T. L. MOORE.

VALVE MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED FEB. 25, 1909.

979,024. Patented Dec. 20, 1910.

Fig. 3.

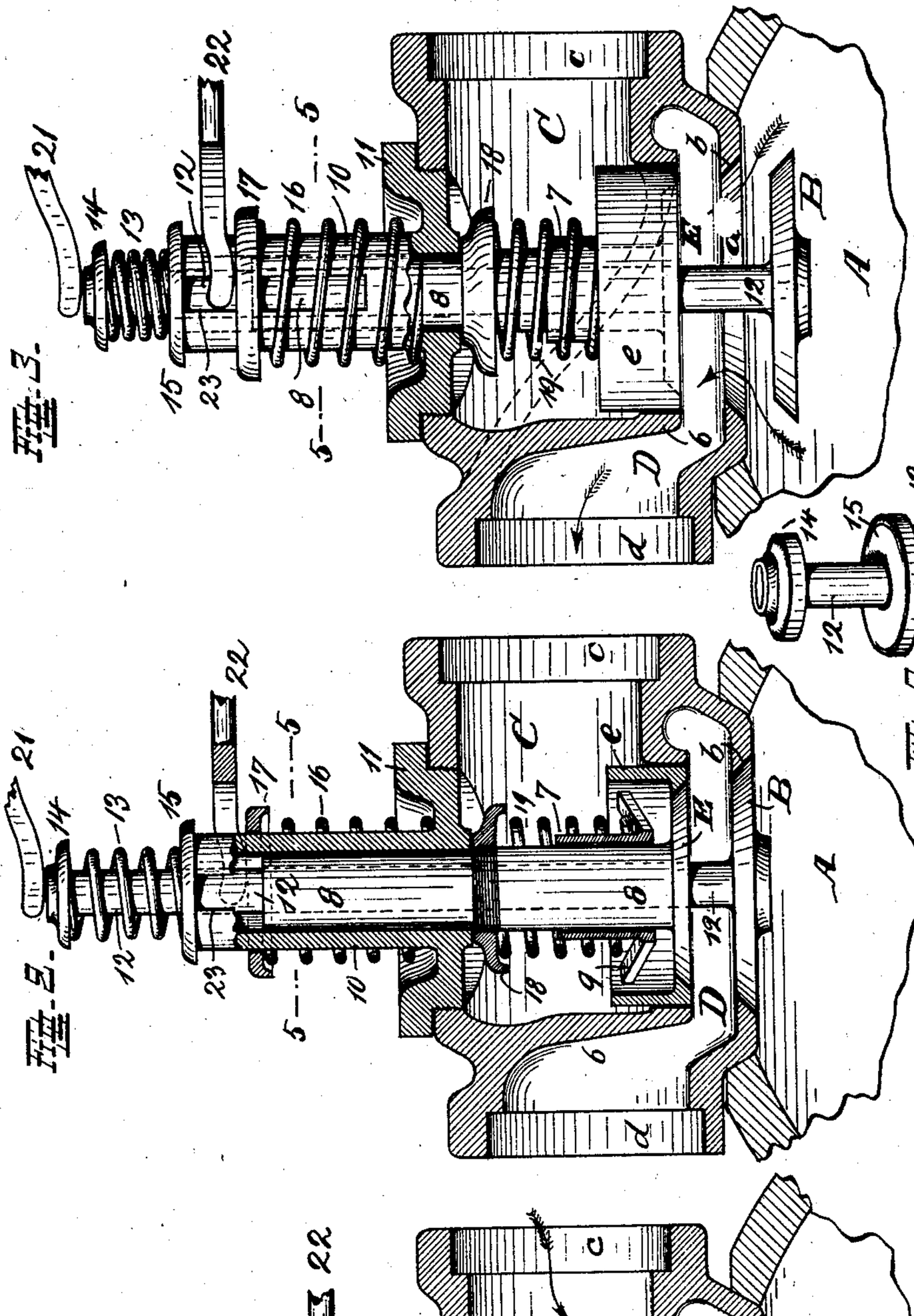


Fig. 2.

Fig. 1.

