No. 872,138. PATENTED NOV. 26, 1907.

H. MAYER.

VALVE GEAR.

APPLICATION FILED JAN. 22, 1907.

2 SHEETS—SHEET 1.

Fig: 1

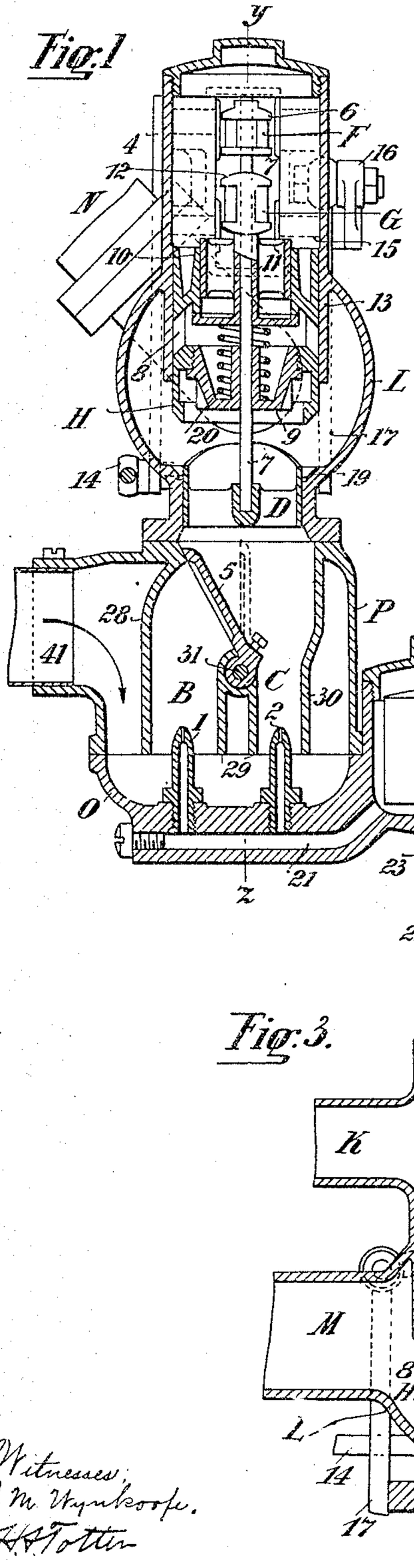


Fig: 2.

