I. LESEM.

EXPLOSION ENGINE.

APPLICATION FILED APR. 27, 1917.

1,291,032.

Patented Jan. 14, 1919.

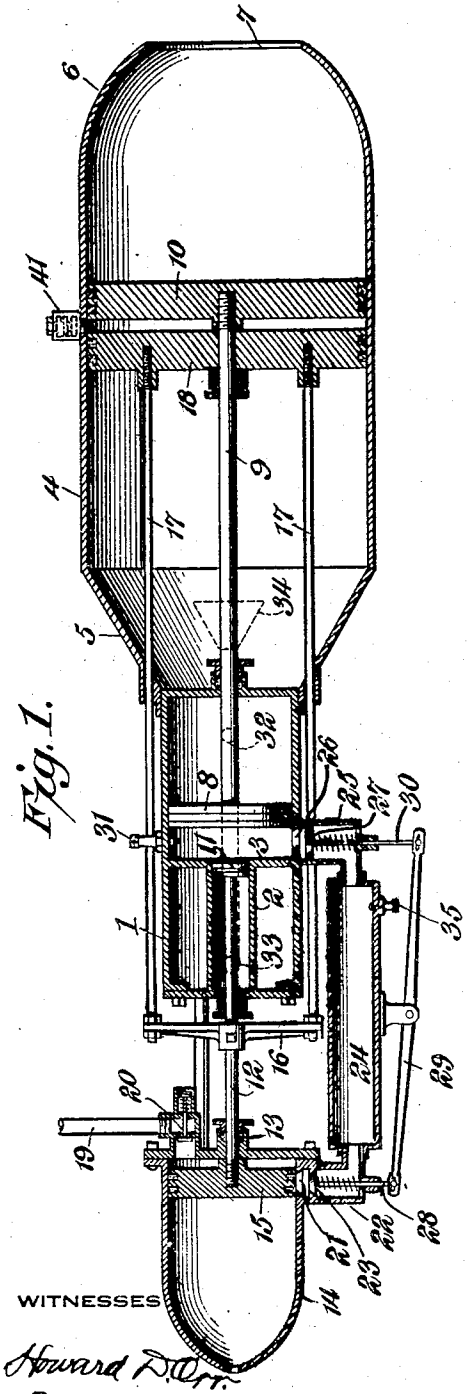

Fig. 1.

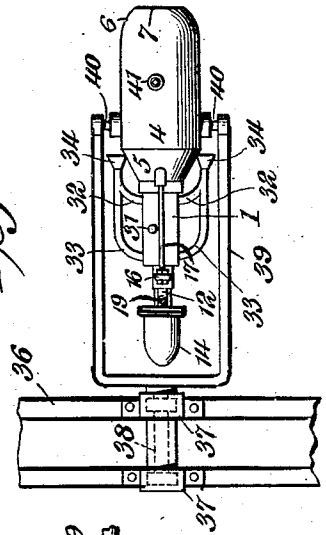

Fig. 3.

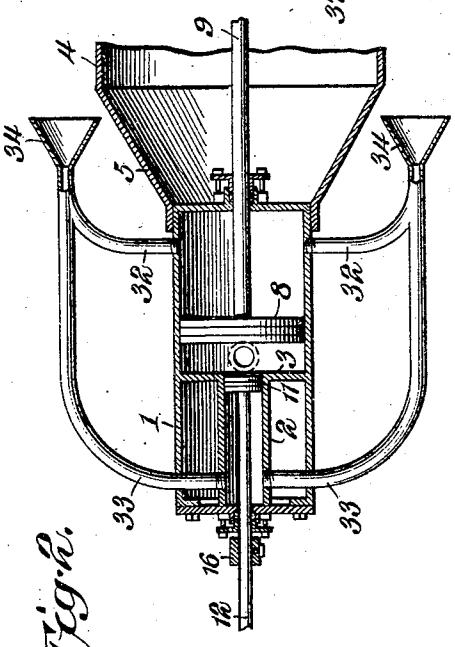

Fig. 2.

WITNESSES

Howard D. Orr.

F. T. Chapman.

Isidor Lesem, INVENTOR,

BY E. G. Siggers.

ATTORNEY

UNITED STATES PATENT OFFICE.

ISIDOR LESEM, OF WICHITA, KANSAS.

EXPLOSION-ENGINE.

1,291,032. Specification of Letters Patent. Patented Jan. 14, 1919.

Application filed April 27, 1917. Serial No. 164,980.

To all whom it may concern:

Be it known that I, ISIDOR LESEM, a citizen of the United States, residing at Wichita, in the county of Sedgwick and State of Kansas, have invented a new and useful Explosion-Engine, of which the following is a specification.

