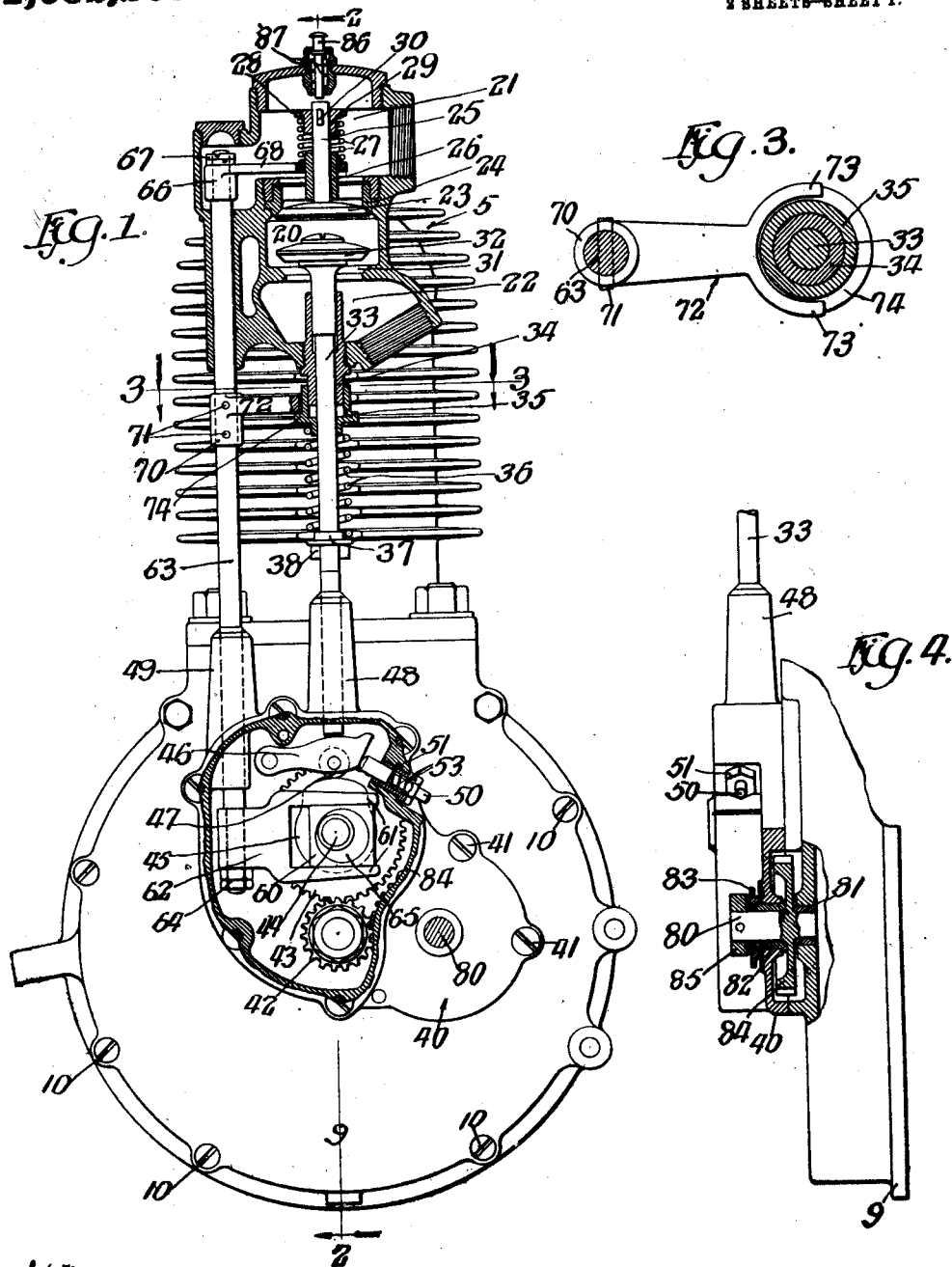


A. LEVEDAHL.
VALVE FOR EXPLOSIVE ENGINES.
APPLICATION FILED JULY 23, 1908.

Patented May 20, 1913.

2 SHEETS—SHEET 1.

1,062,285.



