

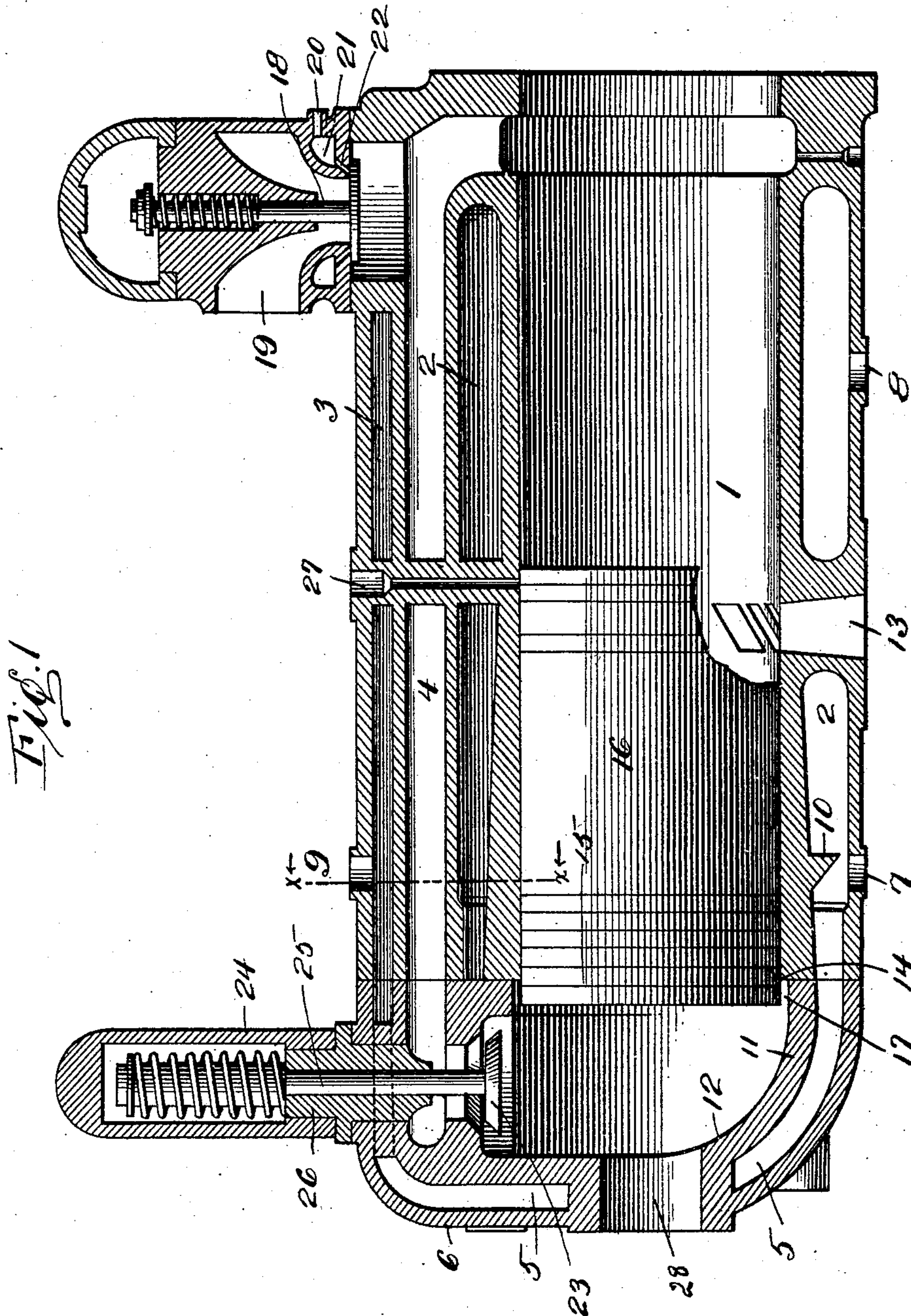
A. F. CLARKE.  
EXPLOSIVE ENGINE.

APPLICATION FILED AUG. 14, 1906.

929,554.

Patented July 27, 1909.

2 SHEETS—SHEET 1.



Witnesses.

Samuel Payne  
Milton E. Lowry

by

Inventor.

