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VARIABLE ADJUSTABLE VOLTAGE BIASING MEANS

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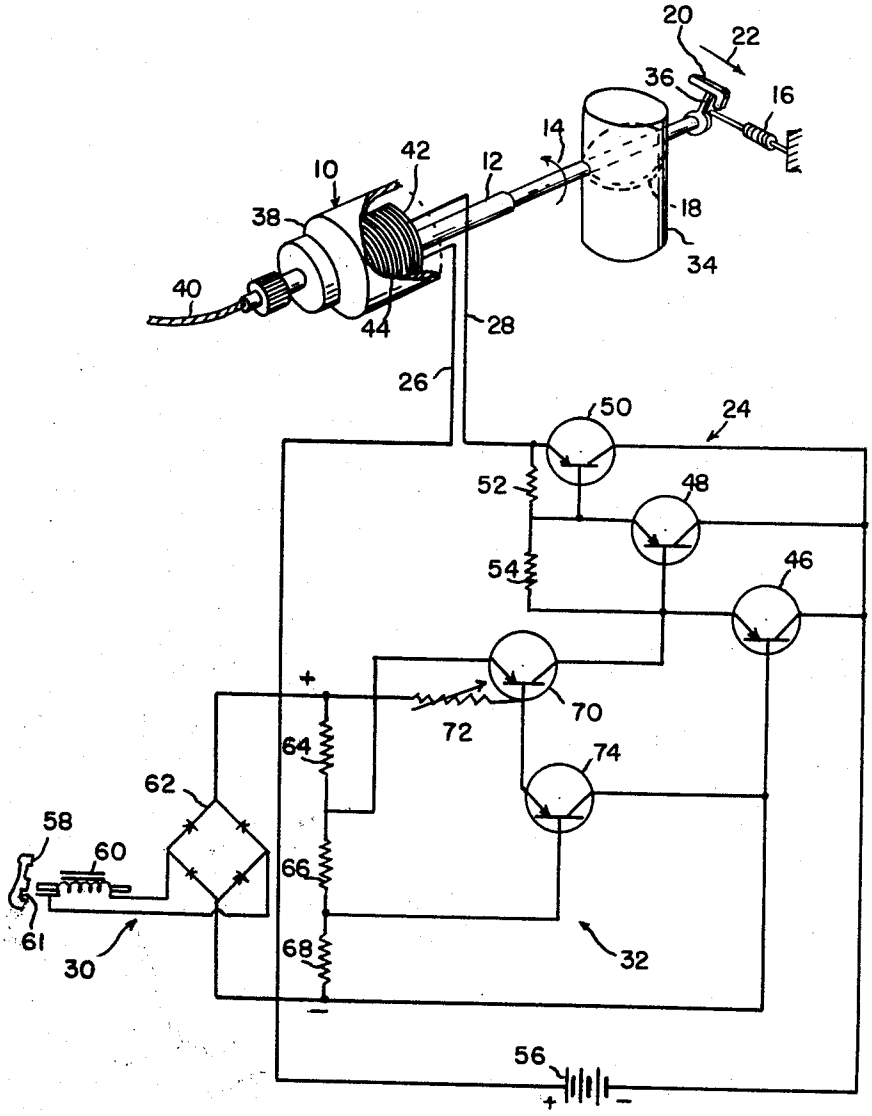

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3,178,612 VARIABLE ADJUSTABLE VOLTAGE BIASING MEANS

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The present invention relates to biasing means and refers more specifically to adjustable variable internal bias means for an electronic engine speed governor.

In the past bias for electronic governors has been provided in opposition to the signal developed by the device being governed so that the governing of the device takes place only after a predetermined signal has been developed by the device being governed. Such bias has in the past been usually provided by means of a battery or other reference voltage source. The bias has in the past therefore usually been dependent upon battery charge and has been constant during operation of the governing apparatus. These bias sources are undesirable therefore where variable bias is advantageous and in any case due to the fact that batteries are relatively expensive and short lived.

