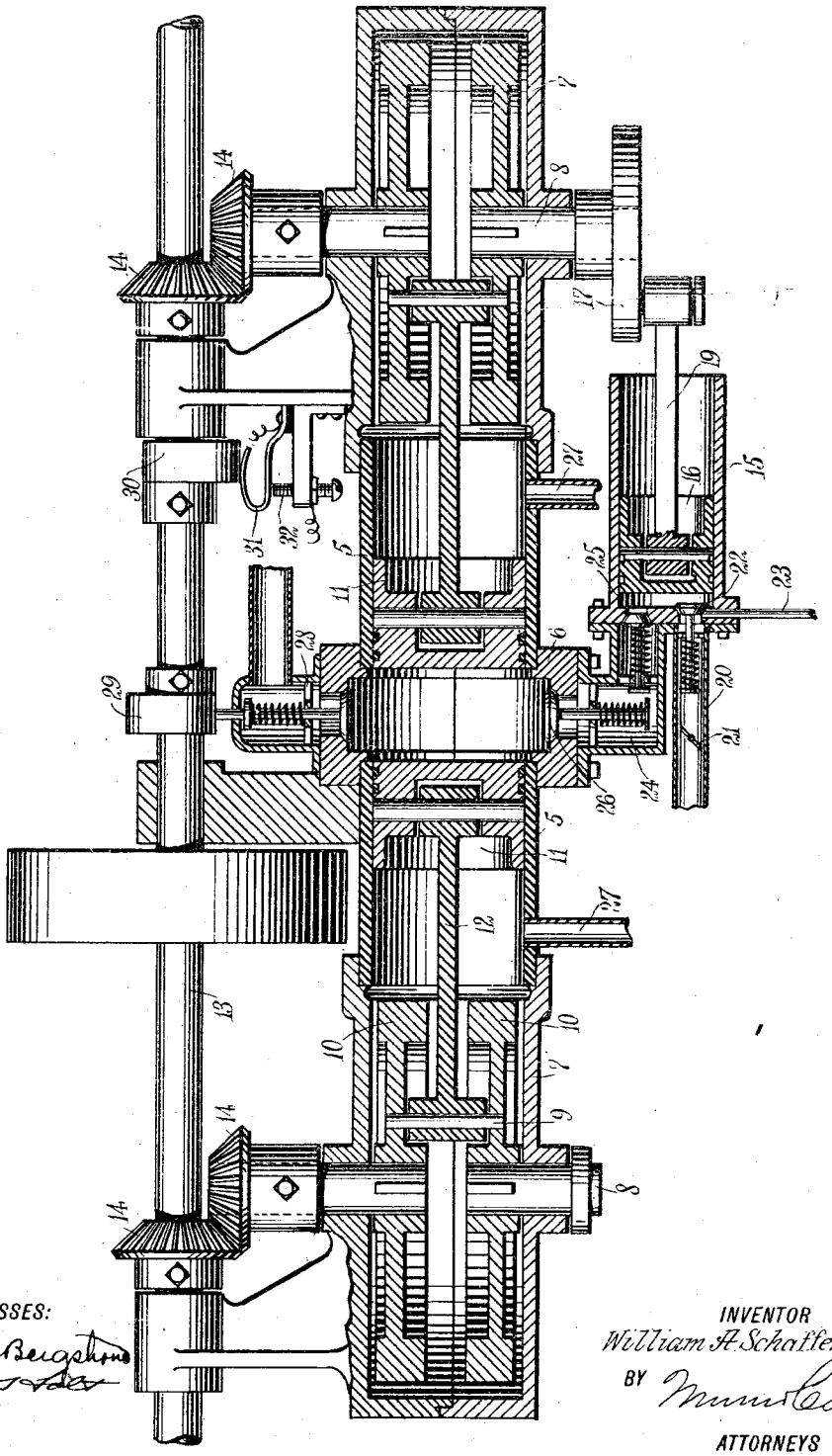
W. A. SCHAFFER.

EXPLOSIVE ENGINE.

APPLICATION FILED SEPT. 27, 1910.

1,037,667. Patented Sept. 3, 1912.



WITNESSES:

John A. Berghaus

INVENTOR

William A. Schaffer

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

WILLIAM ALEXANDER SCHAFFER, OF WACO, TEXAS, ASSIGNOR OF ONE-FOURTH TO JOHN L. ORAND, OF WACO, TEXAS.

EXPLOSIVE-ENGINE.

1,037,667. Specification of Letters Patent. Patented Sept. 3, 1912.

Application filed September 27, 1910. Serial No. 584,027.

To all whom it may concern:

Be it known that I, WILLIAM ALEXANDER SCHAFFER, a citizen of the United States, and a resident of Waco, in the county of McLennan and State of Texas, have invented a new and Improved Explosive-Engine, of which the following is a full, clear, and exact description.

