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L. T. & C. HAGAN.

VALVE GEAR FOR EXPLOSIVE ENGINES.

APPLICATION FILED JUNE 30, 1903.

NO MODEL.

Fig. 1.

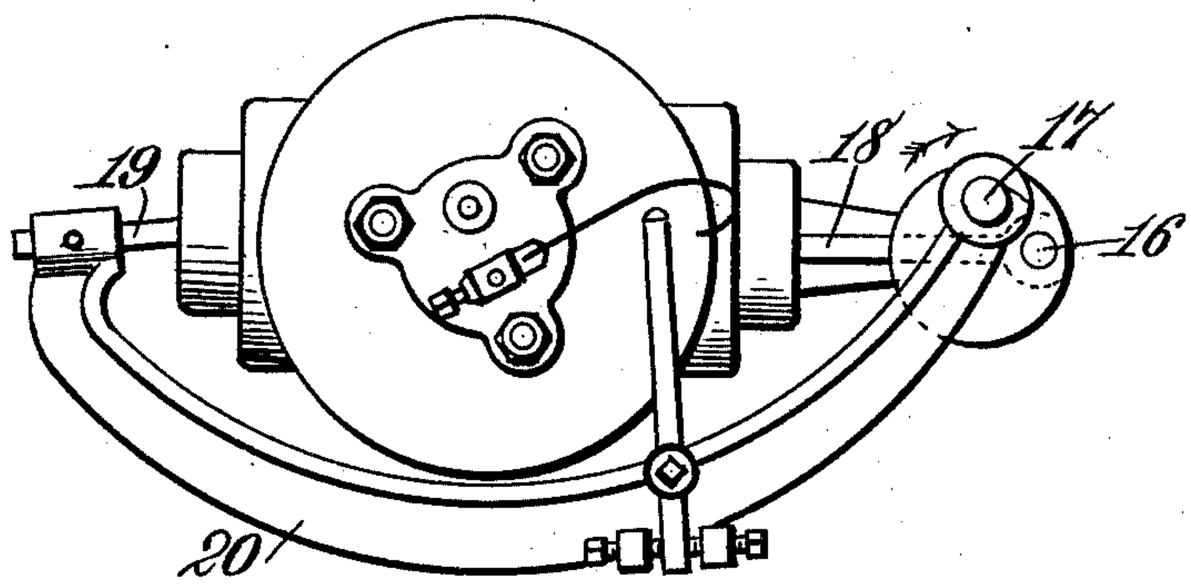
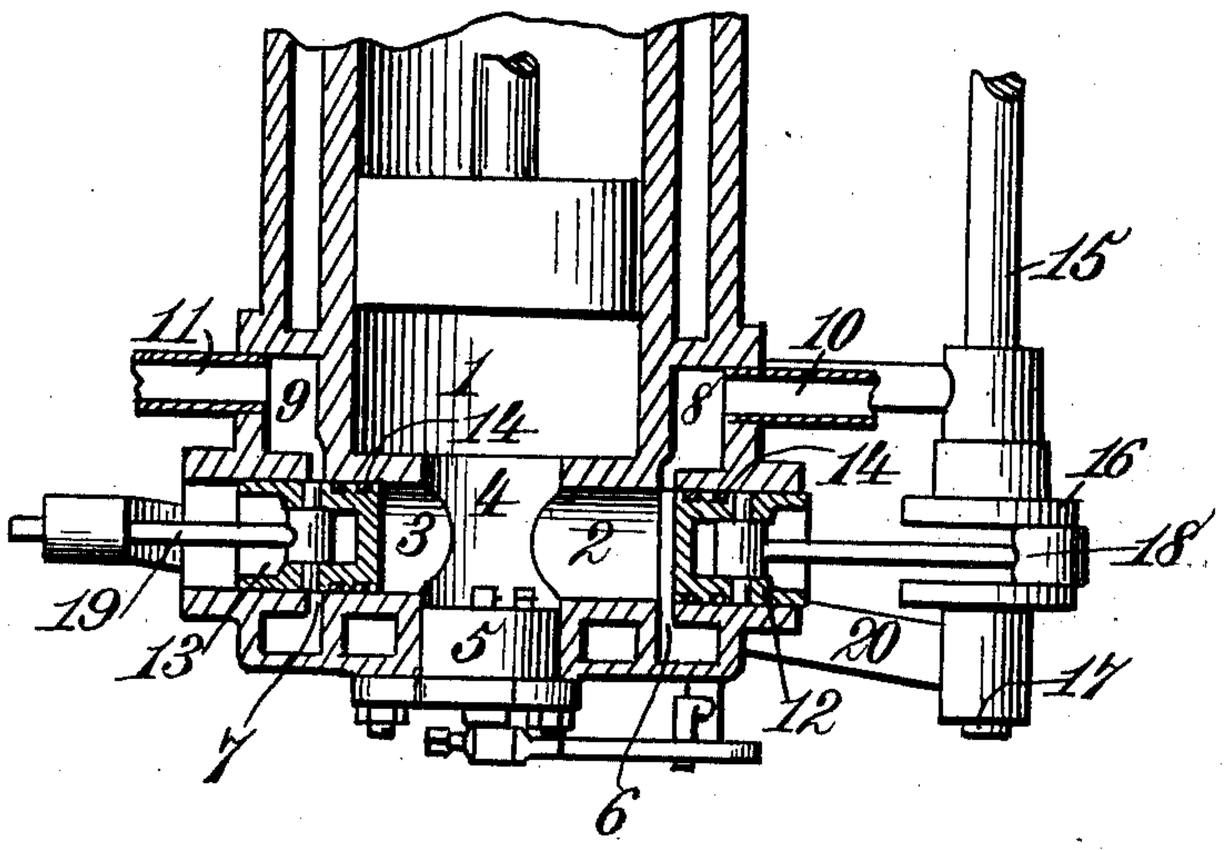