It is therefore one of the objects of the present invention to provide bias means other than a fixed reference voltage for an electronic governor.

Another object of the present invention is to provide adjustable internal variable bias means for devices such as an electronic governor.

More specifically it is an object to provide bias means for an electronic governor or the like including an element biased to non-conduction during low governing signal development and means for causing conduction of said element after a predetermined governing signal has been developed.

More specifically it is an object of the present invention to provide bias means for an electronic governor or the like including a voltage divider adapted to be placed across a governing signal, a bias element connected across the voltage divider in such a manner as to be normally non-conductive, a control element also connected across the voltage divider and operable in conjunction with a variable resistance to cause conduction of the biasing element on the governing signal reaching a predetermined value as determined by the setting of the variable resistance.

Still more specifically it is an object of the present invention to provide an electronic engine speed governor operable in conjunction with a magnetic clutch to control the position of a throttle valve associated with the engine being governed comprising means for developing an alternating electrical signal proportional to engine speed, means for rectifying the alternating signal into a direct signal, means for amplifying the direct signal and applying it to the magnetic clutch and also including means for preventing the direct current signal from being applied to the amplifier means until said signal has reached a predetermined value, comprising a voltage divider connected across the direct current source, a first transistor having its base attached to the positive end of the voltage divider through a variable resistor and its emitter attached to the voltage divider at a relatively more negative point, and a second transistor having its emitter connected to the base of the first mentioned transistor and its base connected to the voltage divider at an even more negative point than the emitter of said first transistor.

Another object is to provide an electronic governor

having improved biasing means which is simple in structure, 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 drawing, illustrating a preferred embodiment of the invention, wherein:

The sole figure is a partly diagrammatic and partly schematic illustration of one embodiment of the improved electronic governor of the invention.

With particular reference to the figure, one embodiment of the adjustable variable internal bias means of the invention will now be disclosed.

An electronic engine speed governor is illustrated in the figure. The magnetic clutch generally indicated **10** is operable on being energized to apply torque to shaft **12** to tend to rotate the shaft in the direction of arrow **14** in opposition to resilient means **16** tending to rotate shaft **12** and throttle plate **18** in a direction to open throttle plate **18** on movement of stop **20** in the direction of arrow **22**. Magnetic clutch **10** is energized through amplifier means generally indicated **24** over conductors **26** and **28** when a signal is received from signal developing means **30**.

In accordance with the invention adjustable variable internal bias means generally indicated **32** is provided to prevent application of the signal developed by means **30** to amplifier **24** until the signal reaches a predetermined value representative of the engine speed at which governing is desired.

More specifically, induction tube **34**, which may operate as a fuel passage in conjunction with a pressure, venturi or other type of fuel feed system is mounted on the engine, the speed of which it is desired to govern and the speed of which is controlled by movement of butterfly valve **18** on rotation of shaft **12**. Stop **20** may be connected to the usual acceleration means (not shown) and on movement in the direction of arrow **22** allows finger **36** to be rotated in a direction opposite arrow **14** by means of spring **16** to open throttle valve **18** causing the engine speed to increase in the usual manner of operation of the throttle valve.

Magnetic clutch **10** as illustrated is of the type wherein in operation one side thereof normally slips with respect to the other side. Side **38** of magnetic clutch **10** as shown is adapted to be attached to a means for rotation thereof through flexible cable **40**. The means for rotation may be the engine to be governed or other non-associated means. Side **42** of magnetic clutch **10** includes coil **44** adapted to be energized over conductors **26** and **28** as previously indicated. On energizing of coil **42** with side **38** of clutch **10** rotating a torque will be created in shaft **12** proportional to the magnitude of the electrical signal in coil **42** which at the desired governed engine speed will exactly balance the torque exerted by resilient means **16** on shaft **12** to hold throttle valve **18** in a fixed position regardless of further movement of stop **20**.

