W. G. WILLIAMS.

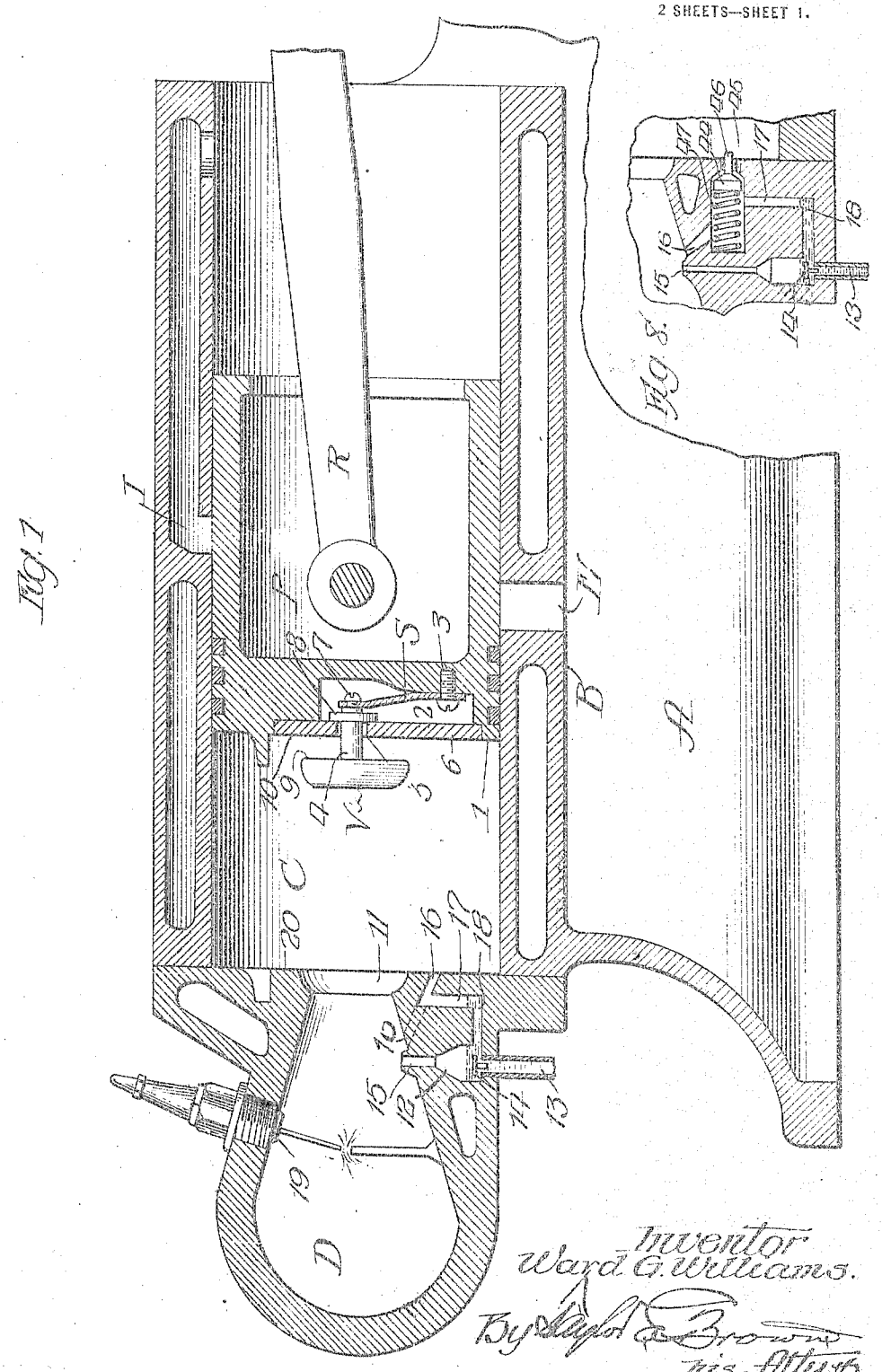
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 10, 1919.

1,345,723.

Patented July 6, 1920.

