T. H. HABERKORN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 29, 1909. RENEWED APR. 22, 1910.

973,651. **Patented Oct. 25, 1910.**

Fig. 1.

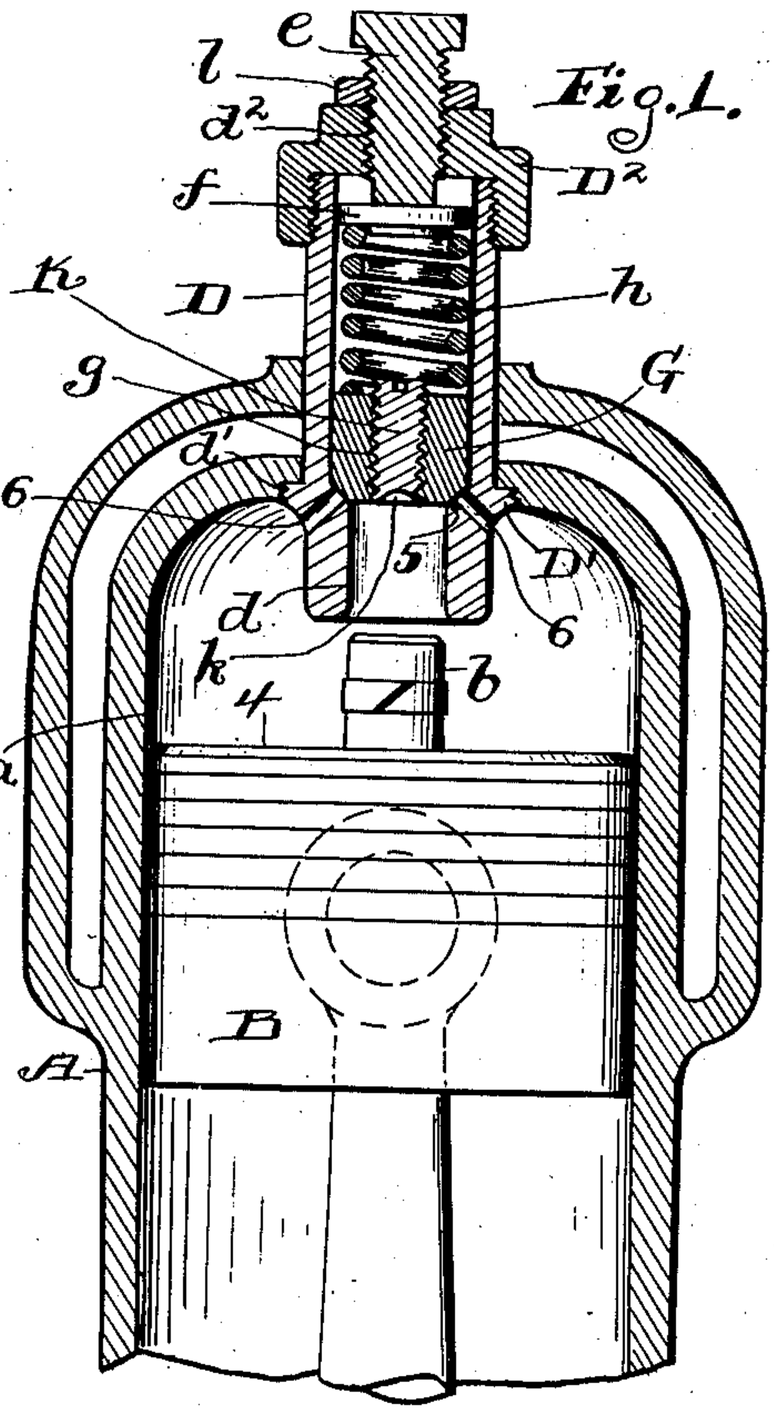


Fig. 2.

