

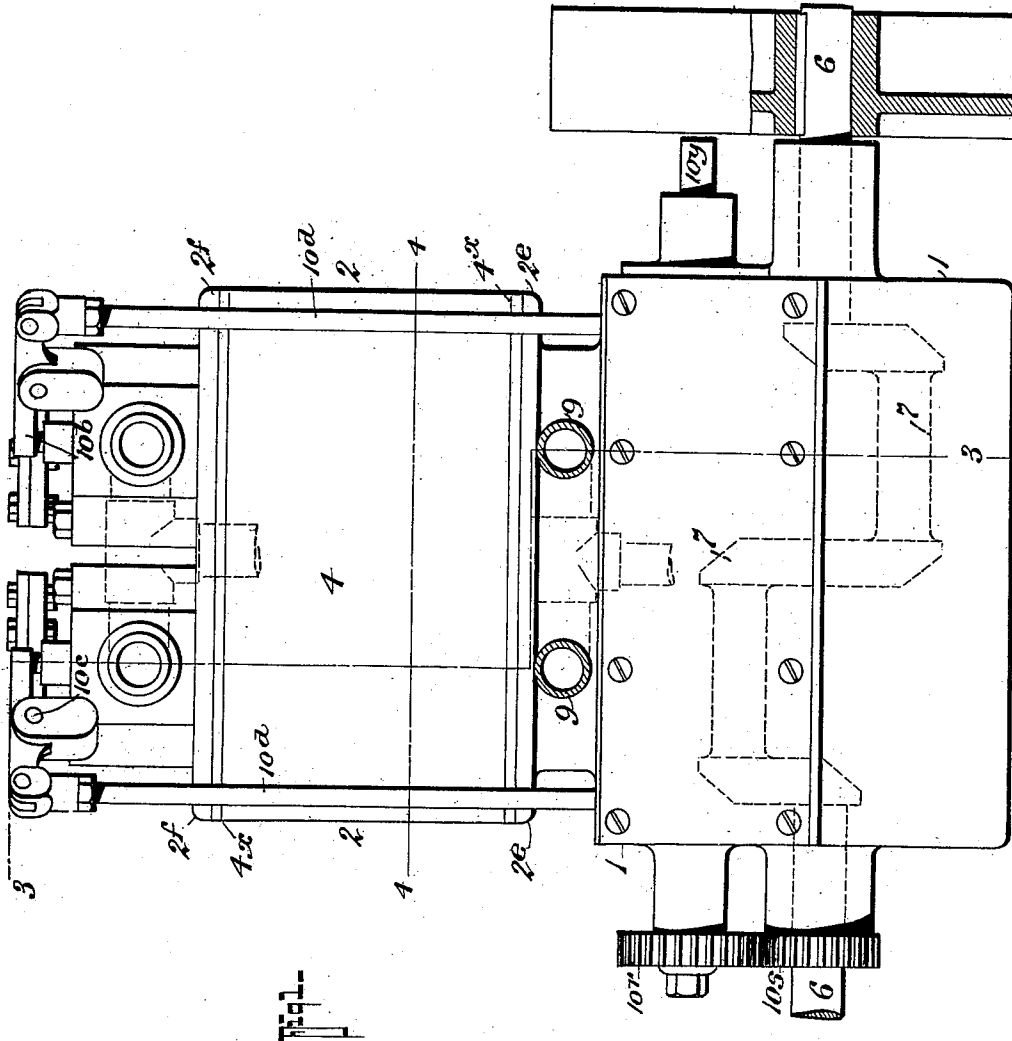
R. W. COFFEE.
EXPLOSIVE ENGINE.

APPLICATION FILED MAY 8, 1908. RENEWED MAR. 20, 1909.

923,491.

Patented June 1, 1909.

2 SHEETS—SHEET 1.



WITNESSES:

