R. B. BENJAMIN.

GAS ENGINE GOVERNOR.

APPLICATION FILED JAN. 11, 1915.

1,212,177.

Patented Jan. 16, 1917.

3 SHEETS—SHEET 1.

Fig. 1.

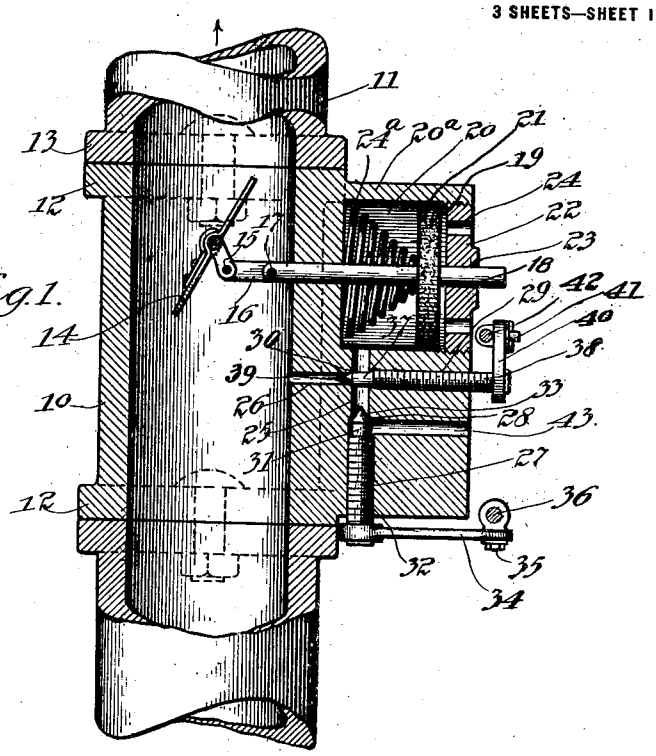
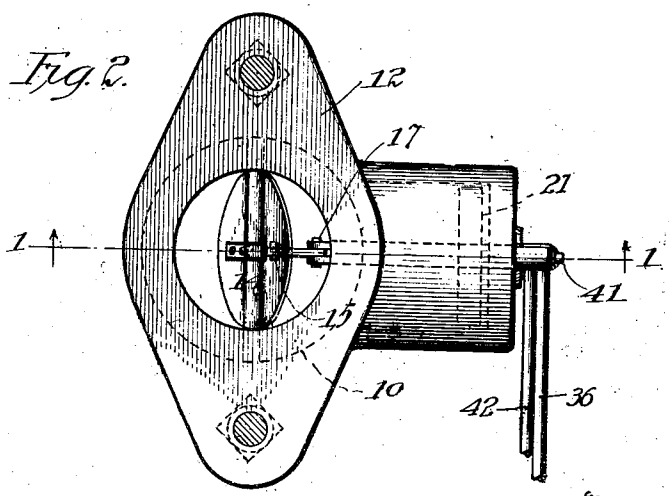


