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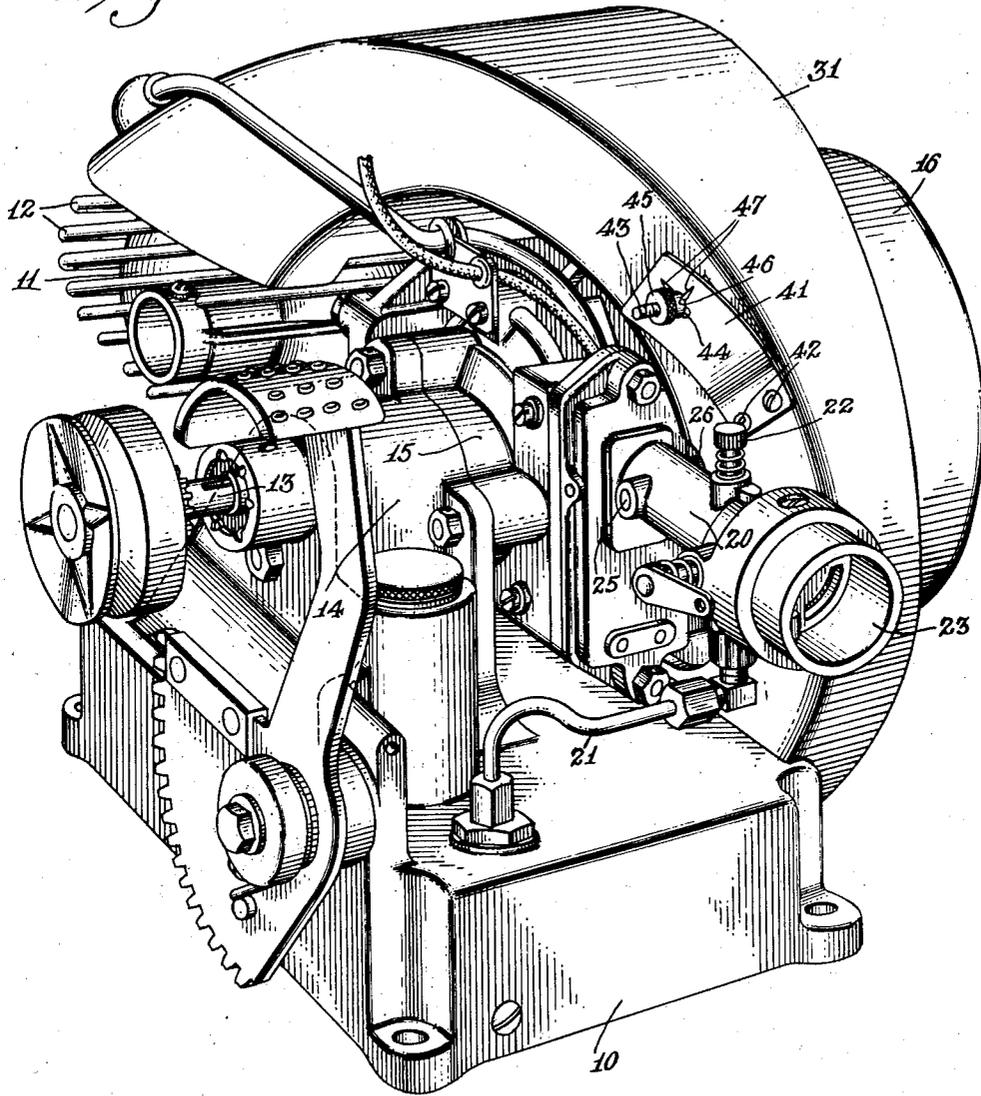
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GOVERNOR FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 1, 1940

2 Sheets-Sheet 1

*Fig. 1.*



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2 Sheets-Sheet 2

Fig. 2.

