No. 886,184. PATENTED APR. 28, 1908.

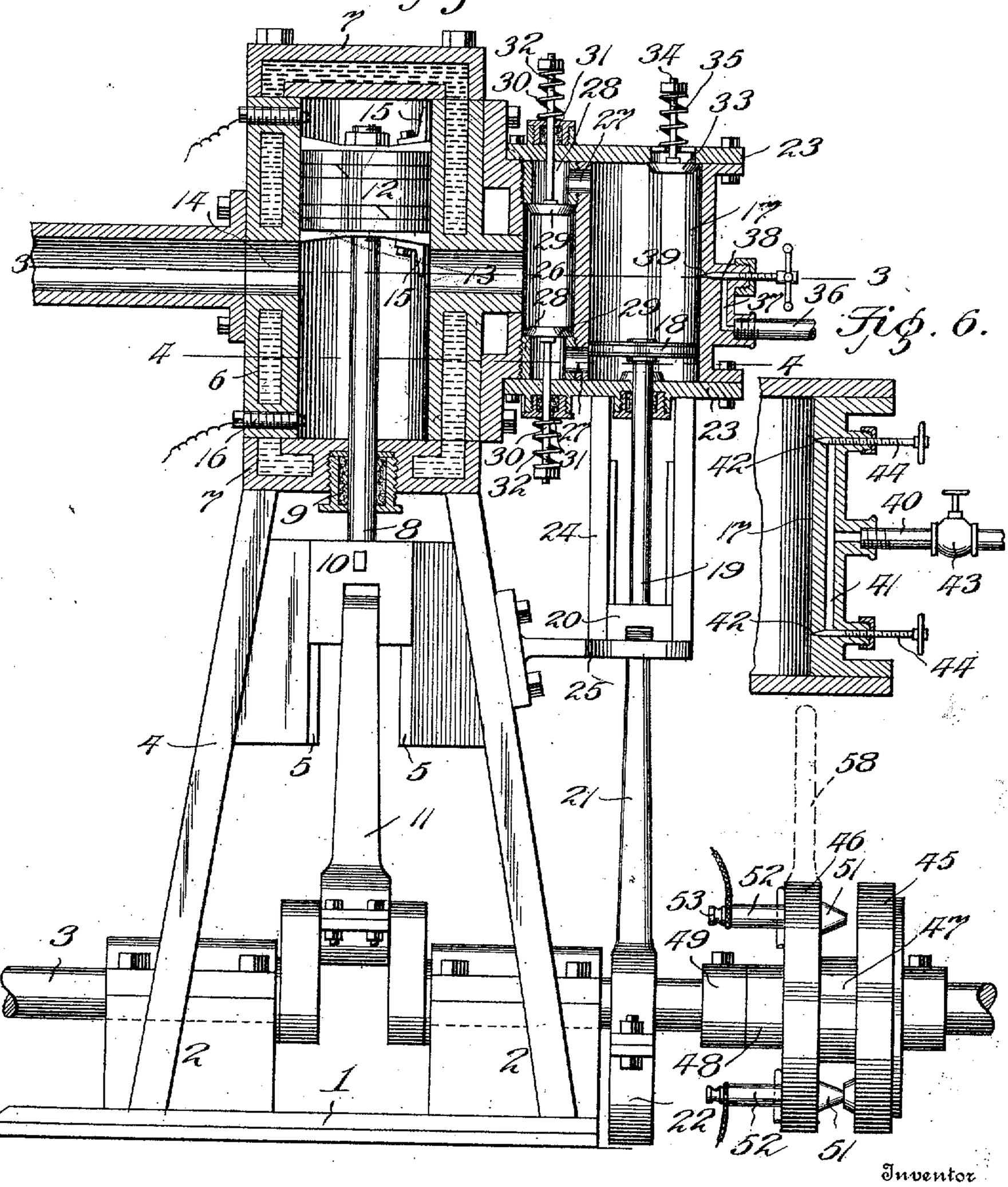
C. R. BRYANT.

EXPLOSIVE ENGINE.