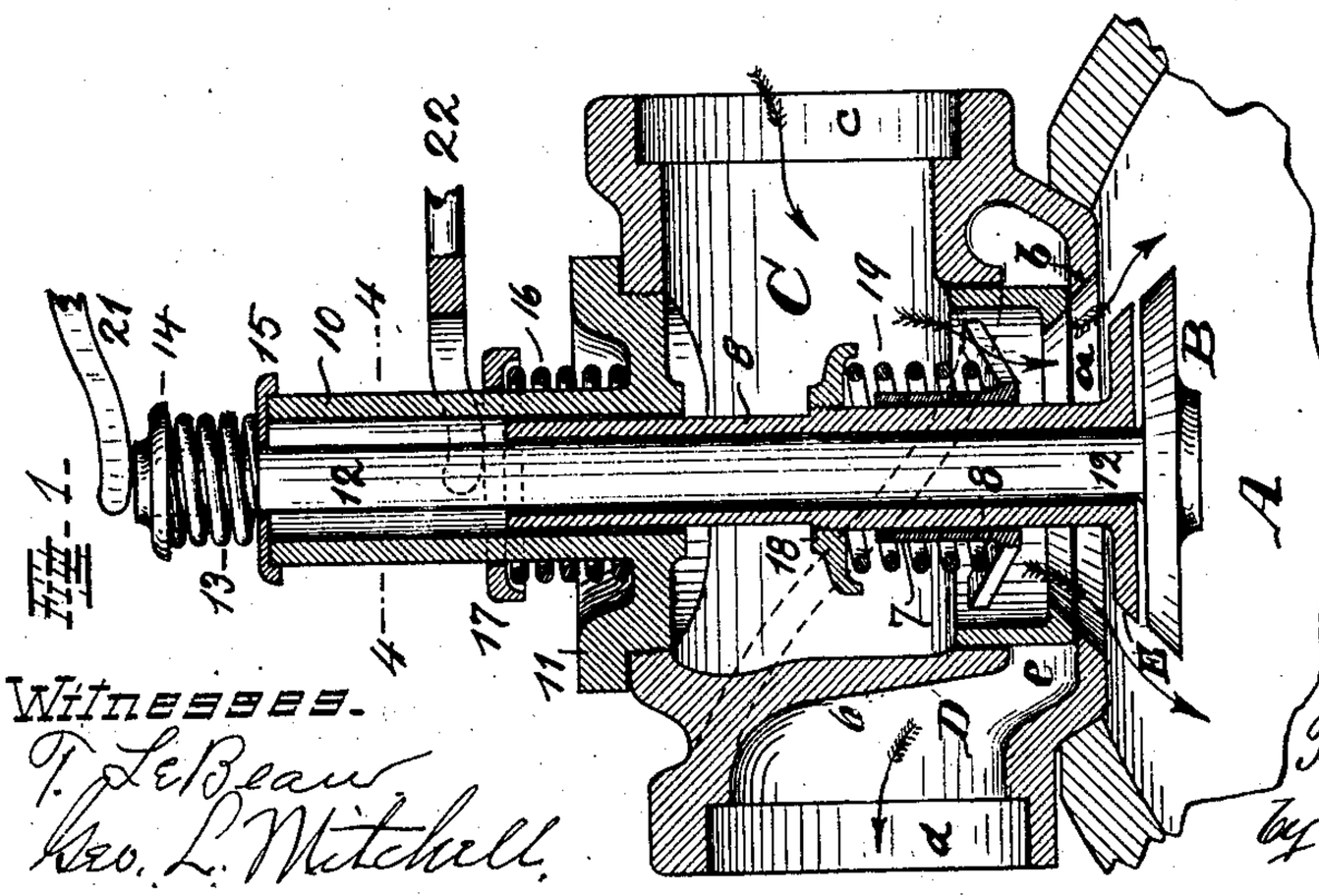


Fig. 3.