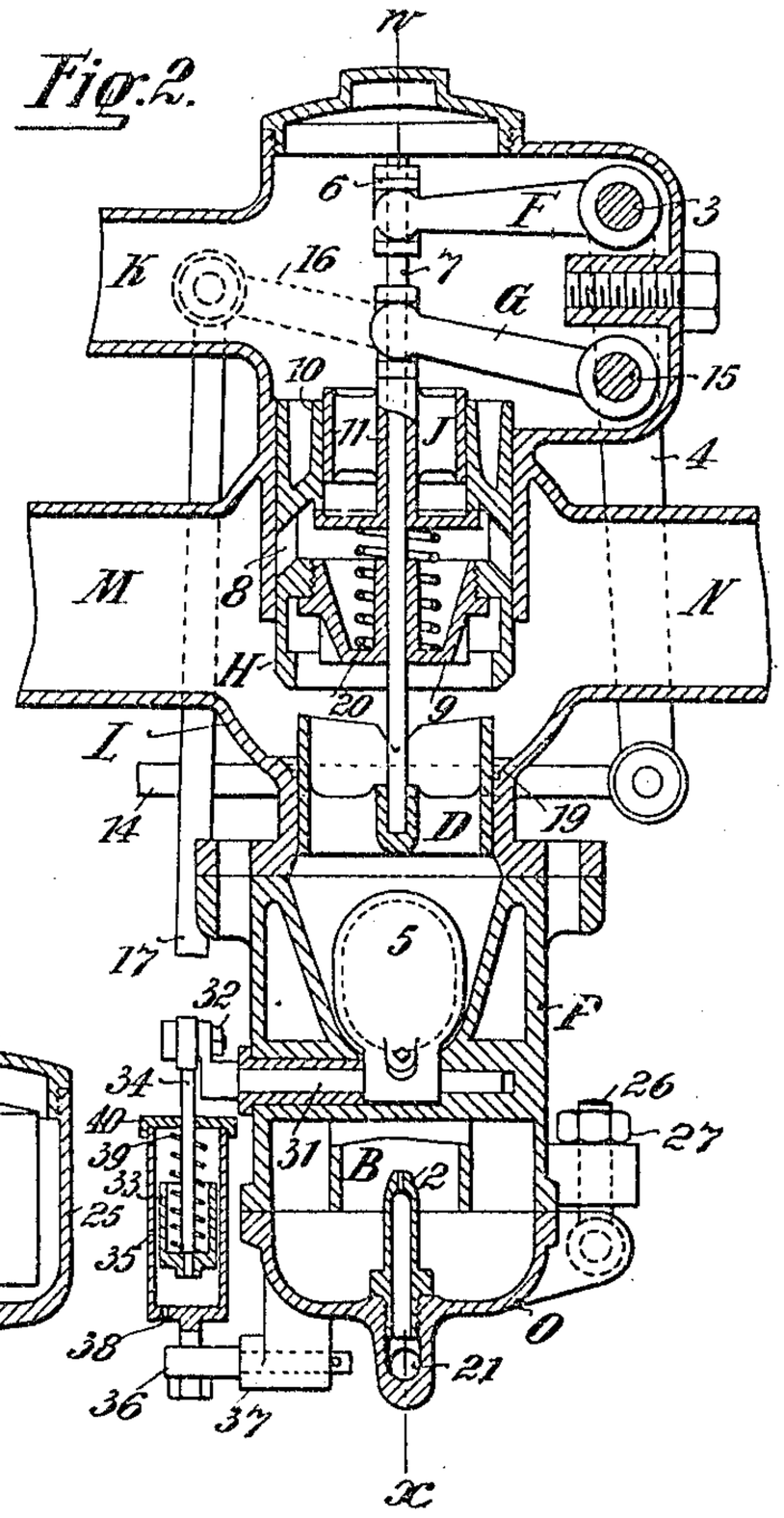
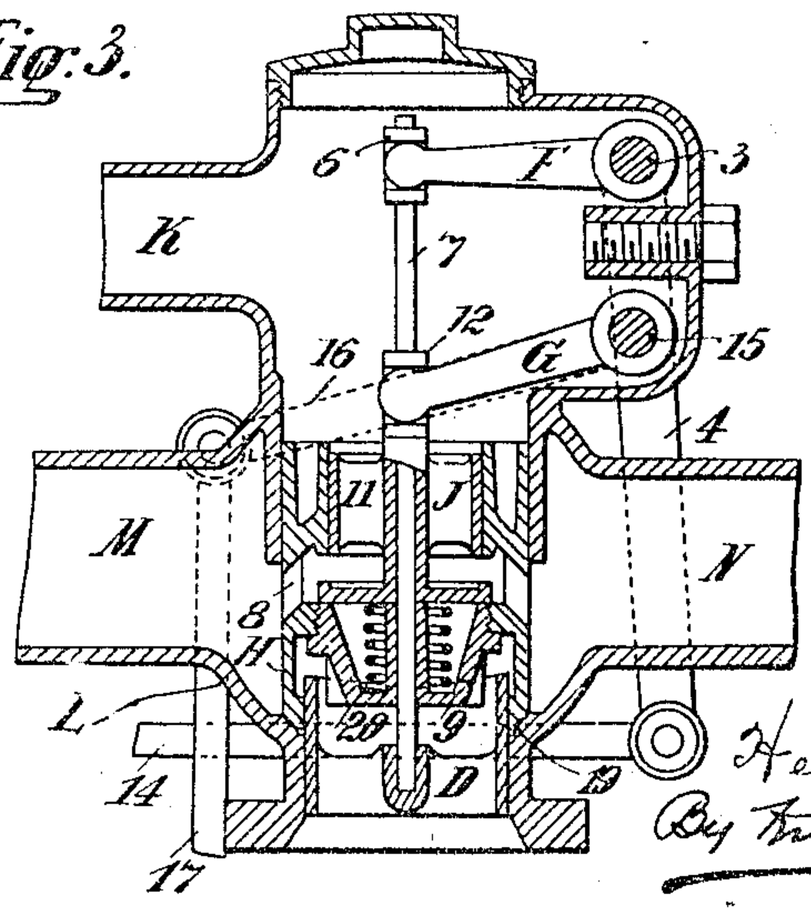