Witnesses:
J. H. Daggitt.
L. R. Wilkins

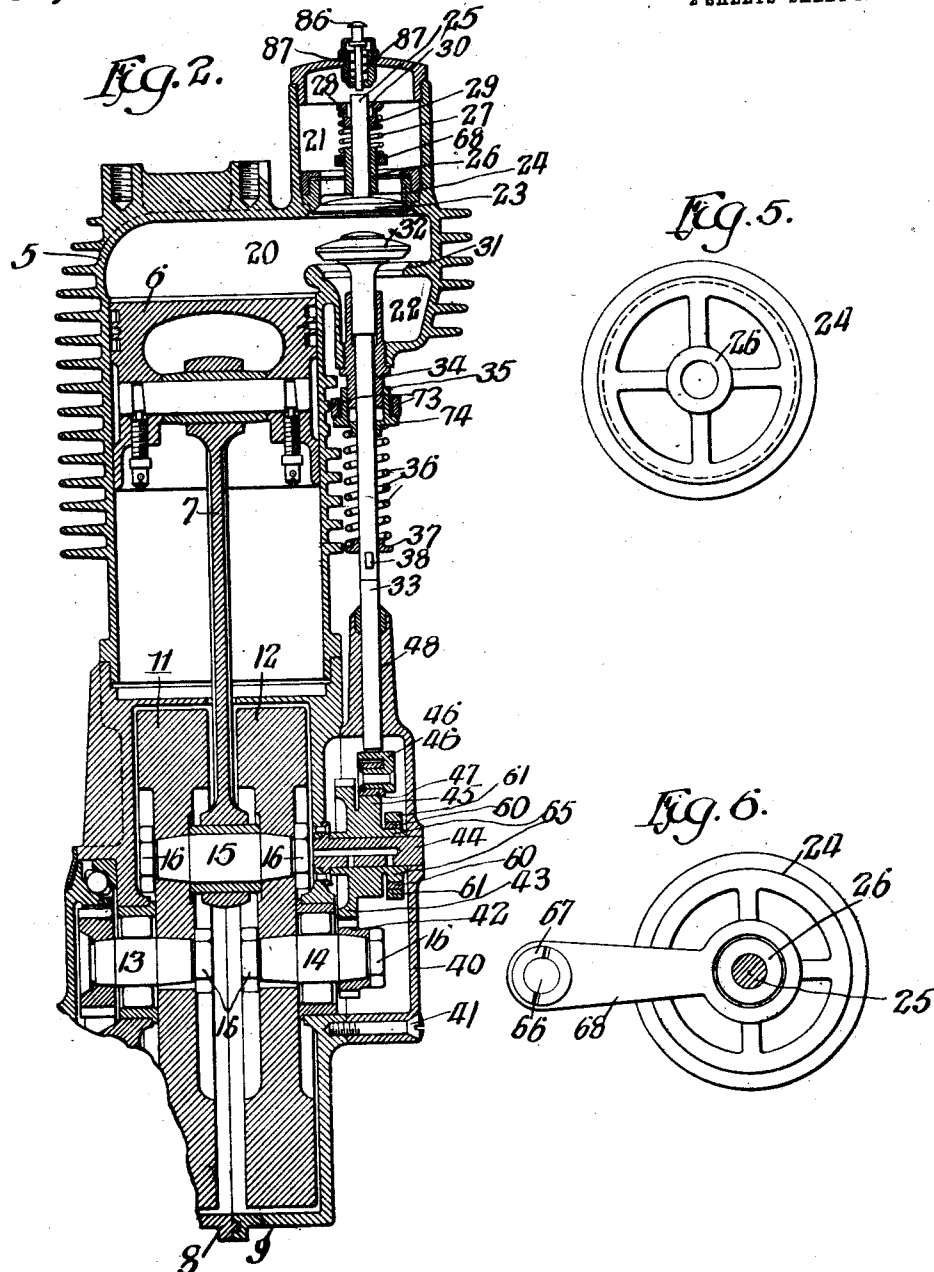
Inventor:
Axel Levedahl
by Cook & Brown
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W. D. Duggan
C. W. Milkins

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by Cooke & Brown
Attys

UNITED STATES PATENT OFFICE.

AXEL LEVEDAHL, OF AURORA, ILLINOIS, ASSIGNOR TO AURORA AUTOMATIC MACHINERY COMPANY, OF AURORA, ILLINOIS, A CORPORATION OF ILLINOIS.