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

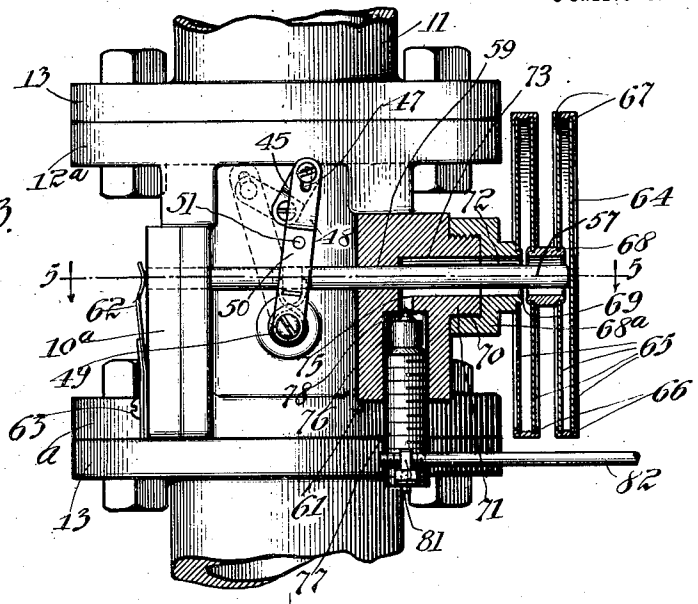
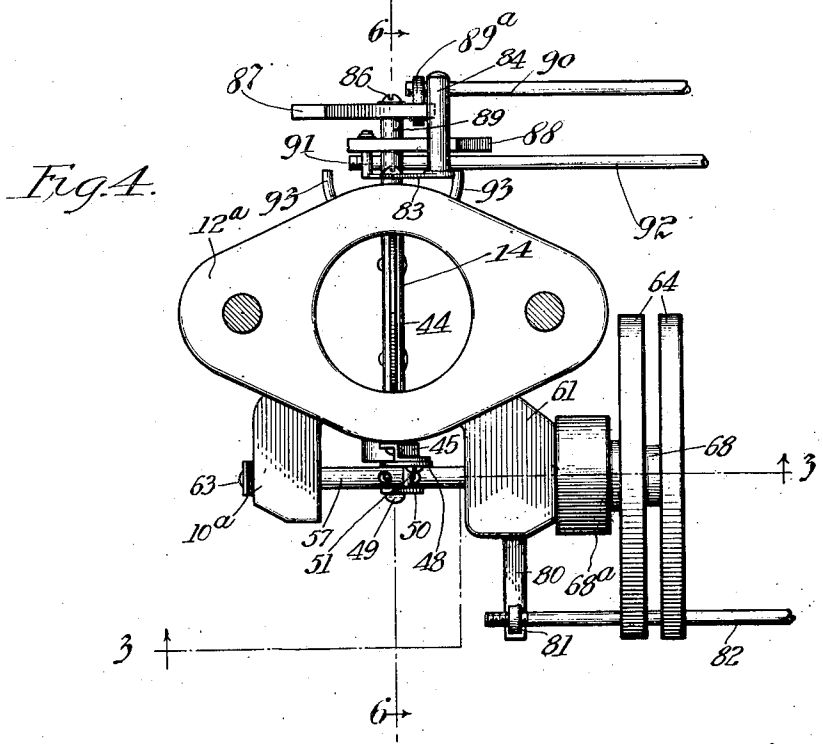


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

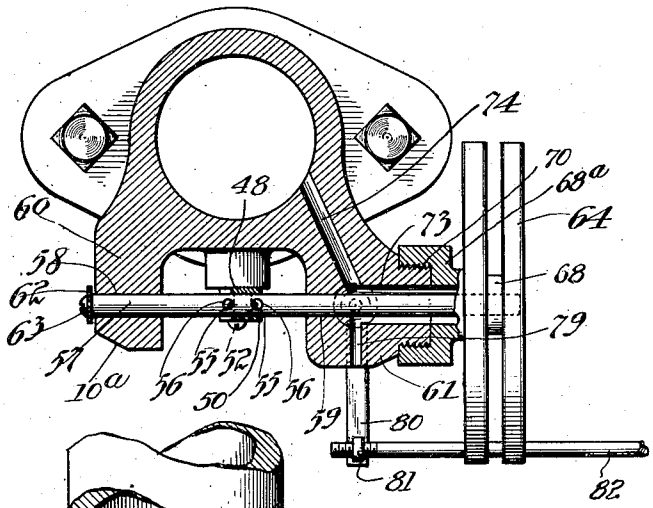
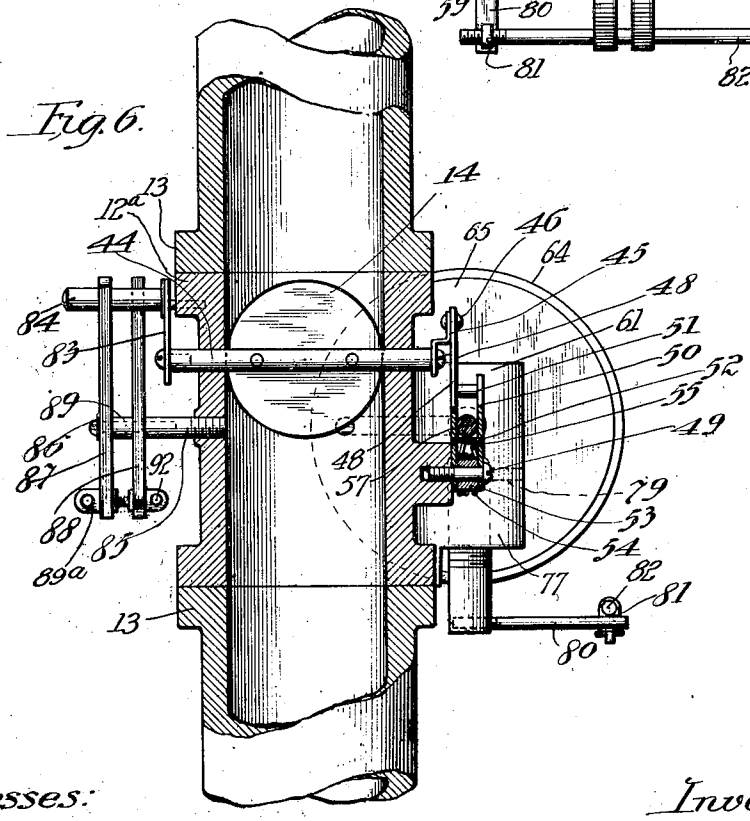


