

1,061,396.

H. MOORE.
EXPLOSIVE ENGINE.
APPLICATION FILED SEPT. 13, 1911.

Patented May 13, 1913.

2 SHEETS—SHEET 1.

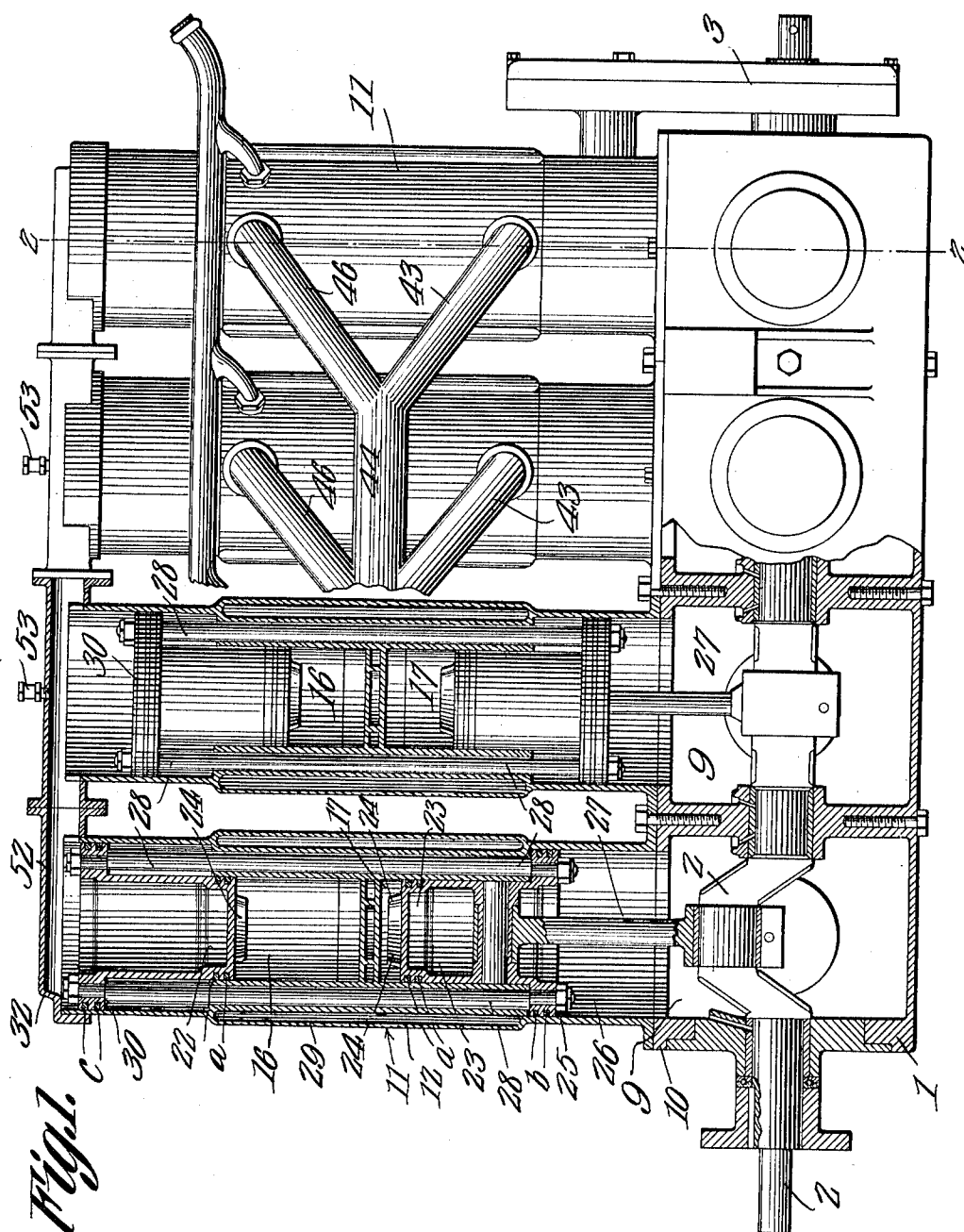


Fig. 1.