This invention has reference to explosion engines and its object is to provide a self-starting engine having no heavy inertia parts, thus adapting the engine particularly to aeroplanes and the like, although it is useful with other vehicles than aeroplanes, and wherein by reactive effect of the explosion and the action of air pressure due to the production of a vacuum by the explosions in the engine, the aeroplane or other vehicle upon which the engine is mounted is propelled.

The invention comprises reciprocatory pistons movable simultaneously in opposite directions in a cylinder for the production of a vacuum between them, so that atmospheric pressure may be utilized for the propulsion of the aeroplane or other air ship, and the oppositely reciprocating pistons are in turn actuated by other reciprocating pistons in an explosion engine and driven by the expansive force of explosions obtained from explosive mixtures of air and hydrocarbon. The impulse given to one of the second set of pistons by the effect of the ignited explosive mixture serves through a suitable pump structure to compress the gaseous fuel into a storage tank from which it is fed to the explosion chamber of the engine to be there ignited, while the exhaust gases of combustion are so directed as to impact against the surrounding atmosphere in a direction to aid in the propulsion of the vehicle. Furthermore, the engine may be so mounted that it may be pointed in different directions to cause the propulsion of the vehicle in correspondingly different directions.

The invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming part of this specification, with the further understanding that while the drawings show a practical form of the invention, the latter is not confined to any strict conformity with the showing of the drawings, but may be changed and modified so long as such changes and modifications come within the scope of the appended claims.

In the drawings:—

Figure 1 is a longitudinal diametric section of an engine embodying the invention, but omitting parts common to explosion engines, and, therefore, needing no illustration.

Fig. 2 is a view of the explosion cylinder portion of Fig. 1 with the section taken at right angles to that of Fig. 1.

Fig. 3 is a more or less schematic view of a mounting for the engine upon the vehicle.

Referring to the drawings there is shown a cylinder 1 in one end of which there is inclosed a concentrically disposed cylinder 2 of considerably smaller internal diameter than the cylinder 1 and terminating at a head 3 between the opposite ends of the cylinder 1. Fast to that end of the cylinder 1 remote from the cylinder 2 is another cylinder 4 joined to the cylinder 1 by a tapering connection 5, since the cylinder 4 may be of suitably larger diameter than the cylinder 1.

That end of the cylinder 4 remote from the cylinder 1 is somewhat contracted, as indicated at 6, to a mouth opening 7 at the extreme end of the cylinder 4 remote from the cylinder 1.

Within the internally larger end of the cylinder 1 is a piston 8 which may follow explosion engine practice, and this piston is fast to one end of a piston rod 9 extending into the cylinder 4 and there carrying another piston 10, the two pistons fitting the respective cylinders in a substantially air-tight manner, but both free to reciprocate together in the respective cylinders.

Within the small cylinder 2 is another piston 11 on a piston rod 12 carried through what may be termed the outer end of the cylinder 2 and entering through a stuffing box 13 into another cylinder 14 spaced from the cylinder 1 at the end thereof remote from the cylinder 4. Within the cylinder 14 the piston rod 12 carries a piston 15 reciprocable with the piston rod within the cylinder 14, but engaging the inner walls of the cylinder in substantially air tight relation thereto.

Secured to the piston rod 12 outside of the cylinder 1 is a cross head 16. Fast to

the cross head 16 at opposite ends thereof are rods 17 extending outside of the cylinder 1 and entering the cylinder 4 through free openings in the reduced end 5 thereof so that said end of the cylinder 4 is open to the atmosphere through said free openings. The rods 17 are ultimately secured to a piston 18 within the cylinder 4. The piston 18 is similar and reciprocable in opposition to the piston 10, but is in substantially air tight relation to the inner walls of the cylinder 4. The cylinder 14 is provided with an inlet pipe 19 for fuel with a self closing valve 20 opening toward the cylinder on the side of the piston 15 toward the cylinder 1.

Near the end of the cylinder 14 adjacent to the cylinder 1 is an outlet port 21 communicating with a valve casing 22 containing a valve 23. The valve casing 22 opens into one end of a storage chamber 24, the other end of which is connected by a valve casing 25 to an inlet port 26 opening into the cylinder 1 adjacent to the head 3. The casing 22 contains a valve 27 opening toward the port 26.

The valve 23 is provided with a valve stem 28 connected to one end of a rock lever 29, the other end of which is connected to a valve stem 30 carrying the valve 27.

The cylinder 1 carries a spark plug 31 in position to ignite an explosive charge between the piston 8 and the piston 11 and head 3.

The cylinder 1 containing the piston 8 has exhaust ducts 32 leading therefrom and the cylinder 2 at a point coincident with the end of the power stroke of the piston 11 has exhaust ducts 33. These exhaust ducts unite adjacent to the reduced portion 5 of the cylinder 4 and terminate in bell mouths 34 opening in the same direction as the mouth of the cylinder 4. The ducts 33 are located at any desired point in the length of the cylinder 2 that the stroke of the piston 11 may demand.

