A. LEE.

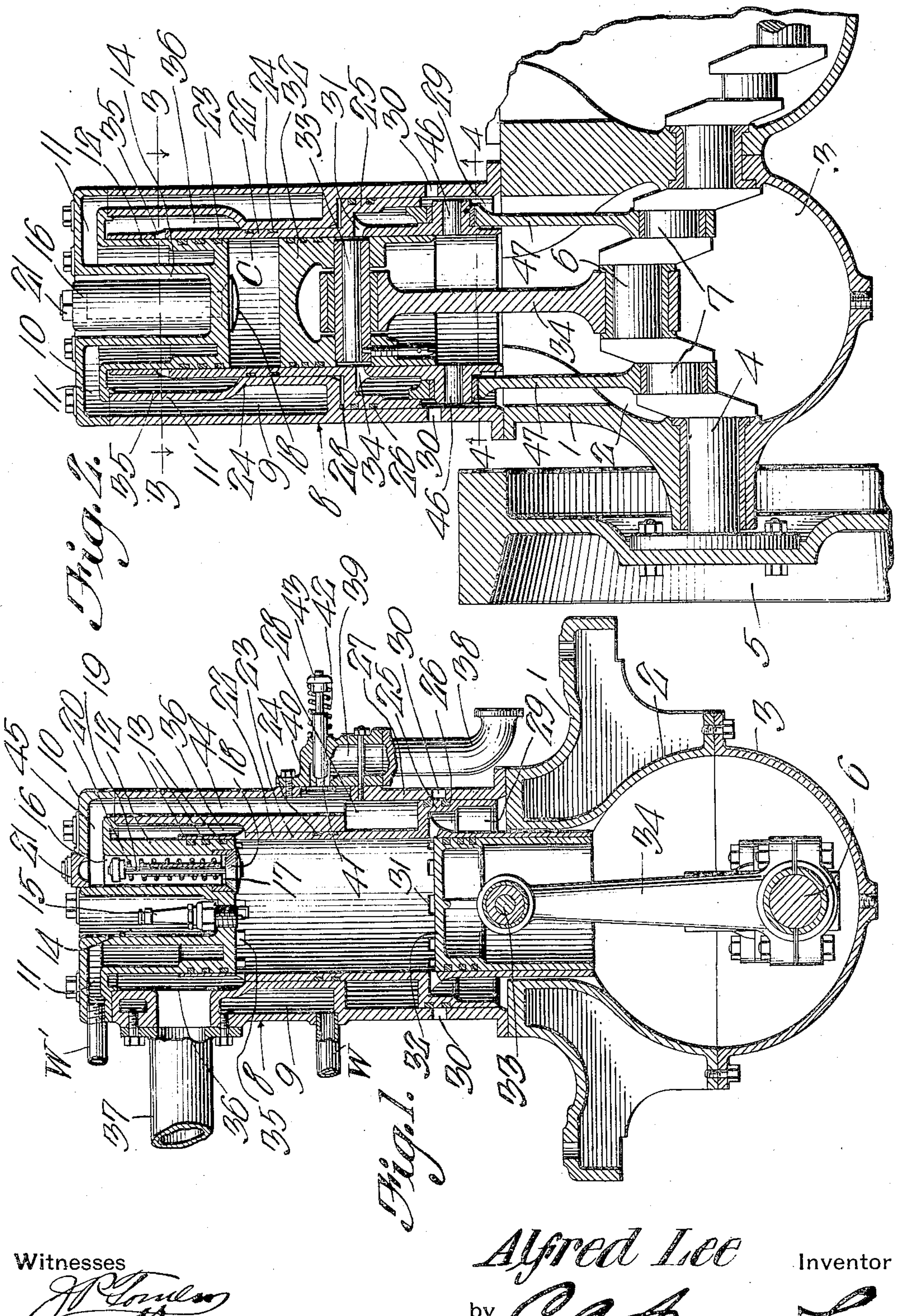
EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 24, 1911.

1,042,572.

Patented Oct. 29, 1912.

2 SHEETS—SHEET 1.



Witnesses

J. P. Lowden

L. H. Walton

Alfred Lee Inventor

by C. A. Snow & Co. Attorneys

A. LEE.

EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 24, 1911.

1,042,572.

Patented Oct. 29, 1912.

2 SHEETS—SHEET 2.

Fig. 3.

