

M. B. CRIST.
VALVE GEAR FOR EXPLOSION MOTORS.
APPLICATION FILED JULY 20, 1909.

1,063,330.

Patented June 3, 1913.

3 SHEETS—SHEET 1.

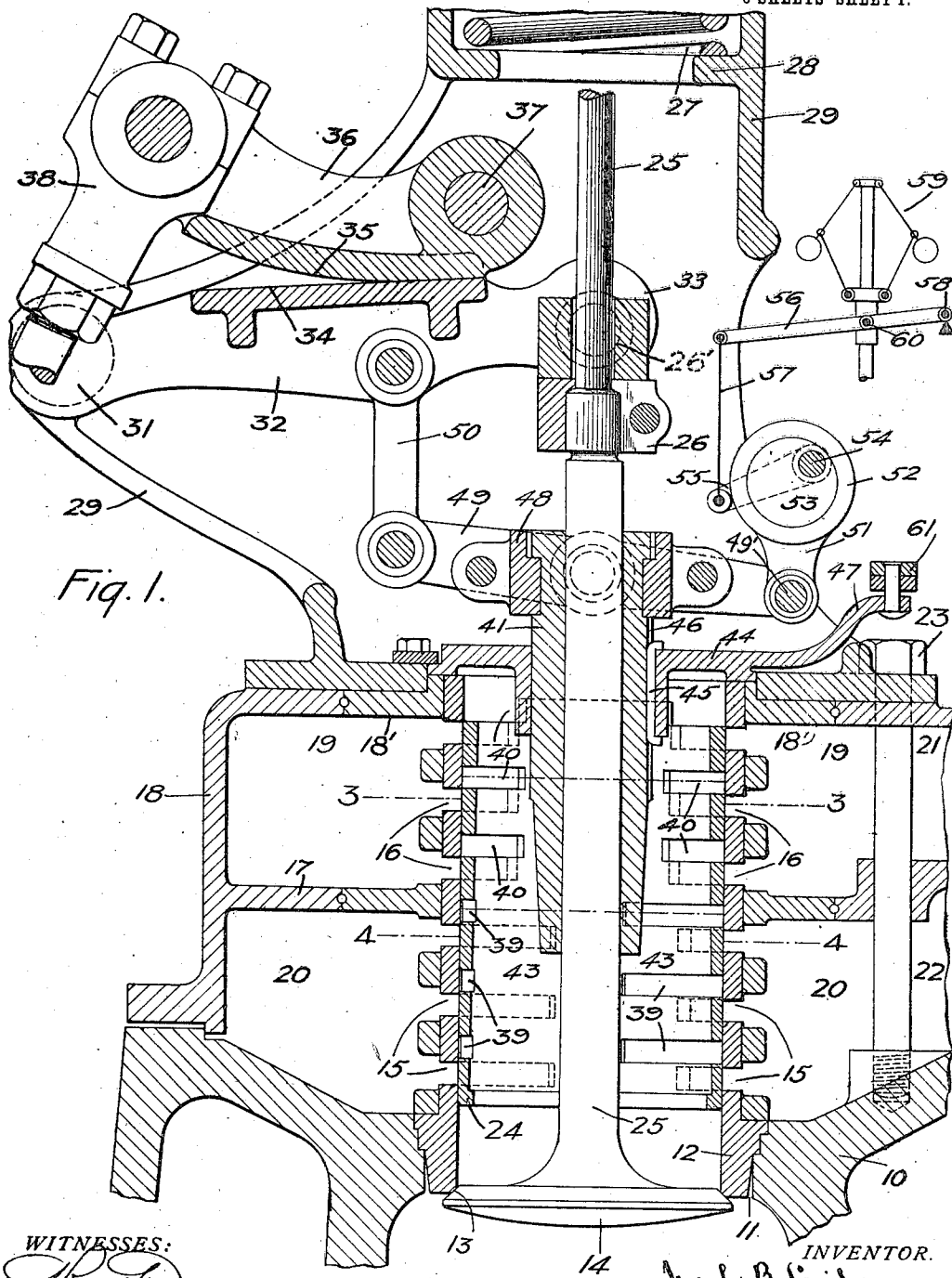


Fig. 1.

