, a transmission selector lever movable to a plurality of driving and non-driving positions, switch means adapted to be actuated by the selector lever when in a non-driving position, means for moving the throttle toward open position for increasing the idling speed of the engine, a first solenoid device controlled by said accessory switch means, a second solenoid device controlled by said transmission selector lever switch means, circuit means electrically interconnecting the first and second solenoid devices and the throttle moving means whereby said devices cooperate when deenergized to maintain the throttle moving means in an inoperative position relative to the throttle valve when the accessory load is not applied and the transmission selector selector lever is in one of its driving positions whereby the throttle valve is disposed in its normal idle position, said first solenoid device when energized by the accessory switch means being adapted to permit said throttle moving means to open said throttle valve to a second position, and said second solenoid device when energized by the selector lever switch means being adapted to permit said throttle moving means to position said throttle valve in a third position more open than the first.

3. An apparatus for controlling the idling speed of the engine of an automotive vehicle comprising in combination an induction passage for admitting a combustible charge to said engine, a throttle valve disposed in said passage for controlling the quantity of flow therethrough, a servo mechanism for moving the throttle toward open position for increasing the idling speed of the engine, said servo mechanism comprising a casing having a movable member disposed therewithin, said casing and movable member defining a pair of chambers on opposite sides of said movable member, conduit means adapted to admit a vacuum control force to both of said chambers, a first valve means normally biased to a position venting one of said chambers to atmosphere, a second valve means normally biased to a position admitting said vacuum force to the other of said chambers whereby said servo mechanism is rendered inoperative to position the throttle valve whereby the throttle valve is disposed in its normal idle position, means for shifting said first valve means to a position blocking said atmospheric vent in which condition the vacuum force is admitted to both of said chambers permitting the servo mechanism to move said throttle valve to a second idle position, and means for moving said second valve means to a position in which the associated chamber is vented to atmosphere permitting said servo mechanism to move said throttle valve to a third idle position.

4. An apparatus for controlling the idling speed of the engine of an automotive vehicle comprising in combination an induction passage for admitting a combustible charge to said engine, a throttle valve disposed in said passage for controlling the quantity of flow therethrough, a servo mechanism for moving the throttle toward open

position for increasing the idling speed of the engine, said servo mechanism comprising a casing having a movable member disposed therewithin, said casing and movable member defining a pair of chambers on opposite sides of said movable member, conduit means adapted to admit a vacuum control force to both of said chambers, a first valve means normally biased to a position venting one of said chambers to atmosphere, a second valve means normally biased to a position admitting said vacuum force to the other of said chambers whereby said servo mechanism is rendered inoperative to position the throttle valve whereby the throttle valve is disposed in its normal idle position, a solenoid for shifting said first valve means to a position blocking said atmospheric vent in which condition the vacuum force is admitted to both of said chambers permitting the servo mechanism to move said throttle valve to a second idle position, and a solenoid for moving said second valve means to a position in which the associated member is vented to atmosphere permitting said servo mechanism to move said throttle valve to a third idle position.

5. An apparatus for controlling the idling speed of an engine as set forth in claim 3 in which said servo mechanism includes a control rod fixed to said movable member and which rod is adapted to actuate said throttle valve, a flange member fixed for movement with said control rod, a sleeve member slidably mounted with respect to said control rod for axial movement relative thereto, spring means biasing said sleeve into engaging position with said flange member to move the control rod in a throttle opening direction, stop means to limit the throttle opening movement of said sleeve, said flange member being adapted to engage said sleeve and compress said spring means when said servo mechanism is in its inoperative position, said spring means being adapted to move said sleeve, flange member and said control rod to position the throttle valve in said second idle position when said vacuum force is admitted to both of said servo chambers, and said flange member and control rod being moved axially away from said sleeve to position said throttle valve in said third idle position when said vacuum force is admitted to the first vented servo chamber.

6. An apparatus for controlling the idling speed of an engine of an automotive vehicle comprising in combination an induction passage for admitting a combustible charge to said engine, a throttle valve disposed in said passage for controlling the quantity of flow therethrough, a servo mechanism for moving the throttle toward open position for increasing the idling speed of the engine, said servo mechanism comprising a diaphragm having chambers formed on opposite sides thereof in open communication with said diaphragm, first conduit means communicating with one of said chambers, second conduit means communicating with the other of said chambers, a common source of vacuum communicating with each of said conduit means, first and second valve means respectively disposed in said first and second conduit means, each of said valve means being adapted to communicate its associated servo chamber with said vacuum source or with the atmosphere whereby said servo mechanism may move the throttle valve to a plurality of open positions.

7. An apparatus for controlling the idling speed of an engine of an automotive vehicle comprising in combination an induction passage for admitting a combustible charge to said engine, a throttle valve disposed in said passage for controlling the quantity of flow therethrough, a servo mechanism for moving the throttle toward open position for increasing the idling speed of the engine, said servo mechanism comprising a diaphragm having chambers formed on opposite sides thereof in open communication with said diaphragm, first conduit means communicating with one of said chambers, second conduit means communicating with the other of said chambers, a common source of vacuum communicating with each of said conduit means, first and second valve means respectively disposed in said first and second conduit means, a spring member normally biasing the first valve means to vent the first conduit means and associated diaphragm chamber to the atmosphere, a spring member normally biasing the second valve means to admit vacuum to the second conduit means to shift the diaphragm to a position permitting the throttle valve to assume a first idle position, means shifting the first valve to admit vacuum to the second conduit means permitting the throttle valve to assume a second idle position and means for opening the second valve means to atmosphere whereby the diaphragm shifts the throttle valve to a third idle position.

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