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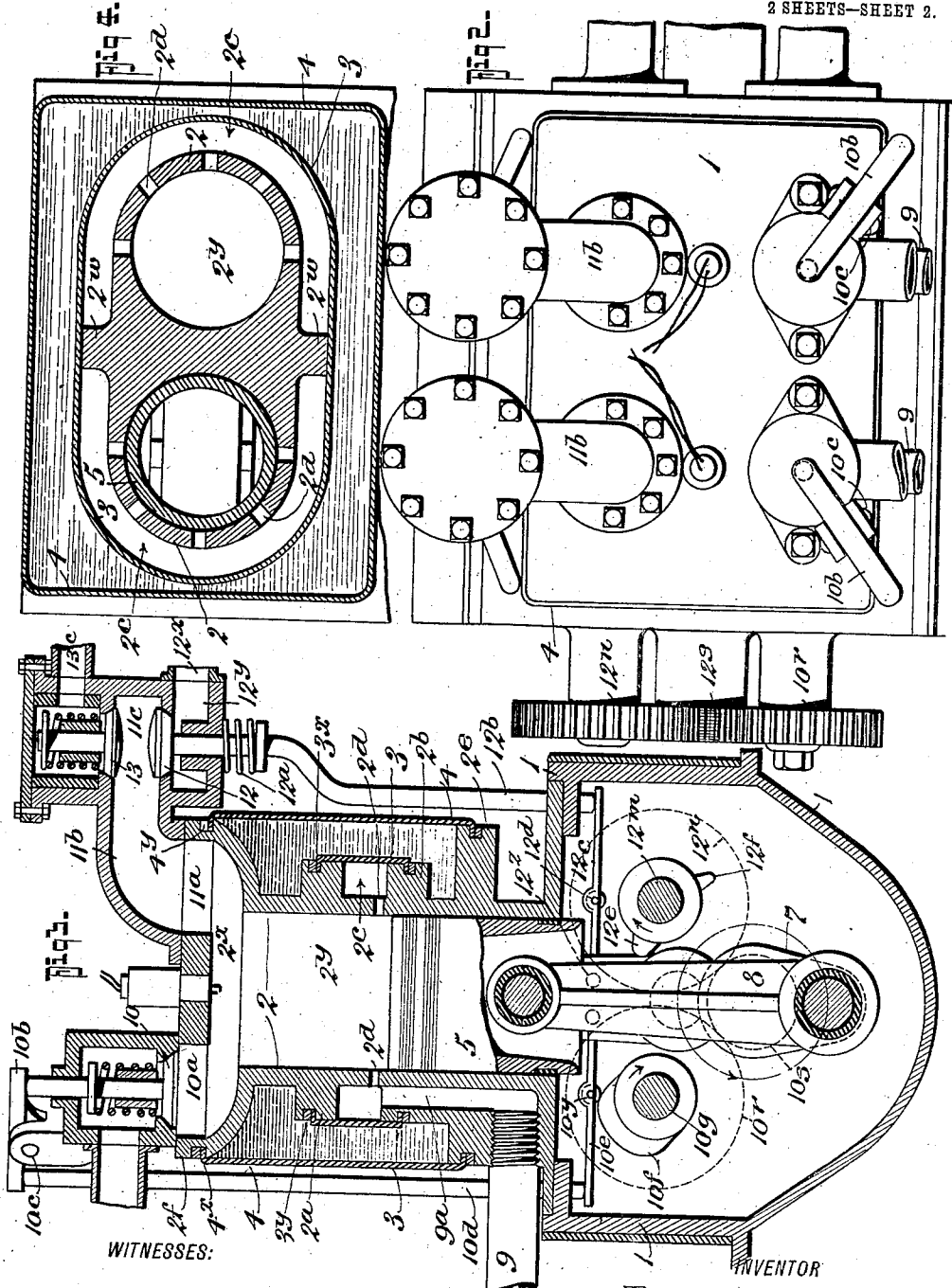
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UNITED STATES PATENT OFFICE.

ROBERT W. COFFEE, OF RICHMOND, VIRGINIA, ASSIGNOR TO LEWIS M. KEIZER, OF BALTIMORE, MARYLAND.

EXPLOSIVE-ENGINE.

No. 923,491.

Specification of Letters Patent.

Patented June 1, 1909.

Application filed May 8, 1908, Serial No. 431,647. Renewed March 20, 1909. Serial No. 434,805.

To all whom it may concern:

Be it known that I, ROBERT W. COFFEE, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

My invention relates to certain new and useful improvements in the mechanical construction of two cylinder explosive engines of the type disclosed in my co-pending application filed on even date herewith, Serial No. 431,646, and in its generic nature, my present invention seeks to provide a two-cylinder engine of the type above specified, so constructed as to embody the maximum strength with a minimum amount of material, and so arranged and designed that the various parts may be easily and cheaply manufactured, and the engine will effectively serve its intended purposes.

More subordinately, my invention includes an improved construction of cylinder, water-jacketing means for the same, and a water-cooled exhaust means for the cylinder, together with those other details of construction, combination and arrangement of parts, which will be hereinafter fully described, and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which:—

Figure 1, is a side elevation of a two cylinder engine embodying my invention. Fig. 2, is a plan view thereof. Fig. 3, is a transverse section on the line 3—3 of Fig. 1. Fig. 4, is a horizontal section on the line 4—4 of Fig. 1.