Fig. 2.



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No. 757,917. Patented April 19, 1904.

UNITED STATES PATENT OFFICE.

LOUIS T. HAGAN AND CHARLES HAGAN, OF WINCHESTER, KENTUCKY.

VALVE-GEAR FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 757,917, dated April 19, 1904.

Application filed June 30, 1903. Serial No. 163,785. (No model.)

To all whom it may concern:

Be it known that we, LOUIS T. HAGAN and CHARLES HAGAN, citizens of the United States, residing at Winchester, in the county of Clark and State of Kentucky, have invented new and useful Improvements in Valve-Gear for Explosive-Engines, of which the following is a specification.

This invention relates to valve-gear for explosive-engines, and has for its object to provide novel valve mechanism for controlling the admission to the explosion-cylinder and the exhaust therefrom of the burned gases, wherein the ends of the valves only are exposed to the pressure of the explosions and the destructive effects of the heat of combustion.

It also has for its object to improve and minimize the expense of construction and render more efficient the operation of this class of valve mechanisms.

To these ends our invention consists in the features and in the construction and arrangement of parts hereinafter described, and particularly pointed out in the claims following the description, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is an end view in elevation of the cylinder, illustrating the manner of coupling together the supply and exhaust valves; and Fig. 2 is a horizontal sectional view, the double crank and its actuating-shaft being shown in plan.

Referring to the drawings, the numeral 1 indicates the explosion-cylinder or the cylinder in which the piston works. Formed in the head of said cylinder are two transverse valve-cylinders 2 and 3, which extend entirely through the cylinder-head and are in alinement with one another, said valve-cylinders at their inner ends communicating with a port 4, that is arranged transversely to the valve-cylinders and extends from the outer end of the cylinder-head to the interior of the cylinder, the outer end of said port being closed by a plug or block 5. Formed in the valve-cylinders 2 and 3 are circumferential apertures 6 and 7, which extend entirely through the periphery of the said cylinders, the aperture 6 communicating with the port or passage-way 8 and the aperture 7 communicating with a similar port or passage-way 9. Leading into the passage-way 8 is a gas-supply pipe 10, and leading from the passage-way 9 to any convenient point is an exhaust-pipe 11. Fitted in the valve-cylinders 2 and 3 are piston-valves 12 and 13, each being of the form of a hollow cylinder closed at its inner end and grooved circumferentially, metallic spring packing-rings 14 being fitted in said grooves.

The numeral 15 indicates a shaft which is rotated from the main crank-shaft of the engine by suitable gearing, (not shown,) the arrangement being such that the shaft 15 will make one revolution while the main crank-shaft makes two.

On the end of the shaft 15 is a double crank 16 17, a pitman 18 being mounted at one end of the crank 16 and pivotally connected at its other end to the piston-valve 12. A similar pitman 19 is pivotally connected at one end to the piston-valve 13 and at its other end is fixed to one end of a curved yoke 20, which passes down beneath the cylinder, and at its other end is sleeved upon the crank 17.

The operation of our improved valve mechanism is as follows, it being assumed that the parts are in the position shown in Fig. 2 of the drawings: Gas enters from the supply-pipe 10 into the passage-way 8, which surrounds the cylinder 2, and is admitted through the circumferential aperture 6 into the valve-cylinder 2 and thence passes by way of the port 4 into the explosion-cylinder 1. After the gas has been compressed by the piston in said cylinder 1 it is ignited and exploded by any suitable igniter and drives the piston forward. By the time the piston has completed its working stroke the gearing (not shown) will have rotated the shaft 15 sufficiently to cause the cranks 16 and 17 through the medium of the connecting-rod 18 and yoke 20 to move the piston-valve 12 into position to close the aperture 6 and cause the piston-valve 13 to uncover the aperture 7, so that as the piston returns the burned gases will be exhausted through the port 4, valve-cylinder 3, aperture 7, passage 9, and exhaust-pipe 11.