2 SHEETS—SHEET 1.



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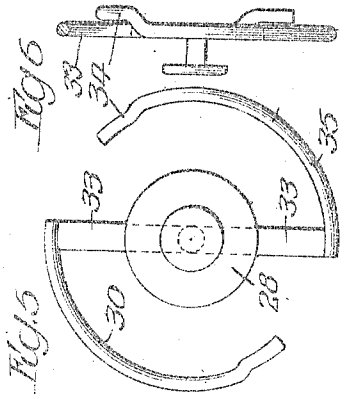
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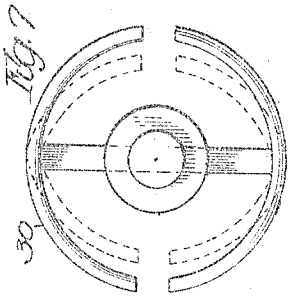
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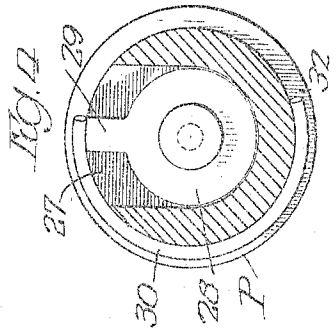
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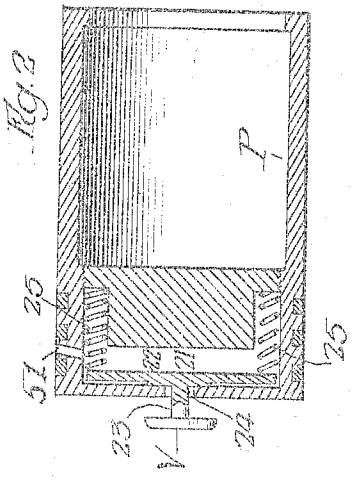
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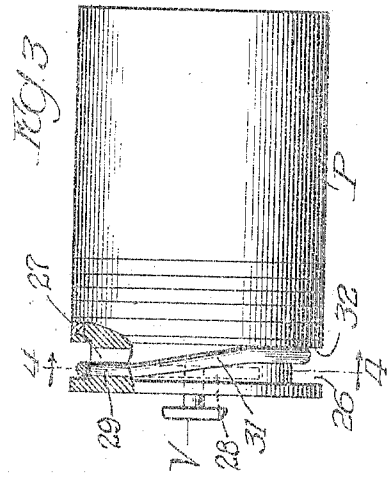
2 SHEETS—SHEET 2.











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UNITED STATES PATENT OFFICE.

WARD G. WILLIAMS, OF BRANDON, WISCONSIN.

INTERNAL-COMBUSTION ENGINE.

1,345,723. Specification of Letters Patent. Patented July 6, 1920.

Application filed March 10, 1919. Serial No. 281,756.

To all whom it may concern:

Be it known that I, WARD G. WILLIAMS, a citizen of the United States, and a resident of Brandon, in the county of Fond du Lac and State of Wisconsin, have invented certain new and useful Improvements in Internal-Combustion 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.

My invention relates to improvements in internal combustion engines of that type wherein the explosive power of the fuel used is generated in a separate combustion chamber adjacent to and communicating with a cylinder, whereby the force of the exploded fuel will act upon a piston movable in said cylinder; the invention being more particularly applicable to a two cycle engine.

One of the objects of my invention is to provide an engine in which the degree of compression in the cylinder will be greatly increased shortly before the end of the compression stroke of the piston, whereby the proper vaporization of the fuel will be greatly increased.

Another object of the invention is to provide a construction whereby the passageway between the compression chamber and the combustion chamber of the engine will be closed or restricted as the piston in the former nears the end of its compression stroke, thereby coöperating with the moving piston to increase the pressure of the air in the compression chamber, and provide for a more thorough mixture of the air and fuel and a more efficient vaporization.

Another object of my invention is to provide in such an engine a spring controlled, movable valve adapted to close or restrict a communicating passageway located between the compression and combustion chambers, when the piston is near the end of its compression stroke, and yet permit the piston to continue its movement and to complete the stroke.