Witnesses
Frank B. Woodrow
L. H. Wilson.

Harry Moore Inventor.
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Attorneys.

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2 SHEETS—SHEET 2.

Fig. 3.

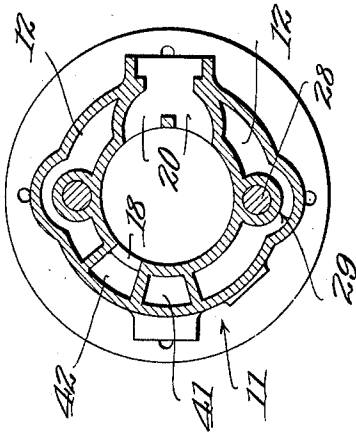


Fig. 4.

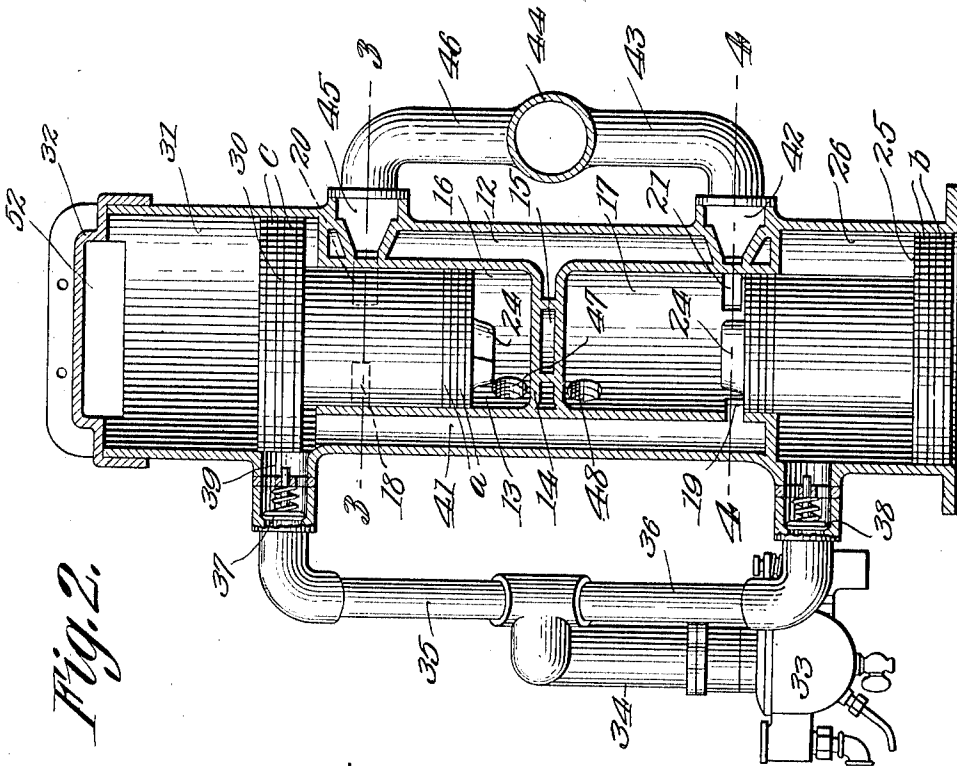
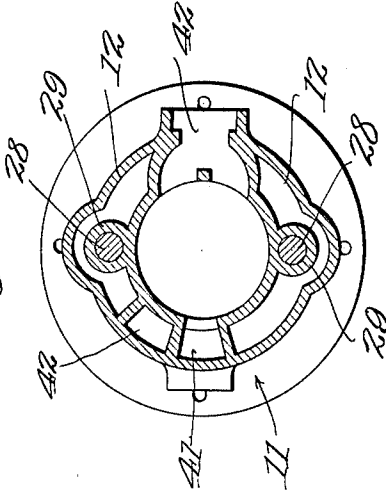


Fig. 2.