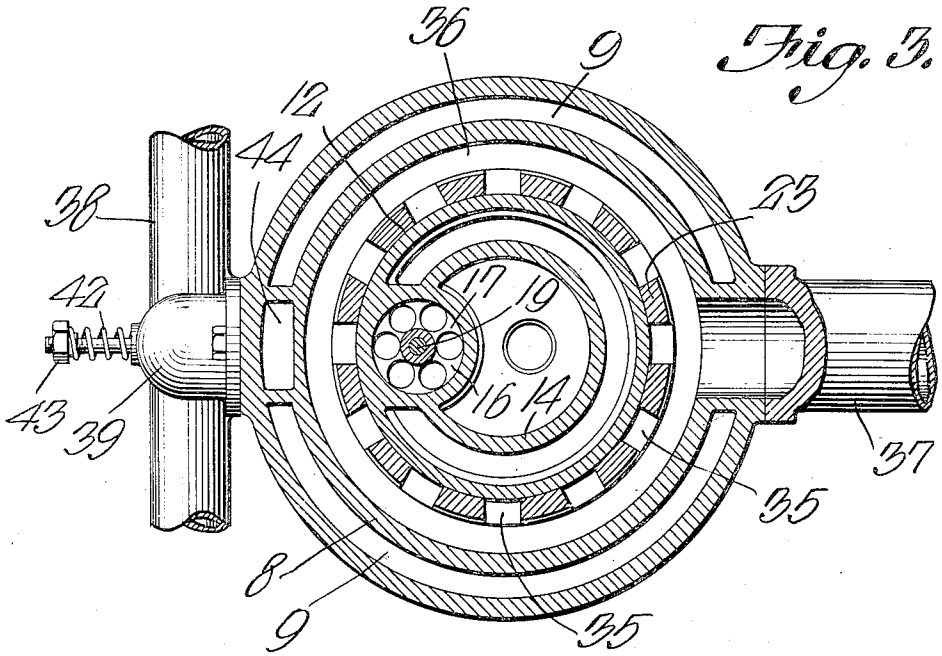
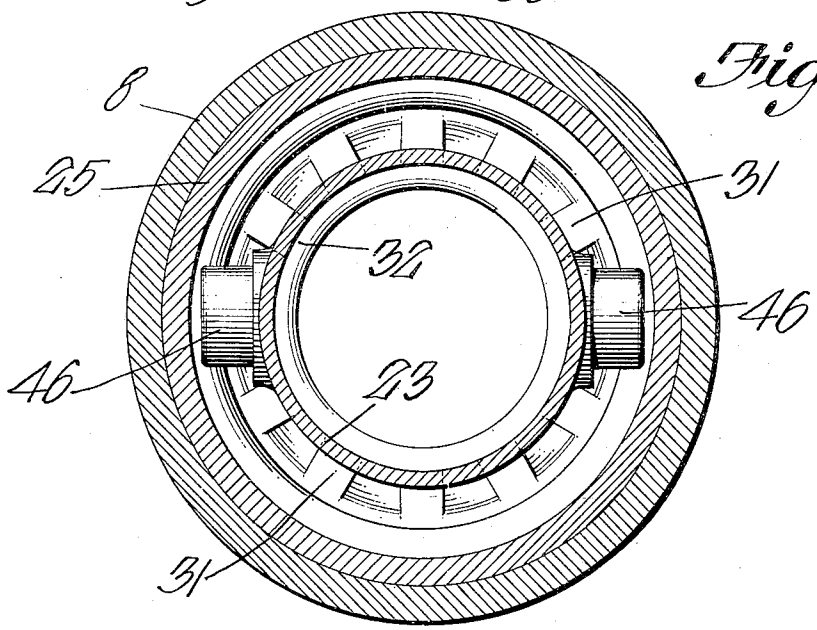


Fig. 4.



Witnesses

J. Tennis

L. H. Wilcox

Alfred Lee Inventor

by C. A. Snow & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ALFRED LEE, OF BELLINGHAM, WASHINGTON.

EXPLOSIVE-ENGINE.

1,042,572. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed October 24, 1911. Serial No. 656,380.

To all whom it may concern:

Be it known that I, ALFRED LEE, a citizen of the United States, residing at Bellingham, in the county of Whatcom and State of Washington, have invented a new and useful Explosive-Engine, of which the following is a specification.