These and other objects will be fully realized as I proceed with my specification.

In the drawings:

Figure 1 illustrates in a central, vertical, sectional view, an engine of the two cycle type embodying my invention.

Fig. 2 is a central, vertical, sectional view of the piston, on a smaller scale, showing a form of valve construction carried thereby, different from that illustrated in Fig. 1.

Fig. 3 is a plan view of a piston showing another modified form of valve construction.

Fig. 4 is a transverse, sectional view, taken upon the line 4—4 of Fig. 3, of the piston illustrated therein.

Fig. 5 is a face view of a modification of the spring shown in Figs. 3 and 4.

Fig. 6 is a side view of the modified form of the spring shown in Fig. 5.

Fig. 7 illustrates yet another modification of the spring shown in Fig. 5.

Fig. 8 is a sectional view showing a modification of the form of structure generally illustrated in Fig. 1.

Referring now to Fig. 1 of the drawing,—in which I have chosen to illustrate my invention as applied to a two cycle engine, A represents the base or support for a cylinder B. P is a piston, movable in the cylinder B, the latter having a compression chamber C connected with a combustion chamber D. The piston P is connected in the usual way to a shaft, not shown, by the connecting rod R. The piston P, in this instance, is provided in its face 1 with a suitable recess 2, within which is located a spring S, which spring may be secured at one end in said recess 2 by the screw 3. V is a valve provided with a valve stem 4, which latter passes through a suitable aperture 5, in a face plate 6 on the piston P. Said valve stem 4 is mounted on its inner end at 7 to the end of the spring S. The valve stem 4 is preferably provided with a collar or shoulder 8, which shoulder, in the reciprocation of the valve V, will normally rest against the side of the face plate 6, thereby limiting the extent of the outward movement of the valve, with respect to the face of the piston P, due to the influence of the spring S. The depth of the recess 2 is such as to permit of such inward movement or reciprocation of the valve V, as that its inner face 9 may, as hereinafter explained, contact with the face of the piston P or the face plate 6 thereon.

The combustion chamber D is provided with a passageway 11, which affords communication between the compression chamber C and the combustion chamber D. In this instance, the passageway 11 takes the complemental form of the valve V and constitutes a valve seat, whereby the passageway 11 may be completely closed at proper

times by the valve V. A small fuel chamber 12 is located in the shell of the combustion chamber D, and is connected with a source of fuel supply at 13, controlled by a valve 14. From this chamber 12, a small conduit or feed port 15 opens into the combustion chamber D. A relatively small conduit or passageway 16 leads from the compression chamber C to the combustion chamber D, and opens into the latter in close proximity to the feed discharge end of the conduit 15. The passageway 16 is connected with the fuel chamber 12 by a branch passage or conduit 17, one leg of which, at least, is horizontally arranged, as shown at 18. Any suitable means for igniting the fuel in the combustion chamber D may be employed, and I have shown a conventional spark plug 19 to indicate such means. The engine cylinder B is provided with an inlet port I and an exhaust port E.

The operation of the engine thus illustrated in Fig. 1 is such that on the power stroke of the piston P, the valve 14 is raised, and the fuel is admitted to the chamber 12, either by a forced feed (or any suitable means, not shown), and the consumed gases are exhausted through the port E. A fresh supply of air is admitted through the inlet port I, and upon the compression stroke of the piston P, the usual compression takes place in the chamber C. When the piston moving on its compression stroke, nears the end 20 of the cylinder B, the valve V projecting outwardly from the face of the piston by reason of its being mounted upon the spring S, will contact with its seat and close the passageway 11 before the end of the compression stroke. The further movement of the piston P to complete the compression stroke, will by reason of the passageway 11 being closed and the conduit or passageway 16 being relatively small, result necessarily in an increased pressure in the chamber C, so that air under high pressure will be forced through the conduit 16 and to some extent through the passageway 17, 18 and 15, and close the valve 14. The fuel will thus be forced through the chamber 12 and the passageway 15, thoroughly and completely mixed with the air and the desired vaporization will occur.