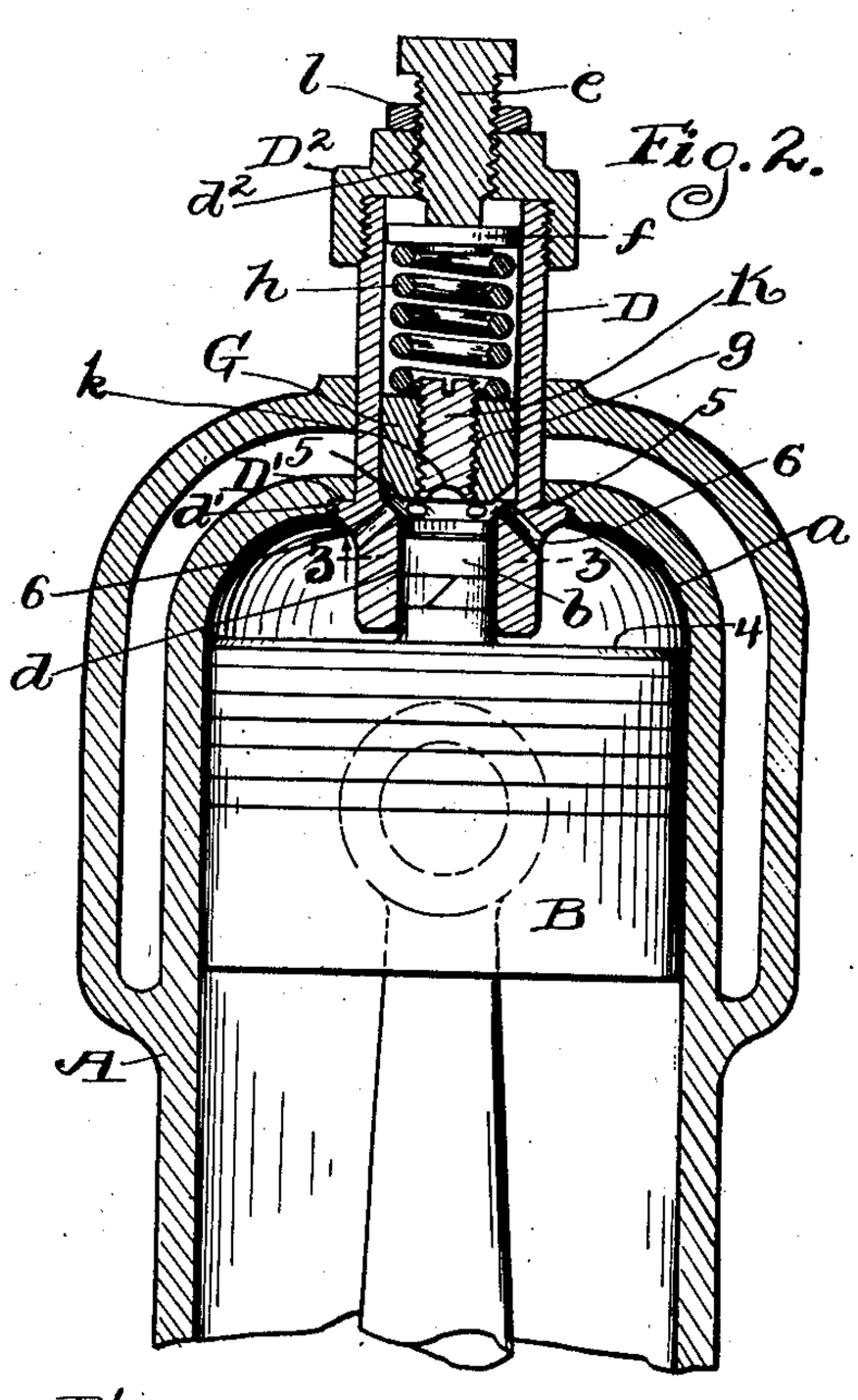
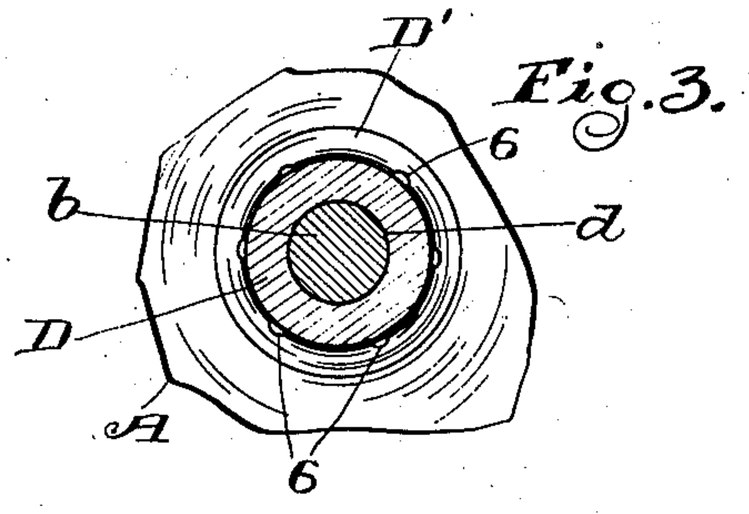


Fig. 3.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

973,651. Specification of Letters Patent. Patented Oct. 25, 1910.