WITNESSES:
B. J. Dunk
B. J. Dunk

INVENTOR.
Mark B. Crist.
J. D. Green
HIS ATTORNEY IN FACT.

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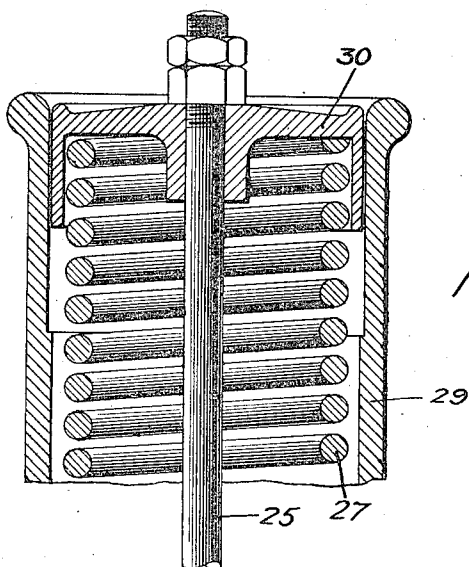


Fig. 2.

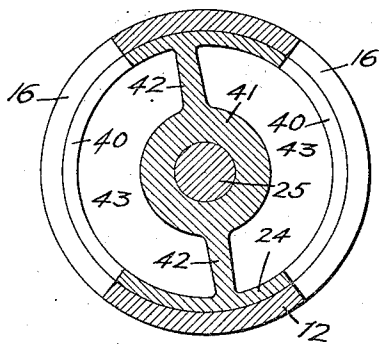


Fig. 3.

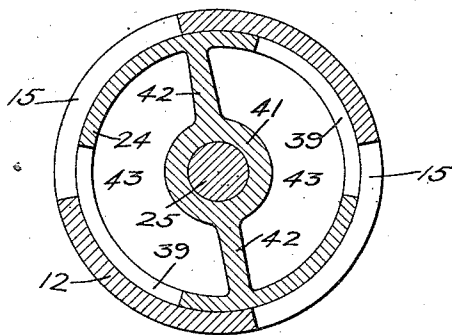


Fig. 4.

WITNESSES:

W. H. H. H.
B. J. H. H.

INVENTOR.

BY

Mark B. Crist
J. M. D. H. H.
HIS ATTORNEY IN FACT.

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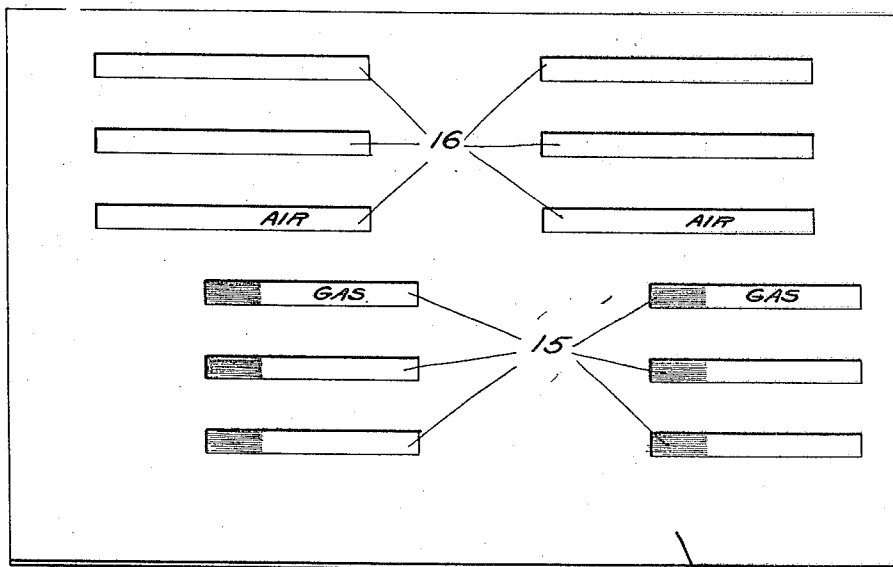


Fig. 5.