Fig. 6.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE GOVERNOR.

1,212,177. Specification of Letters Patent. Patented Jan. 16, 1917.

Application filed January 11, 1915. Serial No. 1,708.

To all whom it may concern:

Be it known that I, REUBEN B. BENJAMIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Gas-Engine Governors, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to gas engine governors.

One of the objects of my invention is to provide a device which will maintain the speed of the gas engine substantially constant irrespective of the variations in load.

Further objects will appear from the detailed description to follow, and from the appended claims.

In the accompanying drawings, in which I have illustrated two embodiments of my invention Figure 1 is an axial section through one embodiment of my device in which the butter-fly throttle valve is governed by means of a piston operating in a chamber which is in communication both with the interior of the fitting and with the atmosphere; Fig. 2 is a plan view of the modification shown in Fig. 1; Fig. 3 is a section substantially on the line 3—3 of Fig. 4, showing a modification of my device in which the butter-fly throttle valve is governed by means of a plurality of spring diaphragms which form a pressure chamber, a yielding connection being provided between the governor and the valve to enable the valve to be operated independently by means of the accelerator; Fig. 4 is a plan view of the modification shown in Fig. 3; Fig. 5 is a section substantially on the line 5—5 of Fig. 3 showing the passages connecting the diaphragm chamber with the interior of the fitting and with the atmosphere; and Fig. 6 is a section substantially on the line 6—6 of Fig. 4 showing in detail the yielding connection between the diaphragms and the valve and showing also the manner in which the accelerator lever is related to the valve.

Referring now to the drawings in detail, and first to the modification of Figs. 1 and 2 reference character 10 indicates a pipe fitting which is adapted to be inserted in the intake pipe 11 leading to the intake manifold of the gas engine. The fitting 10 is provided with flanges 12 for engagement with corresponding flanges 13 on the intake pipe 11. A throttle valve 14 which may, as shown, be of the usual butter-fly type, is provided with an off-set lug 15 which is pivotally connected to a link 16 which is pivoted at 17 to a sliding rod 18. This rod 18 is connected with a piston 19 operating in a chamber 20 in an off-set portion 20^a in the fitting 10, the piston fitting loosely in the chamber as shown at 21 to allow a restricted flow of air past the piston. The chamber 20 is closed at its outer end by means of a head 22 having an opening 23 therein in which the rod 18 slides. The head 22 is also provided with a number of openings 24 to admit air back of the piston 19. A coil spring 24^a engages the piston 19 and tends to hold it against the head 22. The off-set portion 20^a is provided with communicating passages 25 and 26. The passage 25 has an enlarged threaded portion 27 and a conical portion 28 forming a valve seat. The passage 26 has a threaded portion 29 and a conical portion 30 forming a valve seat. A needle valve 31 is provided with a threaded portion 32 for engagement with the threaded portion 27 and is also provided with a conical portion 33 for engagement with the valve seat 28. Secured to the end of the valve 31 is an arm 34 having a pivotal connection 35 through which a link 36 has a threaded engagement. The link 36 leads to the throttle lever (not shown). A needle valve 37 has a threaded portion 38 for engagement with the threaded portion 29 and also has a conical portion 39 for engagement with the conical valve seat 30. Secured to the end of the needle valve 37 is an arm 40 provided with a pivotal connection 41 through which is threaded a link 42 which is connected with the accelerator lever (not shown). A passage 43

connects the passage 25 with the atmosphere.