APPLICATION FILED APR. 6, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



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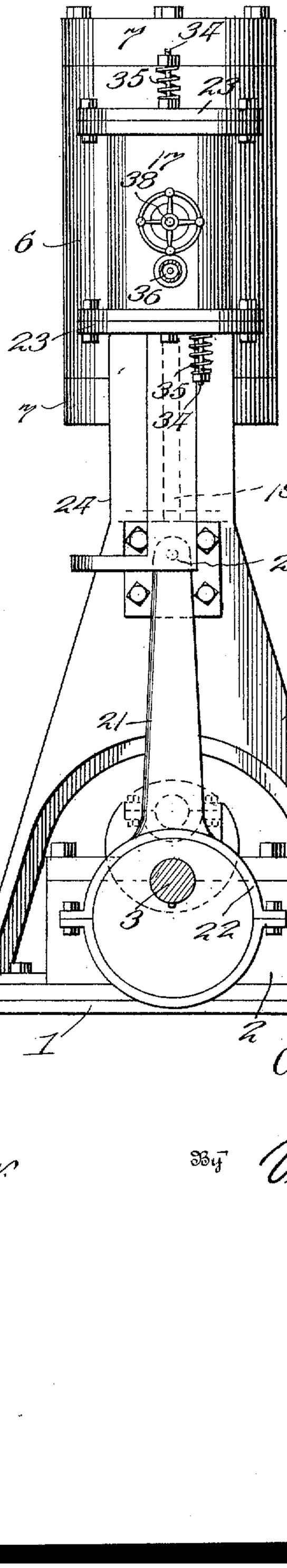
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

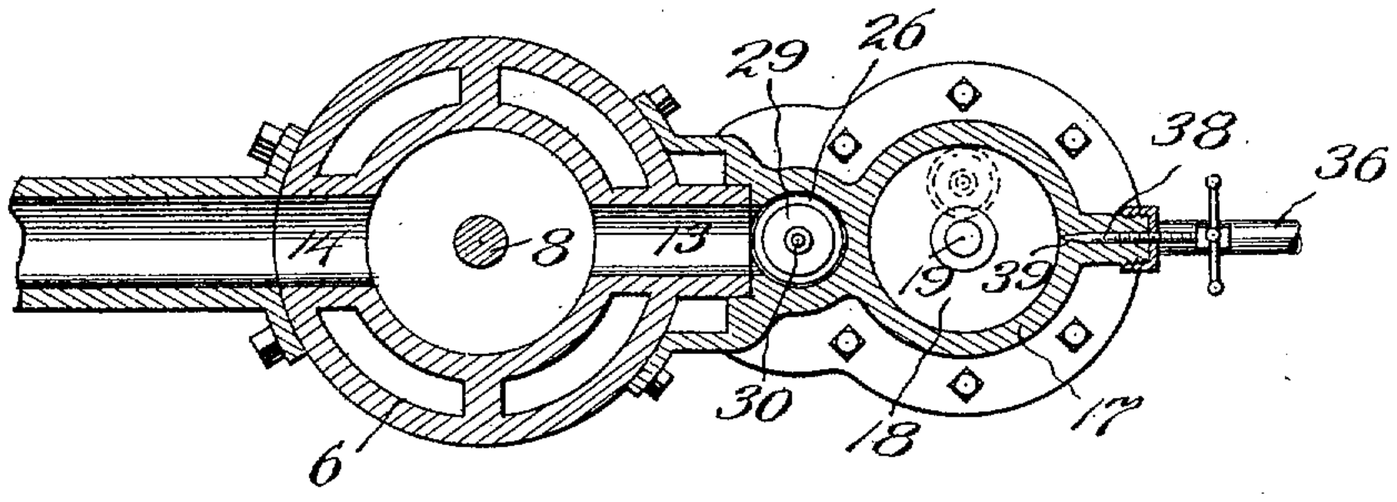


Fig. 4.

