Nov. 23, 1965 J. PICKLES 3,219,777

GOVERNOR SWITCH HAVING A LINK WITH CONTACTS AND A LEVER WITH CONTACTS BOTH PIVOTALLY MOUNTED ON THE SAME AXIS

Filed March 20, 1961 3 Sheets-Sheet 1

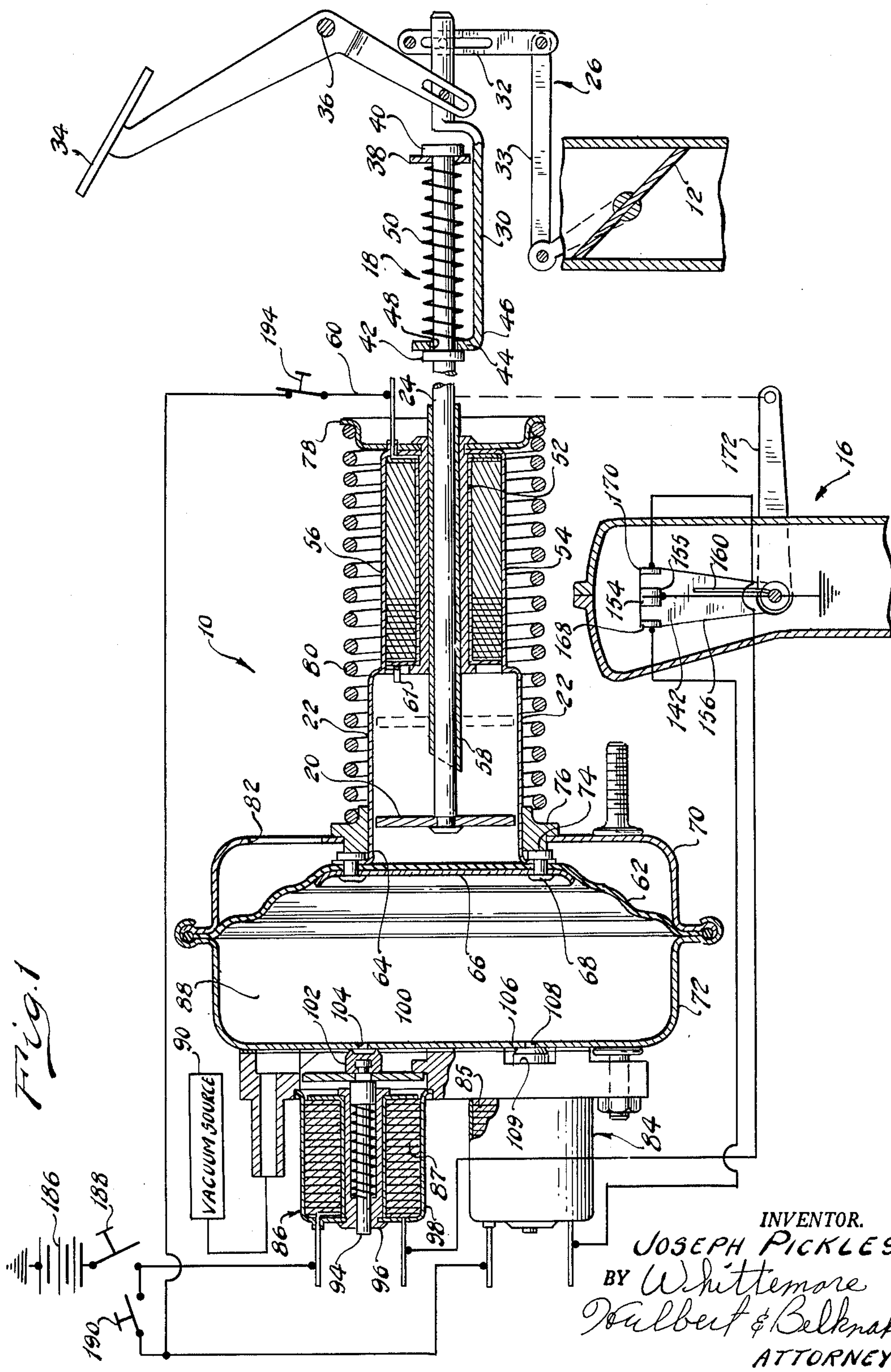

Fig. 1

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Fig. 2

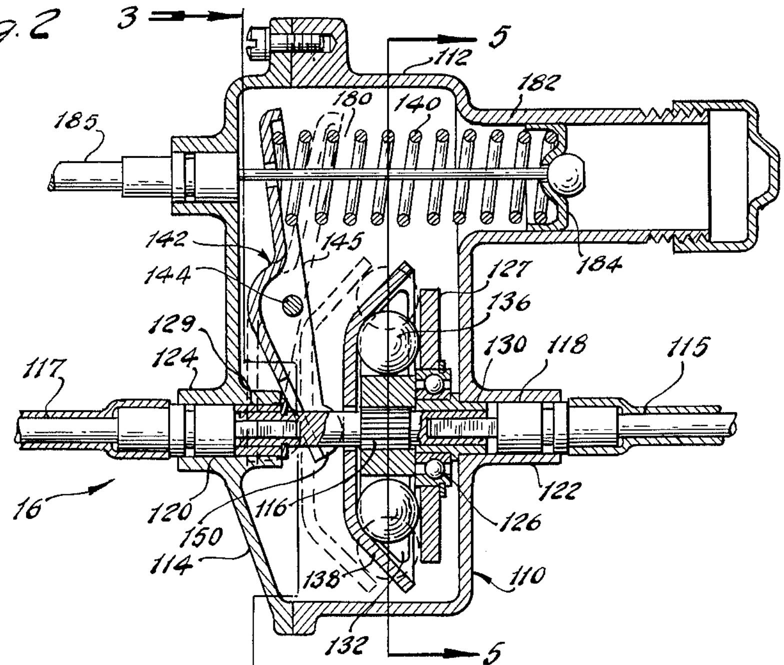

Fig. 3

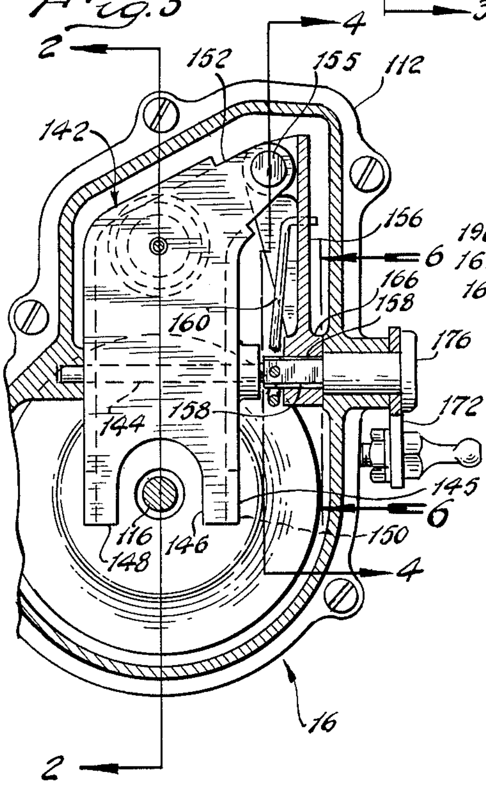

Fig. 4

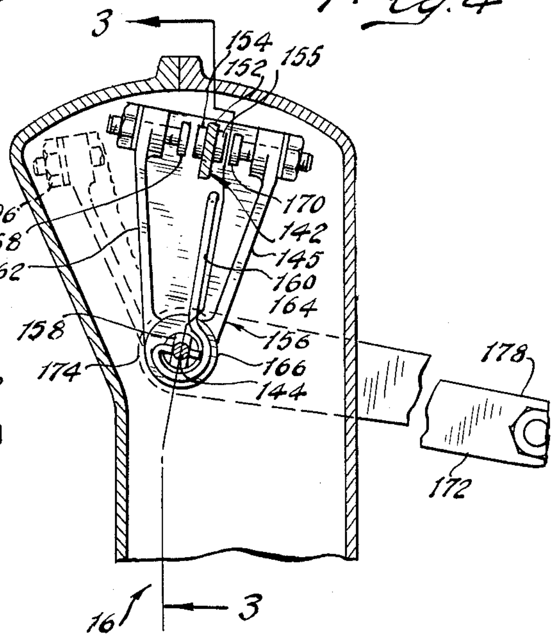