The invention is an improvement in explosion engines, particularly such as embody two communicating cylinders arranged end to end, with each cylinder provided with a working piston between which the charge is fired.

The invention has in view a two-cycle engine of this type, in which the cylinders are thoroughly cleared of the burnt gases after each explosion, preparatory to introducing the succeeding charge, whereby there is little opportunity for the engine to back-fire.

The invention further resides in the means for introducing the charge after the pistons have completed a substantial part of their return stroke.

Reference is to be had to the accompanying drawings forming a part of this specification, wherein is shown an explosive engine construction in accordance with my invention, in central longitudinal section.

The engine embodies in its construction two cylinders 5, 5, which are arranged end to end, with an intermediate explosion chamber 6, through which the cylinders are placed in communication. Each cylinder at its outer end has the customary crank case 7, in which is journaled the driving shaft 8, having the crank 9 between the customary balance wheels 10. Within each cylinder is a working piston 11, connected to its respective crank by a pitman 12.

The two driving shafts of the engine are operatively connected to a driven shaft 13, journaled in suitable bearings at one side of the engine, the connection between each driving shaft and the shaft 13 being preferably effected by providing the same with intermeshing miter gears 14, the connection between the two driving shafts being such that both pistons are moved to and from each other in synchronism.

At the opposite side of the engine from the driven shaft 13 is a pump for compressing the explosive charge, comprising a cylinder 15 and a piston 16, the latter being operatively connected to a crank 17 carried by one of the driving shafts 8, by a pitman 19, the connection being such as to cause the piston to move about ten degrees ahead of the working pistons of the cylinder. Leading to the pump cylinder 15, back of the pump piston, is an air admission or inlet pipe 20, having a damper 21, the passage of the air from this pipe into the cylinder being controlled by an inwardly-opening valve 22, which also controls the admission of gasolene or other hydrocarbon liquid through a pipe 23, the latter terminating on the valve seat. The outlet for the explosive mixture from the pump connects with a receiving chamber 24, and is controlled by the outwardly-opening valve 25, the receiving chamber connecting with an explosive mixture inlet of the explosion chamber, which inlet is controlled by an inwardly-opening valve 26.

Each cylinder 5 is provided with an exhaust pipe or port 27, which are controlled by the respective working pistons and are arranged to be uncovered by the pistons when the latter have substantially reached the end of the working stroke. A further auxiliary exhaust port is provided, which leads from the explosion chamber and is controlled by an inwardly-opening valve 28, the stem of this valve projecting into the path of an operating cam 29, which is arranged on the shaft 13 to open the valve 28 about the same time the exhaust ports 27 are uncovered, and to hold this valve open until the pistons have completed about one-third of their return stroke. A cam 30, also arranged on the shaft 13, is designed to close the circuit between the two contact members 31 and 32, and fire the engine charge.

Assuming the parts of the engine to be in the positions illustrated in the drawing figure, in which the pistons are at the limit of their return movement, the firing of the charge at or slightly before this time forces the pistons from each other, the gases working expansively until the exhaust ports 27 are reached. At or about the time these ports are uncovered, the exhaust port 28 is also opened and is held open until the pistons have returned a substantial part of their stroke, as above set out. This allows the burned gases to escape at both ends of the cylinders and to be substantially expelled, and the cylinders cleared before the

valve 28 is closed. Immediately or about the same time the valve 28 closes, the charge compression pump which has drawn in the hydrocarbon vapor and air and caused the same to be mixed and compressed in the pump cylinder, forces the explosive mixture into the explosion chamber, the valve 26 closing before the full return of the working pistons of the engine, whereby the charge is by these pistons further compressed. In the return stroke of the pump piston, the explosive mixture is compressed to a certain degree before the valve 25 is opened, and is still further compressed into the receiving chamber 24 before the valve 26 is overcome by the pressure, and allows the charge to pass into the explosion chamber. By reason of the pump piston working in advance of the engine working pistons, the maximum compression in the pump cylinder is had before the working pistons are fully returned. By the exhaust and admission arrangement, the cylinders are well cleared of the burnt gases before the admission of the explosive charge, without any lost stroke of the pistons for this purpose, the new charge being fired upon each return of the pistons to working positions.

While I have described the preferred construction and arrangement of the engine, it is nevertheless to be understood that I consider myself entitled to such modifications as fall within the scope of the annexed claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In an engine of the character described, an explosion chamber having cylindrical extensions at each side thereof provided with exhaust ports, working pistons mounted in the cylindrical extensions, the exhaust ports being arranged to be uncovered by the pistons when the latter substantially complete their working stroke, a valve controlled exhaust port leading from the periphery of the explosion chamber, between the cylinders, means for engaging and actuating the said exhaust valve to open the same and hold it open during the period the said cylinder exhaust ports are uncovered and until the pistons have completed a substantial part of their return stroke to complete the expulsion of the burnt gases, a valve controlled inlet port arranged in the peripheral wall of the explosion chamber opposite the exhaust port, and means for forcing the charge into the explosion chamber through said inlet valve during the return stroke of the pistons.