The operation of the device of this modification is as follows: Assuming that the load on the engine is increased so that there is a tendency for the engine to slow down this will immediately result in a decrease of the suction in the intake pipe 11, fitting 10 and also in the chamber 20, since the chamber 20 is in communication with the fitting through the passages 25 and 26. This decrease of suction in the chamber 20 will permit the spring 24ª to move the piston 19 to the right, as shown in Fig. 1, until the lessening tension of the spring is just balanced by the suction on the piston 21. This movement of the piston to the right will open the valve 14 wider to allow a freer flow of the fuel to the engine to take care of the increased load on the engine and to prevent any substantial decrease in speed. In case the load on the engine is decreased, the action of the piston 19 will be the reverse of that just described and will move the valve 14 to further restrict the flow of fuel to the engine to prevent any substantial increase in speed. In case it is desired to increase the speed at which the governor will cause the engine to run, the throttle valve is moved in a direction which will tend to open the valve 31. This will allow a freer flow of air through the passage 43 and the passage 25 leading to the chamber 20, and also to the passage 26 leading to the interior of the fitting and to the intake pipe. This increased opening of the valve will have two effects; first, it will decrease the suction in the chamber 20 permitting the spring 24ª to move to open the valve 14 wider to allow a freer flow of fuel; second, it will admit a larger quantity of air to the intake pipe through the opening 26 to be mixed with the fuel which will result in the leaner mixture and will secure economical running. If it is desired to reduce the speed of the engine the throttle is moved in a direction which will tend to close the valve 31. This will tend to increase the suction in the chamber 20 and reduce the flow of air through the passages 43 and 26 to the intake pipe resulting in a closing of the throttle valve 14 and a richer mixture which is desirable with the lower speed. If it is desired to increase the speed of the engine and at the same time increase the power the accelerator lever is moved in the direction which will tend to close the valve 37. This will restrict the communication between the chamber 20 and the interior of the fitting 10, resulting in a decrease of the suction in the chamber 20. The decrease of suction in the chamber 20 will permit the spring 24ª to open the valve 14 wider to permit a freer flow of fuel to the engine. The closing of the valve 37 will also restrict the flow of air through the passages 43 and 26 thus increasing the richness of the mixture. Thus a movement of the accelerator lever to open the valve 37 will tend to open the valve 14 wider and will also increase the richness of the mixture giving the maximum power.

In the modification of Figs. 3, 4, 5 and 6 I have provided a device in which the governing action is effected by means of a variable pressure chamber comprising a plurality of spring diaphragms, which chamber is in communication with the interior of the intake pipe fitting. In this modification I have also provided a yielding connection between the spring diaphragm chamber and the throttle valve, whereby the throttle valve may be actuated independently of the action of the diaphragm chamber by means of the accelerator lever. In this modification reference character 10ª indicates a pipe fitting provided with flanges 12ª for connection with the flanges 13 of the intake pipe. The throttle valve 14, which may be of the usual butter-fly type is mounted on a rock shaft 44 to one end of which is secured a bent arm 45, which arm is provided with a pin 46 which works in a slot 47 of the arm 48 which is pivotally mounted on the fitting 10ª by means of a screw 49. A short arm 50 is secured to the arm 48 by means of a rivet 51 and a plate 52 extending between said arms as shown in Fig. 6. A collar 53 is placed on the pin 49 between the arms 50 and 48. Surrounding this collar is a coil spring 54, the ends 55 of which extend upwardly on opposite sides of the plate 52 and into apertures 56 in a rod 57 slidably mounted in openings 58 and 59 in the lateral extensions 60 and 61 on the fitting 10ª, as shown in Fig. 5. The openings at the apertures 56 are considerably larger than the ends 55 of the coil spring 54 to provide a yielding connection as will appear more fully hereinafter. A flat spring 62 bears against the end of the rod 57 and is secured to the off-set portion 60 by means of a screw 63, as shown in Fig. 3. The opposite end of the rod 57 bears against the outer wall of the variable pressure diaphragm chamber, indicated in general by reference character 64. This diaphragm chamber comprises a plurality of spring diaphragms 65 secured together in pairs at their outer edges by means of annular members 66 flanged over the spring plates 65, as shown at 67. The pairs of spring plates 65 are secured together at their inner edges by means of a hollow rivet member 68 as shown in Fig. 3. Reference character 68ª indicates a fitting which is flanged over the innermost one of the spring plates 65, as shown at 69, and is threaded internally at 70 to engage a threaded boss 71 on the off-set portion 61 as