When the engine is first prepared for running a fuel mixture is pumped into the chamber 24 through a suitable nipple 35, this being accomplished by means of a hand pump or otherwise, whereby several charges are compressed into the chamber 24, which therefore constitutes a fuel reservoir.

The pressure of the stored fuel causes the opening of the valve 27 and the charging of the explosion chamber within the cylinder 1 between the piston 8 and the head 3. When equilibrium is established the valve 27 automatically closes.

Now, on passing a spark through the spark plug 31, the explosion mixture in the explosion chamber is ignited, and, assuming that the parts have been in the position shown in Fig. 1, the expansion of the ignited mixture is exerted suddenly and with great force against the piston 8, reacting upon the head 3, of but little smaller area than the piston 8, with the result that the piston 8 is driven toward the cylinder 4, and since the piston 10 is fixed to the piston 8 through the piston rod 9, it is moved with great rapidity toward the mouth 7.

At the same time the explosive force is exerted although to a much less degree upon the piston 11, thus causing the piston 18 to travel toward the cylinder 1 in a direction opposite to the direction of travel of the piston 10. At the same time the piston 15, which is fast to the piston 11 through the rod 12, is moved away from the cylinder 1 toward the other end of the cylinder 14. This results in the in-drawing of a charge of fuel which may be of gaseous form into the cylinder 14.

As soon as the pistons 8 and 11 reach the ends of their power strokes, the exhaust ducts 32 and 33 are opened by being over ridden by the pistons and the gases of combustion pass from the cylinders 1 and 2 into the ducts 32 and 33 and are discharged through the mouths 34 against the surrounding air, thus imparting a propelling movement to the engine and structure carrying it in the same direction that a propelling effort is caused by the power stroke of the piston 10.

The separation of the two pistons 10 and 18 because of their opposite travel establishes a vacuum in the cylinder 4 between these two pistons. During the power stroke of the piston 11 a fuel charge has been drawn into the cylinder 14.

Now, when the exhaust takes place the pressure due to the explosion is greatly reduced, being near to, if not actually below atmospheric pressure, and then the atmospheric pressure immediately and forcefully returns the two pistons 10 and 18 to the first or intermediate position, as soon as the force of the explosion is exhausted. When the two pistons 8 and 11 are returned to their first position, there is again formed a small explosion chamber and the piston 15 is forced toward its first position, thereby closing the valve 20 and opening the valve 22 and forcing a charge into the chamber or reservoir 24. This maintains the pressure within the reservoir 24, while permitting a fresh charge to enter the explosion chamber, whereupon a spark passing the terminals of the spark plug 31 produces a new explosion and the actuation of the pistons as before. These operations follow each other with great rapidity.

No attempt has been made in the drawings to show cooling jackets, carbureters, timers, or other parts customarily employed in explosion engine practice, since these parts may be readily supplied by any engineer familiar with explosion engines, and

their presence would only serve to confuse an understanding of the salient features of the invention.

Since the pistons 10 and 18 on their separation produce a vacuum, and since it is difficult to wholly prevent leakage about the pistons 10 and 18, a check valve 41 is provided in the cylinder 4, so that in case air should leak into the space between the pistons 10 and 18 on their separation, it will be forced out through the check valve 14 when the pistons again move into their position of close approach.

In Fig. 3 there is indicated a small portion 36 of an air ship or other vehicle. On the vehicle 36 there are provided bearings 37 for a swivel stud 38 carrying a yoke 39 in line with the swivel spindle 38.

Mounted at the free ends of the legs of the yoke 39 is a cylinder 4 which is provided with trunnions 40 for the purpose. By suitable supports the engine may be turned and tilted at various angles from a straight line of propulsion, so that the vehicle may be lifted or depressed or driven straight ahead, as may be desired.

By the provision of a suitable number of engines distributed about the vehicle it is possible to direct the propelling impulses wherever desired to drive the vehicle straight ahead, or to turn the vehicle in any desired direction.

Reference is herein made to another application Serial No. 112,793, filed by me on August 2, 1916, for an explosion engine, in which application features are described which are similar to certain features herein shown and described.

What is claimed is:—

1. An explosion engine comprising a cylinder inclosing an explosion chamber and provided with oppositely movable power pistons, a cylinder alined with the first-named cylinder and open at both ends to the atmosphere, oppositely movable pistons within the second cylinder and connected to respective pistons of the first-named cylinder for simultaneous opposite movements, and the production of a vacuum between them when moving apart, and means for directing explosive charges into the explosion chamber of the first-named cylinder and there igniting them.