2. In an engine of the character described, an explosion chamber having cylindrical extensions at each side thereof provided with exhaust ports, working pistons mounted in the cylindrical extensions and adapted to uncover said exhaust ports when the pistons have substantially completed their working stroke, a valve controlled inlet port, and a valve controlled exhaust port for the explosion chamber arranged opposite each other in the peripheral wall of said chamber, means for engaging and actuating the exhaust valve of the explosion chamber, to open the same and hold it open during the period the cylinder exhaust ports are uncovered and until the pistons have completed a substantial part of the return stroke to complete the expulsion of the burnt gases, and a charge compression pump having a piston driven from the engine in advance of the cylinder pistons, and adapted to draw in the charge during the working stroke of the pistons, and to force the said charge into the explosion chamber through said inlet valve during the return stroke of the pistons.

3. In an engine of the character described, the combination of two cylinders disposed end to end and having between them a common explosion chamber provided with an exhaust port located in its periphery, a valve for opening and closing said exhaust port, a working piston in each cylinder, the pistons being operatively connected to move toward and from each other synchronously, each cylinder having an exhaust port so located as to be uncovered by said piston when the latter substantially completes its working stroke, a shaft provided with a cam for actuating the valve to open and close the exhaust port of the explosion chamber, driving shafts connected with the pistons, gearing connecting said cam shaft with the driving shafts, said gearing being so proportioned that said valve controlling said exhaust port remains open until said pistons have completed a substantial part of their return stroke, and means for forcing an explosive mixture into the explosion chamber, when said exhaust valve of the explosion chamber is closed and before the pistons have fully completed their return stroke.

4. In an engine of the character described, piston cylinders having a common explosion chamber provided in its periphery with an inlet port for the explosive mixture, and an outlet port for the burnt gases, the said ports being arranged opposite to each other, pistons mounted within the cylinders, at each side of the explosion chamber, the cylinders being provided with exhaust ports controlled by said pistons, a crank case at the outer end of each cylinder, driving shafts journaled in pairs in each crank case, the shafts of each pair being in axial alinement with each other and provided with crank, connecting rods engaging the piston and also engaging said cranks, a driven shaft provided with a cam, a valve for controlling the exhaust port of the explosion

chamber and engaged and actuated by said cam, gearing connecting one of the driving shafts of each pair with the said driven shaft, a pump communicating with the inlet port of the explosion chamber for forcing the explosive mixture into said chamber, and means for actuating said pump from one of the driving shafts.

5. In an engine of the character described, the combination of two cylinders arranged in line with each other and having working pistons, the cylinders being provided with a common explosion chamber located between the inner ends of the cylinders, each cylinder having an exhaust port adapted to be uncovered by its piston when the latter substantially completes its working stroke, a driving shaft operatively connected with each piston, a driven shaft operatively connected with the driving shafts, a cam on said driven shaft, the said explosion chamber having a valve controlled inlet port for the explosive mixture, and a valve controlled exhaust port arranged opposite said inlet port, the stem of the last mentioned valve extending into the path of the said cam, the cam being adapted to open said valve about the time the exhaust ports of the cylinders are uncovered and to hold said valve open until the pistons have completed a substantial part of the return stroke to complete the expulsion of the burnt gases, and a charge compression pump having a piston driven from one of the driving shafts in advance of the cylinder pistons and adapted to force the charge into the explosion chamber through the inlet valve, the exhaust port valve of the explosion chamber closing before the inlet port is opened by the charge pressure.

6. In an engine of the class described, two cylinders arranged in line with each other, working pistons mounted in the said cylinders, an explosion chamber between the cylinders and having a valve controlled exhaust port, the cylinders each having an exhaust port uncovered by the pistons when the latter substantially complete their working stroke, means for actuating the exhaust valve of the combustion chamber to open the exhaust port at the time the cylinder ports are uncovered and to keep said exhaust port open until the pistons have completed a substantial part of their return stroke to complete the expulsion of the burnt gases, a pump for drawing in and compressing the explosive mixture, a valve controlled receiving chamber into which the compressed charge is forced by the pump and further compressed, a valve controlled connection between the said receiving chamber and the explosion chamber, the valve of said connection being opened by the pressure of the charge to admit the same to the explosion chamber at substantially the time the exhaust valve of said explosion chamber closes, the piston of the said pump working in advance of the cylinder pistons, the valve between the receiving chamber and the explosion chamber closing before the full return of the working pistons, whereby the explosive mixture charge is further compressed in the explosion chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM ALEXANDER SCHAFFER.

Witnesses:
A. C. RIDDLE,
E. WOODWARD.