The present invention relates to improvements in explosive engines, this particular engine being a two-cycle engine, with the advantages of a four-cycle, a novel form of scavenging means being provided, whereby scavenging air is under compression simultaneously with the exhaust of the burnt charges of the explosive chamber so that air will be projected at the lower end of said explosive chamber; and before said scavenging air is cut off, the said chamber is filled with pure air and a portion thereof exhausted through the exhaust of the engine, thereby providing a means whereby the explosive chamber is cleared of all burnt gases to produce a more efficient explosive motor.

A further object of the present invention is the provision of an explosive motor provided with an explosive propelled piston connected to a crank shaft, said crank shaft having operably connected thereto an air compressing and explosive charge cleaning piston which is mounted concentrically of the motor piston, said cleaning piston having imparted thereto a stroke substantially one-half of the stroke of the motor piston whereby at the discharge of the burnt gases from the explosive chamber of the motor, a supply of fresh or scavenging air is forced in at the lower end of the explosive chamber and partially exhausted before the closure of the exhaust to thoroughly scavenge the explosive chamber and free the same of the burnt gases.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawings—Figure 1 is a transverse vertical central sectional view through one cylinder of the explosive engine. Fig. 2 is a longitudinal section thereof. Fig. 3 is a section taken on line 3—3 of Fig. 2. Fig. 4 is a section taken on line 4—4 of Fig. 2.

Referring to the drawings, the numeral 1 designates the supporting casting for the motor provided with the upper portion 2 of the crank piece which with the lower portion 3 connected thereto forms a crank case and air compression chamber for the motor. Journaled in the crank case is the usual crank shaft 4 having mounted upon one end the fly or balance wheel 5, said crank shaft being provided with the central motor crank 6 and the two oppositely disposed and shorter cranks 7. Connected to the crank or base of the motor, is the usual engine casing or cylinder 8, which as shown is provided with the water jacket 9 having the circulation pipes W and W′ connected thereto, the cap 10 of the cylinder being detachably connected thereto and having the water jackets 11 and 11′ formed therein. Formed concentrically of and integral with the cap 10 is a cylinder 12 provided with packing rings 13, said cylinder 12 having a cylindrical depression 14, in which is mounted a spark plug 15, a suitable threaded aperture being provided at the lower end thereof to receive said plug 15. Formed in the said cylinder 12 parallel to the recess 14 thereof is a cylindrical channel or a duct 16 having mounted in its lower end the valve seat and spider 17 controlled by the upwardly closing disk valve 18, whose stem 19 is mounted within the said duct 16 and provided with a spring 20 which normally holds the said valve upwardly and closed, a plug 21 being threaded in the top of the cap 10 to aline with the upper end of the duct 16, thus providing means whereby access may be had to adjust the tension of the spring thereupon.

In the main casing of the engine is disposed a concentric cylinder 22, in which slidably fits an open ended cylindrical piston 23 provided with the centrally disposed packing rings 24 adjacent the face of the cylinder 22, the said hollow piston 23 providing with the main casing below the water jacketed portion thereof, the annular chamber 28 above enlarged annular piston 25 of the hollow piston 23 which is disposed to reciprocate and engage the inner face of the main cylinder of the engine as clearly shown in Figs. 1 and 2, the said enlarged piston 25 being provided with the packing

rings 26 and dividing the enlarged portion at the lower end of the main cylinder into the upper annular chamber 28 and the lower annular chamber 29, the lower chamber being in communication with the outside air through the circumferentially disposed air inlet ports 30 and with the upper end of the crank case chamber around the lower end of the hollow piston 23 whereby the crank case chamber may be employed as an air compression chamber. Formed in the wall of the hollow piston 23 and adapted to be in communication with the lower chamber 29 of the main casing, are the air inlet or scavenging ports 31 which as shown in Fig. 1 are disposed to be slightly above the upper face of the motor piston 32 when the said motor piston is in its lowermost position as shown in Fig. 1. The motor piston 32 is provided with the crank pin 33 which is connected with the crank or piston rod 34 which as shown is connected to the crank 6 of the crank shaft. The burnt gas escape ports 35 are formed circumferentially through the walls of the hollow piston 23 near the upper end thereof and when the said piston 23 is in the position as shown in Fig. 1 at the exhaust stroke of the motor piston, the burnt gases are permitted to pass through said ports 35 into the annular exhaust chamber 36 of the engine, and finally out of the exhaust manifold 37.