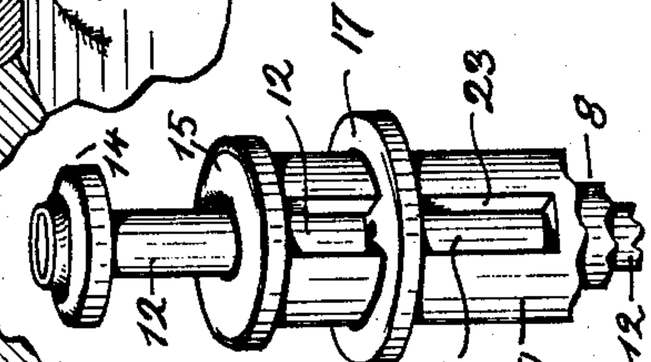
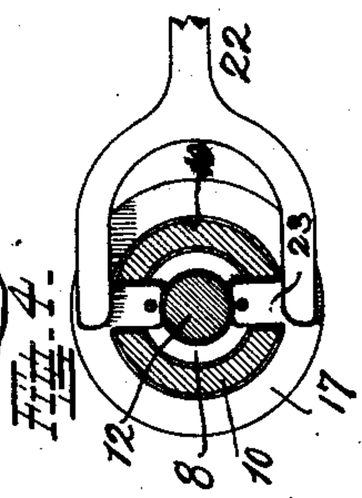


Fig. 5.

Fig. 4.



Witnesses.

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VALVE MECHANISM FOR EXPLOSIVE-ENGINES.

979,024. Specification of Letters Patent. Patented Dec. 20, 1910.

Application filed February 25, 1909. Serial No. 480,024.

To all whom it may concern:

Be it known that I, THOMAS L. MOORE, a citizen of the United States, and a resident of Cincinnati, Hamilton county, State of Ohio, have invented a certain new and useful Valve Mechanism for Explosive-Engines; and I do declare the following to be a clear, full, and exact description thereof, attention being called to the accompanying drawing, with the reference characters marked thereon, which forms also a part of this specification.

This invention relates to improvements in the construction of the valve-mechanism for explosive engines, meaning thereby the devices which control the admission of the explosive agent to the engine cylinder and the exhaust therefrom of this agent after it has spent its force.

In the following specification and particularly pointed out in the claims at the end thereof, will be found a full description of my invention, together with its operation, parts and construction, which latter is also illustrated in the accompanying drawing, in which:—

Figure 1, shows a vertical central cross-section of the parts involved, including also portions of the adjacent engine cylinder, the valves being shown in a position during the suction stroke and when they are open to permit the explosive agent to enter. Fig. 2, in a similar view shows the valves in a normal position, that is seated, this being also the position they occupy during the compression and power strokes. Fig. 3, in another similar view shows position of the valves during the exhaust stroke of the piston, meaning thereby the stroke by which the spent gases are expelled. Fig. 4, is a horizontal section on line 4—4 of Fig. 1. Fig. 5, is a similar section on line 5—5 of Fig. 2, note this line also in Fig. 3. Fig. 6, is a perspective view of certain parts projecting above the upper part of the valve-housing.

In the drawing, A indicates that much as is shown of the cylinder of an explosive engine. A piston is fitted to it and connected by means of the usual intermediate machine-elements to a shaft, also called drive, or power-shaft, because it constitutes the medium which delivers the power developed by the engine and permits it to be applied in a practical manner. These parts are not directly concerned in my invention and being well understood, are not shown. The agent used for moving the piston is gas or a vapor, usually mixed with air and will hereafter be referred to as the charge. A proper quantity of it is drawn into the cylinder by the outgoing piston, which movement is called the suction-stroke. Returning, the piston compresses this charge which movement is called the compression-stroke. At the end of this stroke ignition of the charge takes place, after which the piston is forcibly driven out by the concurrently ensuing explosion, which movement constitutes the working or power-stroke. Returning again, the piston clears the cylinder of the spent-gases, which movement constitutes the exhaust-stroke. Thereafter this cycle of movements is continually repeated as long as the engine is in operation. The charge, as well as the spent gases pass through a port *a*, one in one direction, and the other opposite thereto. This passage is controlled by a valve B fitted to a seat *b* formed within the passage by which the valve-chamber communicates with cylinder A. The valve-chamber consists of two parts C and D, each arranged to be suitably connected to communicate, as for instance by pipes to be attached to nipples *c* and *d*, the one with the charge-supply and the other with the open air. I refer hereafter to these chamber-parts as the charge-chamber C and the exhaust chamber D. These two parts are separated from each other by a partition 6 and by a compound valve E which is arranged to operate in a manner that it always prevents communication between the two chamber parts, but permits either one of them to communicate with the cylinder. In the normal condition shown in Fig. 2, each of the two chamber parts is kept separated from the other as well as from the cylinder. As shown in Figs. 1 and 3, the same relation as to the chamber-parts is still maintained, that is they are closed against each other but in the first case, chamber C is in open communication with the cylinder, permitting the same to receive the explosive charge. In the other case the exhaust-space is open to the cylinder, permitting escape therefrom of the spent gases. Valve B is open during the suction-stroke as well as during the exhaust-stroke as shown in Figs. 1 and 3, to permit passage in either direction through the opening by which the valve-chamber communicates with cylinder A. It is closed