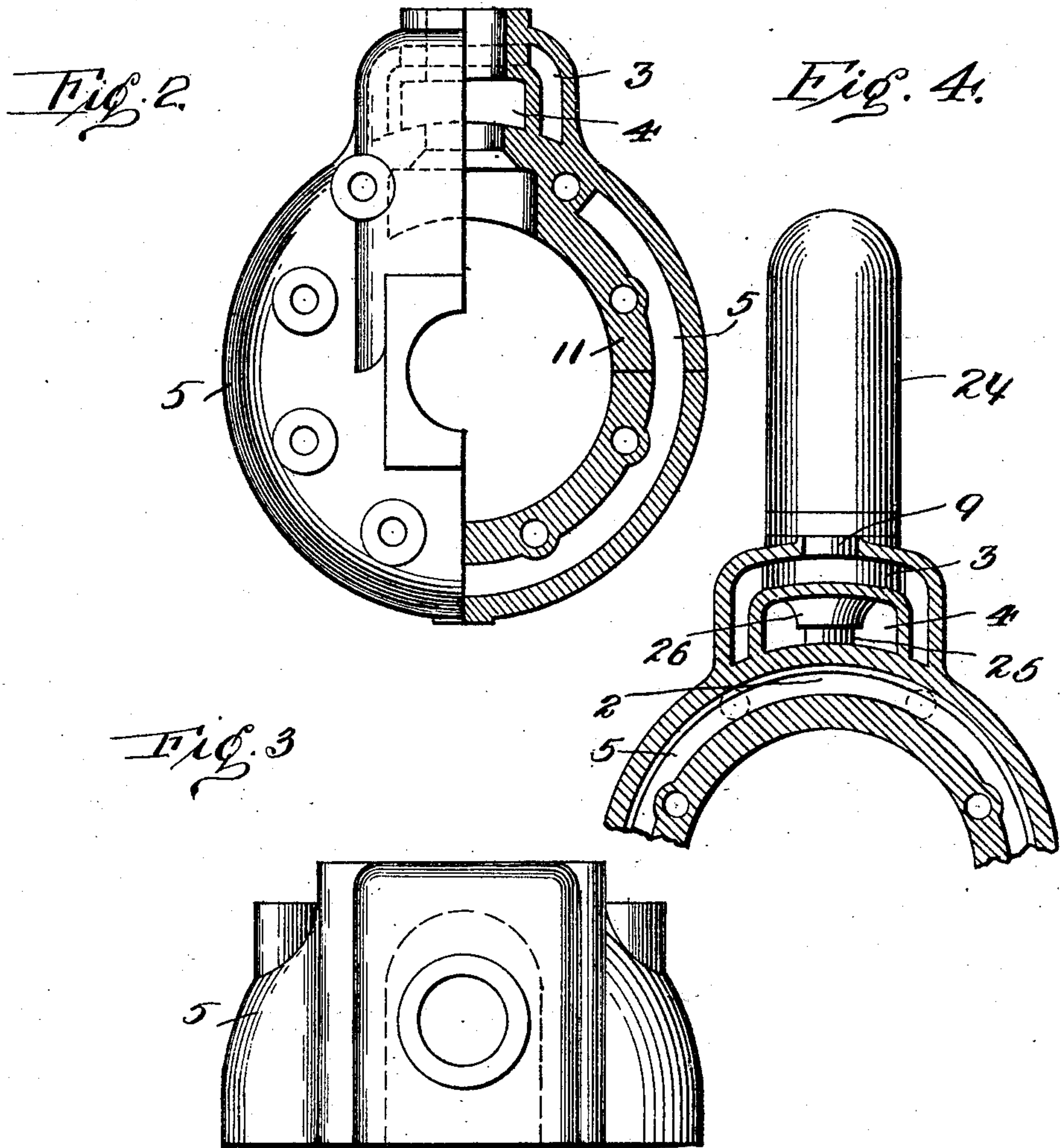
Arthur F. Clarke  
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# UNITED STATES PATENT OFFICE.

ARTHUR F. CLARKE, OF BUTLER, PENNSYLVANIA.

## EXPLOSIVE-ENGINE.

No. 929,554.

Specification of Letters Patent.

Patented July 27, 1909.

Application filed August 14, 1906. Serial No. 330,523.

*To all whom it may concern:*

Be it known that I, ARTHUR F. CLARKE, a citizen of the United States of America, residing at Butler, in the county of Butler and State of Pennsylvania, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to explosive engines, and its primary object is to provide a cylinder head of novel construction whereby the clearing of the cylinder of the spent charge will be insured.

A further object of the invention is to provide a semi-spherical cylinder head whereby a strong and durable construction is afforded with the minimum thickness of metal.

A further object of the invention is to provide a cylinder so constructed as to avoid counter-boring the cylinder adjacent to the end of the path of travel of the piston.

A further object of the invention is to provide a cylinder with water passages so disposed as to insure the cooling of the cylinder at the head and adjacent to the point where the explosion takes place.

The invention also includes various features of construction and combinations of parts, which will be fully described herein-after in connection with the accompanying drawing, and particularly set forth in the appended claim.

In the drawing, Figure 1 is a vertical section of an explosive engine, constructed in accordance with the invention, Fig. 2 is a front elevation of the cylinder, with one-half of the cylinder head cut away. Fig. 3 is a top plan of the cylinder head removed, and Fig. 4 is a sectional detail on line X—X Fig. 1 looking toward the cylinder head.