Connected to the casing 1 at the opposite side to the exhaust manifold 37, is the intake manifold 38 which is connected to the usual carbureter (not shown), the upper end 39 thereof being in communication through the ports 40 with the vertically disposed chamber 44 within the casing of the engine, the disk valve 41 preferably made of leather, being disposed to control the flow of the explosive charge from the manifold 38 into the chamber 44 of the engine, the said valve having mounted upon its stem the coiled spring 42 and the adjusting nut 43 whereby the tension of said spring may be adjusted to give the proper tension to the valve 41 which is actuated by the suction of the engine to draw the explosive charge into the lower end of the chamber 44 and into the annular chamber 28, the hollow piston 23 being in the position as shown in Fig. 1. Upon the movement of the pistons 23 and 32 upwardly to the position as shown in Fig. 2, the explosive charge within the chamber 28 and vertically disposed channel or chamber 44 is compressed and forced upwardly through the channel or chamber 44 through the duct 45 in the cap 10 of the engine through the channel 16 forcing the valve 17 open so that the explosive charge is forced into the chamber C which is sealed when in the position as shown in Fig. 2. Thus the charge is admitted to the chamber C at the highest point of compression of the piston 32 at which point, the spark plug will ignite said charge and propel the piston 32 to the position shown in Fig. 1 operating the crank so that the hollow piston 23 will be moved simultaneously, but by reason of the fact that the stroke of said hollow piston 23 is approximately one-half the stroke of the motor piston 32, the said piston 23 travels at only one-half the speed of the motor piston 32 and brings the exhaust ports 35 in line with the exhaust channel 36 formed in the main casing of the engine simultaneously with the movement of the piston 32 below the air inlet or scavenging ports 31, the action of the hollow piston 23 moving downwardly and when in such position as shown in Fig. 1, causing the compressed air within the crank case and chamber 29 to be forced through the apertures 31 into the lower end of the explosive chamber C to assist in expelling the burnt charges from the chamber C through the apertures 35 into the exhaust manifold 37, thus thoroughly scavenging the cylinder of the burnt gases and leaving the chamber full of pure air. Thus the cylinder contains no consumed gases, but has fresh air that will have no detrimental effect upon the next explosive charge.

When the hollow piston 23 is in the position as shown in Fig. 1, its apron or rim portion seals the air inlet apertures 30 so that the air compressed within the crank case is instantly expelled upwardly through the apertures 31 as soon as the motor piston 32 uncovers the same. Upon the movement of the hollow piston 23 upward as viewed in Fig. 2, a suction is created by the larger portion 25 so that when the apron portion of the piston passes beyond the apertures 30 as viewed in Fig. 2, an inrush of air through said apertures and into the lower portion of the chamber 29 is caused, thus keeping a continuous supply of fresh air as a scavenging means at the desired point of exhaust or lowest point of movement of the motor piston 32.

As before stated it is desired that the hollow piston 23 move approximately one-half the distance of the motor piston 32 and in order to accomplish this, the piston pins or trunnions 46 are provided upon opposite sides of the apron of the enlarged portion 25 of the hollow piston 23, and have connected thereto the two piston rods 47, whose lower ends are connected to the cranks 7 of the crank shaft 4, whereby as the motor piston 32 is actuated to rotate the crank shaft 4, motion is imparted through the piston rod 47 to the hollow piston 23 so that the same moves simultaneously with the motor piston 32 traveling only half the distance and therefore moving at a slower rate of speed.

What is claimed is:

1. An explosive engine, having a com-

municating cylinder and crank case, said crank case being sealed and providing an air chamber, the lower portion of the cylinder adjacent the crank case being enlarged and having a plurality of ports therethrough in communication with the outside, a scavenging piston disposed for reciprocation within the cylinder and acting as a valve to control the ports thereof, the up-stroke of said piston drawing air through said ports to be compressed within the chamber of the crank case upon the down-stroke thereof, said scavenging piston being provided with a plurality of ports near the upper and lower ends thereof, a crank shaft operably connected to said scavenging piston, a motor piston mounted for reciprocation within the scavenging piston and disposed to control the lower openings therethrough and when at its lowest point of movement to uncover the same to permit the projection of compressed air from the crank case chamber within the chamber formed in the scavenging piston to act as a scavenging medium therefor, the other perforations of the scavenging piston forming exhaust outlets.