As shown, the piston-valves are so set that one of said valves, the valve 12, for example,

will close the aperture in its cylinder before the other valve will uncover its aperture, whereby the engine is enabled to complete a cycle of four movements—namely, the parts being in the position shown the piston moves forward to take in a supply of gas, and as it starts to return the shaft 15 and crank 16 through the medium of the pitman 18 will move the piston-valve 12 sufficiently to close the aperture 6, but not sufficiently to cause the piston-valve 13 to uncover the aperture 7. Hence both the apertures 6 and 7 will be closed during the return stroke of the piston and the gas will be compressed.

It will be borne in mind that during the return stroke of the piston to compress the gas the shaft 15 continues to rotate and moves the piston-valve 12 farther in the valve-cylinder 2 and also moves the valve-cylinder 13 nearer to the aperture 7, but the apertures 6 and 7 still remain closed by the respective piston-valves, so that when the explosion takes place, which occurs at this moment, the gases are wholly confined within the cylinder, and the full force of the explosion is exerted on the piston to drive the latter forward. By the time the piston has reached the end of its working stroke, however, the shaft 15 and cranks 16 and 17 will have moved the piston-valve still farther in the direction before set forth, and at the moment the piston starts on its return stroke the piston-valve 13 commences to uncover the aperture 7 and permits the burned gases to be exhausted in the manner before described.

It will be obvious from the crank arrangement shown that during one complete revolution of said cranks the valves will twice be moved at a relatively rapid rate—that is to say, as the cranks approach their highest and lowest positions and recede therefrom the pitmen actuating the valves will be given a relatively long throw, and that as said cranks approach and recede from the dead-centers the pitmen and the valves will be moved but slightly. In practice the valves are so set that as the cranks are operating to give the greatest amount of throw to the valves and are moving them the fastest the valves will be approaching their opening and closing movements, so that the valves will quickly open and close to admit and exhast the gas and at other times will move slowly to afford ample time for the explosion and expansion of the gas in the cylinder and for the exhaust.

It will be noted that the ends only of the cylinder-valves are exposed to the pressure of the gas and to the heat resulting from the combustion thereof, whereby the valves are not subjected to undue strain and the packings are not subjected to the injurious and destructive action of the burning gases.

We are aware that puppet-valves have been employed in gas-engines for controlling the admission and exhaust ports, wherein the valves are not subjected to the pressure of the gases and the injurious effects of the burning gases; but this type of valve has for many reasons proven unsatisfactory in practice for gas-engines.

Our improved valves being in the form of pistons having metallic spring-rings working in valve-cylinders and being driven by crank motion, as described, instead of by cams and equivalent devices the engine can be run at a very high speed, practically without noise and with a minimum amount of wear.

Having described our invention, what we claim is—

1. In a gas-engine, the combination with the explosion-cylinder provided with two alined valve-cylinders formed transversely in the cylinder-head and communicating at their inner ends with a port common to both of them leading into the explosion-cylinder, said valve-cylinders having circumferential apertures communicating with admission and exhaust passage-ways, of piston-valves disposed in said valve-cylinders, and means for simultaneously moving said valves in the same direction to open one of said apertures and close the other, substantially as described.

2. In a gas-engine, the combination with the explosion-cylinder provided with two alined valve-cylinders formed transversely in the cylinder-head and communicating at their inner ends with a port common to both of them leading into the explosion-cylinder, said valve-cylinders having circumferential apertures communicating with admission and exhaust passage-ways, of piston-valves disposed in said valve-cylinders, and coupled together to move in unison, and means for alternately moving said valves to open one of said apertures while the other still remains closed and finally close the first-named aperture and open the other aperture, substantially as described.

3. In a gas-engine, the combination with the explosion-cylinder provided with two alined valve-cylinders formed transversely in the cylinder-head and communicating at their inner ends with a port common to both of them leading into the explosion-cylinder, said valve-cylinders having circumferential apertures communicating with admission and exhaust passage-ways, of piston-valves disposed in said valve-cylinders, a shaft rotated by the engine and provided with a double crank, a pitman connecting one of said cranks to one of the valves, and a curved yoke connecting the other crank to the other valve, substantially as described.

4. In a gas-engine, the combination with the explosion-cylinder provided with two alined valve-cylinders formed transversely in the cylinder-head and communicating at their inner ends with a port common to both of them leading into the explosion-cylinder, said valve-

cylinders having circumferential apertures communicating with admission and exhaust passage-ways, of piston-valves disposed in said valve-cylinders, a shaft rotated by the engine and provided with a double crank, a pitman connecting one of said cranks to one of the valves and a yoke connecting the other crank to the other valve, the said crank-shaft being arranged to rotate at one-half the speed of the main shaft and the ends only of the valves being exposed to the effects of the explosion, substantially as described.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

LOUIS T. HAGAN.
CHARLES HAGAN.

Witnesses:
W. T. ADAMS,
P. E. BRUCE.