Fig: 3.



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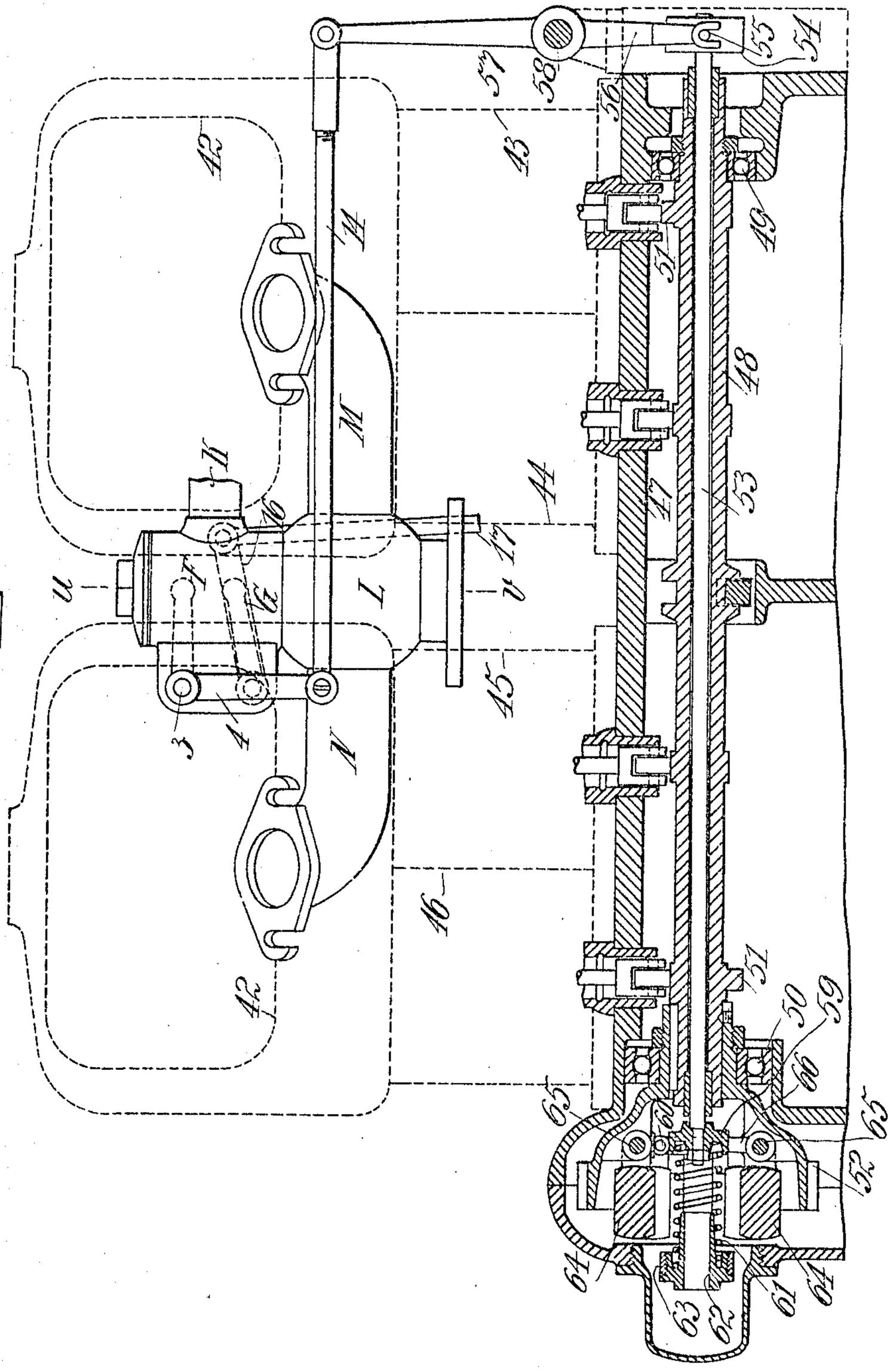
2 SHEETS—SHEET 2.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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VALVE-GEAR.