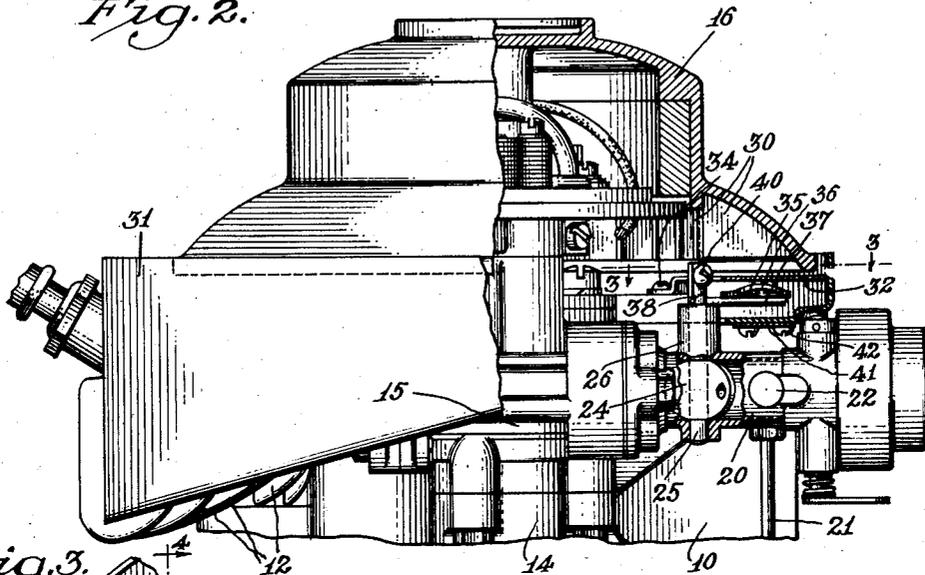


Fig. 3.

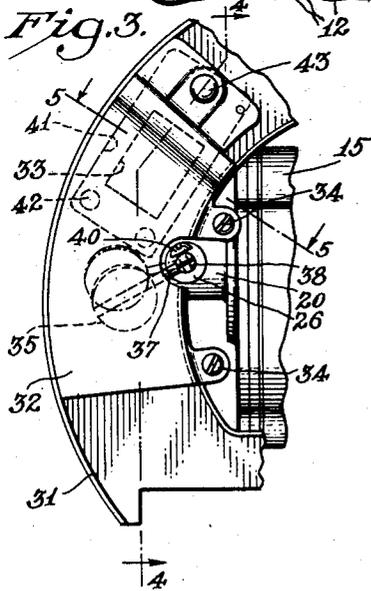


Fig. 4.

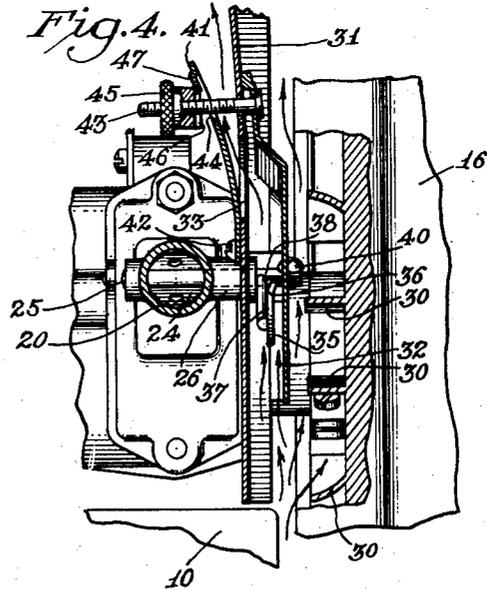
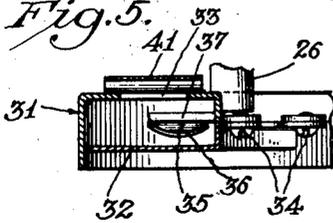


Fig. 5.



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# UNITED STATES PATENT OFFICE

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## GOVERNOR FOR INTERNAL COMBUSTION ENGINES

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The invention relates generally to internal combustion engines and more particularly to a governor therefor.