VALVE FOR EXPLOSIVE-ENGINES.

1,062,285.

Specification of Letters Patent.

Patented May 20, 1913.

Application filed July 23, 1908. Serial No. 444,957.

To all whom it may concern:

Be it known that I, AXEL LEVEDAHL, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Valves for Explosive-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in explosive engines and more particularly to a means for controlling the tension of the springs which are applied to close the inlet and exhaust valves of such an engine or motor.

In explosive engines of the kind having an inlet valve of the automatic type, that is, one which is opened by the suction in the cylinder of the engine and is closed automatically by a spring, the spring must be stiff enough to close the valve quickly and such a spring if made stiff enough to effect the desired prompt closing of the valve, requires an undesirable degree of pressure or suction to open the inlet valve, or does not permit the inlet valve to remain open long enough for the proper quantity of explosive mixture to enter the cylinder of the engine. In such an engine the exhaust valve, which is mechanically opened, is closed by means of a spring which is necessarily of considerable stiffness in order that the suction stroke will not lift the exhaust valve from its seat.

In a construction made in accordance with this invention, there is provided a mechanically operated tension controlling means, timed with the engine stroke, whereby the tension of the valve springs may be increased or decreased at the proper period to insure free opening and quick closing of the inlet valve and a tight fit between the exhaust valve and its seat during the intake stroke of the engine.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings—Figure 1 is a view partially in side elevation and partially in sec-

tion of the power cylinder of a gasoline motor and the parts relating to my invention. Fig. 2 is a view in vertical cross-section of the motor and the parts comprising my invention, taken on line 2—2 of Fig. 1. Fig. 3 is a detail view illustrating partially in elevation and partially in cross-section, taken on line 3—3 of Fig. 1, the parts for controlling the tension of the exhaust valve spring. Fig. 4 is a fragmentary side view, with parts in section, of the sparking cam and gear. Fig. 5 is a detail plan view of the valve seat for the intake valve. Fig. 6 is a detail plan view of the intake valve seat and an arm by which the tension of the intake valve spring is controlled.

As illustrated in the said drawings, 5 indicates the explosion cylinder of an internal combustion engine. Within the said cylinder is a piston 6 of a familiar form with which is connected a piston rod 7. A crank casing is attached to the lower end of the cylinder, the same being composed of two sections 8 and 9 which are provided with rib and groove connections at their margins where they are joined and are secured together by means of bolts 10, 10. In said crank-casing are located two parallel crank disks 11 and 12. The said crank disks, which serve as balance wheels, are mounted upon stub or sectional shafts 13 and 14 which are axially aligned and rotatively supported in the walls of the crank casing. At a point radially distant from their supporting shafts, the crank disks 11 and 12 are united by means of a crank pin 15, to which the lower end of the piston rod 7 is connected. The said shafts 13, 14 and 15 are tapered in their parts, which enter the crank disks and the openings in said disks are correspondingly tapered, the said shafts and disks being locked together by means of nuts 16 which engage the screw-threaded ends of the shafts to clamp the tapered ends of the shafts in the tapered walls of the openings in the disk.

At its upper end the cylinder 5 is provided with a chamber 20 through which the explosive mixture is admitted to the cylinder and the combustion products are discharged. The said chamber 20 extends into a laterally projecting integral extension on the upper

portion of the cylinder, said extension being provided with upper and lower chambers 21 and 22. The upper of said chambers (denoted by 21) forms the supply passage for the explosive mixture and opens into the chamber 20 through an admission port in the upper wall of the chamber. The said chamber 21 has in its side wall an inlet opening provided with internal screw-threads for the attachment thereto of a supply pipe. The lower chamber 22, which constitutes the exhaust passage for the combustion products, opens at its top into the chamber 20 through an exhaust port in the lower wall of the said chamber 20, and is provided with a lateral obliquely disposed neck forming an exhaust opening, and which is provided with internal screw-threads for the attachment thereto of an exhaust pipe.