No. 872,138. Specification of Letters Patent. Patented Nov. 26, 1907.

Application filed January 22, 1907. Serial No. 353,650.

To all whom it may concern:

Be it known that I, HEINRICH MAYER, a citizen of the Confederation of Switzerland, residing at Arbon, in Switzerland, have invented a new and useful Valve-Gear, of which the following is a specification.

My invention relates to a valve gear for explosion-engines, which are provided with carbureters, governors and special valve gears adapted to admit air, so that the latter may be compressed in the cylinder or cylinders of the engine for retarding the latter, should the latter be driven by a force other than that of the explosive mixture. For example the explosion-engine may be employed in a descending automobile, that is to say an automobile which is required to make long descents without special braking devices. Or the explosion-engine may be employed as a hauling or winding engine, which is periodically required to lower loads or to allow trains to run downhill.

The new valve gear according to my invention is so arranged, that the operator is enabled to admit the explosive mixture from the carbureter to the cylinder or cylinders at any moment while permitting the governor to regulate the speed of the engine, or to shut off the explosive mixture and to admit air to the cylinder or cylinders. The new valve gear is inserted between the carbureter and the inlet or inlets of the cylinder or cylinders and comprises a regulating piston-valve, a second piston-valve, a spring-pressed air-valve and means for actuating these three valves. The regulating piston-valve is placed in the passage from the carbureter to the engine and is controlled by the governor for increasing or decreasing the area in accordance with the momentary work performed by the engine, so as to maintain a certain and constant number of revolutions. The second piston-valve is adapted to shut off the explosive mixture and to admit air to the engine, while the governor is perfectly at liberty to actuate the regulating piston-valve. The air-valve is adapted to admit air from without through the second piston-valve. The spring inserted between the second piston-valve and the air-valve serves for protecting these parts from unnecessary shocks or jerks and for preventing the air-valve from prematurely opening.

I will now proceed to describe my invention with reference to the accompanying drawings, in which the valve-gear is assumed to be applied to the engine of an automobile.

Figure 1 is a vertical section on an enlarged scale through the line *u*—*v* in Fig. 4 (when looked at from right to left) and a section on the same scale through the line *w*—*x* in Fig. 2 (when looked at from left to right) and shows a valve-box and a carbureter, Fig. 2 is a vertical section at right angles thereto through the line *y*—*z* in Fig 1, Fig. 3 is a similar section through the valve-box alone, in which the second piston-valve shuts off the explosive mixture from the engine and the air-valve admits air from without to any one of the four cylinders of the motor, and Fig. 4 is a vertical longitudinal section on a reduced scale through the upper part of the base of a four stroke cycle explosion-engine with four cylinders for a descending automobile and an elevation of the valve-box, the four cylinders being before the valve-box but removed for the sake of clearness and only indicated by dotted lines.

Similar characters of reference refer to similar parts throughout the several views.

The lower parts of Figs. 1 and 2 represent for example a carbureter for a benzin motor with one or more cylinders, which carbureter is fully described in the application for a U. S. patent filed by Kunkel on August 2, 1906, Serial No. 328914.