Referring to the drawings in detail, 1 denotes the engine cylinder provided with a water space 2 substantially surrounding the same and constituting a water jacket. Upon the top of the cylinder 1 and above the water space 2 is a longitudinally extending inlet passage 4 for the explosive mixture, the outer wall of the water space 2 constituting the inner wall of the inlet passage 4. Inclosing the two sides and the top of the inlet passage 4 is a water passage 3 which is closed at its rear end and has its forward end open. The cylinder head is indicated by the reference character 6 and is provided with a water space 5 constituting a water jacket, the water space 5

at its upper end communicates with the water passage 3 and at its lower end opens into the water space 2. The water space 2 is provided with inlets 7 and 8 and the water passage 3 with an outlet 9 and with the outlet and inlets communicate suitable pipes (not shown) for discharging and supplying water from and to the jackets.

Within the water passage 2 adjacent to the water inlet 7 is provided a deflector 10 projecting from the outer surface of the inner wall 11 of the cylinder and extending approximately half way around the cylinder or spanning the lower half thereof. The function of the deflector is to direct the inflowing current of water toward the cylinder head, and around that part of the cylinder in which the explosion occurs. The entire area of the water passages 2 and 3 is also filled with water but the deflector causes a quicker and more thorough circulation of water around the front end of the cylinder where the cooling action is most required.

The cylinder head 6 is of semi-spherical form to present the rounded surface 12 below and around the point of ignition. This feature of the improved construction is one of great importance for the reason that it provides a rounded deflecting surface to facilitate the rapid expulsion of the spent charges through the exhaust port 13 when the piston moves past said port. A further advantage of the semi-spherical head is that it insures great strength and durability with the least thickness or amount of metal.

As clearly shown in Fig. 1, the head 6 is of slightly larger diameter than the body of the piston, so that the end 14 of the latter adjacent to the head projects over the inner end of the head. The purpose of this construction is to avoid counter-boring the end of the cylinder, which is commonly done to prevent the formation of a shoulder on the inner face of the cylinder by the frictional movement thereon of the piston rings 15 carried by the piston 16. It will be noted that the forward piston rings project into the space 17 within the cylinder head, and this space serves the purpose of the counter-bored space ordinarily provided in cylinders of this type.

The numeral 18 designates the inlet valve controlling the admission of air and gas of the passage 4. The air enters through an inlet 19 and the gas through an inlet 20, communicating with an annular passage 21



formed with a series of downwardly inclined openings 22, which divide the inflowing gas into jets to insure a thorough admixture of the air and gas.

5 The valve 23 for controlling the admission of the explosive mixture through the cylinder head, is disposed vertically within a suitable casing 24, and its stem 25 extends through a guide 26 supported within the  
10 casing.

A suitable oil-cup 27 is arranged centrally of the cylinder and extends through a suitable opening to convey oil to the interior of the cylinder to lubricate the piston.

15 The operation of the engine constructed as thus described is as follows: The initial movement of the piston is effected by an explosion of gasoline or in a small engine, by hand, and the rearward movement of the  
20 piston drives out the air in the cylinder. The return movement opens the inlet valve by suction and the admitted mixture is then forced by the piston along the fluid passage 4 to the cylinder head, the valve 23 opening  
25 automatically. The further movement of the piston compresses the charge which is then exploded by a suitable igniter, arranged within the igniter opening 28 in the cylinder head. The piston will then continue to  
30 operate compressing the charge ahead of it and forcing the inflowing charge through the passage 4 under the force of the explosion. When the piston recedes from the cylinder head the spent charge follows the  
35 rearward movement of the piston and passes out through the exhaust port 13. Any portion of the spent charge which remains by reason of its lacking sufficient pressure to pass through the exhaust port, will be blown  
40 out by a portion of the incoming charge when the piston passes the exhaust port. The rounded or spherical contour of the

head makes this clearing of the cylinder thorough and complete, so that there will be no admixture of the spent charge with the  
45 incoming charge to be compressed. This insures an effective explosion and the consequent steady and quick reciprocation of the piston. The location of the valve 23 in a  
50 vertical relation to the spherical head contributes materially to this effective clearing of the cylinder with a very small loss of explosive mixture, the quantity of fluid necessary for blowing out the remnant of  
55 spent fumes being relatively very small.

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

In an explosive engine, the combination with a cylinder having a water jacket substantially surrounding the same, said cylinder  
60 provided with a vertical offset extending longitudinally with respect to the cylinder and constituting an inlet passage for an explosive mixture exteriorly of said water jacket, said cylinder further provided with  
65 means to form a water passage inclosing the sides and top of said inlet passage, said water passage independent of the water space formed by the said water jacket, a semi-spherical head having a water space  
70 communicating at one end with said water passage and at its other end with said water jacket, said water jacket provided with an inlet, said water passage provided with an  
75 outlet, and a deflector within said water jacket and adjacent to said inlet and adapted to deflect the water into the water space in the cylinder head.

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

ARTHUR F. CLARKE.

Witnesses:

A. J. TRIGG,

SAMUEL PAYNE.