No. 898,317. PATENTED SEPT. 8, 1908.

V. F. CARPENTER.

EXPLOSIVE ENGINE.

APPLICATION FILED DEC. 21, 1907.

Fig. 2.

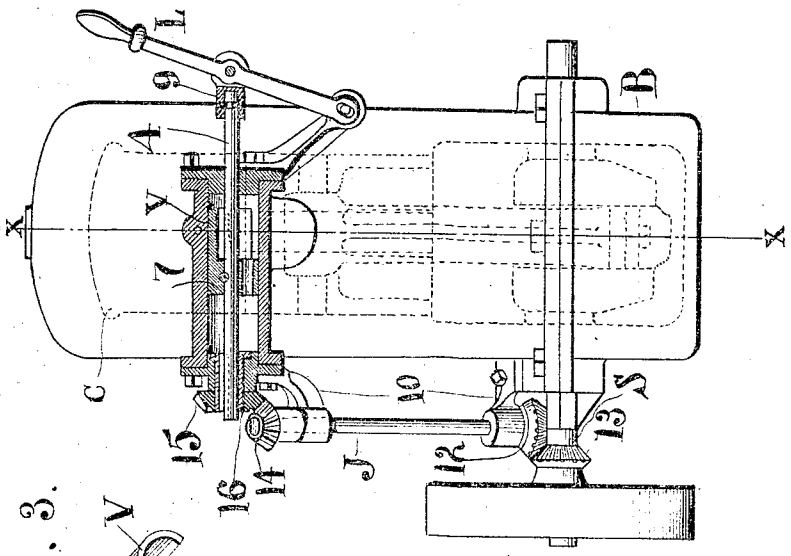


Fig. 3.

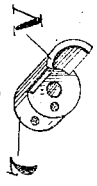
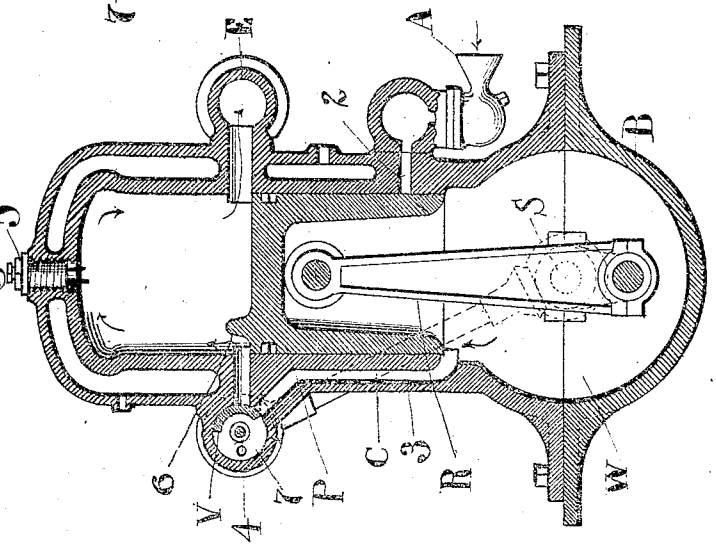


Fig. 1.



ATTEST

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EXPLOSIVE-ENGINE.

No. 898,317. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed December 21, 1907. Serial No. 407,527.

To all whom it may concern:

Be it known that I, VARNUM F. CARPENTER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines, and do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to explosive engines, and the invention consists in an engine adapted to be converted into either a two-cycle or four-cycle engine, or from one to the other, at the will of the operator by means of a single valve, all substantially as shown and described and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of an engine of a marine pattern embodying the invention, taken on line *x*—*x*, Fig. 2, and Fig. 2 is a plain elevation of the machine at right angles to Fig. 1, looking from the left. Fig. 3 is a perspective view of the valve.

For the purposes of the present illustration of the invention I have chosen a well known and popular style or manufacture of marine engine of an upright or vertical type, but the style or kind or use of the engine is not in itself material, and the invention is equally adaptable to engines of a wholly different kind or type from that shown, and to any arrangement thereof whether vertical or horizontal, and stationary or portable. For example, I have planned its introduction into an engine for automobiles and general traction purposes, such as street cars and the like, and hence the invention is regarded as being practically as broad as the art to which it relates and as being applicable to explosive engines generally. Now, with this broad conception in view, we come to the present embodiment of the invention which comprises a cylinder C, a base B upon which the structure is erected, a piston P and a cycle controlling and converting valve V. A crank shaft extends through base B, or, more properly, between said base and the bottom portion of cylinder C, and rod R connects the crank of said shaft with piston P. The wall of the cylinder is provided with the usual cooling jacket, and the engine has a gas and air intake A at one side which discharges into the well W within the base or bottom of the cylinder where admixture of the elements is effected, and a sufficient compression of the mixture occurs in this well to force the mixture or gas forward into the explosion chamber before piston P. Exhaust for the products of explosion from this chamber is by exit E. Gas, or the gas and air mixture from well or space W enters the explosion chamber through duct or passage 3 in which the cycle controlling valve V is located.