Witnesses
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UNITED STATES PATENT OFFICE.

HARRY W. MOORE, OF NEBRASKA CITY, NEBRASKA, ASSIGNOR TO RALPH A. DUFF,
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EXPLOSIVE-ENGINE.

1,061,396.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed September 13, 1911. Serial No. 649,010.

To all whom it may concern:

Be it known that I, HARRY W. MOORE, a citizen of the United States, residing at Nebraska City, in the county of Otoe and State of Nebraska, have invented a new and useful Explosive-Engine, of which the following is a specification.

This invention relates to improvements in explosive engines, this particular engine being a double acting two-cycle engine, the cylinder of which is divided centrally by a partition upon opposite sides of which are oppositely disposed explosive chambers and in which are adapted to reciprocate two connected piston heads, one of said piston heads exploding and exhausting while the other piston head is charging and compressing, each cylinder of the particular engine being a unit *per se*.

The main object of the present invention is the provision of an explosive engine each cylinder of which is a separate power unit and is provided with two superposed piston receiving and explosive cylinders having oppositely disposed open ends for the reciprocatory reception of their respective piston heads, one of said heads being directly connected by means of a piston rod to the crank shaft of the engine, while the other head is connected through passages exterior of the cylinder explosive chambers to the other piston head, whereby the reciprocation of one will correspondingly reciprocate the other, said heads being reciprocated in the same direction, but acting oppositely with relation to exploding and exhausting.

A further object of this invention is the provision of an explosive engine, each cylinder of which is a power unit, *per se*, and is provided with two superposed explosive cylinders and piston heads, said piston heads being connected for movement in unity but acting oppositely with relation to exploding and exhausting, the upper piston head being provided with an enlarged piston reciprocatingly mounted in a superimposed chamber above the exploding cylinders to control the intake of the explosive mixture in the lower cylinder, while the lower cylinder is provided with an enlarged piston mounted in an enlarged chamber at the lower end of the cylinder to draw in the explosive charge for the upper cylinder, the pipe leading from the carbureter and

the explosive charge manifold being provided with check valves or any means which will prevent the back flow of the explosive charge but permit its being forced from its mixing chamber through by-passes disposed exterior of the explosive cylinder to its proper cylinder.

A still further object of the present invention is the provision of a double acting two-cycle explosive engine, in which the compression takes place within opposite ends of the cylinder and not in the crank case, the explosive cylinders being interposed between the compression chambers and said compression chambers being oppositely disposed with relation to the cylinder to which the explosive charge is admitted.

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 view partly in side elevation and partly in section of an engine constructed in accordance with the present invention, two of said cylinders being shown in vertical section, the piston heads of one of said cylinders being shown in section to show the details of construction. Fig. 2 is an enlarged detail sectional view taken on line 2—2 of Fig. 1, showing a portion of the intake manifolds and the exhaust manifolds in elevation. Fig. 3 is a cross section taken on line 3—3 of Fig. 2. Fig. 4 is a cross section taken on line 4—4 of Fig. 2.

Referring to the drawings, the numeral 1 designates the crank case and base of the engine, which as shown in Figs. 1 and 2 is composed of four casing cylinders, and disposed within said crank case is the usual crank shaft 2, being connected at one end to the gears in the case 3. The said crank case is divided into separate compartments 9, one to each casing cylinder of the engine, each cylinder of the engine being a separate unit and if desired may be cut out to use one, two, three or four or each alternate one or in pairs as desired, the flange 10 pro-

viding a means for the attachment of the vertically disposed casing cylinder 11 thereto.