The general object of the invention is to provide a novel governor for regulating the speed of operation of an internal combustion engine.

Another object is to provide a governor of this character which may be adjusted so that it will hold the speed of operation of the engine to any desired rate.

Still another object is to provide a governor for an air-cooled engine having a fan which utilizes a part of the air delivered by the fan, solely for operating the governor, the flow of such air being regulable so that the rate of speed at which the engine is held will be adjustable.

A further object is to provide an adjustable governor of simple and inexpensive construction, which operates in quick response to any changes in speed, and which holds the speed steady without fluctuation under normal operating conditions.

A still further object is to provide a novel method of regulating the speed of an internal combustion engine.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of an internal combustion engine having a governor embodying the features of the invention.

Fig. 2 is a fragmentary plan view partially in section of the engine shown in Fig. 1.

Fig. 3 is a fragmentary end elevational view with the flywheel removed and taken on the line 3—3 of Fig. 2.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3.

A governor embodying the features of the invention is particularly constructed for use with an internal combustion engine which it is desired to run at a constant speed. The engine herein shown is of a small fractional horsepower type such as may be used for driving lawn mowers, washing machines, or other apparatus.

The engine herein shown for purposes of illustration and to which the governor is applied, is of the air-cooled two-cycle type. It comprises a base 10 which in the present instance is cast to provide a fuel tank. The base 10 supports a cylinder 11 provided with air cooling fins 12, the cylinder in the present instance being located on

a horizontal axis extending at right angles to the axis of a crank shaft 13. The crank shaft 13 is supported in a bearing 14 extending upwardly from the base and adjoining which is located a crank case 15. On one end of the crank shaft is mounted a combined flywheel and magneto 16.

To supply a fuel mixture to the engine a carburetor 20 is secured to the crank case 15. The carburetor, due to suction produced in the crank case 15, draws fuel from the fuel tank in the base 10 through a pipe 21, the flow being manually controllable by a valve 22. Air is taken into the carburetor through the opening 23, and the mixture of fuel and air passing into the crank case is controlled by a butterfly valve 24 located in a passage in the carburetor. The butterfly valve 24 is mounted on a stem 25 rotatably supported by a boss 26 extending to one side of and integral with the carburetor casing.

In order to keep the cylinder cool, a rotary fan is provided. In the present instance such fan comprises a plurality of radially positioned blades 30 formed integrally in the casing portion of the combined flywheel and magneto 16. To direct the flow of air from the fan onto the cylinder a deflector 31 is provided. The deflector is of generally arcuate shape extending from a point below the crank shaft upwardly and thence over the top of the engine to direct the air downwardly at an angle onto the cylinder head. The deflector 31 is of generally channel shape cross section of increased size near the cylinder. The arcuate shape of the deflector 31 thus fits snugly around the upper portion of the periphery of the combined flywheel and magneto.

A governor embodying the features of the invention is adapted to be operated by the flow of air created by the fan blades 30. Since the rate of flow of air so created varies with the speed of the fan and hence the speed of the engine, means is provided which is responsive to such flow of air to operate or regulate the butterfly valve 24 controlling the flow of fuel to the engine. Thus should the engine tend to speed up, there will be an increased flow of air to which the governor responds and partially closes the butterfly valve 24, thereby reducing the flow of fuel to the engine and consequently reducing its speed. Should the speed of the engine be too slow, there is less flow of air, thereby decreasing the tendency of the governor to partially close the butterfly valve, and gravity acts to open the valve the required amount. Thus more fuel will be taken into the engine, and the speed will be increased. The means or device responsive to the air flow com-

prises a small air vane adapted on increase of air flow to turn the butterfly valve shaft 25 in one direction, with the weight of the vane tending to turn the valve shaft 25 in the other direction.