Application filed January 29, 1909, Serial No. 474,926. Renewed April 22, 1910. Serial No. 557,078.

To all whom it may concern:

Be it known that I, THEODORE H. HABERKORN, a citizen of the United States of America, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Internal-Combustion Engines; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to improvements in internal combustion engines, and pertains more especially to improved means for igniting the combustible and explosive mixture in the engine-cylinder by compression.

I am aware that the combustible and explosive mixture has heretofore been compressed to such a high pressure in the engine-cylinder during the compressing stroke of the piston in the said cylinder as to result in ignition and consequent explosion of the said mixture, but the excessive pressure thus employed in bringing about ignition and consequent explosion caused an excessive heating of the engine and a loss of power resulting from the excessively high compression, and the ignition could not be controlled so that not infrequently a retarding force was created before the completion of the compressing stroke of the piston.

The primary object of my invention is to successfully avoid the objectionable features encountered in igniting and thereby exploding the combustible and explosive mixture by compression during the compressing stroke of the piston, and to partially form an ignition-chamber by a member which is adjustable outwardly or inwardly to enlarge or decrease the size of the said chamber so that only a proper manipulation of the said adjustable member is required to produce the proper compression for ignition at the proper time in relation to the piston, and thereby accommodate the use of different combustible and explosive mixtures which vary as to the degree of compression thereof required to produce ignition.

With this object in view, and to the end of realizing any other advantages hereinafter appearing, this invention consists in certain features of construction, and combinations of parts, hereinafter described, pointed out in the claims, and illustrated in the accompanying drawings.

In the said drawings, Figure 1 is a side view, largely in central section, illustrating a portion of the cylinder of an internal combustion engine, the piston within the said cylinder and my improved means for effecting the ignition and consequent explosion of the combustible and explosive mixture compressed within the said cylinder by the piston during the compressing stroke of the piston. Fig. 2 is a view corresponding with Fig. 1, except that in Fig. 2 the piston is shown in position at the completion of its compressing stroke, whereas in Fig. 1 the piston is shown at the commencement of the said stroke. Fig. 3 is a transverse section on line 3—3, Fig. 2, looking outwardly.

Referring to the drawings, A indicates the cylinder of an internal combustion engine, and *a* represents the piston-containing internal chamber of the said cylinder.

B indicates the piston employed in compressing the combustible and explosive mixture supplied to the chamber *a* preparatory to the impact had upon the face 4 of the said piston by the explosion of the said mixture upon the compression of the mixture during the compressing stroke of the piston.

Means for supplying and controlling the supply of the combustible and explosive mixture to the chamber *a*, in advance of the piston preparatory to the compressing stroke of the piston, and means for exhausting the gases upon the impact had upon the face 4 of the piston by the explosion of the said mixture, are too well known in the art to require illustration and description in this specification.

The cylinder A is provided at and centrally of the face 4 of the piston B with a comparatively small plunger *b* which is arranged in line endwise with and rigid with the piston B and consequently parallel with the cylinder A. The plunger *b* is adapted to enter and snugly fit within but reciprocate endwise of a cylindrical chamber *d* formed within the inner end of a valve-casing D which is arranged centrally of and parallel with the cylinder A in advance of the range of movement of the piston B and in position to receive the plunger *b* during the compressing stroke of the piston. The

valve-casing D extends from the exterior of the cylinder A into the cylinder and projects a suitable distance into the cylinder-chamber *a* toward the face of the piston B. The valve-casing D is secured to the cylinder A in any approved manner. Preferably, the valve-casing D is provided next externally of the chamber *a* with an annular flange D′, and the said flange and the cylinder A are provided with mutually engaging screw-threads, as at *d*′, so that the valve-casing D is removably attached to the cylinder A.

The valve-casing D is provided at its outer end with a cap or head D^2. The valve-casing D is provided internally and a suitable distance from the inner extremity of the chamber *d* with an outwardly flaring valve-seat 5, and ports 6 are formed in the valve-casing and extend from the valve-seat 5 to the exterior of the valve-casing and communicate at their outer ends with the cylinder-chamber *a*.

The ports 6 are normally closed at their inner ends by a valve G which is arranged within and adapted to reciprocate endwise of the valve-casing between the valve-seat 5 and the outer end of the valve-casing. That is, the valve G engages the valve-seat 5 in the closed and normal position of the valve and in the said position closes the inner ends of the ports 6 and thereby obstructs communication through the ports, but is movable endwise and outwardly against the action of a suitably applied spring *h* to uncover the inner ends of the ports and thereby establishing communication between the chamber *d* and the cylinder-chamber *a*.