The carbureter shown is provided with two vertical benzin nozzles 1 and 2, which are disposed in the bottom piece O and are arranged to be supplied with benzin through the common channel 21 from a supply tube 22 by means of a valve 33 under the control of a float 24 within a box 25. The casing P can be connected with the bottom piece O in any known manner, for example by means of turnable bolts 26 and nuts 27. The casing P is cast in one piece with partitions 28, 29 and 30, whereby two separate air-passages B and C of any suitable cross section, for example of an oval section, around the mouths of the two nozzles 1 and 2 are formed. The one larger air-passage B is normally closed with an inclined trap or clack-valve 5 fastened on a cross shaft 31, which latter is mounted in the casing P to rock, as is clearly shown at Fig. 2. At the external end of the shaft 31 a lever 32 is fastened, which is pivotally connected with an air-piston 33 by means of a connecting rod 34. The air-piston 33 is mounted to reciprocate in a cylinder 35,

which latter may be arranged to swing around the horizontal axis of a pin 36 rocking in an eye 37 on the bottom piece O. An air-hole 38 is provided in the bottom of the cylinder 35, through which air may be sucked in and forced out respectively. A helical spring 39 is inserted between the cover 40 of the cylinder 35 and the air-piston 33 and is arranged for normally closing the trap or clack-valve 5. A suitable tube 41 may be connected with the casing P for the admission of air from without.

The casing P is connected with a casing L, which in turn is in any known manner connected by branches M and N with the inlet valve boxes 42, 42 of the four cylinders 43, 44, 45 and 46. It will be understood, that in case the explosion-engine has a single cylinder, the casing L need be connected with the inlet of the cylinder by a single pipe.

When assuming the various parts shown in the casing L in Figs. 1 and 2 to be omitted, in other words when assuming the upper part of the casing P to be connected direct with the inlet or inlets of the several cylinders, the carbureter described will operate as follows: The float 24 is arranged for admitting benzin from the tube 22 to the box 25 and to the common channel 21, so that the level of the benzin will be near the mouths of the two nozzles 1 and 2, as may be determined according to trials or experience. Each time, when during the suction period in any one of the several cylinders the respective piston exerts a sucking action, air will enter the annular space in the casing P through the tube 41 in the direction of the arrow and will pass upwards through the small air-passage C, when the air-current will suck in benzin from the one nozzle 2, so that the benzin is nebulized and mixes with the air, whereupon the explosive mixture will pass upwards to the respective cylinder. Should the draft increase, more air will be sucked in, so that the trap or clack-valve 5 is more or less opened, while the pressure of the helical spring 39 is overcome. For the maximum draft the trap or clack-valve 5 will occupy a vertical position indicated by dotted lines in Fig. 1. When the draft ceases, of course the trap or clack-valve 5 will be again closed by the helical spring 39 and no air will pass upwards through the small air-passage C, nor will it suck in any benzin from the nozzle 2. However, the carbureter may also be of any other known and approved construction, the essential point being, that a mixture of air and benzin or the like be therein formed. I have merely shown this carbureter to illustrate the effect of the new valve gear.

A tubular regulating piston-valve D is mounted in the lower cylindrical part of the casing L to reciprocate, and is rigidly connected with a vertical spindle 7. The latter is provided at its upper end with a doubly recessed cross-head 6. In the two recesses of the crosshead 6 engages a forked lever F, which is fastened on a shaft 3. The latter is mounted to rock in the upper part of the casing L and carries without a lever 4, which in a manner to be described later on is controlled from the governor by means of a rod 14. The upper part of the casing L may be provided with a suitable connection K, through which air can be admitted from without. The casing L is in its middle cast in one piece with a cylinder 13, in which according to my invention a second piston-valve H is mounted to vertically reciprocate.