shown in Figs. 3 and 5. The interior of the spring diaphragm chamber 64 is in communication with the interior of the intake fitting 10^a by means of a channel or passage 72 in the fitting 68^a and passages 73 and 74 in the pipe fitting 10^a. Extending downwardly from the passage 73 is a passage 75 leading to a valve chamber 76 with which the needle valve 77 has a screw threaded engagement. The valve has a conical portion 78 to control the flow of air through the passage 75. Extending laterally from the valve chamber 76 is a passage 79 through which the valve chamber is in communication with the atmosphere, as shown in Figs. 5 and 6. Screwed into the lower end of the needle valve 77 is an arm 80 having a pivotal connection 81 which has a screw threaded engagement with the rod 82 leading to the throttle lever (not shown). Secured to the rock shaft 44 at the end opposite that to which the arm 45 is secured is an arm 83 to which is secured a pin 84. 85 indicates a support which is screwed into the fitting 10^a. A screw 86 is mounted on this support 85 to provide a pivotal support for the levers 87 and 88. A collar 89 is mounted on the screw 86 between the levers 87 and 88. The lever 87 is provided with a pivotal connection 89^a which has a screw threaded engagement with the rod 90 which leads to the accelerator lever (not shown). The lever 88 is provided with a pivotal connection 91 which has a screw threaded engagement with the rod 92 which is so connected with the clutch mechanism that when the clutch is operated to disconnect the engine the link 92 will be actuated to move the upper end of the arm 88 against the pin 84 to move the throttle valve 14 to a position in which only a small quantity of fuel will be supplied to the engine to prevent the engine from racing. Stops 93 are provided on opposite sides of the arm 83 to limit the movement of the arm.

The operation of the device of this modification is as follows: Assuming that the load on the engine is increased, the first effect will be a slight decrease in the speed of the engine which will result in a decrease of suction in the intake pipe 11, the intake fitting 10^a and spring diaphragm chamber 64 which latter is in communication with the interior of the fitting 10^a through the passages 72 and 73 and 74. This decrease in suction in the diaphragm chamber 64 will permit the chamber to expand slightly to permit the spring 62 to move the rod 57 to the right, as shown in Figs. 3 and 5. This movement of the rod 57 to the right will result in an opening of the valve 14 because of the engagement of the ends 55 of the spring 54 with the apertures 56 in the rod and with the plate 52 which is secured to the arm 48, and because of the pin and slot connection 46 and 47 of the arm 48 with the arm 45 which is secured to the rock shaft 44 of the throttle-valve. This increased opening of the throttle valve will permit a freer flow of fuel to the engine to take care of the increased load and to prevent any substantial decrease in speed of the engine. If the load on the engine is decreased the spring diaphragm chamber 64 will be actuated in the opposite direction to tend to close the valve 14 to restrict the flow of fuel to the engine and prevent any substantial increase in speed. If it is desired to modify the action of the governor to secure a different regulated speed, the throttle valve is actuated in one direction or the other to permit a more or less restricted communication between the atmosphere and the passage 75 which will tend to increase or diminish the suction in the diaphragm chamber 64 to cause the throttle valve 14 to permit a more or less restricted flow of fuel to the engine. In this connection it will be noted that when the valve 77 is moved to open the atmospheric communication wider the throttle valve will be opened wider and the fuel mixture will be somewhat leaner because of the air admitted through the passages 79, 75 and 74 to the interior of the intake fitting, thus securing an increased speed in an economical manner. If it is desired to secure an increase in speed without a leaner fuel mixture the accelerator lever is moved in a direction which will bring the upper end of the lever 87 against the pin 84 to move the valve 14 to a position which will permit an increased fuel flow. As previously stated the rod 92 is so connected with the clutch mechanism that when the clutch is operated to disconnect the engine the rod 92 will move the lever 88 to cause its upper end to engage the pin 84 to move the throttle valve 14 into a position which will permit only a slight flow of fuel to the engine to prevent the engine from racing when the load is taken off. The valve 14 can be moved by means of either of the levers 87 or 88 without moving the rod 57 which may possibly be held somewhat firmly in a certain position because of its engagement with the outer spring diaphragm 65 of the spring diaphragm chamber 64. This independent movement of the throttle valve is possible because of the yielding connection of the arm 48 with the rod 57. Thus, if the rod 57 is firmly held by means of the spring diaphragm in the position shown in Figs. 3 and 5, a movement of the arm 48 to the right as shown in said figures will be resisted by the right hand upper end 55 of the coil spring 54 which will be moved to the right, this movement being permitted because, as previously stated, the opening 56