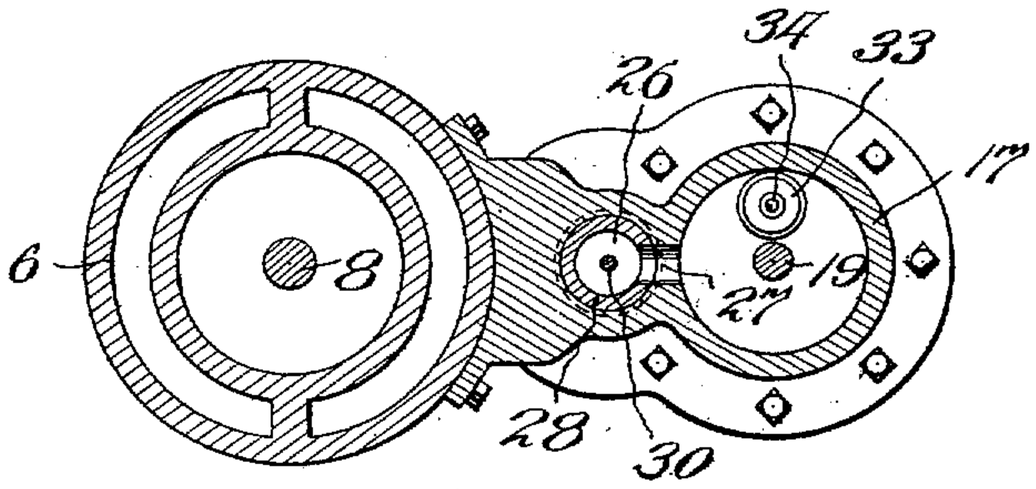
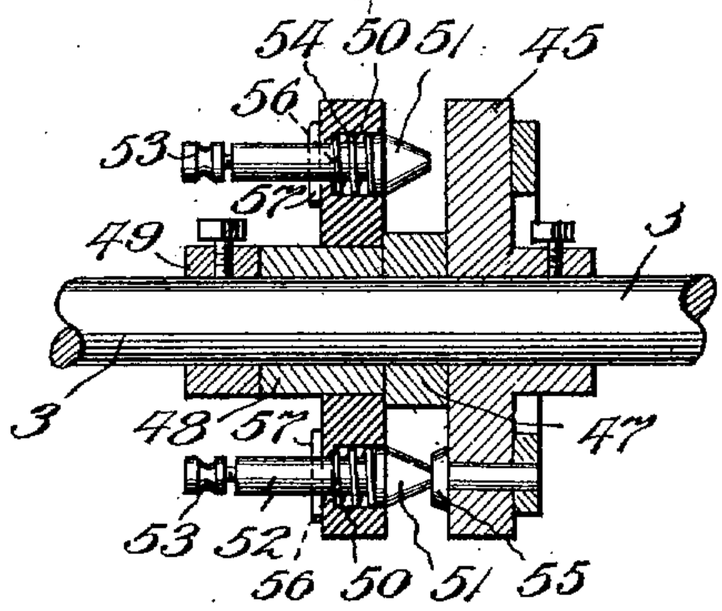


Fig. 5.



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UNITED STATES PATENT OFFICE.

CLARANCE R. BRYANT, OF MANISTEE, MICHIGAN.

EXPLOSIVE-ENGINE.

No. 886,184. Specification of Letters Patent. Patented April 28, 1908.

Application filed April 6, 1907. Serial No. 366,859.

To all whom it may concern:

Be it known that I, CLARANCE R. BRYANT, a citizen of the United States, residing at Manistee, in the county of Manistee and State of Michigan, have invented new and useful Improvements in Explosive-Engines, of which the following is a specification.

This invention relates to an explosive engine of the two cycle type in which the explosive charges are delivered to the engine cylinder by a pump operating in consonance with the engine piston, and it relates more particularly to an engine having combustion chambers at opposite ends to operate on the double-acting principle, the pump serving to discharge alternately the combustible mixture to the separate explosion chambers.

The invention has for one of its objects to improve and simplify the construction and operation of apparatus of this character so as to be comparatively easy and inexpensive to manufacture, both as regards the material and labor, highly efficient and economical in operation, and readily controlled.

A further object of the invention is the provision of an engine which can be readily convertible to three different ratings, as for instance, the engine can be operated to deliver forty horsepower maximum under certain conditions, and converted to operate as a twenty or ten horsepower engine, thus readily adapting it to automobile work where a single engine which can be adjusted to operate under a heavy, light or medium load is advantageous.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawing, which illustrates one of the embodiments of the invention, Figure 1 is a vertical central section of the engine with the parts in elevation. Fig. 2 is a side view thereof. Figs. 3 and 4 are horizontal sections on lines 3—3, and 4—4, Fig. 1, respectively. Fig. 5 is a central section of the timer or circuit making and breaking device of the ignition system. Fig. 6 is a detail sectional view of a modified construction.

Similar reference characters are employed to designate corresponding parts throughout the several views.

In the present instance, I have elected to illustrate the invention in connection with a single cylinder, double-acting engine, but it is obvious that any number of cylinders may be employed.