The piston-valve H is provided with a recessed bottom 9, which may be secured in it in any known manner, for example by means of a screw-thread as shown. This bottom 9 is provided with a central nave, which is adapted to slide up and down on the vertical spindle 7. The lower edge of the piston-valve H is preferably beveled off and can rest on a seat 19 in the casing L. The internal surface of the lower edge of the piston-valve H can slide on the external surface of the upper part of the regulating piston-valve D.

The piston-valve H is provided about in its middle with several slots 8 in a horizontal plane above the bottom 9, which slots are fully opened by the lower edge of the cylinder 13, if the piston-valve H occupies its lowermost position, as is shown in Fig. 3. In the uppermost position of the piston-valve H, on the contrary, the several slots 8 will be closed by the cylinder 13, see Figs. 1 and 2.

The upper part of the piston-valve H is cast in one piece with a guide 10 for the tubular part of an air-valve J, whereby the stroke of the latter is limited. The air-valve J has a long hollow spindle 11, which is made to slide up and down on the spindle 7. The upper end of the hollow spindle 11 is formed to a doubly recessed cross-head 12, in the two recesses of which a forked lever G engages. The latter is fastened on a shaft 15, which is mounted in the casing L to rock and carries without a lever 16. This lever 16 can be actuated from the operator's stand or seat by means of a rod 17 and a suitable lever transmission. A helical spring 20 is inserted between the air-valve J and the bottom 9 and serves for normally closing the former.

The upper edge of the regulating piston-valve D is preferably made to slightly slope towards the central line from two opposite sides and is provided with two opposite notches in the said central line, as is shown in Fig. 2. Thereby the area between the two opposite edges of the two piston-valves D and H is made to slowly and gradually increase at the commencement of the upward motion of the piston-valve H, if the latter is raised.

In Figs. 1 and 2 the piston-valve H is

shown in its uppermost position, so that an annular space is left between its lower edge and the upper edge of the regulating piston-valve D for the passage of the explosive mixture. The maximum of this area for the lowermost position of the regulating piston-valve D and for the uppermost position of the second piston-valve H is proportioned to the maximum load and the maximum speed of the engine. When the piston-valve H rests on its seat 19, it will entirely shut off the carbureter. It will be seen, that the piston-valve H in its uppermost position will be suspended from the air-valve J, so that its own weight in addition to the tension of the helical spring 20 will keep the air-valve J closed. When the piston-valve H rests on its seat 19, the air-valve J may be still kept closed by the helical spring 20, so that the lever G will require to be brought into its lowermost position shown in Fig. 3 for opening the air-valve J and at the same time for compressing the helical spring 20.

The air is admitted in place of the explosive mixture to the explosion-engine, in case there should be any danger, that the engine may run fast under the action of a force other than the explosion of the explosive mixture. Then the air will be compressed in the cylinder or cylinders of the engine for retarding the latter. Thereby the cylinder or cylinders will be constantly cooled and will be protected from being heated by the friction. At the same time all the known braking devices, more particularly the band brakes, are thereby avoided, which is of great usefulness, since such braking devices are liable to rapid wear.