For opening and closing the supply passage 21 there is provided an automatic valve, that is to say, one which is opened by the suction of the intake stroke of the piston and is automatically closed by a spring. The disk 23 of the said valve is located in the passage 20 and bears upwardly against a valve seat ring 24 which is inserted into the inlet port in the horizontal wall between the chambers 21 and 20. The said valve disk is provided with a valve stem 25 which extends upwardly therefrom through a cylindric guide 26 which is supported centrally on the valve seat ring by radial arms. Surrounding the said valve stem is a coiled actuating spring 27. Said spring bears upwardly against a flange 28 on a collar 29 which is loosely mounted on the said valve stem, the said collar being provided in its upper side with opposite recesses engaged by the ends of a stop pin 30 inserted transversely through the upper end of the valve stem and which limits the upward movement of the said collar 29 on the said valve stem. The said spring 27 bears at its lower end against a moving part of the tension controlling means.

The exhaust chamber 22 is provided with an upwardly or inwardly facing valve seat 31 which surrounds the exhaust port in the horizontal wall which separates the said exhaust chamber from the chamber 20. Fitting on said valve seat 31 is a valve disk 32 which is adapted to move upwardly or into the chamber 20 when the exhaust valve is opened. A valve stem 33 is attached to the valve disk and extends downwardly therefrom, through a guide passage provided in an upright guide tube 34, which is inserted through and secured in the bottom wall of the exhaust chamber. Below the lower end of the said guide tube 34 and loosely surrounding the valve stem 33, is a collar 35 which is adapted to vertically slide on said stem and is provided with a recess in its upper portion adapted to receive the

lower end of the said guide tube, on which said collar also vertically slides. Surrounding the valve stem 33, below the said collar 35, and adapted to bear upwardly thereon is a coiled actuating spring 36 which bears at its lower end upon a flanged collar 37. The said flanged collar 37 is loosely mounted with respect to the said valve stem by means of a stop pin 38 inserted transversely through the said valve stem.

The mechanism for operating the exhaust valve of the engine is located in an auxiliary casing 40 secured to the section 9 of the crank casing by means of screws 41, 41 and is constructed as follows: Secured to the outer end of the shaft 14 of the crank disk 12 is a gear wheel 42. A second gear wheel 43, which is driven from the said gear wheel 42, is rotatively mounted upon a shaft 44 which is supported at its inner end upon the wall of the section 9 of the crank casing and at its outer end in an aperture in the wall of the auxiliary casing 40. Carried by the said gear wheel 43 is a cam disk 45 which is preferably made integral therewith. Pivotaly supported within the said auxiliary casing 40 is a horizontally arranged vertically swinging lever 46 adapted to bear against the lower end of the valve stem 33 which extends downwardly through a guide passage formed in an upwardly extending tubular neck 48 made integral with the top wall of the auxiliary casing 40. Pivotaly supported on the said lever 46 is an antifriction roller 47, with a portion thereof projecting below the said lever, said roller being adapted to engage the cam disk 43 which operates through the said lever 46 to lift the exhaust valve disk 32 from its seat.

For limiting the downward movement of the lever 46 there is provided a spring stop mechanism comprising an endwise movable plunger 50 mounted in the casing 40 with its inner end in position for contact with the rising and falling end of the said lever 46. Said plunger is arranged in an inclined position and slides in a guide passage formed in a plug 51 which is inserted through and secured in a thickened part of the wall of the casing 40. Said plug is made adjustable in said wall by means of exterior screw threads on the plug which engage interior screw threads in the opening in the wall through which it is inserted. Surrounding a reduced portion of the plunger 50, which is within the base of the said plug 51, is a coiled actuating spring 53 which acts against the outer end wall of the plug and an outwardly facing shoulder on the said plunger, to hold said plunger in contact with the end of said lever 46, which has a beveled end surface substantially at right angles to the plunger.

The tension of the spring 27 of the intake valve is automatically increased during the exhaust stroke of the engine piston and auto-