Now, at this point in the description I pause to note again that by my invention it is possible to have either a two-cycle or a four-cycle engine at will and with instantaneous conversion from one to the other according as either may be wanted for any given service. For example, in hill climbing with an automobile the maximum possibilities of the engine may be taxed to ascend a steep grade, and in such case the engine would be worked as a two-cycle for the greatest possible development of power of which it is capable, but for lighter work or common grades as they are met with in ordinary travel the four-cycle adjustment might be deemed better. At any rate, either is under convenient command and may be called into action according to the work to be performed and the speed to be made, and which an experienced operator will easily learn and govern himself accordingly. To these ends the valve V is provided with two movements, or rather one adjustment and one operating movement. The adjustment carries the valve into and out of operating position and to this end the valve is mounted on a rod 4 adapted to slide lengthwise in the valve chamber a sufficient distance to wholly uncover duct or passage 3, which takes the valve out of service, or it may be held in working relation to said passage, as in Fig. 2, and open and close said passage by rotation through said rod. When out of action the passage 3 is open throughout and constantly except as it is covered by piston P during the strokes thereof, and when thus open or valveless the engine is in two cycle form and there is an explosion with every forward stroke of the piston, the sparker 5 being adapted to ignite the gas with every such stroke. In such case, also, the mixture fills the explosion chamber under the compressing and forcing action of the piston as it retires in its stroke, as in Fig. 1, and the waste products from the preceding explosion are swept out, more or less completely

through exhaust E. A rib or fin 6 on the piston in front of inlet duct 3 causes the inflowing gas to be deflected to the forward or outer end of the explosion chamber, thus promoting clearance of the vitiated products by crowding them down to the exhaust port. Valve V is segmental in cross section and has a hub 7 by or through which it is secured to rod or shaft 4. Said rod is controlled for adjustment of the valve to and from working position by lever L, which has a head 9 pivoted thereon and constructed to receive the headed end of rod 4 rotarily therein, thus providing for the rotation of said rod and the valve through gears and connections seen in Fig. 2. These involve a shaft J, which is supported at its ends in brackets or arms 10 and carries a bevel gear 12 below in mesh with bevel gear 13 on main shaft S, and a bevel gear 14 on the other end which meshes with gear 15 on a sleeve 16 on the end of rod 4. The said rod is slidable in said sleeve to enable the valve to be moved lengthwise out of position as to gas duct 3, but is so engaged in or with said sleeve as to be always rotated thereby, in any position of the valve, when the engine is running.

It will thus be seen that only a single valve is employed in the entire engine and it is used to convert the engine from one cycle to the other, and that otherwise no valves are used or needed. The piston controls the air and gas intake, causing a suction when it travels forward and closing the ducts 2 through which these elements enter together when on the back or return stroke. In this instance the said elements are contained in well W, but any other space, chamber, or receptacle may be employed for this purpose and so also may any suitable mechanism be employed for operating the valve, whether it proceeds initially from shaft S or from some other rotating or opening part.

When the engine runs on a four-cycle adjustment of the valve there are two down strokes of the piston and the exhaust port is opened twice before an explosion occurs. In this operation there is compression of whatever products of combustion remain in the cylinder after the first down stroke, but whatever power is absorbed in making this idle stroke is measurably compensated by the expansion of the compressed vitiated gases. When this occurs however, the clearance of said gas is more complete than when there is but one down stroke of the piston to clear the cylinder before another explosion occurs. The gears which control the valve and the valve itself are so constructed that the valve remains closed through alternate strokes of piston, or is open only for every other stroke. Obviously this works a considerable saving in gas and at the same time leaves the engine with sufficient power, say for ordinary or average conditions.

The word "gas" in the claims has reference to the explosive mixture.

What I claim is:—

1. An engine having an explosion chamber and a piston therein, a duct for the charge leading to said chamber, a rotatable valve in said duct, means to rotate said valve and open and close the same at alternate strokes of the piston and means to retire said valve bodily from said duct and leave the duct unobstructed, whereby a two cycle engine is obtained.

2. A four cycle engine having an explosion chamber, a piston and shaft, and a gas supply duct to said chamber, a rotatable valve in said duct, means to continuously rotate the valve while the engine is in operation, and means to retire the valve from said duct to obtain two-cycle operations.

3. A four-cycle engine having a vertically disposed explosion chamber, a piston and a duct leading to the said chamber, a rotatable valve in said duct and time gears to rotate said valve once during two strokes of said piston, a shaft slidable in one of said gears and having said valve fixed thereto, and a lever to operate said shaft and retire said valve.

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

VARNUM F. CARPENTER.

Witnesses:
R. B. MOSER,
E. M. FISHER.