The plunger *b* is arranged wholly externally of and far enough from the chamber *d* when the piston is in position at the commencement of its compressing stroke, as shown in Fig. 1, to establish communication between the said chamber at its inner end and the cylinder-chamber *a*, and the plunger *b* is beveled somewhat at its outer end and the chamber *d* flares somewhat at the inner end of the valve-casing D to facilitate an easy entrance of the plunger into the said chamber during the compressing stroke of the plunger.

Obviously the chamber *d*, when the plunger *b* is entirely outside of and away from the said chamber so as to place the said chamber in communication at its inner end with the cylinder-chamber *a*, as shown in Fig. 1, is supplied with combustible and explosive mixture during the supply of the combustible and explosive mixture to the cylinder-chamber in advance of the piston B, so that the plunger *b* when it enters and moves inwardly within the chamber *d* during the compressing stroke of the piston B, compresses the explosive and combustible mixture within the chamber *d*. It will be observed that the valve G forms the outer end wall of the chamber *d*, and the relative arrangement of the parts is such that the piston B, when in position at the completion of its compressing stroke, shall not have compressed the combustible and explosive mixture within the cylinder-chamber *a* to the extent required to ignite the said mixture, but that the plunger *b* upon the actuation of the piston into the said position shall have compressed the combustible and explosive mixture within the chamber *d* to the extent required to ignite the said mixture, and the valve G during the compression of the combustible and explosive mixture within the chamber *d* is not actuated by the said compression against the action of the spring *h* but is actuated into its open position, as shown in Fig. 2, by the force resulting from the explosion of the said mixture so as to uncover the ports 6 and thereby result in the communication of fire from the chamber *d* through the said ports to the combustible and explosive mixture compressed within the engine-cylinder in advance of the face of the piston. That is, the spring *h* is powerful enough to retain the valve seated until the combustible and explosive mixture compressed within the chamber *d* has been ignited, but is not powerful enough to retain the valve seated against the force of the explosion resulting from the ignition of the said compressed mixture.

The cap or head D^2 is provided centrally with a screw-threaded hole d^2 which extends through the said head and is engaged by a correspondingly threaded screw *e* employed in regulating the tension of the spring *h* which is confined within the valve-casing between the outer end of the valve and a washer *f* which is interposed between the outer end of the spring and the screw *e*, and a lock-nut *l* is mounted on the said screw externally of the head D^2 and secures the screw in the desired adjustment.

The valve is provided centrally with a screw-threaded hole *g* arranged parallel with the valve-casing and engaged by a correspondingly threaded screw K which extends through the valve. The screw K is preferably provided in its inner end with a cavity *k*. The screw K obviously constitutes a member which is instrumental in the formation of the chamber *d*.

By the construction hereinbefore described it will be observed that the chamber *d* constitutes the ignition-chamber of the engine, and that the capacity of the said chamber is increased or decreased according as the screw or member K is manipulated to shift the latter outwardly or inwardly, and obviously therefore only a proper manipulation of the said screw or adjustable member is required to produce the proper compression for ignition at the proper time in relation

to the piston B, and the adjustability of the capacity of the said chamber is essential because different combustible and explosive mixtures vary as to the degree of compression thereof required to produce ignition.

What I claim as new and desire to secure by Letters Patent is:—

1. In an internal combustion engine, the combination, with a cylinder, and a piston arranged within and adapted to reciprocate endwise of the cylinder, of a small plunger arranged at the face of and operatively connected with the piston; a valve-casing containing an ignition-chamber in which a combustible and explosive mixture is to be ignited by compression, said ignition-chamber being arranged to receive the plunger during the compressing stroke of the piston and in communication at its inner end with the cylinder when the piston is in position at the commencement of its compressing stroke; a port for conducting fire from the ignition-chamber a suitable distance from the inner end of the ignition-chamber to the cylinder; a valve normally interrupting communication through the said port and movable to establish communication through the port by force resulting from the explosion of the combustible and explosive mixture supplied to the ignition-chamber; an adjustable member instrumental in forming the ignition-chamber and shiftable outwardly or inwardly to enlarge or decrease the size of the ignition-chamber, and means acting to retain the valve in its closed position and yieldable to the force resulting from the explosion of the combustible and explosive mixture compressed in the ignition-chamber by the plunger during the compressing stroke of the piston to the extent required to ignite said mixture.