Referring to the drawing, 1 designates the bed-plate on which are arranged bearings 2 of substantial dimensions for the single throw crank shaft 3. Extending upwardly from the base plate is the frame 4 having the crosshead guides 5. Supported on the frame 4 is a vertical cylinder 6 of the jacketed type and provided with heads 7 at both ends, the lower head being provided with a central opening for the piston rod 8 that passes through a stuffing box 9 or any approved construction. The piston rod is connected with the cross head 10 which in turn is connected with the crank shaft by the connecting rod 11. The piston 12 is of any approved construction and secured to the inner end of the piston rod, the opposed surfaces of the piston being concaved so as to better abstract the energy of the explosive gases. Extending laterally from one side of the cylinder adjacent its center is an admission passage 13 through which the explosive charges are supplied to the opposite ends of the cylinder. Preferably diametrically opposite from the admission passage or port 13 is an exhaust port 14 that conveys away the spent products of combustion from the cylinder. On the opposite ends of the piston are baffle plates 15 arranged in close proximity to the admission port so as to deflect the incoming gases toward the heads of the cylinder and thereby force out the spent gases through the exhaust port. Each end of the cylinder has a spark plug 16 of any approved construction for igniting the compressed charges.

The means for supplying the engine with the explosive mixture comprises in the present instance a pump forming a part of the organization of the engine. This pump comprises a cylinder 17 cast separate from the engine cylinder and bolted or otherwise suitably secured thereto, and movable back and forth therein is a piston 18 having a rod 19 connected with the cross head 20 which, in turn, is connected by a rod 21 with a concentric strap 22 that coöperates with an ec-

centric on the crank shaft 3 for receiving motion therefrom. The pump is connected with the crank shaft in such a manner that the engine and pump pistons reciprocate simultaneously in opposite directions. The heads 23 of the pump are separate from the cylinder and bolted or otherwise secured in place. The cross head 20 moves on cross head guides 24 connected with a bracket 25 on the frame of the engine and with the bottom head 23 of the pump cylinder. By means of this construction, the cross-head guides and pump cylinder are rigidly secured on the engine. Formed in the pump cylinder casting is a passage 26 disposed parallel with the cylinder and communicating at opposite ends thereof by discharge ports 27 and also communicating with the admission port 13 of the engine. The ends of the passage 26 are closed by the heads 23 that are extended inwardly to cover the same, and within the passage 26 are threaded cylindrical valve seats 28 that are apertured to register with the ports 27. Coöperating with each seat is a discharge valve 29 of the puppet type, whose stem 30 extends outwardly through the adjacent head of the pump cylinder and stuffing box 31, there being an adjustable compression spring 32 on the extended end of the stem. These valves are located intermediate the ports of the pump and admission port 13 of the engine and are adapted to open automatically during the discharge strokes of the pump. The heads 23 are each provided with an inlet valve 33 that opens inwardly under the suction produced by the movement of the piston, the stem 34 of each valve having an adjustable compression spring 35 for varying the amount of air which the pump can induce. The fuel supply for generating an explosive mixture with the air may be effected in any desired manner. As shown in Fig. 1, a fuel supply pipe 36 communicates with a passage 37 formed in the wall of the pump cylinder and arranged with its discharge end about midway of the ends of the latter, a needle valve 38 being employed for regulating the proportion of fuel to the air for producing the explosive mixture. By locating the fuel supply port 39 in this manner, the fuel is drawn into the pump at the last part of each stroke. In other words, upon the first half of the stroke of the pump piston, air is drawn in through one or the other inlet valves until the piston passes the port 39, after which both air and fuel is drawn in. By properly adjusting the valve 38 and springs 35, the proportions of air and fuel can be regulated to a nicety. In transit from the pump cylinder to the engine cylinder, the fuel which may be in the form of vapor or gas becomes thoroughly mixed with the air and warmed to a considerable extent, due to the walls of the pump and the passages 26 and 13 being contiguous with the engine cylinder. It will thus be seen that the explosive mixture will be delivered to the engine in the best condition for efficient ignition.

In practice, the crank shaft is turned over or started in any suitable manner so as to cause the pump to discharge a supply of mixture to the engine cylinder so as to be compressed by the piston thereof and the charge ignited by the spark plug. The impulse thus produced continues the operation of the engine so that the pump delivers another charge to the opposite explosion chamber to produce the second explosion. In this manner, the explosions take place alternately at opposite ends of the cylinder 6 so as to produce two impulses during one revolution of the crank shaft, thus insuring a steady and even torque. Obviously, by varying the supply of fuel, the engine can be operated at different loads.