There are occasions of course in the operation of an engine of this type when it is desired to change or adjust the speed at which the engine is held by the governor. For this purpose a portion of the air flow created by the fan is diverted from that serving to cool the cylinder and is carried through a passage within which the air vane is located. This passage is provided with an outlet the effective size of which is manually adjustable. Thus for a given motor speed and a given effective size of the outlet of the passage, the air flow through the passage will be at a certain rate and the governor will act to hold the engine speed constant at a certain rate. However, should it be desired to hold the engine speed at a higher rate, the effective size of the outlet is decreased, thus decreasing the flow of air through the passage for a given fan speed, or, in other words, varying the ratio between the flow in the passage and the total flow from the fan. Since the governor is responsive to the flow of air through the passage, the decreased flow due to such reduction of effective size of the outlet will tend to open the butterfly valve to a certain extent.

The engine if operating at a constant speed will maintain the flow of air through the passage under these conditions constant and the governor will not change the adjusted position of the butterfly valve. However, should the engine speed fluctuate from that point, the flow of air through the passage will correspondingly fluctuate and the air fan will act to control the butterfly valve in the proper manner. Correspondingly, should it be desired to lower the engine speed, the effective size of the outlet of the passage is increased, thus permitting a greater flow of air through the passage and thereby causing the air vane to partially close the butterfly valve.

As shown in the drawings, a partition 32 is mounted in the deflector adjacent the carburetor 20. This partition 32 extends substantially parallel to the direction of flow of air and diverts a portion of the air from that flowing over to the engine cylinder. The wall of the deflector opposite the fan is provided with an opening or by-pass vent 33 to permit the diverted air to pass through the passage formed by the partition 32 and the wall of the deflector. In the preferred construction both the deflector and the partition 32 are made of sheet metal, the two being preferably secured to each other by screws 34, as shown in Figs. 3 and 5.

Located within the passage formed by the partition 32 is an air vane 35 adapted to respond to the flow of air through the passage. In the preferred form the air vane comprises a disk having a lip 36 (see Fig. 4) bent to one side to be affected by the velocity of the flow of air. The vane 35 is rigidly secured to a pin 37 projecting radially from an extended portion 38 of the butterfly valve shaft 25. To secure the pin 37 to the extended portion 38 of the shaft, the latter is slit to receive the end of the pin 37, and a screw 40 is provided to clamp the two portions of the extended portion 38 together, thus rigidly holding the pin 37 in place. The pin 37 is adapted to extend in a generally horizontal direction so that the weight of the vane 35 and pin 37 will tend to

turn the shaft 25 in a counterclockwise direction as viewed in Fig. 3. Such direction of rotation of the butterfly valve shaft 35 tends to open the valve and permit a greater flow of fuel to the engine. When the flow of air through the passage formed by the partition 32 increases, the vane 35 is thereby lifted and the shaft 25 is partially rotated in the opposite direction and the butterfly valve is moved to a partially closed position, thus reducing the flow of fuel to the engine.

When it is desired to change or adjust the speed to which the engine is governed, the effective size of the outlet 33 is varied, thereby varying the flow of air through the passage for a given fan speed. To this end an adjustable closure for the outlet 33 is provided. In the preferred form the adjustable closure comprises a plate 41 of spring material secured to the outer face of the deflector 31 as by screws 42. The plate 41 is bent so that it normally assumes a curved position (see Fig. 4) extending away from the opening 33 to permit the flow of air therethrough. In order to adjust the plate 41 to vary the effective size of the opening 33, a screw 43 extends through the side wall of the deflector 31 and thence through an aperture 44 in the free end of the plate. On the outer end of the screw is placed a knurled nut 45 bearing against the plate and adapted to be adjusted by hand. By turning the nut 45 down on the plate, the latter is bent toward the deflector and the effective size of the outlet 33 is thereby decreased. Thus merely by turning the nut 45 the speed at which the engine is to be governed may be adjusted.