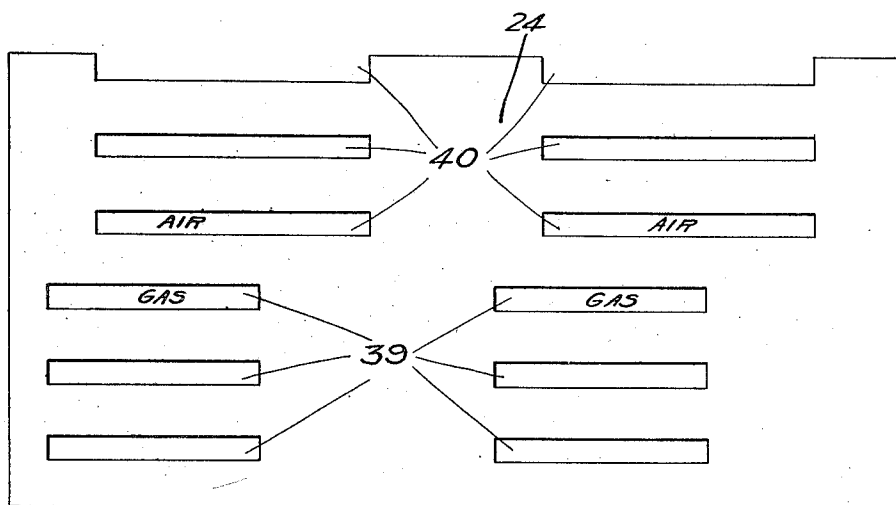


Fig. 6.

WITNESSES:

W. J. Anderson
B. J. Dunk

BY

INVENTOR.
Mar. B. Crist
Geo. D. Green
HIS ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

MARK B. CRIST, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

VALVE-GEAR FOR EXPLOSION-MOTORS.

1,063,330.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed July 20, 1909. Serial No. 508,636.

To all whom it may concern:

Be it known that I, MARK B. CRIST, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have made a new and useful invention in Valve-Gear for Explosion-Motors, of which the following is a specification.

This invention relates to the general class of explosion motors but more particularly to a mixing valve gear for supplying proper proportions of air and gas to the explosion chamber of an explosion motor, and at the same time to properly proportion the charge or charges delivered to the explosion chamber in proportion to the load demand.

One of the objects of my invention is to provide a valve gear so arranged that the valve will be universal for any kind of gas: For example, if a lean gas is utilized, a larger proportion of gas mixed with air will be required than if a relatively rich gas is employed.

The device illustrated is of the variable compression type in which a given charge or volume of mixture is permitted to enter the combustion chamber of the motor for a given load. Such devices have been utilized heretofore, but, so far as I am aware, it has been necessary before my invention to design ports for a given proportion of air and gas to accommodate different kinds of gas. For example, if producer gas is utilized, the proportion of gas to air would be approximately 1 to 1, while if natural gas was utilized, the proportion of gas to air would be approximately 1 to 13. Therefore it is apparent that ordinarily a valve designed for producer gas would not serve for natural gas. My valve is so arranged, however, that a hand adjustment is provided whereby I am enabled to adjust the port areas to accommodate the various gases from the leanest to the richest gas. After the proper adjustment has been made, the valve will operate as a constant mixture variable compression valve. I have also provided governor actuated means for timing the opening and closing of the valve ports according to the speed of the motor.

Other objects and advantages will appear from the following description, it being understood that changes in form, proportion,

and minor details of construction may be resorted to without departing from the spirit of the invention or sacrificing any of the advantages thereof.

In the drawings illustrating one embodiment of my invention: Figure 1 illustrates a longitudinal sectional view through a valve casing, piston valve, inlet valve, and the operating mechanism therefor, the governor and its appurtenances being illustrated in diagram; Fig. 2 is a fragmentary sectional view through a part of the valve hood, showing the spring for returning the piston valve and inlet valve to cut-off positions; Fig. 3 is a sectional view on the line 3—3 of Fig. 1; Fig. 4 is a sectional view on the line 4—4 of Fig. 1; Fig. 5 is a view showing the development of the interior of the valve bush; and Fig. 6 is a view showing the development of the exterior of the piston valve.