during the compression as well as during the working-stroke, as shown in Fig. 2. Valve E is open only during the suction stroke as shown in Fig. 1, to permit communication between the charge-chamber and the cylinder. At the same time its function to prevent communication between the charge-chamber and the exhaust chamber is however never interfered with. For such purpose valve E consists of two parts, which comprise the valve-proper and an annular member *e* to which this valve is fitted. These two parts are arranged so that they may move together as well as one independent of the other. As shown in Figs. 2 and 3, these two parts functionate as one, serving to close the charge-chamber against the exhaust chamber and its open outlet. As shown in Fig. 3, they still remain in that position, closing also the charge-chamber C against cylinder A which has been rendered open at this time by the independent movement of valve B to permit it to exhaust. Their position changes however during the suction-stroke as shown in Fig. 1, when these parts move inwardly toward cylinder A. While so moving part *e* accompanies valve E only during the first part of the movement and until it has reached the edge around the opening in the lower part of the valve-chamber beyond which, being larger, it cannot pass. In this position it carries out the intended function of valve E which is to prevent communication between the two chamber-parts C and D. Valve E proceeds in its movement, opening as soon as it leaves part *e*, the charge-chamber to the cylinder. When the parts return to their closing positions, part *e* does not at once share in this movement, but retains its position in which it closes chamber C and cylinder A against the open exhaust. Nor does it move until chamber C has been closed again and valve B has approached its seat to close the cylinder. To hold the valves to move so in proper direction, suitable guiding means are provided for them. Member *e* is guided by the opening in partition 6, to which it is fitted. It is also provided with a sleeve 7 which is fitted around another sleeve 8, arms 9 connecting said member to its sleeve in a manner preventing interference with the free passage of the charge whenever such takes place. Valve E is carried on the lower end of this sleeve 8 which is guided, below by sleeve 7, and above by neck 10, which forms part of a cap 11 whereby the valve-chamber is closed. Valve B is carried at the lower end of a valve-stem 12, which is fitted into sleeve 8 and guided by it. The parts are normally held to their positions by spring-pressure.

A spring 13, resting upon the upper end of neck 10 and bearing against a shoulder 14 on stem 12 serves to hold valve B to its seat. A seat 15 is preferably provided for this spring for which the upper end of neck 10 serves as a support. Another spring 16 seated upon cap 11, and bearing against a shoulder 17 on sleeve 8, holds the compound valve E in its normal position. A stop 18 on this sleeve, by its contact with the underside of cap 11, defines this position. Another spring 19, holds member *e* separably to valve E, said spring being seated against a shoulder which is immovable with respect to member *e*. Stop 18 may serve for this purpose.

The valves are moved, independent from each other each at the proper time and in the proper manner, by suitable machine-elements, actuated by means operated from the main shaft. Suitably shaped cams are usually provided for this purpose, acting upon the valves by rods, levers, rocker-arms, or other equivalent means in the customary manner well understood in this art. 21 may indicate the end of such a cam-actuated member, or arm which serves to operate valve B, by acting upon the end of its stem 12. 22 may indicate a similar member serving to move valve E by acting against sleeve 8 which carries said valve. The fact that member 22 is outside of neck 10, while sleeve 8 upon which it is to act, is inside of the same, requires a certain construction to permit operative connection between the two. Shoulder 17 which serves to receive the action of spring 16, is also used to receive the action in opposite direction of member 22. For such purpose it projects sufficiently to permit engagement with member 22, its connection to sleeve 8 being made possible by slots 23 in said neck through which it also extends as best shown in Fig. 6. The connection may be accomplished in any suitable way.