2. In an internal combustion engine, the combination, with a cylinder, and a piston arranged within and adapted to reciprocate endwise of the cylinder, of a small plunger arranged at the face of and operatively connected with the piston; a valve-casing containing an ignition-chamber in which a combustible and explosive mixture is to be ignited by compression, said ignition-chamber being arranged to receive the plunger during the compressing stroke of the piston and in communication at its inner end with the cylinder when the piston is in position at the commencement of its compressing stroke; a port for conducting fire from the ignition-chamber a suitable distance from the inner end of the ignition-chamber to the cylinder; an outwardly movable valve normally interrupting communication through the said port and instrumental in forming the ignition-chamber and movable to establish communication through the port by force resulting from the explosion of the combustible and explosive mixture supplied to the ignition-chamber, which valve is provided with an adjustable member instrumental in forming the ignition-chamber and shiftable outwardly or inwardly to enlarge or decrease the size of the ignition-chamber, and means acting to retain the valve in its closed position and yieldable to the force resulting from the explosion of the combustible and explosive mixture compressed in the ignition-chamber by the plunger during the compressing stroke of the piston to the extent required to ignite said mixture.

3. In an internal combustion engine, the combination, with a cylinder, and a piston arranged within and adapted to reciprocate endwise of the cylinder, of a small plunger arranged at the face of and operatively connected with the piston; a valve-casing containing an ignition-chamber in which a combustible and explosive mixture is to be ignited by compression, said ignition-chamber being arranged to receive the plunger during the compressing stroke of the piston and in communication at its inner end with the cylinder when the piston is in position at the commencement of its compressing stroke, a port for conducting fire from the ignition-chamber a suitable distance from the inner end of the ignition-chamber to the cylinder; an outwardly movable valve normally interrupting communication through the said port and instrumental in forming the ignition-chamber and movable to establish communication through the port by force resulting from the explosion of the combustible and explosive mixture supplied to the ignition-chamber, which valve has a screw-threaded hole extending endwise therethrough; a screw-threaded plug screwed into the valve at the said hole and instrumental in regulating the capacity of the ignition-chamber, and means acting to retain the valve in its closed position and yieldable to the force resulting from the explosion of the combustible and explosive mixture compressed in the ignition-chamber by the plunger during the compressing stroke of the piston to the extent required to ignite said mixture.

4. In an internal combustion engine, the combination, with a cylinder, and a piston arranged within and adapted to reciprocate endwise of the cylinder, of a small plunger arranged at the face of and operatively connected with the piston; a valve-casing containing an ignition-chamber in which a combustible and explosive mixture is to be ignited by compression, said ignition-chamber being arranged to receive the plunger during the compressing stroke of the piston and in communication at its inner end with the cylinder when the piston is in position at the commencement of its compressing stroke; a port for conducting fire from the ignition-chamber a suitable distance from

the inner end of the ignition-chamber to the cylinder; an outwardly movable valve normally interrupting communication through the said port and forming the outer end wall of the ignition-chamber and movable to establish communication through the port by force resulting from the explosion of the combustible and explosive mixture supplied to the ignition-chamber, which valve has a hole extending endwise therethrough; a suitably supported member engaging the said hole and adjustable to regulate the capacity of the ignition-chamber, and means acting to retain the valve in its closed position and yieldable to the force resulting from the explosion of the combustible and explosive mixture compressed in the ignition-chamber by the plunger during the compressing stroke of the piston to the extent required to ignite said mixture.

5. In an internal combustion engine, the combination, with a cylinder, and a reciprocatory piston within the cylinder, of a plunger arranged at the face of and operatively connected with the piston; a valve-casing containing an ignition-chamber in which a combustible and explosive mixture is to be ignited by compression, said ignition-chamber being arranged to receive the plunger during the compressing stroke of the piston and in communication at its inner end with the cylinder when the piston is in position at the commencement of its compressing stroke; a port for conducting fire from the ignition-chamber a suitable distance from the inner end of the ignition-chamber to the cylinder; an outwardly movable valve normally interrupting communication through the said port and movable to establish communication through the port by force resulting from the explosion of the combustible and explosive mixture supplied to the ignition-chamber, which valve has a hole extending endwise therethrough; an endwise adjustable member engaging the said hole and instrumental in regulating the capacity of the ignition-chamber and provided with a cavity in its inner end, and means acting to retain the valve in its closed position and yieldable to the force resulting from the explosion of the combustible and explosive mixture compressed in the ignition-chamber by the plunger during the compressing stroke of the piston to the extent required to ignite the said mixture.

In testimony whereof, I sign the foregoing specification, in the presence of two witnesses.

THEODORE H. HABERKORN.

Witnesses:
C. H. Dorer,
Victor C. Lynch.