In the U. S. Patent No. 807581 of December 19, 1905 of Hippolyt Saurer and entitled "Valve-gear for descending automobiles" a valve-gear is described, which is adapted to cause the outlet valves to be opened during the whole or a part of the respective third piston strokes in the four stroke cycle, so that air may be admitted twice during each cycle. In the applications for U. S. patents, Serial Nos. 276183 and 276461, both of August 28, 1905 by Hippolyt Saurer a modified valve gear and a method of regulating descending automobiles respectively is described for a similar purpose. My new valve-gear described so far is suitable for explosion-engines provided with such valve-gears and for such a method. In Fig. 4 the valve-gear is for example shown as applied to a descending automobile so as to illustrate a manner, in which the governor may control the piston-valve D. In the base 47 of the engine a hollow cam shaft 48 is mounted to turn, say by means of the ball-bearings 49 and 50 shown. It is adapted to operate say the inlet-valves (not shown) by means of its several cams 51, 51 in any known manner. A hollow gear wheel 52 is fastened at one end of the hollow shaft 48 and is formed as the casing of a governor. A rod 53 passes through the hollow shaft 48 and can longitudinally move therein and turn in a ring 54 (say by means of a ball-bearing or the like). The ring 54 is provided with two opposite pins 55, which engage in the slotted ends of the forked arm 56 of a two-armed lever 56, 57 rocking on a suitable pin 58. The upper arm 57 of this lever is pivotally connected with the rod 14 mentioned above. At the other end of the rod 53 is fastened a disk 59 which is provided with two opposite pins 60 (of which only one is visible) and is adapted to bear on a helical spring 61. The other end of the latter bears against a recessed ring 62 which is secured in a suitable yoke 63 fastened on the inside of the gear wheel 52. Two weights 64, 64 are mounted to rock on two parallel cross pins 65, 65 in the gear wheel 52 and are provided with arms 66, the slotted ends of which engage the pins 60 on the disk 59. The gear wheel 52 is so driven from the crank-shaft (not shown) as to make one revolution on every two revolutions of the latter as usual. It will be seen, that for the normal speed of the engine the weights 64, 64 of the governor, the two-armed lever 56, 57 and the two levers 4 and F will occupy their middle positions shown. When the speed of the engine decreases, the helical spring 61 will push the disk 59 with the rod 53 from left to right, so that the two weights 64, 64 will approach to the center line of the rod 53 and the lever F will lower the piston-valve D. An increase of the speed will reverse the described motions of the parts.

It is evident, that the governor and its transmission shown may be modified in accordance with the kind of the explosion-engine, to which the valve-gear is to be applied.

The valve-gear is operated as follows: When the explosion-engine with its governor is at rest, the regulating piston-valve D will occupy its lowermost position and the second piston-valve H will normally occupy its uppermost position, so that the area between its lower edge and the upper edge of the regulating piston-valve D will be the largest. After starting the explosion-engine in any known manner, the governor will bring by the parts 53, 54, 56, 57, 14, 4, 3, F, 6 and 7 the regulating piston-valve D into an intermediate position, for example the middle position shown in Figs. 1 and 2. The explosive mixture having been prepared in the carbureter below will be sucked in either from the passage C alone or from both passages B and C, as the case may be, and will be conducted through the regulating piston-valve D, through the annular area between both piston-valves D and H and through the branch M or N to the respective cylinder. The quantity of explosive mixture passed

through the regulating piston-valve D is automatically adjusted from the governor by means of the regulating piston-valve D, which may move up and down. Should any danger arise, that the explosion-engine may run fast, for example in the case of descending automobiles if the gradient of the descent exceeds a certain limit, the operator will by his lever transmission and the parts 17, 16 and 15 move the forked lever G downwards for shutting off the carbureter by means of the piston-valve H and for opening the air-valve J, so that air will be admitted from without through the connection K, the air-valve J, the slots 8 of the piston-valve H and the branches M and N to the several cylinders consecutively. During all the time the governor is perfectly left at liberty to work. It is a great advantage, that the operator is at all times permitted to use the new valve-gear without troubling himself about the position of the governor.

From the above explanations it will be seen, that the supply of benzin is completely stopped and that no benzin is wasted at all, if the speed of the explosion-engine is regulated by means of compressed air alone, also that no benzin smell is given forth during this time, and that exclusively pure cool air is sucked into the one or more cylinders to be therein compressed. It is also an advantage, that the piston-valve H is elastically connected with the forked lever G, as unnecessary shocks or jerks are thereby avoided. The spring 20 is very essential for preventing the air-valve J from prematurely opening before the piston valve H has completely shut off the carbureter.

The valve-gear described may be varied in many respects without departing from the spirit of my invention.