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Fig. 7

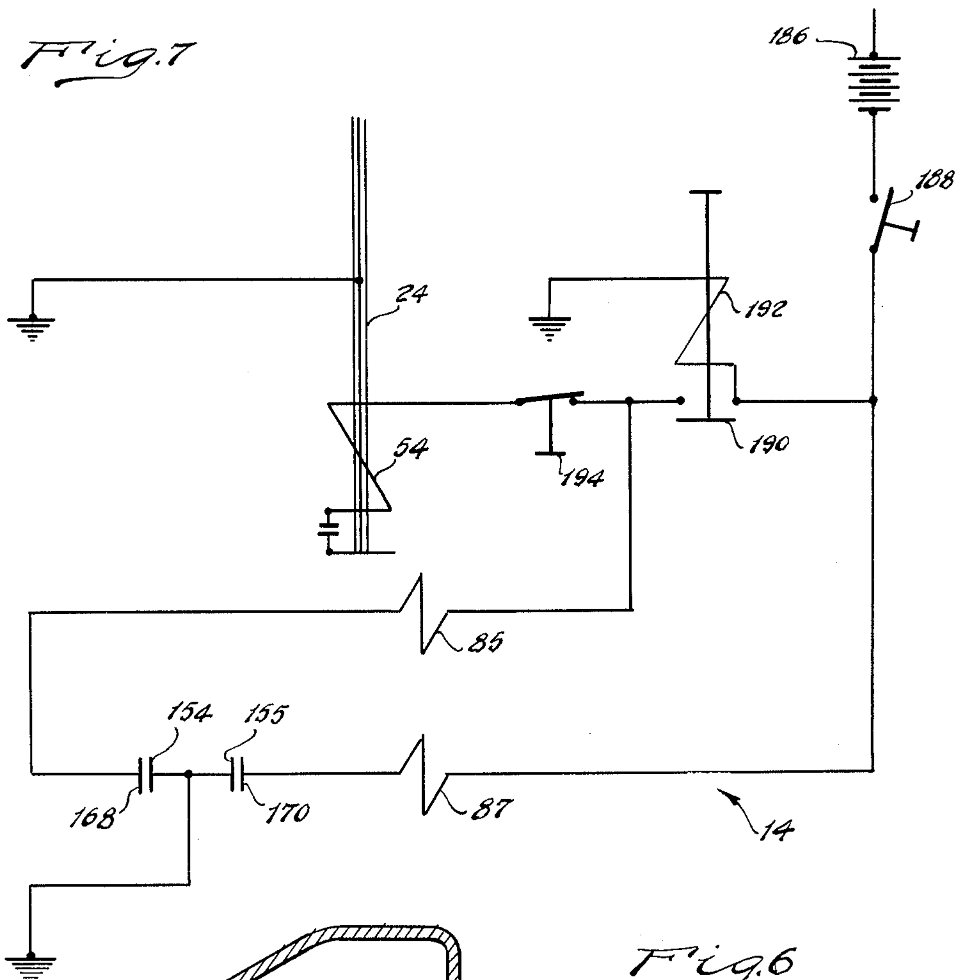


Fig. 6

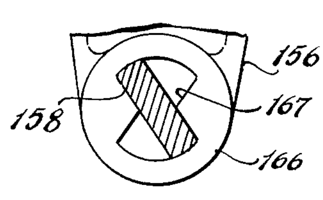
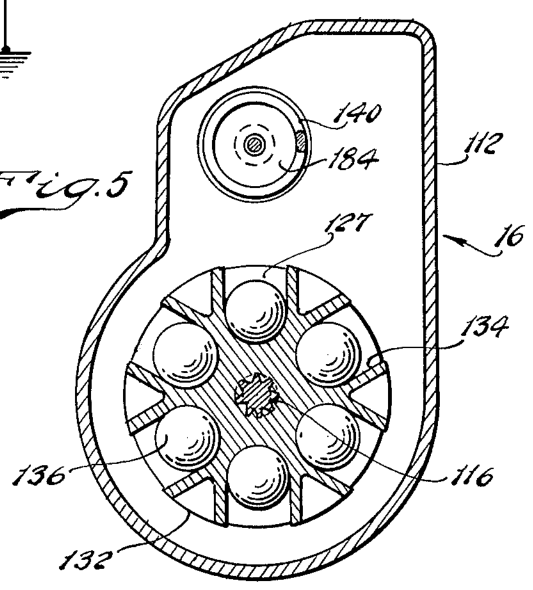


Fig. 5



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GOVERNOR SWITCH HAVING A LINK WITH CONTACTS AND A LEVER WITH CONTACTS BOTH PIVOTALLY MOUNTED ON THE SAME AXIS

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10 Claims. (Cl. 200—80)

The invention relates to speed control systems and refers more specifically to a speed responsive switch in a governor for an automobile or similar device which governor in conjunction with the centrifugal switch is operable to indicate that the device is operating at or above a predetermined speed or to bring the device up to a predetermined speed and to hold the device between limits at the predetermined speed and includes override mechanism to permit exceeding of the predetermined speed.

