A. CLÉMENT.

STARTING DEVICE FOR EXPLOSION MOTORS.

APPLICATION FILED FEB. 6, 1909.

1,047,499. Patented Dec. 17, 1912.

Fig. 1.

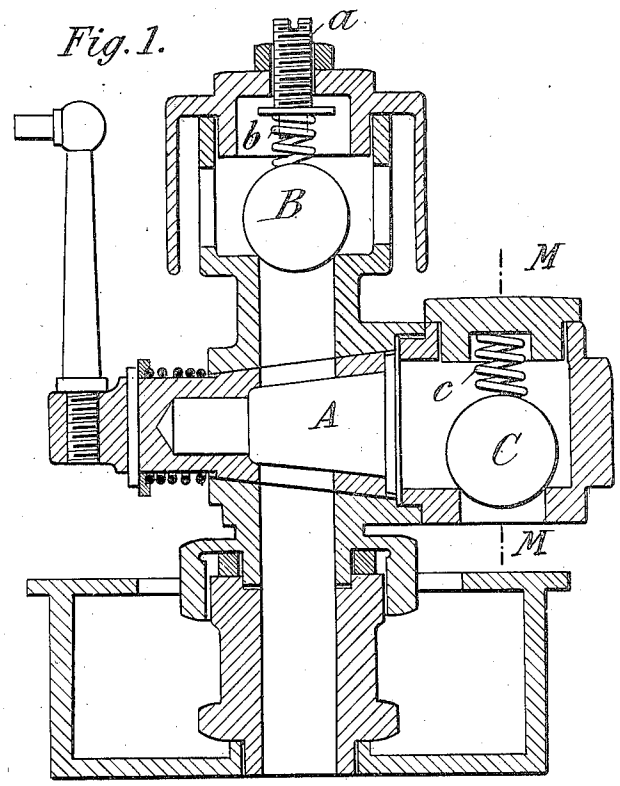
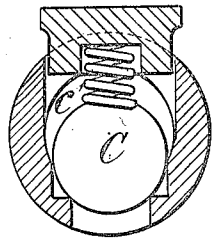


Fig. 2.



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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR EXPLOSION-MOTORS.

1,047,499. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed February 6, 1909. Serial No. 476,517.

To all whom it may concern:

Be it known that I, ADOLPHE CLÉMENT, a citizen of the Republic of France, residing in Levallois-Perret, Seine, France, have invented certain new and useful Improvements in Starting Devices for Explosion-Motors, of which the following is a specification.

The resistance experienced in starting an explosion motor by hand, say a four cylinder motor, is due to two circumstances: The first manifests itself in the compression period in one of the four cylinders of the motor, as the driver has to overcome the resistance encountered by the piston in its cylinder in compressing the gaseous mixture contained therein; in the second place, when the handle is rotated for the purpose of starting a four cylinder explosion motor, one of the cylinders is always in the expansion phase, with all the regular operating (admission and discharge) valves closed. In this cylinder the gas which was at one side of the piston becomes rarefied in starting and thus gives rise to the second resistance. The method of starting under the present invention consists in providing each cylinder of the motor with a special cock which obviates these excessive resistances. With this object each of these cocks comprises two valves, constituted say by balls held on their seats by suitable springs. One of these valves opens during the compression, in starting, to afford a passage for the excess of gas and thus avoid the effort that would have to be furnished by the driver, while the second valve opens during the expansion period to permit the external air to enter, thereby obviating the necessity for the driver exerting efforts corresponding to the rarefaction, which effort is very considerable in the case of a motor with a large bore. The arrangement and the operation of this cock will be readily understood from the following description and with reference to the accompanying drawing, in which:—

Figure 1 is a longitudinal section of the device under the invention, and Fig. 2 is a cross section on the line M—M.