As previously indicated the coil **42** is energized by a signal fed thereto over conductors **26** and **28** from amplifier means **24**. Amplifier means **24** is a three stage transistorized amplifier including transistors **46**, **48** and **50** operating in conjunction with resistors **52** and **54** and battery **56**, which may be a vehicle battery, in the usual well known manner of transistorized amplifier circuits. Thus on application of a governing signal to transistor **46** the signal will be amplified through transistors **46**, **48** and **50** and applied to coil **42** to control the position of throttle valve **18**.

A governing signal is produced by means of a rotating disc, part of which is indicated at **58**, which disc is rotated in accordance with engine speed and may be attached to a rotating engine member such as the distributor

shaft. Magnetic probe 60 positioned adjacent rotating disc 58 is alternately attracted thereto to a greater or less amount due to the recesses 61 around the periphery of the disc 58 and is thus caused to create an alternating electrical signal variable in accordance with the speed of the engine by which the disc 58 is rotated. Rectifier 62 is provided to rectify the alternating electrical signal into a direct electrical signal which is then applied across the voltage divider comprising resistors 64, 66 and 68 with the polarity shown.

In accordance with the invention the direct electrical signal produced by signal developing means 30 is fed to amplifier means 24 after the direct electrical signal has reached a predetermined engine speed approaching the desired governed engine speed through the action of bias means 32.

The bias means 32 comprises bias transistor 70 having its emitter connected to the voltage divider between the resistors 64 and 66 and having its base connected to the positive side of the voltage divider through a variable resistance 72, the variable resistance 72, and transistor 74 having its emitter connected to the base of the transistor 70 and its base connected to the voltage divider between the resistances 66 and 68 as shown.

Thus in operation the bias transistor 70 having a more positive base than emitter will be biased to non-conduction, whereby none of the direct current signal developed proportional to engine speed will be felt by amplifier 24, until the direct current signal is large enough so that the current through control transistor 74 across variable resistor 72 produces a negative potential at the base of bias transistor 70 with respect to the emitter thereof. The ohmic value of resistor 72 may be adjusted to determine the engine speed at which the base of transistor 74 becomes negative with respect to the emitter and the governing signal will be applied to the amplifier means 24.

In the over-all operation of the electronic engine speed governor set forth above, it will be understood that on moving the stop 20 in the direction of arrow 22 the throttle valve 18 will be rotated in a direction opposite to arrow 14 due to resilient means 16 to cause an increase in the speed of the engine associated with induction tube 34. As the speed of the engine is thus increased the disc 58 will be caused to rotate more rapidly and magnetic probe 60 will develop an increasingly large alternating electrical signal which will be rectified into a similarly increasing direct electrical signal for application across the voltage divider.

While the signal developed by magnetic probe 60 is relatively small the potential at the base of transistor 70 will be positive with respect to the potential at the emitter thereof due to the connection of these elements across resistor 64 having the polarity shown. The bias transistor 70 will thus not be allowed to conduct while the engine is running at low speeds and no governing signal is applied to amplifier means 24.

As the engine speed and thus the direct current signal from rectifier 62 increases, conduction through the transistor 74 through the adjustable resistor 72 will increase until eventually sufficient current will flow through the resistor 72 to cause the base of transistor 70 to be negative with respect to the emitter thereof to cause transistor 70 to conduct. On conduction of transistor 70, additional direct electrical signal developed due to increase of engine speed will be applied to the amplifier means 24 where it will be amplified in the usual manner and applied to coil 44 of magnetic clutch 10. The magnetic clutch 10 is thus caused to operate to create a torque in shaft 12 in the direction of arrow 14 to tend to close the throttle valve 18 and maintain engine speed at a predetermined value.

At the predetermined engine speed the torque created by the clutch 10 will exactly equal the torque created on the shaft 12 by resilient means 16, whereby the engine speed will not be allowed to increase regardless of further movement of stop 20 in the direction of arrow 22. The engine speed at which governing starts and therefore the speed at which equilibrium of the throttle valve 18 will be attained will be determined by the setting of the variable resistor 72 as previously indicated.