In the past speed responsive switches for use in conjunction with governors have often lacked desired versatility. In particular prior automobile governors including speed responsive switches have often lacked means for bringing an automobile up to a predetermined governed speed and override means whereby at the option of an operator the speed of the automobile could be increased beyond the predetermined speed. Also such governors have often not included means for selectively initiating operation of the governor.

In addition wherein speed responsive switches having required versatility have in the past been provided in governors the switches and resulting governors have usually been complicated whereby their reliability is poor and their expense prohibits their use by the general public.

Therefore, it is one of the purposes of the present invention to provide an improved speed responsive switch for use in conjunction with an automobile governor or the like.

Another object is to provide a speed responsive switch including a first pivotally mounted lever having electric contacts on one end thereof, centrifugal speed responsive means acting on the other end of the lever, spring means operating on the one end of the lever in opposition to the centrifugal means and a second lever pivotally mounted on the same pivot axis as the first lever having electrical contacts thereon positioned on opposite sides of the contacts on the one end of the first lever.

Another object is to provide switch structure as set forth above and further including means for preloading the spring whereby movement of the first lever will not take place until a predetermined speed is sensed by the centrifugal speed responsive means.

Another object is to provide a lost motion pivot connection for the second lever and means for resiliently biasing the second lever in one direction in the lost motion connection.

Another object is to provide structure as set forth above and further including means for determining the position of the second lever relative to the first lever.

Another object is to provide a speed responsive switch as set forth above which is simple in construction, economical to manufacture and efficient in use.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating a preferred embodiment of the invention, wherein:

FIGURE 1 is a partially diagrammatic, partially schematic representation of governing apparatus including speed responsive switch structure constructed in accordance with the invention.

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FIGURE 2 is a section of the speed responsive switch or mechanical speed sense portion of the governing apparatus illustrated in FIGURE 1 showing the speed sense elements in the position thereof before governing action occurs in full lines and indicating their position at governing speed in broken lines.

FIGURE 3 is a cross sectional view of the speed sense illustrated in FIGURE 2 taken substantially on the line 3—3 of FIGURE 2.

FIGURE 4 is a section view of the speed sense illustrated in FIGURE 2 taken substantially on the line 4—4 in FIGURE 3 showing the speed sense elements in the position thereof at governing speed in full lines and indicating their position before governing action occurs in broken lines.

FIGURE 5 is a cross section of the mechanical speed sense illustrated in FIGURE 2 taken substantially on the line 5—5 in FIGURE 2.

FIGURE 6 is an enlarged partial section of the mechanical speed sense portion of the governing apparatus illustrated in FIGURE 1 taken substantially on the line 6—6 in FIGURE 3.

FIGURE 7 is a schematic diagram of the electric control circuit of the governing apparatus illustrated in FIGURE 1.

With particular reference to the figures one embodiment of the present invention will now be disclosed.

As shown in FIGURE 1 the speed control system comprises the vacuum throttle operating means **10** for positioning a throttle valve **12**. The vacuum throttle operating means **10** is actuated by the electric control circuit **14** shown best in FIGURE 6. Portions of the electric control circuit **14** are energized by the speed responsive or mechanical speed sense **16** of the invention shown best in FIGURES 2–6.

The speed control system operates to open the throttle valve **12** to bring the automobile engine or other device with which the throttle valve **12** is associated up to a governing speed and to maintain the speed of the device between predetermined governing limits. In addition override mechanism **18** is provided so that should the operator of the automobile desire he may at any time override the governing apparatus and increase the speed of the automobile beyond the governing limits.

More specifically the vacuum throttle control mechanism **10** comprises the solenoid armature **20** slidable within the cylinder **22** and secured to one end of the armature rod **24**. The armature rod **24** is connected to throttle actuating linkage **26** through the override mechanism **18**.

The throttle actuating linkage **26** includes the actuating rod **30**, lever **32** and member **33** for pivoting the throttle into an open position on movement of the actuating rod **30** to the right in FIGURE 1. Actuating rod **30** may be moved to the right by moving the accelerator pedal **34** in a counterclockwise direction about pivot means **36**.