In order to prevent the nut 45 from jarring out of its adjusted position due to the vibration of the engine, the face of the nut which bears against the plate is provided with a diametral notch 46 to cooperate with a plurality of small radial ridges 47 formed in the plate. Thus when the nut is turned to a position where one of the ridges 47 is positioned in the notch 46, the nut will be held against inadvertent turning due to vibration, but may be readily turned by hand.

In operation, with a given setting for the plate 41, the fan will cause a certain rate of flow through the passage provided by the partition 32. Should the speed of the motor fluctuate, the vane 35 will be thereby affected and will cause the butterfly valve 24 to open or close as the case may be. The motor is thus held at a constant speed for the given setting of the plate 41.

Should it be desired to increase the speed of the motor and to hold it at such increased speed, the nut 45 is screwed down to decrease the effective size of the opening 33 by bringing the plate 41 closer to the deflector 31. This, in effect, varies the relation between the flow in the passage and the engine speed, and, with such adjustment, a slower rate of flow will occur through the passage formed by the partition 32 for a given engine speed. The vane 35 will thus be less affected by the air flow and will permit the butterfly valve 24 to open to a slightly greater extent, and the engine will thereby increase its speed. When the engine has reached the speed thus permitted, it will remain constant since any fluctuation in the speed of the engine from that point will cause a greater or less flow of air through the passage and will thereby cause the vane 35 to regulate the butterfly valve 24. In any position of adjustment of the nut 45, the notch 46 therein, cooperating with the ridge 47 in the plate, holds the nut against rotation so

that it cannot be jarred out of adjustment by vibration of the engine.

From the foregoing description, it will be apparent that we have provided a governor for an internal combustion engine which will hold the speed of operation of the engine to any desired rate. Thus by utilizing a portion of the air flow created by the fan, which air flow is in proportion to the speed of operation of the engine, we have provided a quickly responsive means for regulating the engine speed. However, with our governor, the speed of operation of the engine may be adjusted to any desired point and then held at such point. The device herein shown is of simple and inexpensive construction and will hold the speed of the engine steady without any great fluctuation. It will also be apparent that I have provided a novel method of regulating the speed of an internal combustion engine.

We claim as our invention:

1. In an internal combustion engine, having a fan for creating a flow of air, the combination of a deflector for passage of air from the fan and terminating adjacent the engine cylinder to provide cooling air for the cylinder, a fuel intake passage, a valve controlling the flow of fuel therein, a partition in said deflector for separating a portion of the air from that flowing to the cylinder, and an air vane located in the separated portion of the flow and responsive thereto to operate said valve.

2. In an internal combustion engine, the combination of means for creating a constantly moving flow of air, means for dividing the flow into two portions and for directing one of said portions toward the engine cylinder for cooling the latter and for discharging the other portion, the flow of the respective portions having a predetermined ratio, means for controlling the flow of fuel to the engine, and a device responsive to the movement of the flow of said other portion for operating said controlling means.

3. In an internal combustion engine, the combination of a valve for controlling the flow of fuel to the engine, an air-flow operated device for regulating said valve, means for creating a flow of air to cool the engine, and means for diverting a predetermined proportion of said flow to operate said device in accordance with the fluctuations in flow produced by said first-mentioned means.

4. In an internal combustion engine, the combination of a valve for controlling the flow of fuel to the engine, means for creating a flow of air, a deflector for directing the said flow of air toward the engine cylinder and provided with a by-pass vent, means for diverting a part of the flow through said vent, and a device responsive to the diverted part of the flow for regulating said valve.

5. In an internal combustion engine, the combination of a valve for controlling the flow of fuel to the engine, a rotary fan for creating a flow of air, an arcuately shaped deflector for directing said flow of air longitudinally thereof toward the engine cylinder, said deflector having a vent in its side wall, a partition within said deflector for diverting a part of the flow of air through said vent, and a device responsive to the diverted part of the flow for regulating said valve.