In describing the engine, a single cylinder will be described, which will suffice for the description of them all. The said cylinder 11 is provided with the peculiarly shaped centrally disposed water jacket 12, and mounted centrally within the cylinder or outer casing is the main explosive cylinder 13, which as shown is centrally divided by means of the two partitions 14, the space 15 therebetween being a water jacket space and being in communication with the vertically disposed water jacket 12. By this means it will be seen that the said cylinder is divided into the two oppositely disposed or superposed explosive chambers 16 and 17 respectively, each of said cylinders being provided with the intake ports 18 and 19, respectively, and with the exhaust ports 20 and 21, respectively, said ports being provided at the opposite ends of the respective explosive chambers.

Mounted within the open ends of the explosive chambers 16 and 17 respectively, are the power piston heads 22 and 23 respectively, each one of which is provided at its sealed end with the baffle plates 24. The piston head 23 has formed at its lower end the enlarged piston 25, having the packing rings *b* which permit the said piston head or auxiliary compression device to fit gas tight within the compression chamber and carbureted air supplying chamber 26 in the lower end of the main casing, a piston rod 27 connecting the lower piston head 23 with the crank shaft 2 as clearly illustrated in Fig. 2.

Connected in diametrically opposed positions to the enlarged piston 25 are the two rods 28, which are mounted for reciprocation through the sleeves 29 formed exteriorly of the explosive cylinder of the motor, their upper ends being connected to the enlarged piston 30 provided with packing rings *c* and connected with the explosive piston 22, the said enlarged piston 30 being mounted for reciprocation within the explosive charge supplying chamber 31 disposed at the upper end of the casing of the engine. By means of the rods 28 it is apparent that the piston 22 and its enlarged piston 30 are connected for simultaneous movement to the lower piston 23 through the medium of the enlarged piston 25, and that by the action of the explosive charges within the explosive chambers 16 and 17 upon opposite sides of the partition 14, that the piston 23 will be forced downwardly and at the same time pull downwardly with it the piston 22 and the enlarged piston 30, into explosive charging and compression position, the explosive charge being exploded at the highest point of compression so that

the piston 23 is propelled upwardly and carries with it through the rods 28 the piston 25 into compression and exploding position. Thus the action is a continued double action and by reason of the fact that each cylinder is exploded every revolution of the crank shaft or full reciprocation of the respective piston head, a double acting two-cycle engine is provided. The upper ends of the respective casing are connected by means of the cap 32, the detail of which will be described later.

In order to supply the proper explosive charge to the cylinder or cylinders, at the proper time, a carbureter 33 is employed and has connected through its manifold 34, the upwardly extending branches 35 and the downwardly extending branches 36 of the intakes of the various cylinders of the motor. These intakes are provided at their junction with the casing of the engine with the check valves 37 and 38 respectively, the branches 35 supplying the explosive mixture through the port 39 upon the up-stroke of the piston 30, the action or suction of said piston 30 drawing the explosive charge through the intake conduit 35, check valve 37 and into the supplying chamber 31, the downward movement of said piston 30 causing the check valve 37 to close and consequently the explosive charge within the chamber 31 will be forced down through the vertical by-pass 41 through the intake 19 of the lower cylinder 17, this action compressing the charge within the by-pass so that the instant that the piston 23 assumes the position as shown in Fig. 3, the explosive charge will be instantly propelled into the chamber 17, the port 19 then being open, so that upon the up-stroke of the piston 23, due to the explosive charge admitted and exploded in the chamber 16, on the upward movement of the piston 22, the said charge within the cylinder and chamber 17 will be compressed and finally exploded at the highest point of compression. It will thus be seen that the charge taken at the upper end of the casing is supplied to the lower cylinder 17 through the vertical by-pass 41, while the piston 25 upon its downward stroke, will draw in the explosive charge through the conduit 36, check valve 38 and port 40 into the supply chamber 26 at the lower end of the casing, the up-stroke of the piston 25 closing the check valve 38 and forcing said explosive charge upwardly through the by-pass 42 into the intake port 18 of the upper explosive chamber 16, the piston 22 when at the position opposed to the position shown in Fig. 3, and beyond the port 18 permitting the sudden entrance of such compressed explosive charge, compressed within the by-pass 42 to enter the port 18 and into the cylinder 16 similarly to the intake of the charge within the cylinder 17 as before de-

scribed. Thus it will be seen that the chambers at the opposite ends of the casing supply the explosive charge to the opposite cylinders, thus permitting the compression of the charge for one cylinder during the explosion and propulsion of the other piston in the other cylinder, whereby a greater compression of the explosive charge is permitted and its consequent maximum power gained therefrom.