Referring now to the accompanying drawings, in which like letters and numerals of reference indicate like parts in all of the figures, 1 designates the bed of the engine which also forms the crank case, and in bearings in which the crank shaft 6 is journaled. The crank shaft 6 is provided with a pair of cranks 7, one for each cylinder to which the piston rod 8 of the respective cylinder is coupled, and the piston rod 8 is in turn coupled with its respective piston 5 that operates in the respective working cylinder of the engine.

2—2 represent the working cylinders, on the outside of which is a pair of spaced flanges 2^a—2^b, the flanges 2^a—2^b being provided with grooves on their peripheral surfaces to receive a thin plate 3 to form an

exhaust chamber 2^c, between the plate and the flanges 2^a—2^b. It will be noticed particularly by reference to Fig. 4 of the drawings that the exhaust chamber 2^c of one cylinder does not go continuously around the same, but is of semi-annular form, and the exhaust chambers of the two cylinders are kept separate by a partition wall 2^w between the two cylinders, the two cylinders being cast together in a single casting. Each cylinder 2 is provided with a series of semi-annularly arranged piston controlled exhaust ports 2^d which communicate between the explosion chamber of the cylinder 2, and the exhaust chamber 2^c, the exhaust from the engine passing from the chamber 2^c through a passage 9^a to a main exhaust outlet 9 for each of the cylinders from which the exhaust may be piped to any desired place. The pair of cylinders is also provided with a casing 4 that surrounds the same and is held in peripheral grooves in flanges 2^f and 2^e respectively of the engine cylinder to form a water jacket for the exhaust chamber 2^c and for the explosion chamber of the cylinder, as clearly indicated in Fig. 3 of the drawings. The cylinder is provided with an explosion chamber 2^x cooperating with the piston chamber 2^y and in communication with the inlet port 11^a and the supplemental exhaust port 10^a, hereinafter again referred to. The passage of the exhaust through the ports 10^a is controlled by a valve 10 on each cylinder which is spring pressed to its closed position and opened through the medium of a lever 10^b for each cylinder fulcrumed at 10^c to a fixed support on the engine. The lever 10^b is operated through a rod 10^d by a lever 10^e and a cam 10^f and the cam 10^f is formed on the cam shaft 10^g that is geared with the crank shaft 6 as shown, by gears 10^h and 10ⁱ, respectively, it being understood that each of the valves of each of the cylinders has a separate operating mechanism and the cams are so timed that the explosion occurs in one cylinder while a new charge is drawn into the other cylinder. The cam 10^f operates on the lever 10^e through the medium of an anti-friction roller 10^j, or in any other approved manner. The inlet port of the cylinder communicates through a pipe 11^b with a double valved chamber 11^c into which the working agent is passed, as is also the compressed air from a suitable storage reservoir. The inlet ports of each cylinder, that is to say, the pipe

11^b from the carbureter to the working agent valve 13 of one cylinder may be directly connected to another cylinder by a T-connection with the pipe that runs to the carbureter, as indicated in Fig. 3, of the drawings. In the same manner, the pipe 12^x of one engine cylinder may be connected with that of the other, and a T-connection made with the pipe from the compressed air reservoir, the pipe from the compressed air reservoir being indicated by the letter of reference 12^w. The inlet port 11^a of the cylinder communicates through a pipe 11^b with a double valve chamber 11^c that receives the working agent from the carbureter pipe, through the medium of the valve inlet that is controlled by the valve 13 which valve is normally spring pressed to its closed position. The valve 13 closes the passage 11^b from the connection 13^c that comes from the cylinder.

A suitable air reservoir or pump is provided (not shown in the drawings) in which compressed air may be stored under a pressure of about five pounds to the sq. inch, and this reservoir is piped to connect with the valve chamber 12^r that is normally held closed by the air valve 12 that is spring pressed by a spring 12^a to its closed position, the chamber 12^r communicating through the valve aperture with the chamber 11^b, so that compressed air may be admitted into the working cylinder at times. The valve 12 is opened through the medium of a rod 12^b operated by a lever 12^c fulcrumed at 12^z and carrying anti-friction rollers 12^d, if desired, the lever 12^b being operated by a cam 12^e on a shaft 12^m that is geared by gears 12ⁿ and 12^s to the crank shaft 6. The cam 12^m is provided with a pair of cam members 12^e and 12^f that coöperate with anti-friction rollers 12^d to operate the lever 12^b at predetermined times and open the valve 12.

Each of the cylinders of my two cylinder engines operates on the four cycle type, that is to say, the four stroke cycle, drawing in a new charge on the first stroke of the cycle, compressing during the second stroke of the cycle, operating under the exploded charge during the third stroke of the cycle and exhausting through the positively operated air exhaust valve during the fourth stroke. The first stroke of one cylinder commences with the third stroke of the other so that the crank of one cylinder will be set 180° from that of the other cylinder, or they may be set on quarters, if desired.