In the modification shown in Fig. 6, the fuel supply pipe 40 connects with a branch passage 41 that terminates in discharge ports 42 adjacent the ends of the pump cylinder and within the pipe may be arranged a controlling valve 43 for varying the supply of fuel to the opposite sides of the pump piston. In each branch of the passage 41 is arranged a cut-off valve 44 whereby either one of the branches may be closed to operate the engine on the single acting principle. Thus, by cutting off the supply to one side of the piston, the pump will draw in a charge of mixture on one side and deliver it to one end of the engine cylinder, while the opposite side of the pump will draw in a supply of pure air and deliver it to the engine cylinder with practically no effective result as to the power of the engine. In other words, one impulse will be given to the piston during one revolution of the crank shaft and the pump will alternately deliver a charge of air instead of a charge of mixture, which would be wasted by passing through the engine without being exploded and thus represent a considerable loss.

A special form of timing or circuit making and breaking device is employed in connection with the present form of engine, whereby the spark plug of the explosion chamber of the engine that is cut out of service may be removed from the circuit of the ignition system, thus economizing the current. The said device comprises a disk 45 rigidly secured to the crank shaft to rotate therewith, and a disk of insulation 46 loosely mounted on the crank shaft and held apart from the first disk by a spacer or washer 47, the insulation disk being mounted on a sleeve of metal 48 that takes the wear and which is held between the washer 47 and the collar 49, as clearly shown in Fig. 5. The disk 46 is provided with a plurality of sockets 50 for

receiving the contacts 51 that are provided with stems 52 extending from one side of the disk to which the conductors of the ignition system may be connected by the binding screws 53. Arranged in each socket is a compression spring 54 that yieldingly holds the contact in position, and coöperating with the contacts is a contact 55 mounted on the disk 45 so as to alternately engage with the contacts 51 as the crank shaft revolves. The stem 52 of each contact has spaced transverse openings 56 for receiving a pin 57, and when the pin is in one opening, the contacts are in operative relation, and when in the other opening, the contact 51 is drawn out of the path of the contact 55, thus when one of the contacts 55 is moved to inoperative position, only one of the spark plugs will be ignited and the other is cut out of service so that there will be no waste of current and unnecessary wear and tear on the ignition system. Any suitable circuit connections may be employed so that it is deemed unnecessary to illustrate the same, since the invention is not limited in this respect. To vary the time of the explosion, the disk 46 may be provided with a lever 58, as shown in dotted lines in Fig. 1, whereby the disk can be rocked in one direction or the other, and thereby varying the relative position of the contacts 51 to the contacts 55.

From the foregoing description, taken in connection with the accompanying drawing, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative and that such changes may be made when desired, as are within the scope of the claims.

Having thus described the invention, what I claim is:—

1. In an explosive engine, the combination of a double-acting piston, a cylinder, an inlet port disposed midway between the ends of the cylinders, a pump, means for discharging fuel thereto after an initial quantity of air is drawn into the pump, valved passages between the pump and inlet port of the engine, and means for igniting the compressed charges in the cylinder.

2. In an explosive engine, the combination of a cylinder, a piston therein of the double-acting type, an inlet port at the middle of the cylinder for supplying an explosive mixture alternately to the opposite sides of the piston, a pump cylinder supported on the engine cylinder, separate means for admitting air and fuel to the pump, a passage connected with the inlet port, automatically actuated valves between the opposite ends of the pump cylinder and passage, and means for igniting the compressed charges in the engine cylinder.

3. The combination of an engine cylinder closed at both ends and having inlet and exhaust ports arranged centrally between the ends, a piston therein for controlling the said ports, a pump cylinder having a passage communicating with both ends of the latter and the inlet port of the engine cylinder, and air admission valves in the pump cylinders automatically actuated valves in the said passage controlling communication between the pump and engine cylinders, and controllable means for supplying fuel to the pump cylinder, whereby the pump and engine can be changed from single to double acting or vice versa.

4. The combination of an engine of the explosive type adapted for single or double acting operation, a pump for supplying explosive mixture to the engine, means for controlling the pump for double or single acting operation, sparking devices arranged in the engine cylinder, and a circuit making and breaking device having controllable contacts for cutting the sparking devices into or out of operation.

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

CLARANCE R. BRYANT.

Witnesses:

GUSTAV STEINGRABER,

ERNEST T. SELLMAN.