The port 21 of the lower cylinder 17 leads into the exhaust chamber 42 through the branch conduit 43 to the main exhaust manifold 44, while the exhaust port 20 of the upper cylinder 16 leads into the exhaust chamber 45 through the branch conduit 46 to the manifold 44. By this arrangement, the explosive charge is exhausted at the extreme end of the stroke of either piston, and by reason of the fact that the exhaust ports are substantially twice the area of the intake ports, and that the baffle plates 24 are so disposed as to prevent the explosive charge entering the intake ports, said exhausted gases are thus emitted at that instant through the exhaust port. By reason of the fact that the compression and supplying of the explosive charge is accomplished in this manner the cylinders and pistons are rendered self-scavenging, thus keeping the surfaces of the cylinders and pistons clean, and preventing the collection of carbon within the cylinders. The pistons 22 and 23 are provided with the usual packing rings *a* thereby making the proper joint between the walls of the cylinders and the respective piston heads.

As the present form of invention is especially designed for the use of the jump spark, the spark plugs (not shown) are mounted within the threaded apertures 47 and 48, respectively, disposed in line with the explosive ends of the respective chambers 16 and 17.

The sealing caps 32 clearly shown are provided with a continuous compartment 52 which forms the means of communication with the upper ends of the casings and by means of the valves 53, the compression of the air or gases in the upper end of the respective chamber 31 may be relieved, the said valves 53 being relief valves either to be operated automatically by the pressure in the caps 32 or to be operated manually if desired. The cushioning of the air within the upper end of the cylinder 31 and in the chamber 52 of the casing or cap 32 and the communication between the upper ends of the various cylinders form a sort of compensating means, and under ordinary conditions will not affect the reciprocation of the pistons in their respective cylinders and as before stated should the compression be too great the same will be relieved by the relief valve 53.

The ratio of the areas of the chambers 26 and 31 to their respective explosive chambers 17 and 16, is approximately three to two, that is the area of the chamber 26 or 31 is one and one-half times that of the area of the explosive chamber 17 or 16, thus providing a highly compressed charge when delivered through the respective by-pass 41 or 42 through the intake ports 19 or 18, and finally to the explosive chamber 17 or 16.

What is claimed is:

1. An explosive engine, having a main cylinder, a concentrically disposed reduced cylinder providing enlarged chambers beyond its respective ends within the main cylinder, said main cylinder having a carbureted air supply port at the junction of each enlarged chamber with its reduced cylinder, said reduced cylinder having a central diaphragm dividing said cylinder into oppositely disposed explosive chambers, each of said chambers being provided with intake and exhaust ports near one end and in substantially the same circumferential line, said reduced cylinder providing two parallel channels between its outer shell and the wall of the main cylinder, one of said channels forming communication between the lower enlarged chamber and the intake of the upper explosive chamber while the other channel forms communication between the upper enlarged chamber and the intake port of the lower explosive chamber, two superposed and connected explosive and explosive charge supplying pistons mounted in the respective ends of the main cylinder and reduced cylinder, a branched carbureted air supply manifold leading to each carbureted air supplying port, and a valve in each branch thereof to permit carbureted air to enter its enlarged chamber upon the out-stroke of its explosive charge supplying piston and to close on the in-stroke thereof.