Thus applicant has provided an electronic governor with adjustable internal variable bias means comprising transistor elements 70 and 74 and variable resistor 72, in conjunction with the voltage divider comprising resistors 64, 66 and 68, thereby eliminating the need for a bias battery or reference voltage source.

The drawing and the foregoing specification constitute a description of the improved variable adjustable voltage biasing means 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 governor comprising control means for regulating the value of a variable to be governed in accordance with a signal applied to said control means, signal developing means for producing a governing signal the magnitude of which is proportional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, biasing means operatively associated with said amplifier means and signal developing means for preventing amplification of said governing signal before said signal has reached a predetermined magnitude, and means for producing and applying to said biasing means a bias varying with the magnitude of the governing signal.

2. A governor comprising control means for regulating the value of a variable to be governed in accordance with a signal applied to said control means, signal developing means for producing a governing signal the magnitude of which is proportional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, a biased biasing element operably associated with said signal developing means and said amplifier means to prevent amplification of said governing signal before said signal has reached a predetermined minimum magnitude, means including a control element operatively associated with said bias element for varying the bias applied to said biasing element in accordance with the magnitude of the governing signal, said last mentioned means also including adjusting means operatively associated with said bias and control elements for adjusting said predetermined magnitude at which amplification of said governing signal is initiated.

3. An electronic governor comprising control means for regulating the value of a variable to be governed in accordance with an electronic signal applied to said control means, signal developing means for producing an electronic governing signal the magnitude of which is proportional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, a biased electronic bias element operably associated with said amplifier and said signal developing means for preventing amplification of said governing signal until said signal has reached a predetermined magnitude in accordance with the bias applied to the bias element, and electronic control means operatively associated with said bias element and said signal developing means for continuously varying the bias of said bias element in accordance with the value of said governing signal.

4. An electronic governor comprising control means for regulating the value of a variable to be governed in accordance with an electronic signal applied to said control means, signal developing means for producing an electronic governing signal the magnitude of which is pro-

portional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, a voltage divider connected across the output of said signal developing means, a biasing element connected in parallel with said voltage divider so as to be biased to non-conduction at low output signals from said signal developing means, said biasing element also being connected in series between said signal developing means and said amplifier means to prevent a developed signal from reaching said amplifier means while said biasing element is non-conducting, and control means also connected in parallel with said voltage divider and operably associated with said biasing element to cause conduction through said biasing element on said developed signal reaching a predetermined minimum value.

5. An electronic governor comprising control means for regulating the value of a variable to be governed in accordance with an electronic signal applied to said control means, signal developing means for producing an electronic governing signal the magnitude of which is proportional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, a voltage divider connected across the output of said signal developing means, a biasing element connected in parallel with said voltage divider so as to be biased to non-conduction at low output signals from said signal developing means, said biasing element also being connected in series between said signal developing means and said amplifier means to prevent a developed signal from reaching said amplifier means while said biasing element is non-conducting, and a resistor and a control element in series also connected in parallel with said voltage divider and operably associated with said biasing element to cause conduction through said biasing element on said developed signal reaching a predetermined minimum value.

6. Variable electronic bias means between a variable signal source and a signal utilizing element which bias means is operable to prevent utilization of the signal from the signal source by the utilizing element before the signal reaches a predetermined minimum value, said bias means comprising a voltage divider connected across the variable signal source, a biasing element connected in parallel with said voltage divider and in series between the signal source and the utilizing element for preventing a signal from the signal source from reaching the utilizing element while the bias element is in non-conducting state, and control means operably associated with said bias element and signal source for maintaining said bias element in a non-conductive state before the signal reaches a predetermined minimum magnitude.

7. Variable electronic bias means between a variable signal source and a signal utilizing element which bias means is operable to prevent utilization of the signal from the signal source by the utilizing element before the signal reaches a predetermined minimum value, said bias means comprising a voltage divider connected across the variable signal source, a biasing element connected in parallel with said voltage divider and in series between the signal source and the utilizing element for preventing a signal from the signal source from reaching the utilizing element while the bias element is in non-conducting state, and a resistance element and a control element connected in series with each other and in parallel across said voltage divider operably associated with said bias element for maintaining said bias element in a non-conductive state before the signal reaches a predetermined minimum magnitude.