Override mechanism **18** comprises an abutment **38** on the end **40** of the armature rod **24**, and a further abutment **42** on the armature rod **24** spaced from the end **40** thereof. A flange **44** on the end **46** of the actuating rod **30** is provided with an opening **48** therein, and is sleeved over the end **40** of the armature rod **24** for reciprocation between the abutments **42** and **38**. The override mechanism is completed by the prestressed spring **50** acting between the abutment **38** and the flange **44** to urge the flange **44** into contact with the abutment **42**.

Thus in operation when it is desired to override the governor mechanism and to move the actuating rod **30** to the right a distance greater than allowed by the positioning of the armature rod **24** by the vacuum throttle operating means, sufficient pressure is placed on the accelerator pedal to overcome the prestressing of the spring **50** whereby the flange **44** is moved toward the abutment **38** of the armature rod **24** and the throttle valve **12** is opened.

Armature rod **24** reciprocates within the core **52** of the solenoid **54** secured within the reduced diameter portion **56** of the cylinder **22**. The armature rod **24** is insulated from the solenoid **54** by the insulating sleeve **58** as shown. The solenoid **54** is energized through conductor **60**, the flexibily mounted contact **61**, armature **20**, and armature rod **24** to ground on movement of the armature rod to the right in FIGURE 1 by means of the accalerator pedal **34** and actuating rod **30**. After the initial completing of the circuit through the solenoid **54** by means of the accelerator pedal the armature is held in contact with the solenoid **54** by magnetic attraction to maintain electric engagement between armature **20** and contact **61** and thereby keep the solenoid **54** energized.

Cylinder **22** has diaphragm **62** secured to the end **64** by convenient means, such as plate **66** and rivets **68**. The outer periphery of diaphragm **62** is secured between the housing members **70** and **72** as shown. Housing members **70** is provided with an opening **74** therethrough in which the collar **76** is rigidly mounted to provide a guide for sliding axial movement of the cylinder **22**. The housing part **70** is also provided with an opening **82** therethrough for maintaining the pressure between housing part **70** and diaphragm **62** at that of the surrounding atmosphere.

The cylinder **22** further includes an abutment **78** secured to the other end thereof. Spring **80** having one end abutting against the abutment **78** and the other end abutting against the collar **76** is provided to bias the cylinder **22** which is connected to the diaphragm **62** and guided in the collar **76** to the right, as shown in FIGURE 1.

A pair of solenoid actuated valves **84** and **86** are secured to the housing portion **72**. The valve **86** is provided to connect the chamber **88** formed between the diaphragm **62** and housing member **72** to a source of vacuum **90** when energized. The valve **84** is operable only when energized to connect the chamber **88** with the surrounding atmosphere. Solenoids **85** and **87** of valves **84** and **86** respectively are connected in the electric control circuit **14** so that both may not be energized at the same time.

Valves **84** and **86** are entirely similar and therefore only valve **86** will be considered in detail. The valve **86** includes an actuating solenoid **87** and the shaft **94** extending axially through and guided by the solenoid core **96**. Spring **98** is provided to bias the shaft **94** and the disc **100** carried thereon toward the housing member **72**. The valve head **102** is mounted on disc **100** for seating against the housing portion **72** over the metering orifice **104** therein.

Thus on coil **87** being energized the shaft **94** and disc **100** will move to the left as shown in FIGURE 1 whereby the valve head **102** will unseat to permit a vacuum to be drawn in chamber **88** by vacuum source **90**. The valve **84** which is similar to the valve **86** is un-energized at this time so that the valve head **106** thereof has sealed the metering orifice **108**.

Conversely if the solenoid valve **84** is energized the chamber **88** is open to the atmosphere and valve head **102** is seated against the housing member **72**. When both valves are closed thet chamber **88** is constructed to maintain the vacuum condition therein at the time of seating of the valve heads **102** and **106**.

Thus in operation the position of the armature rod **24** is determined by the vacuum condition in the chamber **88** when the solenoid **54** has been energized since the vacuum condition in chamber **88** determines the position of the cylinder **22** which moves in opposition to the spring **80** on a vacuum being drawn in the chamber **88**.