6. In an internal combustion engine, the combination of a valve for controlling the speed of operation of the engine, means for creating a flow of air, means for dividing said flow of air into two portions and for directing one of said portions toward the engine cylinder to cool the lat-

ter, a device responsive to the flow of the other portion for regulating said speed control means, and means for controlling the flow of said other portion to regulate the speed of operation of the engine.

7. In an internal combustion engine, the combination of speed controlling means for the engine, means for creating a flow of air, a device responsive to said flow of air for regulating said speed controlling means, and manually adjustable means for varying said flow to regulate the speed of operation of the engine.

8. In an internal combustion engine, the combination of speed controlling means for the engine, means for creating a flow of air, a passage for said flow, a device located in said passage and responsive to said flow of air for operating said speed controlling means, and manually adjustable means for varying the outlet from said passage to vary the flow therethrough and consequently regulate the speed of operation of the engine.

9. In an internal combustion engine, the combination of speed controlling means for the engine, a fan, a deflector for directing the flow of air from the fan toward the exterior of the engine cylinder, said deflector having a by-pass vent, a partition in the deflector for diverting a part of the flow of air through said vent, a device responsive to the rate of flow of said diverted part for operating said speed controlling means, and manually adjustable means for varying the flow through said vent and consequently regulating the speed of operation of the engine.

10. In an internal combustion engine, the combination of speed controlling means for the engine, a fan, a deflector for directing the flow of air from the fan toward the engine cylinder, said deflector being of arcuate form of channel-shape cross section with the open side facing the fan and having a by-pass vent in the wall opposite the open side, a partition in the deflector for diverting a part of the flow of air through said vent, a device responsive to the rate of flow of said diverted part for operating said speed controlling means, and a manually adjustable closure for varying the effective size of said vent to vary the rate of flow of said diverted part and consequently regulating the speed of operation of the engine.

11. In an internal combustion engine, the combination of speed controlling means for the engine, means for creating a flow of air in proportion to the speed of the engine, a passage for said flow of air, a device responsive to the rate of flow for operating said speed controlling means, and a manually adjustable closure for the outlet end of said passage to restrict the flow therethrough and consequently regulate the speed of operation of the engine.

12. In an internal combustion engine, the combination of speed controlling means for the engine, means for creating a flow of air at a rate varying with the speed of the engine, a passage for said flow of air including a wall having an opening constituting an outlet for said passage, a device responsive to the rate of flow for operating said speed controlling means, a resilient plate secured at one end to said wall adjacent said opening and normally having an arcuate shape curving away from said wall to permit flow of air through said opening, and manually adjustable means to bend said plate back toward said opening to restrict the flow therethrough and

thereby adjust the speed of operation of the engine.

13. In an internal combustion engine, the combination of speed controlling means for the engine, means for creating a flow of air at a rate varying with the speed of the engine, a passage for said flow of air including a wall having an opening constituting an outlet for said passage, a device responsive to the rate of flow for operating said speed controlling means, a resilient plate secured at one end to said wall adjacent said opening and normally having an arcuate shape curving away from said wall to permit a part of said flow of air through said opening, a screw extending from said wall through the free end of said plate, a nut adjustable on said screw and bearing on said plate to bend the latter toward said opening to restrict the flow of air therethrough and thereby adjust the speed of operation of the engine, said nut and said plate having cooperating means to prevent rotation of the nut from vibration of the engine.

14. In an internal combustion engine, the combination of means for creating a flow of air in proportion to the speed of the engine, means for diverting a portion of said flow, means responsive to the flow of said diverted portion for regulating the fuel supplied to the engine, and manually adjustable means for varying the ratio of said flow to the total flow of air for adjusting the speed of operation of the engine.

15. In an internal combustion engine, the combination of means operated by the engine for creating a flow of air, a passage through which said air passes, means extending into said passage responsive to the flow of air therein for regulating the fuel supplied to the engine, and manually adjustable means for varying the relation between the flow of air in said passage and the engine speed for adjusting the speed at which the engine will be operated.

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