8. Structure as claimed in claim 7 wherein said resistance element is an adjustable resistor whereby said predetermined minimum magnitude of said signal may be varied.

9. Variable electronic bias means between a variable signal source and a signal utilizing element which bias means is operable to prevent utilization of the signal from the signal source by the utilizing element until the signal reaches a predetermined value, said bias means comprising a voltage divider connected across the variable signal source, a biasing transistor having a base connected to a relatively positive portion of said voltage divider through a control resistor, an emitter connected to a less positive portion of the voltage divider than the base, and a collector connected to said utilizing element, said biasing transistor being operable to prevent a signal from the signal source from reaching the utilizing element when the bias transistor is in a non-conducting state, and control means operably associated with said bias transistor, signal source, and utilizing element for maintaining said bias transistor in a non-conductive state until the signal reaches a predetermined magnitude.

10. Variable electronic bias means between a variable signal source and a signal utilizing element which bias means is operable to prevent utilization of the signal from the signal source by the utilizing element until the signal reaches a predetermined value, said bias means comprising a voltage divider connected across the variable signal source, a biasing transistor having a base connected to a relatively positive portion of said voltage divider through a control resistor, an emitter connected to a less positive portion of the voltage divider than the base, and a collector connected to said utilizing element, said biasing transistor being operable to prevent a signal from the signal source from reaching the utilizing element when the bias transistor is in a non-conducting state, and a control transistor having an emitter connected between said control resistor and bias transistor base, a base connected to a less positive portion of the voltage divider resistor than the emitter of the bias transistor, and a collector connected to an even less positive portion of the voltage divider than the base of the control transistor, said control transistor being operable to maintain said bias transistor in a non-conductive state until the signal reaches a pre-determined magnitude.

11. Structure as defined in claim 10 wherein said bias resistor is adjustable whereby said predetermined magnitude of said signal may be varied.

12. A governor comprising control means for regulating the value of a variable to be governed in accordance with a signal applied to said control means, signal developing means for producing a governing signal the magnitude of which is proportional to the value of the variable to be governed, amplifier means operatively associated with said signal developing means for amplifying said governing signal and for applying said amplified signal to said control means, and variable electronic bias means between the amplifier means and the signal developing means for preventing amplification of said governing signal before said signal has reached a predetermined minimum magnitude, said bias means comprising a voltage divider connected across the signal developing means, a biasing transistor having a base connected to a relatively positive portion of said voltage divider through a control resistor, an emitter connected to a less positive portion of the voltage divider than the base, and a collector connected to said control means, said biasing transistor being operable to prevent a signal from the signal developing means from reaching the control means when the bias transistor is in a non-conducting state, and means operably associated with said bias transistor, signal developing means, and control means for maintaining said bias transistor in a non-conductive state until the governing signal reaches a predetermined magnitude.

13. A governor comprising control means for regulating the value of a variable to be governed in accordance with a signal applied to said control means, signal de-

veloping means for producing a governing signal the magnitude of which is proportional to the value of the variable to be governed, means operatively associated with said signal developing means for applying said signal to said control means, and biasing means operable between said signal developing means and control means for preventing application of said governing signal to said control means before said governing signal has reached a predetermined minimum magnitude, and means for producing and applying to said biasing means a bias varying with the magnitude of the governing signal, including a pair of parallel biasing resistors connected across the signal developing means for providing voltages varying as the governing signal varies, and means for varying the voltage across one of said resistors at a greater rate than across the other of the resistors.

14. Structure as claimed in claim 13 wherein the last mentioned means includes a resistor in series with said other of the resistors across the signal developing means and a transistor in series with aid one resistor across the ignal developing means.

15. Structure as claimed in claim 14 wherein said one resistor is variable whereby different predetermined minimum governing signal magnitudes may be selected.

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