It will be understood, of course, that after the valve V has closed the passageway 11, the movement of the piston P will not be arrested but the further compression stroke movement of the piston will continue, the relative position of the valve and piston being changed. In such further movement, the valve stem 4 will be actuated against the force of the spring S, until as stated, the face 9 of the valve will approximately touch the face 10 of the piston.

Upon the sparking means being applied, the explosion takes place in the combustion chamber D. Immediately and before the force of the explosion is exhausted, the valve V is unseated, and the passageway 11 is again opened (there being sufficient clearance between the rear face 9 of the valve and the face 10 of the piston for this preliminary valve movement), and the full force of the explosion is thus practically and almost instantaneously exerted upon the entire face of the piston, forcing it back.

This arrangement whereby the valve closure for the passageway 11 is yieldingly held away from the face of the piston, during the major portion of the compression stroke, and shifts its position as the piston approaches dead center or the end of the compression stroke, is of great advantage, permitting the increase of air pressure in the cylinder, resulting in turn in the proper admixture or vaporization of the air and fuel and permitting also by the unseating of the valve, the complete explosive pressure to act upon the entire surface of the piston at the moment of explosion.

In the construction illustrated in Fig. 2, I have shown a modified form of valve mounting for the spring S. The piston P is provided with a recess 21 in which is positioned a disk or plate 22 connected with the valve stem 23, the latter passing through a suitable aperture 24 in the face of the piston P. Spiral springs 25 are suitably located in the recess 21 and tend to press the disk 22 outwardly, as shown. The action is similar to the arrangement described with respect to the construction shown in Fig. 1.

In Figs. 3 and 4, I show a different form of spring, for holding the valve V outwardly from the face of the piston. The piston P is provided in this instance with an annular or circumferential exteriorly arranged groove 26 and with an interior recess 27. The valve stem passes through the face of the piston, as in the other forms, and its inner end is connected with a disk 28, provided with a lug 29. It will be understood that the interior recess 27 extends to and communicates with the exterior groove 26 and that the lug 29 projects sufficiently into the groove 26 so that one end of a spring 30 may be secured thereto.

The spring 30 is shown as bent at 31 into a different plane, as indicated clearly in Fig. 3, so that a portion of the spring 30 will bear against the rear wall 32 of the recess or groove 26 in the piston, while the other portion of the spring 30 will lie more nearly to the front wall of said groove 26. When the piston shown in Fig. 3 has reached that point in its compression stroke where the valve V will seat and thus close the passageway 11, the further movement of the piston P will cause the spring 30 to yield so that the relative position of the valve V and the piston will occur precisely as in

the instances shown in Fig. 2, and explained with reference to Fig. 1.

In Figs. 5 and 6, substantially the same form of spring is illustrated as that shown in Figs. 3 and 4, there being, however, two lugs 33, 33, to the disk 28, and instead of one spring, two shorter bent springs 30 are employed, one attached to each lug. The bent ends 34 in each case and the unbent portions 35, bear against the opposite walls of the groove 26, as previously explained with respect to the spring shown in Fig. 3.

In the modification of spring illustrated in Fig. 7, the idea being similar to that of the spring shown in Fig. 5, each spring 30, is secured at its center to the lug 33 instead of being secured at one end thereto as shown in Fig. 5.

In some instances, I find it convenient to use the modified form of construction of the conduit 16, throttling the same with a valve. Such a modification is shown in Fig. 8 wherein the conduit 16 is provided with a suitable enlargement adapted to receive a valve 44 so arranged as, at times, to be seated against a valve seat or shoulder 45. This is accomplished by means of a valve stem 46 which projects into the compression chamber C under the influence of a spring 47 located in the enlarged part of the conduit 16 and adapted to press against the back of the valve 44. The length of the stem 46 projecting into the compression chamber will be sufficient to permit the top of the piston 10 to operate the valve 44. In the operation of this type of valve, the compression stroke of the piston P will proceed until the valve V by being seated, closes the aperture 11 leading into the combustion chamber D, at which time the conduit 16 is closed by the action of the valve 44. This results in a higher pressure being built up in the compression chamber C and to retard the injection of fuel and air into the combustion chamber D until the piston reaches the end of its stroke. Of couse, it will be understood that the face 10 of the piston ultimately strikes the end of the valve stem 46 and thus opens a passageway into the conduit 16.