is considerably larger than the end 55 of the spring. Similarly the valve 14 may be moved to restrict the fuel opening by means of the lever 88 without necessitating the movement of the rod 57 to the left against the action of the spring 62, as movement of the arm 48 to the left as shown in Figs. 3 and 5 will be resisted only by the spring pressure of the left hand end 55 of the coil spring 54 which end 55 has considerable play in the aperture 56 in the rod 57.

It will be noted that in both modifications I have provided manually controlled pneumatic means for modifying the action of the speed governing means, whereby, in effect, the governor may be set to cause the engine to run at various regulated speeds.

It will also be noted that in both modifications, when the throttle valve is moved to increase the regulated speed the mixture is made leaner by the admission of air to the intake pipe, but that when the accelerator lever is moved to increase the speed of the engine no additional air is admitted to the intake pipe.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A controlling device for gas engines comprising an intake flow conduit, a throttle valve controlling the intake flow, pneumatic governing means for said valve actuated by variations in pressure of the intake flow, and manually controlled pneumatic means for controlling said governing means.

2. A controlling device for gas engines comprising an intake flow conduit, a butterfly throttle valve controlling the intake flow, pneumatic governing means for said valve actuated by variations in pressure of the intake flow, and manually controlled pneumatic means for controlling said governing means.

3. A controlling device for gas engines comprising a throttle valve controlling the intake flow, and pneumatic means for controlling said valve including a variable pressure chamber, means affording communication between said chamber and the controlled gas, and manual means for controlling said communication.

4. A controlling device for gas engines comprising a throttle valve controlling the intake flow, and pneumatic means for controlling said valve including a variable pressure chamber, means affording communication between said chamber and the atmosphere, and manually controlled means for controlling said communication.

5. A controlling device for gas engines comprising a throttle valve controlling the intake flow, and pneumatic means for controlling said valve including a variable pressure chamber, means affording communication between said chamber and the controlled gas, and manual means for controlling said communication, means affording communication between said chamber and the atmosphere, and manually controlled means for controlling said communication.

6. A controlling device for gas engines including an intake pipe fitting having an opening, a butter-fly valve controlling the flow through said opening, means for controlling said valve comprising a chamber and a piston operating therein, a passage connecting said chamber with said opening, a manually controlled valve controlling said passage, a passage controlling said chamber with the atmosphere, and manually controlled means for controlling said passage.

7. A controlling device for gas engines comprising a throttle valve controlling the intake flow, and pneumatic means for controlling said valve including a variable pressure chamber, means affording communication between said chamber and the atmosphere, and manually controlled means for controlling said communication including a needle valve.

8. A controlling device for gas engines comprising a throttle valve controlling the intake flow, and pneumatic means for controlling said valve comprising a plurality of communicating spring diaphragm chambers.

9. A controlling device for gas engines comprising an intake pipe fitting having an opening, a valve controlling said opening, and pneumatic means for controlling said valve comprising a plurality of communicating spring diaphragm chambers, and means affording communication between said chambers and said opening.

10. A controlling device for gas engines comprising an intake pipe fitting having an opening, a valve controlling said opening, and pneumatic means for controlling said valve comprising a plurality of communicating spring diaphragm chambers, means affording communication between said chambers and said opening, means affording communication between said chamber and the atmosphere, and manually controlled means for controlling said communication.

11. A controlling device for gas engines comprising a throttle valve controlling the intake flow, pneumatic governing means for said valve actuated by variations in pressure of the intake flow, yielding connections between said governing means and said valve, and manually controlled means for actuating said valve independent of said governing means.

12. A controlling device for gas engines comprising a throttle valve controlling the intake flow, pneumatic governing means for said valve actuated by variations in pressure of the intake flow, yielding connections be-

tween said governing means and said valve, manually controlled means for actuating said valve in one direction independent of said governing means, and a second manually controlled means for actuating said valve in the opposite direction independent of said governing means.

In witness whereof, I have hereunto subscribed my name in the presence of a witness.

REUBEN B. BENJAMIN.

Witness:
ANNE SOLOMON.