In operation, the description of the operation of one cylinder will be sufficient, as that of the other cylinder is precisely the same. The piston 5 draws in a new charge during the first stroke through the valved opening 13 that is in connection with the carbureter, it being understood that the new charge of working agent is rich in gasolene. As the piston 5 reaches the limit of its first stroke

downwardly, in drawing in the new charge, and starts on its back stroke or second stroke, to compress such new charge, as soon as the piston has closed the exhaust port 2^d the air valve 12 is opened by the cam 12^e for an instant, to permit the compressed air from the tank to enter the working agent cylinder in back of the new charge and impart an initial compression thereto as well as admitting sufficient air to reduce the richness of the mixture to its proper chemical proportion. As the piston continues on its second stroke and again returns to its initial position, at the top of the cylinder, it will have compressed the new charge fully and the new charge is now exploded, forcing the piston down again on its third stroke, by virtue of the force of the exploded mixture. As soon as the piston has completed its stroke under the force of the exploded mixture the piston will uncover the exhaust port 2^d and permit the exploded charge to pass into the exhaust chamber 2^c from whence it is conveyed to the passage 9^a and exhaust opening 9 to any desired place. The piston then starts on its fourth stroke to force out the remainder of the burned mixture and as the piston starts on its fourth, or upper stroke, the valve 10 will be opened and remain open during the full fourth stroke of the piston. As the piston nears the end of its fourth or exhausting stroke the air valve 12 will open for a limited time by the action of the cam 12^e to permit the compressed air being forced into the explosion chamber and scavenge the remaining burned mixture. As soon as the piston has reached the limit of movement on its fourth stroke it will begin the cycle over again, and continue on so long as the engine is running.

The jackets 3 and 4 are secured in place by having their edges 3^x and 4^x respectively, wedged into the peripheral grooves of the flanges of the cylinder by means of wedges 3^y and 4^y, or in any other approved manner, so that the exhaust 2^c which receives the hottest part of the burned mixture will be surrounded by water and water cooled.

Suitable inlet and off-take pipes 4^a and 4^b are provided for the water jacket by means of which water may be circulated there-through.

From the foregoing description taken in connection with the accompanying drawings, it is thought the complete construction, operation and advantages of my invention will be readily understood by those skilled in the art to which the invention appertains.

What I claim is:—

1. In an engine, a pair of cylinders having spaced peripheral flanges and formed in one, a closure plate held in peripheral grooves in said flanges to inclose an exhaust chamber, said cylinders having ports from the explosion chamber to the exhaust chamber, and means formed with the cylinders to separate

the exhaust chamber into separate sections one for each cylinder, substantially as shown and described.

2. In an engine, a pair of cylinders having spaced peripheral flanges and formed in one, a closure plate held in peripheral grooves in said flanges to inclose an exhaust chamber, said cylinders having ports from the explosion chamber to the exhaust chamber, means formed with the cylinders to separate the exhaust chamber into separate sections one for each cylinder, and a water jacket surrounding the cylinders and the exhaust chambers.

3. In an engine, a pair of working cylinders formed together and having a pair of spaced peripheral flanges, a cover therefor to form an exhaust chamber around said cylinders, means for dividing said chamber into two separate parts, said cylinders each having a series of exhausts arranged in semi-circles and communicating between the respective exhaust chamber sections and the interior of the respective cylinders, and a water jacket surrounding the cylinders and exhaust chamber.

4. In an explosive engine, a pair of cylinders formed together, a base therefor, a crank shaft mounted in bearings in said base, and having a crank to cooperate with each of said cylinders, a piston for each cylinder, a piston rod connecting each cylinder with its respective crank, each cylinder having piston controlled exhaust ports, and a valved controlled exhaust port, a valved

working agent inlet for each of said cylinders, an exhaust chamber surrounding said piston controlled exhaust into which the exhaust empties, said chamber surrounding said cylinders for one-half their circumference and said cylinders having a partition to separate the exhaust chambers into two sections one for each cylinder, and independent off-takes for each exhaust chamber section.

5. In an explosive engine, a pair of cylinders formed together, a base therefor, a crank shaft mounted in bearings in said base, and having a crank to cooperate with each of said cylinders, a piston for each cylinder, a piston rod connecting each cylinder with its respective crank, each cylinder having piston controlled exhaust ports, and a valved controlled exhaust port, a valved working agent inlet for each of said cylinders, an exhaust chamber surrounding said piston controlled exhaust into which the exhaust empties, said chamber surrounding said cylinders for one-half their circumference and said cylinders having a partition to separate the exhaust chambers into two sections one for each cylinder, and independent off-takes for each exhaust chamber section, and a single water jacket surrounding both cylinders of the exhaust chamber thereof.

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Witnesses:

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