matically decreased during the intake stroke by means as follows: The hub of the gear wheel 42 which extends outwardly beyond the cam disk 45 thereon, is provided with an eccentric 65. The said eccentric engages a block 60, which is mounted between two inwardly extending, horizontal fork arms 61, on a vertically movable head 62; the said block being adapted to slide longitudinally backward and forward between the said fork arms 61, 61. At its outer end the said head 62 is provided with an aperture extending perpendicularly therethrough and through which is inserted the reduced end of a vertically arranged operating rod 63. The end of said reduced portion of the rod 63 which extends through the fork 62 is screw-threaded and the said rod is secured rigidly in the head by means of a nut 64, applied to the end of the rod below the head. Extending upwardly from the said head 62, the rod 63 passes through a guide passage in a tubular neck 49, formed upon the auxiliary casing 40, and at its upper end through a guide passage formed in a projecting portion of the engine cylinder located at one side of the extension thereof which contains the chambers 21 and 22. At its upper end, which extends into a lateral extension of the chamber 21, the said rod 63 is reduced in size and provided with screw threads. Over the said reduced portion of the rod is fitted a collar 66 which is clamped thereon by means of a lock nut 67. On said collar is a horizontally arranged arm 68 which extends to the valve stem 25 and is provided at its end with a ring which loosely encircles the guide cylinder 26 and upon which the lower end of the valve spring 27 rests. Above the upper end of the said rod the top wall of the chamber 21 is provided with an opening, closed by a screw plug 69, through which a spanner wrench can be inserted for tightening or removing the lock nut 67 at the upper end of said rod.

The operation of the above described tension controlling mechanism is so timed that, during the period of the intake stroke, the eccentric will actuate the rod 63 to move the arm 68 to its lowermost position and release the tension on the intake valve spring 27, thus permitting the valve to be easily opened. During the next cycle of the engine, which consists of the compression and combustion strokes, the intake valve disk 23 will be held against its seat 24 by the pressure exerted thereon by the mixture in the cylinder as it is compressed and exploded. Meanwhile, however, the eccentric will have moved the arm 68 to a position where the tension of the intake valve spring 27 will be increased to such an extent that the said intake valve will be closed quickly and held in a closed position against the suction exerted during the exhaust stroke of the engine.

In a manner similar to that above described, the tension of the exhaust valve spring is automatically increased and decreased during the time when such an increase or decrease in tension will be best adapted to the effective operation of the engine. Located upon the end 67 between its upper and lower ends, is a collar 70 which is rigidly secured thereto by means of a nut 71, extending transversely through the said rod and the said collar. Upon the said collar 70 is a rigid horizontal arm 72 which extends inwardly toward the valve stem 33 of the exhaust valve. At its inner end the said arm 72 is provided with two fork arms 73, 73 which partially surround the collar 25 which is engaged by the lower portion of the exhaust valve spring 36 and are adapted to bear downward upon an outwardly extending flange 74 of the said collar. In the operation of these parts the tension of the exhaust valve spring will be relieved when the tension of the intake valve spring is increased and will be increased when that of the intake valve is decreased. It is provided so adjust the device that it will be timed perfectly with the inlet valve and when this is done it will be closed approximately with the exhaust valve and will give the desired result in connection with the exhaust valve. When the charge of explosive mixture is drawn into the cylinder by the suction stroke, the exhaust valve will have a tendency to lift from its seat and with the device hereinbefore described a sufficient tension for overcoming this lifting tendency can be had from a lighter spring, the tension of which is increased at the time of the suction stroke. A considerable portion of the hammer and wear caused by a heavy exhaust valve spring will be thereby eliminated.

As is usual in engines of this description, the sparking device is operated by a cam driven from the engine shaft and timed with the stroke of the engine. Parts of such device are illustrated in Figs. 1 and 2, in which 80 designates a shaft supported at its inner end in a journal bearing 81, situated in an opening in the wall of the main body of the engine casing wall, and extending through and supported in a journal bearing 82 mounted in an opening through the side wall of the auxiliary casing 40. A journal bearing 82 is provided in the outer end with a flange which is in contact with an inwardly projecting shoulder formed on the inner face of the wall of the main auxiliary casing. At its outer end the said journal bearing is screw-threaded and is fitted into a clamping nut 83 which is adapted to retain the said journal bearing in position. Between the walls of the main casing and the auxiliary casing of the engine wheel 84 which is formed in a cam disk 27.

shaft 80 and is adapted to be driven by the gear wheel 42 on the shaft 16 of the crank disk 12. Upon the outwardly extending end of the shaft 80 which extends beyond the journal bearing 82 and the retaining nut 83 is mounted a cam disk 85 which is secured to the said shaft and by means of which the ignition circuit is controlled.

The top wall of the chamber 21 is shown as provided with a well known form of device for testing the operation of the intake valve, consisting of a plunger 86 arranged vertically in line with and adapted to act on the upper end of the valve stem 25, said plunger being held normally at the outward limit of its movement by a spring 87.