2. An explosive engine, having a main cylinder, a concentrically disposed reduced cylinder providing enlarged chambers beyond its respective ends within the main cylinder, each enlarged chamber having a carbureted air intake port near its junction with the reduced cylinder, said reduced cylinder having a central diaphragm dividing said cylinder into oppositely disposed explosive chambers, each of said chambers being provided with intake and exhaust ports near one end and in substantially the same circumferential line, said reduced cylinder providing two parallel channels between its outer shell and the wall of the main cylinder, one of said channels forming communication between the lower enlarged chamber and the intake of the upper explosive chamber while the other channel forms communication between the upper enlarged chamber and the intake port of the lower explosive chamber, two superposed and connected ex-

plosive and explosive charge supplying pistons mounted in the respective ends of the main cylinder and reduced cylinder, a two branched carbureted air supply conduit in communication with the ends of the respective enlarged chambers adjacent the junction thereof with the respective ends of the reduced cylinder, and a spring closed valve to each branch to permit the flow of carbureted air to its enlarged chamber upon the out-stroke of its piston and to close its branch upon the in-stroke thereof.

3. An explosive engine, having a main cylinder, a concentrically disposed reduced cylinder providing enlarged chambers beyond its respective ends within the main cylinder, each enlarged chamber having a carbureted air intake port near its junction with the reduced cylinder, said reduced cylinder having a central diaphragm dividing said cylinder into oppositely disposed explosive chambers, each of said chambers being provided with intake and exhaust ports near one end and in substantially the same circumferential line, said reduced cylinder providing two parallel channels between its outer shell and the wall of the main cylinder, one of said channels forming communication between the lower enlarged chamber and the intake of the upper explosive chamber, while the other channel forms communication between the upper enlarged chamber and the intake port of the lower explosive chamber, an explosive piston and a carbureted air supplying piston mounted in each explosive chamber of the reduced cylinder and the enlarged portion of the main cylinder, rods connected to the two enlarged pistons for connecting all of the pistons for movement in unison, a two branched carbureted air supplying manifold, each branch of which leads to its respective intake port of its enlarged chamber, and a valve in each branch to permit the supplying of carbureted air and to prevent back pressure in the manifold.

4. An explosive engine, having a main cylinder, a concentrically disposed reduced cylinder providing enlarged chambers beyond its respective ends within the main cylinder, each enlarged chamber having an intake port, said reduced cylinder having a central diaphragm dividing said cylinders into oppositely disposed explosive chambers, each of said chambers being provided with intake and exhaust ports near one end and in substantially the same circumferential line, said reduced cylinder providing two

parallel channels between its outer shell and the walls of the main cylinder, one of said channels forming communication between the lower enlarged chamber and the intake of the upper explosive chamber, while the other channel forms communication between the upper enlarged chamber and the intake port of the lower explosive chamber, two superposed and connected explosive and explosive charge supplying pistons mounted in the respective ends of the main cylinder and reduced cylinder, the said explosive pistons controlling both the intake and exhaust ports of their respective explosive chambers, and a valve to each intake port of the enlarged chambers opened upon the outstroke of its explosive charge supplying piston, and closed upon the in-stroke thereof.

5. An explosive engine, having a main cylinder, a concentrically disposed reduced cylinder providing enlarged chambers beyond its respective ends within the main cylinder, each enlarged chamber having an intake port, said reduced cylinder having a central diaphragm, dividing said cylinders into oppositely disposed explosive chambers, each of said chambers being provided with intake and exhaust ports near one end and in substantially the same circumferential line, said reduced cylinder providing two parallel channels between its outer shell and the wall of the main cylinder, one of said channels forming communication between the lower enlarged chamber and the intake of the upper explosive chamber, while the other channel forms communication between the upper enlarged chamber and the intake port of the lower explosive chamber, two superposed and connected explosive and explosive charge supplying pistons mounted in the respective ends of the main cylinder, the said explosive pistons controlling both the intake and exhaust ports of their respective explosive chambers, a two branched carbureted air supply conduit having each branch in communication with its respective intake port of the enlarged chambers of the main cylinder, a valve in each branch, and an exhaust conduit leading from the respective exhaust ports of the explosive chambers.

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

HARRY W. MOORE.

Witnesses:

GEO. R. ROURKE,
RICHARD TOBIN.