I claim:

1. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing having two apertures, of which the one leads to the carbureter and the other to without, of two piston-valves mounted to reciprocate in the two apertures of said casing, connections between said casing and the cylinder or cylinders of the explosion-engine, and means for opening the one and closing the other of said two piston-valves and vice versa for admitting explosive mixture or air to the engine respectively.

2. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing, of connections between said casing and the cylinder or cylinders of the explosion-engine, two piston-valves in said casing and adapted to admit explosive mixture from the carbureter and air from without respectively to the engine, and means for opening the one and closing the other of said two piston-valves and vice versa.

3. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing, of connections between said casing and the cylinder or cylinders of the explosion-engine, a piston-valve mounted to reciprocate in said casing and adapted to admit explosive mixture from the carbureter to the engine, an air-valve in said casing and adapted to admit air from without to the engine, an elastic connection between said piston-valve and said air-valve, and means controlled from the operator for first closing said piston-valve and then opening said air-valve or for first closing the latter and then opening the former.

4. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing, of connections between said casing and the cylinder or cylinders of the explosion-engine, a piston-valve mounted to reciprocate in said casing and adapted to admit explosive mixture from the carbureter to the engine, means controlled from the governor for actuating said piston-valve, a second piston-valve mounted in said casing to reciprocate and adapted to encircle with its edge the opposite edge of said piston-valve in the one extreme position for shutting off the explosive mixture and to leave between these two edges in the other extreme position a passage for the explosive mixture, an air-valve in said casing and adapted to admit air from without to the engine, an elastic connection between said second piston-valve and said air-valve, and means controlled from the operator for first closing said second piston-valve and then opening said air-valve or for first closing the latter and then opening the former.

5. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing having two cylindrical parts of which the one communicates with the carbureter, of connections between said casing and the cylinder or cylinders of the explosion-engine, a tubular regulating piston-valve mounted to reciprocate in the cylindrical part of said casing contiguous to the carbureter, means controlled from the governor for actuating said regulating piston-valve, a piston-valve with a partition mounted to reciprocate in the other cylindrical part of said casing and adapted to encircle with its edge the opposite edge of said tubular regulating piston-valve in the one extreme position and to bear against a seat in said casing for shutting off the carbureter and to leave between these two edges in the other extreme position a passage for the explosive mixture, slots be-

ing provided in the piston-valve on the side of its partition opposite to the tubular regulating piston-valve and being adapted to be opened in the one extreme position and to be closed in the other extreme position by the cylindrical part, an air-valve mounted to reciprocate in said piston-valve and adapted to admit air from without through the slots of the latter to the engine, a spring inserted between the partition of said piston-valve and said air-valve, and means controlled from the operator for actuating said air-valve and thereby said piston valve.

6. In a valve-gear for four stroke cycle explosion-engines with carbureters and governors, the combination with a casing having two cylindrical parts, of which the one communicates with the carbureter, of connections between said casing and the cylinder or cylinders of the explosion-engine, a tubular regulating piston-valve mounted to reciprocate in the cylindrical part of said casing contiguous to the carbureter, a spindle rigidly connected with said tubular regulating piston-valve, means controlled from the governor for actuating said spindle, a piston-valve with a partition mounted to reciprocate in the other cylindrical part of said casing and to slide on said spindle, it being adapted to encircle with its edge the opposite edge of said tubular regulating piston-valve in the one extreme position and to bear against a seat in said casing for shutting off the carbureter and to leave between these two edges in the other extreme position a passage for the explosive mixture, slots being provided in the piston-valve on the side of its partition opposite to the tubular regulating piston-valve and being adapted to be opened in the one extreme position and to be closed in the other extreme position by the cylindrical part, an air-valve mounted to reciprocate in said piston-valve and adapted to admit air from without through the slots of the latter to the engine and being provided with a hollow spindle which is adapted to slide on said spindle and is provided with a crosshead, a lever mounted in said casing to rock and engaging the cross-head of said air-valve, a spring inserted between the partition of said piston-valve and said air-valve, and means controlled from the operator for actuating said lever.

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