It is convenient, at times, to admit fresh air to the piston P adjacent to the valve V for the purpose of cooling said valve. In the operation of the machine, when the piston is moved back toward the inlet port, some of the cool air is permitted to pass to the valve V through the medium of a conveniently arranged passageway or conduit 51, as shown in Fig. 2. I have not shown this cooling arrangement in connection with the other forms of piston, but it is manifest that the idea may be applied in various ways.

I claim as my invention:

1. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber, means for supplying fuel thereto, a passageway leading from said compression chamber to said combustion chamber, and a spring controlled valve carried by the piston and adapted to automatically close said passageway immediately prior to the completion of the compression stroke of the piston.

2. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber and means for supplying fuel thereto, a passageway leading from said compression chamber to said combustion chamber, a tapered valve seat surrounding said passageway and a tapered valve carried by the piston and movable longitudinally thereon and adapted to engage said seat and close said passageway, immediately prior to the completion of the compression stroke of the piston.

3. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber and means for supplying fuel thereto, a passageway leading from said compression chamber to said combustion chamber, a tapered valve seat surrounding said passageway, a tapered valve carried by the piston and movable longitudinally thereon and adapted to engage said seat and close said passageway, immediately prior to the completion of the compression stroke of the piston and means normally operating to resiliently hold said valve out of contact with the piston.

4. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber and means for supplying fuel thereto, a passageway leading from the compression chamber to the combustion chamber and provided with a valve seat, a valve carried by the piston and adapted to fit into said seat, and a spring contacting said piston and valve and normally holding the latter spaced from the former.

5. An internal combustion engine, comprising a compression chamber, a recessed piston movable therein, a combustion chamber and means for feeding fuel thereto, a passageway between the compression chamber and the combustion chamber and provided with a valve seat, and a valve carried by said piston and adapted to fit into said seat, the inner end of said valve being movable longitudinally relative to the piston, in the recess thereof, substantially as described.

6. An internal combustion engine, comprising a compression chamber, a recessed piston movable therein, a combustion chamber and means for feeding fuel thereto, a passageway between the compression chamber and the combustion chamber and provided with a valve seat, a valve carried by said piston and adapted to fit into said seat,

the inner end of said valve being movable longitudinally relative to the piston, in the recess thereof, and a spring engaging said inner end and normally holding said valve spaced from the piston.

7. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber, a passageway leading from the compression chamber to the combustion chamber, a port leading from the compression chamber to the combustion chamber, means carried by the piston for closing said passageway, and means normally holding said port closed but operable by contact with the piston to open said port.

8. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber, a passageway leading from the compression chamber to the combustion chamber, a port leading from the compression chamber to the combustion chamber, means carried by the piston for closing said passageway, and means normally holding said port closed but operable by contact with the piston to open said port after said passageway is closed.

9. An internal combustion engine comprising a compression chamber, a piston movable therein, a combustion chamber, a passageway leading from the compression chamber to the combustion chamber, a port leading from the compression chamber to the combustion chamber, means carried by the piston for closing said passageway, and resilient means normally holding said port closed but operable by contact with the piston to open said port.

10. An internal combustion engine, comprising a cylinder, a piston therein, a combustion chamber, means for supplying fuel to said chamber, a passageway connecting said chamber and said cylinder and including a valve seat, a smaller passageway or conduit leading from the cylinder and discharging into the chamber in proximity to the point of fuel supply thereto, and a yieldingly mounted valve adapted to close the first named passageway before the piston reaches the end of its compression stroke, said valve being carried by a spring mounted on the piston.

In testimony that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 6th day of March, A. D. 1919.

WARD G. WILLIAMS.

Witnesses:
W. H. LYON,
P. W. ATWOOD.