The mechanical speed sense **16** includes the housing **110** having the base **112** and cap **114** which may be secured together by convenient means (not shown). A rotatable shaft **116** extends through the housing **110** and is supported in bushings **129** and **130** for rotation due to engagement with the squared ends of drive cables **115** and **117**. Drive cables **115** and **117** are rotatably supported in bearings **118** and **120** in the sleeves formed by the annular flanges **122** and **124** respectively on the base **112** and cap **114** as shown. Bearing **126** carrying disc **127** is secured to bushing **130** mounted on shaft **116** as shown. A ball separator **132** having radially extending slots **134** therein in which the ball weights **136** move on rotation of shaft **116** is secured to shaft **116** for rotation therewith as shown best in FIGURES 2 and 5. The annular ball retaining cup **138** is sleeved over shaft **116** and retains the ball weights **136** within the radial slots **134**.

In operation the shaft **116** is rotated at a speed proportional to the speed to be governed. For example, in an automobile the shaft **116** may be connected to rotate at the speed of the speedometer cable through cable **115** or cable **117** or if it is desired to govern engine speed cable **115** or **117** may be rotated by the engine. On rotation of the shaft **116** the balls **136** move radially outwardly in the slots **134** due to centrifugal force and force the cup **138** which is slidably mounted on the shaft **116** to move to the left, as shown in FIGURE 2, against the bias applied thereto by means of the spring **140** through lever **142**. Thus the position of the lever **142** is a direct function of the speed of rotation of the shaft **116** and the resisting force applied thereto by the spring **140**.

Lever **142**, shown best in FIGURES 2, 3 and 4, is pivotally mounted on pivot pin **144**. Lever **142** is provided with flanges **145** for stiffening and pivotal mounting thereof. Lever **142** has notch **146** in the end **148** thereof through which the shaft **116** extends. The flanges **145** are further provided with the rounded end portion **150** urged into engagement with the cup **138** by the spring **140**. End **152** of lever **142** is provided with electric contacts **154** and **155** on opposite sides thereof.

A contact member **156** as shown best in FIGURES 3 and 4 is sleeved on the flat portion **158** of the pivot pin **144** and is secured to the pivot pin **144** for rotation therewith by means of the lost motion connection therebetween as shown in FIGURE 6. The contact member **156** is generally U-shaped, as shown best in FIGURE 4, and has the leg portions **162** and **164** rigidly secured together by means of the hub **166** having opening **167** shaped as shown therein through which the pivot pin **144** extends.

Electrical contacts **168** and **170** are secured to the outer ends of the legs **162** and **164** of contact member **156** on opposite sides of the end **152** of lever **142**. On pivoting of the lever **142** about the pivot pin **144** in a counterclockwise direction, as shown in FIGURE 4, the contact member **168** will engage the contact member **154** on one side of the lever **142** whereby an electrical circuit will be completed through the contact members. On pivoting of the lever **142** in a clockwise direction about the pivot pin **144** an electric circuit will similarly be completed through the contact members **170** and **155**.

Spring **160** which is fixed to the pivot pin **144** at one end and to the contact member **156** at the other end is provided to urge the contact member into the position relative to the pin **144** shown in FIGURE 6. Substantial angular movement between the contact member and pin **144** due to clockwise movement of lever **142** is permitted by spring **160** on application of little force to lever **142** above that necessary to overcome the force of spring **140** since spring **160** is relatively weak. The lost motion connection illustrated in FIGURE 6 and spring **160** thus cooperates to prevent any substantial pressure from being applied to accelerator pedal **34** by lever **142** during operation of the governor which might otherwise occur as will become more evident when the over-all operation of the governor is considered.

The link **172** is rigidly secured at end **174** to the outer end **176** of pivot pin **144** as shown best in FIGURE 3. The link **172** is connected at the other end **178** to the armature rod **24**, as shown diagrammatically in FIGURE 1, to provide a feed back from the vacuum throttle operating means **10** in operation. The link **172** is so connected to the armature rod **24** that closing the throttle **12** produces clockwise movement of the link **172**, as shown in FIGURE 4, and movement of contact **168** toward engagement with the contact **154**. Similarly opening of the throttle **12** causes counterclockwise movement of the link **172** in FIGURE 4 by the rod **24**, so that the contact **170** is moved toward engagement with contact **155**.

As previously indicated the spring **140** is provided to bias the lever **142** into engagement with the cup **138** of the speed sense at all times. The end **180** of spring **140** thus bears against the end **152** of the lever **142** while the end **182** of the spring **140** bears against the adjustable abutment **184**. Spring **140** is under initial compression so that the lever **142** will not begin to pivot about the pivot pin **144** until a speed closely approaching the governing speed is reached. At the governing speed the force applied to lever **142** by the spring **140** will exactly balance the force applied to the lever **142** by the cup **138** due to radially outward movement of the balls **136** on rotation of the shaft **116**. The speed at which such balance will occur may be adjusted by moving the position of the abutment **184** by means of cable **185**.