Referring now to the drawings by numerals of reference: 10 designates a portion of the cylinder of an explosion motor to which the valve mechanism is applied. The cylinder 10 is provided with an inlet port 11 in which is fitted a bush 12, having a valve seat 13 for the inlet valve 14. The bush 12 is provided with a plurality of gas ports 15, and a plurality of air ports 16. The sets of gas ports and air ports are separated by a partition 17 in the casing 18, (secured to the motor cylinder) so that the partition 17 divides its casing into an air chamber 19 and a gas chamber 20. The casing is shown as consisting of an outer shell 18 and an inner shell 18' properly connected together. The inner shell is provided with ports corresponding to the ports 15 and 16 in the bush 12. This is merely for convenience in manufacture and if desired, the bush 12 may be a part of the casing. The air chamber 19 has an inlet port 21 and the gas chamber has an inlet port 22, so that air and gas may enter said chambers 19 and 20 to be drawn into a mixing chamber preparatory to entering the combustion chamber of the motor. The casing 18 may be fastened to the cylinder of the motor in any well-known manner: For example, bolts 23 may be employed for this purpose.

A good idea of the general arrangement of the air and gas ports in the bush may

be obtained by reference to Figs. 5 and 6. In these figures it will be observed that the gas ports in the mixing valve 24 and the bush 12 are offset with respect to one another so that when the mixing valve 24 is rotated the effective area of the air and gas ports may be set for any desired condition; as an example, the shaded lines in Fig. 5 indicate the effective areas of the gas ports, the entire air port areas being effective. If, however, the valve 24 be turned, the effective gas port areas may be increased and the effective air port areas decreased.

The inlet valve 14 is provided with a stem 25 which extends beyond the casing 18 and supports a ring 26 to which the trunnions 26¹ are secured. In the form shown, it is intended that the valve 14 will normally be held seated by a spring 27 bearing at one end against the flange 28 of the hood 29, and at the opposite end against a head 30 on the stem 25. (See Fig. 2).

The opening movement of the valve 14 is effected by a mechanism which I will now describe. Pivotally secured at 31 to the hood 29 is a lever 32, the end 33 of which engages the trunnions 26¹ on the ring 26 on the stem 25 of the valve 14. This lever 32 has a bearing face 34 to be engaged by the rolling face 35 of a cam or rocking lever 36 pivoted to the hood 29 at 37 and actuated by a pitman or rod 38 from a lay shaft by proper mechanism: as, for example, a cam. Mounted upon the stem 25 is a piston valve 24 having gas ports 39 and air ports 40. This valve 24 is longitudinally movable upon the stem 25 by a governor mechanism and is so arranged that the length of its longitudinal movement will be approximately constant and coextensive with that of the valve 14 for every impulse given by the lever 32, but the positions of the ports in the valve 24 with respect to those in the bush 12 may be varied by the governor due to changes in load or speed changes, so as to throttle the charges of air and gas dependent upon the load demand. This piston valve 24, consists of a cylinder snugly fitting the interior of the bush 12 and is provided with a hub 41 connected to the cylindrical portion of the valve by webs 42. These webs may be in the form of spiders so as not to interfere with the mixing of air and gas in the mixing chamber 43. The mixing chamber 43 is closed at the top by a cap 44 provided with a feather or key 45 which engages an elongated groove or slot 46 in the hub 41 of the piston valve 24, so that the valve may slide with respect to the cap 44 but partake of any rotative movement of the cap due to turning the handle 47 thereof. One end of the hub 41 is held in a shouldered ring 48 which is connected to a lever 49. The lever 49 is secured at one end to an intermediate portion of the lever 32 by a link 50, and said

lever 49 is loosely secured to the arm 51 on the strap 52 of a cam 53, which in turn is supported on a shaft 54. The fulcrum of the lever is indicated at 49¹. The shaft 54 is shown as being provided with an arm 55 connected to the lever 56 by a link 57, said lever 56 being fulcrumed at 58 and connected to a governor or speed responsive device 59 at 60. In view of the fact that both the valve 14 and the valve 24 are connected to the lever 32, it is obvious that the two valves will move together for every downward impulse of the lever 32. It will also follow that inasmuch as the fulcrum for lever 32 is fixed that the amplitude of the movement of the valve 14 will remain constant, but as the fulcrum for the lever 49 is variable (on account of the cam 53), the position of the movement and consequently the lap of the valve 24 may be variable, although the extent of movement of both valves 14 and 24 will be approximately constant, so that the governor or speed responsive device will be effective in moving the valve 24 longitudinally and independent of the valve 14 so as to throttle the charge of gas and air according to the load demands. This throttle effect, however, will not change the relative proportions of air and gas, but merely the charge, so that the proportions of air and gas remain constant after the valve 24 has been set to accommodate a determined gas, but the compression will be variable in the cylinders according to whether the load is heavy or light.