I claim as my invention:—

1. An explosive engine, comprising an intake valve adapted to be opened by suction, a spring applied to close said intake valve, and means including a member against which said spring constantly bears, operated by the engine, for controlling the tension of said spring during all of the strokes of the engine piston, adapted to decrease the tension of said spring by permitting the same to expand at the time of the suction stroke of the engine piston and increase the tension of said spring by compressing the same during the remaining strokes of the engine piston.

2. An explosive engine comprising an exhaust valve, a spring applied to close said valve, means for opening said exhaust valve against the action of the spring, and means operated by the engine for decreasing the normal tension of the spring just preceding the time of the exhaust stroke and maintaining the decreased tension of the said spring during said exhaust stroke of the engine piston.

3. An explosive engine comprising an intake valve, a spring adapted to close said intake valve, an exhaust valve, a spring applied to close said exhaust valve, and means operated by the engine for increasing and decreasing the tension in both of said springs, adapted to decrease the tension of the intake valve spring during the suction stroke and to increase the tension of the same during the remaining strokes of the engine piston and also adapted to increase the normal tension of the exhaust valve spring at a time just preceding the exhaust stroke and to maintain the increased tension during the remaining strokes of the engine piston.

4. An explosive engine comprising an intake valve adapted to be opened by suction and embracing a valve disk provided with a valve stem, a coiled spring surrounding said valve and which tends to always close said inlet valve, an arm upon which said spring rests, an endwise movable rod to which said arm is attached, and means oper-

ated by the engine in time with the piston stroke acting to decrease the tension of the spring during the suction stroke and to increase the tension in the said spring during the intervening strokes of the engine piston.

5. An explosive engine comprising a power cylinder, a piston, intake and exhaust valves, each embracing a valve disk provided with a valve stem, an endwise movable rod arranged parallel with said valve stem and provided with two laterally extending arms, coiled springs surrounding the said valve stems and bearing severally against said arms, said disks being arranged to move toward each other in the opening of the valves, and the said springs acting in opposite directions to effect the closing of the valves, and means operated by the engine giving endwise movement to said rod, said rod being shifted in a direction to decrease the tension of the intake valve spring and to increase the tension of the exhaust valve spring at the time of the suction stroke of the engine.

6. An explosive engine, a power cylinder, a piston, an intake valve, a spring applied to close the said intake valve, an exhaust valve, a spring applied to close said exhaust valve, means for opening said exhaust valve against the action of said spring, an endwise movable rod provided with two laterally projecting arms against which bear the springs of the intake and exhaust valves, and means operated by the engine for giving endwise movement to said rod.

7. An explosive engine comprising a power cylinder, a piston, intake and exhaust valves, each embracing a valve disk provided with a valve stem, coiled springs surrounding said valve stem, an endwise movable rod arranged parallel with said valve stem, and provided with two rigid arms against which the springs of the intake and exhaust valves severally bear, and means operated by the engine for giving endwise movement to said rod.

8. An explosive engine comprising a power cylinder, a crank shaft, valve for controlling one of the ports of said cylinder, a spring which tends constantly to close said valve, an endwise movable rod provided with a lateral arm against which the spring bears, and means for giving endwise movement to said rod, embracing gearing actuated by the crank shaft and adapted to give endwise movement to said rod, to increase the tension of one of said springs and to decrease the tension of the other of said springs during each suction stroke of the engine piston and to decrease the tension of one of said springs and to increase the tension of the other of said springs during the intervening strokes of the engine piston.

9. An explosive engine comprising a power cylinder, a piston, a crank shaft, valve

for controlling one of the ports of said cylinder, embracing a valve disk provided with a valve stem, a fixed collar on the valve stem, a coiled spring surrounding said
5 valve stem and bearing at one end on said collar, said spring tending to always hold said valve closed, an endwise movable rod having a laterally extending arm which is provided with a ring which bears against
10 the other end of said spring, and means for operating said rod from the crank shaft adapted to shift the rod to change the nor-

mal tension of said spring at the time of the suction stroke and to maintain said changed tension of the spring during the in- 15
tervening strokes of the engine piston.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 16th day of July A. D. 1908.

AXEL LEVEDAHT

Witnesses:

R. A. VORLING,

W. W. ARMSTRONG.