The electric control circuit **14** of the speed control system of the invention, best shown in FIGURE 7, will be considered in conjunction with the over-all operation of the speed control system. In over-all operation it will be assumed that the speed control system is installed in a vehicle having a battery **186** and that the vehicle is in operation at a speed below the desired governing speed with the ignition switch **188** closed.

When the vehicle operator desires to operate the vehicle at governed speed a manual switch **190** which may be conveniently located for operation by the vehicle operator is actuated to complete an electric circuit from the battery **186** through a switch holding solenoid **192**. The accelerator pedal **34** of the vehicle is then pivoted counterclockwise to open the throttle **12** and move the actuating rod **26** and armature rod **24** to the right in FIGURE 1 to cause engagement between armature **20** and flexible contact **61** of solenoid **54**. The solenoid **54** is thus energized by the battery **186** through the normally closed brake switch **194**, solenoid **54**, armature **20** and armature rod **24**. The armature **20** is therefore held in contact with the solenoid **54** for movement with the cylinder **22** as previously indicated.

At this time the cylinder **22** is biased in a limiting position to the right in FIGURE 1 by the spring **80** so that the rod **24** holds the throttle **12** in an open position. Also the feed-back link **172** at this time is in a limiting counterclockwise position in FIGURE 4 whereby the contact member **156** is also in a limiting counterclockwise position, as illustrated in dotted lines at **196** in FIGURE 4.

The lever **142** is in a limiting counterclockwise position since the vehicle has been travelling at a speed below the governing speed thereof and the spring **140** is under compression so that it will not begin to move in a clockwise direction about the pivot pin **144** until the speed of the automobile approaches the governing speed. If, for instance, the governing speed of the vehicle is set at sixty miles per hour, the compression of the spring **140** may be set so that the lever **142** does not begin to move in a clockwise direction until the speed of the vehicle is fifty-nine miles per hour.

Thus until the speed of the vehicle is raised by the open throttle to fifty-nine miles per hour contacts **168** and **154** are engaged to energize the solenoid actuated valve **84**, as shown in FIGURE 1, whereby the chamber **88** is opened to atmospheric pressure. At fifty-nine miles per hour the rotation of the shaft **116** produces movement of the cup **138** to pivot the lever **142** in a clockwise direction in opposition to the bias of the spring **140** so that the engagement between the contacts **154** and **168** is broken so that valve **106** closes opening **108**. The clockwise movement of the lever **142** will continue as the speed of the vehicle increases to sixty miles per hour at which time the contacts **155** and **170** engage to energize the solenoid actuated valve **86** whereby a vacuum is produced in the chamber **88** by vacuum source **90**.

The vacuum in chamber **88** will cause the cylinder **22** to move in a left direction in FIGURE 1, to produce closing of the throttle **12** through the armature rod **24**. Movement of the armature rod **24** in a leftward direction produces clockwise movement of the feed-back link **172** to produce clockwise movement of the contact member **156** and therefore disengagement of the contact members **155** and **170**. Since both solenoid actuated valves **84** and **86** are unactuated at this time the vacuum condition in the chamber **88** will be maintained. The vehicle speed at this time will be between fifty-nine and sixty-one miles per hour or approximately sixty miles per hour at which speed the lever **142** is balanced by spring **140** and weights **136** through cup **138** with the contacts **154**, **168**, **155** and **170** all out of engagement.

Should the vehicle speed again increase beyond the governing speed the lever **142** will again move to engage the contacts **155** and **170** to draw vacuum in the chamber **88** and more fully close the throttle **12** in the manner previously indicated. Should the speed of the automobile decrease the lever **142** will move in a counterclockwise direction to engage the contacts **154** and **168** whereby the chamber **88** is open to the atmosphere through port **109** and the cylinder **22** is moved to the right in FIGURE 1 by the spring **80** to open the throttle.

Thus it will be seen that the speed of a vehicle having the speed control system including the speed responsive switch of the invention installed therein may be brought to governing speed and maintained between very close limits, for example, between fifty-nine and sixty-one miles per hour if the governing speed is sixty miles per hour automatically after the initial actuation of the governor switch and the initial opening of the throttle valve.

Further it will now be evident that during an increase in speed when the lever **142** is moved in a clockwise direction the lost motion connection between the pivot pin **144** and contact member **156** prevents link **172** from applying force to accelerator pedal **32** other than that transmitted by the relatively weak spring **160**.