In a multi-cylinder engine, a plurality of valves may be adjusted together for a particular gas, and after being once adjusted the rod may be fixed by a pin, dog, or other fastening device, and any accidental rotative movement of the valve 24 will be prevented.

The link and lever mechanism which constitutes the connections between the cam 53 and the speed responsive device, may be so arranged that the movement of the cam will be effective in moving the valve an invariable distance for any given movement of the speed responsive device, or the arm 55 may be so disposed on the shaft 54 that the valve will have constantly increasing movement for a given movement of the speed responsive device. As the latter effect will merely depend upon the position of the lever 55 with respect to the shaft 54, I have deemed it unnecessary to illustrate it in detail.

I have illustrated and described the mixing valve as being provided with an upper series of air ports and a lower series of gas ports. It is obvious, however, that the disposition of the air and gas ports is immaterial: For example, the air and gas ports might be arranged in staggered relation to each other, or the air ports might all be in a common plane and the gas ports arranged in a common plane. I prefer the arrange-

ment shown, however, because by having the port area of the lesser fluid, either air or gas, immediately in the middle of the port area of the fluid having the greater volume, I am enabled to obtain a desirable mixture by causing the air and gas to be thoroughly commingled in the chamber 43 preparatory to being introduced into the combustion chamber of the motor.

10 While the valve 24 will move approximately the same longitudinal distance for each impulse imparted by the lever 32 as the valve 14, the governor actuated mechanism will so control the valve 24 that the ports for air and gas will be opened and closed earlier or later according to the position of the fulcrum of the lever 49 due to the shifting of the cam 53. So it is obvious that the valve 24 serves not only as a throttle valve but as a cut-off valve whose lap may be changed automatically by the governor.

61 is a bar connected to the handle 47 whereby the handle may be operated from a distance, or the bar 61 may be connected to a plurality of handles so that all of the valves in a multi-cylinder engine may be turned synchronously.

From the foregoing, it will be apparent that a valve constructed in accordance with my invention might be properly termed a universal valve, inasmuch as it may be made standard and adjusted by the handle 47 for any determined gas, and that the engine may be changed over to receive any richness of gas without changing the valve mechanism other than adjusting the piston valve 24.

In the foregoing description I have referred to the valve mechanism as of the constant mixture variable compression type and the drawings illustrate such a structure, but it will be apparent to one skilled in the art that, by rearranging the valve ports and the speed responsive actuated mechanism,

the valve may be designed for a constant compression valve.

What I claim is:

1. In an ignition engine, an inlet valve, a valve casing around the inlet valve and having air and gas ports, a valve having air and gas ports to register with those in the casing, means for imparting movement to said second mentioned valve and said inlet valve to admit the charge, means for delivering a constant proportion of air and gas from said second mentioned valve during the entire suction stroke, means for adjusting said second mentioned valve to vary the volumes of air and gas passing through said ports, and means for intermittently moving said second mentioned valve longitudinally of the first mentioned valve to change the port areas uncovered by said second mentioned valve.

2. In an ignition engine, an inlet valve, a valve casing around the inlet valve and having air and gas ports, a valve having air and gas ports to register with those in the casing, means for imparting movement to said second mentioned valve and said inlet valve to admit the charge, means for delivering a constant proportion of air and gas from said second mentioned valve during the entire suction stroke, means for adjusting said second mentioned valve to vary the volumes of air and gas passing through said ports and governor controlled means for intermittently changing the relative positions of one of said valves with relation to the other whereby the port areas uncovered by the second mentioned valve will be changed.

In testimony whereof, I have hereunto subscribed my name this sixteenth day of July, 1909.

MARK B. CRIST.

Witnesses:

B. F. FUNK,
C. W. MCGHEE.