2. An explosion engine comprising an explosion cylinder with pistons of different areas therein and movable simultaneously in opposite directions, another cylinder of larger area carried by the first-named cylinder and open to the atmosphere at both ends, pistons within the second-named cylinder simultaneously movable in opposite directions with one piston connected to the larger piston in the first cylinder and the other piston connected to the smaller piston in the first cylinder, means for directing explosive charges to the space between the two pistons in the first-named cylinder, and means for there igniting the charges.

3. An explosion engine comprising an explosion cylinder with pistons of different areas therein and movable simultaneously in opposite directions, another cylinder of larger area carried by the first-named cylinder and open at both ends to the atmosphere, pistons within the second-named cylinder simultaneously movable in opposite directions with one piston connected to the larger piston in the first cylinder and the other piston connected to the smaller piston in the first cylinder, means for directing explosive charges to the space between the two pistons in the first-named cylinder, and means for there igniting the charges, the engine also being provided with a pump for directing explosive charges to the explosion chamber of the first-named piston and connected to the smaller one of the pistons in the first-named cylinder.

4. An explosion engine provided with a power piston and cylinder inclosing it, another cylinder in line with the first-named cylinder and open to the atmosphere at both ends, a piston within the second cylinder connected to the first-named piston for actuation thereby, and means for establishing a vacuum on the side of the second-named piston remote from the open end of the cylinder containing it, said means comprising a piston in the second-named cylinder, and a piston in the first-named cylinder connected therewith for the actuation of the second piston in the second cylinder by the effect of an explosion in the first-named cylinder acting on the second-named piston therein, with the movement of the second-named piston in the second-named cylinder opposite to the movement of the first-named piston in the second-named cylinder.

5. An explosion engine comprising two cylinders each with a pair of pistons therein, one of the cylinders having one of its pistons of smaller diameter than the other piston, with the pistons of each cylinder movable simultaneously in opposite directions, and each piston in one cylinder connected to a corresponding piston in the other cylinder, one cylinder having means for the introduction and ignition of an explosive mixture between its pistons and the other cylinder being open to the atmosphere at both ends.

6. An explosion engine comprising a relatively large cylinder with both ends open to the atmosphere, a smaller power cylinder, a pair of pistons in each cylinder with the pistons of each pair movable simultaneously in opposite directions and each piston of one pair connected with the corresponding pistons of the other pair, the power cylinder having means for supplying it with

explosive charges and igniting said charges, whereby the pistons in the larger cylinder produce a vacuum between them when they are moved one away from the other to cause the bodily propulsion of the engine and the return of all the pistons to initial position after being displaced therefrom on the power strokes of the pistons in the power cylinder.

7. An explosion engine comprising a large cylinder with the ends open, oppositely movable pistons therein, a smaller power cylinder alined with the larger cylinder, oppositely movable pistons therein with one piston of smaller area than the other, connections between the larger power piston and the piston in the first-named cylinder toward the outer end thereof, connections between the smaller power piston and the piston in the larger cylinder toward the smaller cylinder, means for supplying explosive charges to the power cylinder and igniting them therein, storage means for fuel connected to the power cylinder, and a pump for storing the fuel in the storage means having connections with the smaller power piston for actuation thereby.

8. An explosion engine comprising a relatively large cylinder with the ends open, a smaller power cylinder in line therewith and connected thereto, two oppositely movable pistons in the large cylinder, two oppositely movable pistons in the power cylinder with one of the pistons of greater area than the other, a piston rod connecting the larger piston in the power cylinder with that piston in the first-named cylinder toward the outer end thereof, a piston rod connected to the smaller power piston and extending beyond the end of the power cylinder remote from the first-named cylinder, connections between the piston rod of the smaller piston and the second piston in the larger cylinder, a pump with a piston therein in line with the power cylinder with the piston of the pump connected to the piston rod of the smaller power piston, a storage reservoir between the pump and the power cylinder with the storage reservoir connected to the pump and also connected to the power cylinder to deliver explosive charges thereto between the two pistons in the power cylinder, and valves and actuating means therefor to cause the pump to deliver charges of fuel to the reservoir and the reservoir to deliver charges to the power cylinder at each stroke of the engine.

9. An explosion engine for air ships and other like vehicles, comprising a cylinder with reciprocatory pistons therein and with the cylinder having the ends open to the atmosphere, an explosion engine cylinder and pistons carried by the first-named cylinder in line therewith, with the pistons of the second cylinder separately connected to respective pistons of the first-named cylinder for the reciprocation of the pistons simultaneously in opposite directions, and a mounting for the engine connected to the first-named cylinder with said mounting movable about different axes for presenting the open end of the first-named cylinder in directions with respect to an air ship on which the engine is mounted for causing impulses delivered to the engine to propel the air ship in directions corresponding to the angular relation of the engine to the air ship.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

ISIDOR LESEM.

Witnesses:
E. S. WONELL,
J. T. MCCALL.