Should the operator desire at any time, such as during passing of another automobile, to exceed the governed speed, it is only necessary to depress the accelerator by a force sufficient to overcome the compression of the spring **50** of the override mechanism previously considered to open the throttle as wide as desired.

Also, it will be noted that if it is desired to slow down the brake switch **194** operates to de-energize the solenoid **54** whereby normal operation of the vehicle may be continued until the accelerator pedal is again actuated to complete the circuit through the solenoid **54**.

The drawings and the foregoing specification constitute a description of the improved speed control system in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A speed responsive switch comprising a housing, a pivot pin extending transversely of said housing, a movable link rigidly secured to said pivot pin externally of said housing, a contact member mounted on said pivot pin within said housing for limited rotation with respect thereto, a pair of spaced apart electric contacts secured to said contact member, resilient means secured to the pivot pin and engaged with the contact member for biasing the contact member into a predetermined position relative to the pivot pin, a lever mounted on said pivot pin within said housing for rotation relative thereto having a pair of contact members secured thereto alternatively engageable with a corresponding one of the electric con-

tacts on the contact member on relative movement between the lever and contact member in opposite directions, a centrifugal speed responsive weight assembly positioned within said housing engageable with one end of said lever for producing relative movement between said lever and contact member and pre-loaded resilient means enageable with the other end of the lever for determining at what speed movement of the lever relative to the contact member will be initiated by the centrifugal speed responsive means.

2. A speed responsive switch comprising a movable link, a contact member, a lost motion connection between the link and contact member for securing the contact member to the link for movement therewith, a pair of spaced apart electric contacts secured to the contact member, a lever positioned adjacent said link, a pair of electric contacts secured to said lever for selective engagement with the separate electric contacts on the contact member on movement of the lever and contact member in opposite directions relative to each other and speed responsive means engaged with said lever for producing relative movement between the contact member and said lever.

3. A speed responsive switch comprising a rotatable shaft, a movable link rigidly secured to said shaft for rotation therewith, a contact member, means mounting said contact member on the shaft for limited rotation with respect thereto, spring means acting between the shaft and contact member urging the contact member into a predetermined position with respect to said shaft for movement with said link, a pair of separate, spaced apart electric contacts secured to the contact member, a lever positioned adjacent said link, a pair of electric contacts secured to said lever for selective engagement with the separate electric contacts on the contact member on movement of the lever and contact member in opposite directions relative to each other, and speed responsive means engaged with said lever for producing relative movement between the contact member and said lever.

4. A speed responsive switch comprising a movable link, a contact member secured to the link for movement therewith, a pair of spaced apart separate electric contacts secured to the contact member, a lever positioned adjacent said link, a pair of electric contacts secured to said lever located between the contacts on the contact member for selective alternative engagement with a corresponding one of the separate electric contacts on the contact member on movement of the lever and contact member in opposite directions relative to each other, and speed responsive means engaged with said lever for producing relative movement between the contact member and said lever.

5. Structure as set forth in claim **4** wherein the speed responsive means comprises a centrifugal weight assembly acting on one end of the lever and further including spring means engaged with the other end of the lever acting in opposition to the centrifugal weight assembly.

6. Structure as set forth in claim **5** and further including means for pre-loading the spring means a variable amount for selecting at what speed the lever will be moved by the centrifugal weight assembly.

7. A speed responsive switch comprising a housing, a pivot pin extending transversely of said housing, a movable link rigidly secured to said pivot pin externally of said housing, a contact member mounted on said pivot pin within said housing, an electric contact secured to said contact member, a lever mounted on said pivot pin within said housing for rotation relative thereto having a contact member secured thereto engageable with the electric contact on the contact member on relative movement between the lever and contact member and a centrifugal speed responsive weight assembly positioned within said housing engageable with one end of said lever for producing relative movement between said lever and contact member.

8. Structure as set forth in claim **7** including means for providing limited rotation between said contact member and pivot pin and further including resilient means operable between the pivot pin and contact member for biasing the contact member into a predetermined position relative to the pivot pin.

9. Structure as set forth in claim **7** and further including resilient means engageable with the other end of the lever for determining at what speed movement of the lever relative to the contact member will be initiated by the centrifugal speed responsive weight assembly.

10. Structure as set forth in claim **9** and further including means for selectively pre-loading the said resilient means to vary the speed at which movement of the lever relative to the contact member will be initiated.

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