This cock comprises a plug A with two valves constituted for example by balls B and C which are held upon their seats by springs *b c*. The valve B opens during the compression to afford a passage for the excess gas and thereby avoid the effort that would have to be exerted by the person starting the motor. The spring *b* of this expansion valve may be regulated by means of a screw *a*. Owing to this spring the escape of gas may be stopped slightly before the piston has reached its dead point, in such a manner that the pressure in the explosion chamber is slightly greater than the atmospheric pressure of a given, regulated quantity, according as it is considered desirable to produce an explosion of greater or less force. The second valve C is intended to rise from its seat when there is a rarefaction of the gas in the cylinder head; an admission of external air then takes place, thus avoiding the necessity for the driver to make an effort corresponding to the rarefaction in starting. It should be noted that during the period of drawing the gaseous mixture into the cylinder, this valve C is unable to open because the passage around the admission valve into the cylinder presents far less resistance than this valve C; in addition its non-opening in these circumstances is insured by the small spring *c*. In this manner gases rich in fuel coming from the carbureter are drawn into the cylinder without an inopportune introduction of air disturbing the carburization. This system therefore permits of starting a motor in the following manner; in the first place care should be taken that the ignition circuit through the accumulators and the coil is interrupted. The plug A of the cocks is then opened and the motor is rotated by hand in order to fill the cylinders with fairly inflammable gas at atmospheric pressure or at a slightly higher pressure as explained above, and this without effort. The plug of the cocks is then closed; the cylinder heads are filled with inflammable mixture which is of a nature to enable the motor to start. For this to take place, it is only necessary to close the electric circuit of the accumulators; a spark passes in the cylinder which is at the ignition point and the motor starts.

What I claim and desire to secure by Letters Patent of the United States is:—

1. An apparatus for use in starting explosion motors adapted to be placed on each of the cylinders and comprising in combination automatic valves, one of them opening during compression in its cylinder, and the other opening during rarefaction in its cylinder, and a means for simultaneously opening and closing communication between the cylinder and both said automatic valves.

2. An apparatus for use in starting explo-

sion motors adapted to be placed on each of the cylinders and comprising in combination automatic valves, one of them opening during compression in its cylinder, and the other opening during rarefaction in its cylinder, and a single hand-operated cock arranged to open or to close communication between the cylinder and both said automatic valves simultaneously.

3. An apparatus for use in starting explosion motors adapted to be placed on each of the cylinders and comprising in combination automatic valves, one of them opening during compression in its cylinder, and the other opening during rarefaction in its cylinder, and a means for simultaneously opening and closing communication between the cylinder and both said automatic valves, and an adjustable spring which bears on the valve which opens during compression in its cylinder so as to permit of stopping the exhaust of the compressed gas while the pressure in the explosion chamber is slightly greater than atmospheric.

4. An apparatus for use in starting explosion motors adapted to be placed on each of the cylinders and comprising in combination automatic valves, one of them opening during compression in its cylinder, and the other opening during rarefaction in its cylinder, and a means for simultaneously opening and closing communication between the cylinder and both said automatic valves, and a spring operating on the valve which opens during rarefaction in its cylinder so as to avoid the admission of air through said automatic valve during suction through said normal inlet valve of the cylinder to which said apparatus is applied, said spring being designed to have greater strength than that of said normal inlet valve.

5. An apparatus for use in starting explosion motors comprising in combination a cylinder, two automatic valves one adapted to open inwardly and the other to open outwardly in communication with said cylinder whereby one or the other opens successively upon rarefaction and compression in the cylinder, and a means for placing said valves in and out of communication with the cylinder.

6. In a gas engine the combination of a cylinder having a normal spring-controlled inlet valve therein, and auxiliary automatic valves, one of which opens during compression in the cylinder and the other of which opens during rarefaction in the cylinder, means for opening and closing communication between said cylinder and said auxiliary valves, and a spring operating on the auxiliary valve which opens during rarefaction, said spring being of greater strength than the spring of said normal inlet valve, whereby admission of air through said auxiliary valve which opens during rarefaction is prevented when suction takes place on the suction stroke of the engine through said normal inlet valve.

7. In a gas engine the combination of a cylinder having a normal spring-controlled inlet valve therein, and a device for relieving compression and rarefaction in said cylinder, said device comprising in combination two automatic auxiliary valves, one of which opens during compression in the cylinder and the other of which opens during rarefaction, a means for simultaneously opening and closing communication between the cylinder and both said automatic auxiliary valves, and a spring operating on the valve which opens during rarefaction so as to avoid the admission of air through said automatic auxiliary valve which opens during rarefaction during suction through said normal inlet valve during the suction stroke of the engine, said spring being of greater strength than the spring of said normal inlet valve.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ADOLPHE CLÉMENT.

Witnesses:
JULES ARMENGAUD, Jeune,
ELLWOOD AUSTIN WELDEN.