2. An explosive engine, having a communicating cylinder and crank case, said crank case being sealed and providing an air chamber, the lower portion of the cylinder adjacent the crank case being enlarged and having a plurality of ports therethrough in communication with the outside, a scavenging piston disposed for reciprocation within the cylinder and acting as a valve to control the ports thereof, the upstroke of said piston drawing air through the said ports to be compressed within the chamber of the crank case upon the downstroke thereof, said scavenging piston being provided with a plurality of ports near the upper and lower ends thereof, a crank shaft operably connected to said scavenging piston, a motor piston mounted for reciprocation within the scavenging piston and disposed to control the lower openings therethrough and when at its lowest point of movement to uncover the same to permit the projection of compressed air from the crank case chamber within the chamber formed in the scavenging piston to act as a scavenging medium therefor, the other perforations of the scavenging piston forming exhaust outlets, a valve controlled intake manifold connected to the cylinder and actuated upon the down-stroke of the scavenging piston to intake the explosive charge, a valve controlled inlet disposed at the upper end of the cylinder for admitting the charge within the scavenging piston upon the up-stroke of the scavenging piston.

3. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports thereof, said open ended piston having ports in its wall at the junction of the reduced upper and enlarged lower ends thereof to admit air from the crank case into the lower end of the explosive chamber, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge at the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston.

4. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports thereof, said open ended piston having ports in its wall at the junction of the reduced upper and enlarged lower ends thereof to admit air from the crank case into the lower end of the explosive chamber, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge at the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods

connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston, the distance traveled by the hollow piston being substantially one-half of the distance traveled by the motor piston.

5. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports thereof, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge at the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston, the said hollow piston being provided with two series of ports through the walls thereof, one series near the upper end and the other near the lower end, whereby air is admitted to the lower end of the hollow piston and controlled by the motor piston to form a scavenging air current therewithin simultaneously with the bringing of the exhaust openings of the hollow piston into play.

6. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports thereof, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge at the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston, the said hollow piston being provided with two series of ports through the walls thereof, one series near the upper end and the other near the lower end, whereby air is admitted to the lower end of the hollow piston and controlled by the motor piston to form a scavenging air current therewithin simultaneously with the bringing of the exhaust openings of the hollow piston into play, the upper series of openings formed in the hollow piston being adapted at that time to be placed in communciation with the exhaust chamber surrounding the cap cylinder to permit of the burnt gases and scavenging air currents.

7. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge at the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston, the said hollow piston being provided with two series of ports through the walls thereof, one series near the upper end and the other near the lower end, whereby air is admitted to the lower end of the hollow piston and controlled by the motor piston to form a scavenging air current therewithin simultaneously with the bringing of the ex-

haust openings of the hollow piston into play, said hollow piston and motor piston moving simultaneously the motor piston at a speed and distance approximately twice that of the hollow piston.

8. An explosive engine, having a cylinder the lower end of the bore of which is enlarged, the wall of said cylinder at such point being provided with a plurality of ports, a sealed crank case in communication with the lower end of the cylinder, a cap upon the cylinder provided with a cylindrical projection forming an annular exhaust chamber therearound within the cylinder, an open ended piston having a reduced upper end mounted to fit slidably upon the cylindrical projection of the cap and having an enlarged lower end forming a piston to reciprocate in the enlarged bore of the cylinder and to control the ports thereof, a manifold leading from the exhaust chamber at the upper end of the cylinder, a valve controlled explosive charge intake in communication with the upper end of the enlarged bore of the cylinder, a valve controlled inlet in the cap to admit the explosive charge to the upper end of the hollow piston, a motor piston mounted for reciprocation within the outer piston, a crank shaft, a piston rod connected to the motor piston and the crank shaft whereby the motor piston imparts rotation to the crank shaft, and a plurality of piston rods connected to the hollow piston for imparting to said hollow piston a simultaneous reciprocation with the motor piston, the said hollow piston being provided with two series of ports through the walls thereof, one series near the upper end and the other near the lower end, whereby air is admitted to the lower end of the hollow piston and controlled by the motor piston to form a scavenging air current therewithin simultaneously with the bringing of the exhaust openings of the hollow piston into play, the upper series of openings formed in the hollow piston being adapted at that time to be placed in communication with the exhaust chamber surrounding the cap cylinder to permit of the burnt gases and scavenging air currents, said hollow piston and motor piston moving simultaneously the motor piston at a speed and distance approximately twice that of the hollow piston.

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

ALFRED LEE.

Witnesses:

JANETTE HUTCHISON,

L. H. RUGE.