A condensed résumé presents the operation as follows: Beginning with the exhaust-stroke, cam-actuated member 21 acts upon valve-stem 12 and opens valve B as shown in Fig. 3. This valve remains also open during the suction-stroke following, when compound valve E moves also into open position by action of cam-actuated member 22 upon sleeve 8. During the first part of this movement, member *e* and valve E move as one until the former is prevented from proceeding farther by reason of its contact with the lower part of the valve-chamber. This does not prevent however the further independent movement of valve E, since the connection between the two is not a rigid one and subject merely to the action of spring 19. This last part of the movement opens communication between charge-chamber C and cylinder A, part *e* holding these parts closed against the exhaust outlet, all as illustrated in Fig. 1. Thereafter valve B closes cylinder A for the compression stroke, and

the power-stroke following it, valve E moving at the same time out of the way. This movement of both valves is due to the expanding action of previously compressed springs 13 and 16 and the concurrently receding movement of members 21 and 22. Member *e* is taken up as soon as valve E reaches it, when both move together again to close as before the charge-chamber against the open exhaust. Fig. 2 illustrates the position of the valves during this as well as during the power-stroke.

The construction considered with regard to wear is quite simple since only one valve-seat has to be considered for close fitting. The engagement between valve E and member *e* is no valve-seat, nor is a valve-seat-fit required for member *e*, since there is no pressure on either side of these parts. The comparatively slow movement of valve B which has one half of the cycle to make its movement is another circumstance in favor of simplified construction and reduced wear. Another advantage is that both valves are exposed to the cooling effects of the charge while passing over them when entering the cylinder so that excessive heating is prevented. At the same time the heat so absorbed by the charge, puts the same in a most favorable condition for subsequent ignition.

Having described my invention, I claim as new:

1. In valve-mechanism for explosive engines, the combination of a cylinder, a valve-housing subdivided to form a charge-space open to the charge-supply and an exhaust-space open to the outside, a port whereby this valve-housing communicates with the cylinder, a valve controlling passage through this port and provided with a stem, an additional valve within the valve-housing provided with a sleeve fitted to the stem mentioned, a neck being laterally slotted projecting outwardly from the valve-housing into which both sleeve and stem extend to be guided, the stem extending beyond the neck, a spring seated upon the upper end of the neck and adapted to engage the stem to hold the valve thereon to a normal position, another spring seated upon the valve housing and adapted to engage the sleeve to hold the valve thereon in normal position, levers adapted to actuate independently each the sleeve and the stem in opposition to the action of the springs, to open the valves and means interposed between the lever for actuating the sleeve and this latter and extending through the slots in the neck mentioned.

2. In valve-mechanism for explosive engines, the combination of a cylinder provided with a port, a subdivided valve-chamber having a charge space open to the charge-supply and an exhaust-space open to the atmosphere, both spaces being adapted to communicate with the cylinder through the port mentioned, a valve which controls passage through this port and is provided with a stem, a compound valve which consists of two parts, one of which has a hollow stem which is fitted upon the stem of the valve first mentioned, and serves to control communication between the cylinder and the charge space of the valve-chamber, the other part having a sleeve whereby it is seated upon the hollow stem of the valve last mentioned with a spring-yielding fit and serves to close against the exhaust-space while cylinder and charge space are in communication, means acting upon the stem of the valve first mentioned to actuate this valve and means acting upon the hollow stem of the compound valve to actuate the same independent of the other valve and in a manner that both its parts are caused to coact to close the charge-space against the exhaust-space and that one part is caused to control communication between this space and the cylinder.

3. In valve-mechanism for explosive engines, the combination of a cylinder provided with a port, a subdivided valve-chamber having a charge-space open to the charge-supply and an exhaust-space open to the atmosphere, both spaces being adapted to communicate with the cylinder through the port mentioned, a valve which controls passage through this port, a compound valve which consists of two parts, of which one part controls communication between the cylinder and the charge-space of the valve-chamber, while the other serves to close both cylinder and charge-space against the exhaust-space while they are in communication, means for each of these valves to guide them and a device to actuate each valve, one valve independent of the other, operating means for the valve first mentioned and additional operating means for the two parts of the compound valve whereby each valve is caused to perform its particular function entirely independent of the other valve.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

THOMAS L. MOORE.

Witnesses:

C. SPENGEL,

T. LE BEAU.