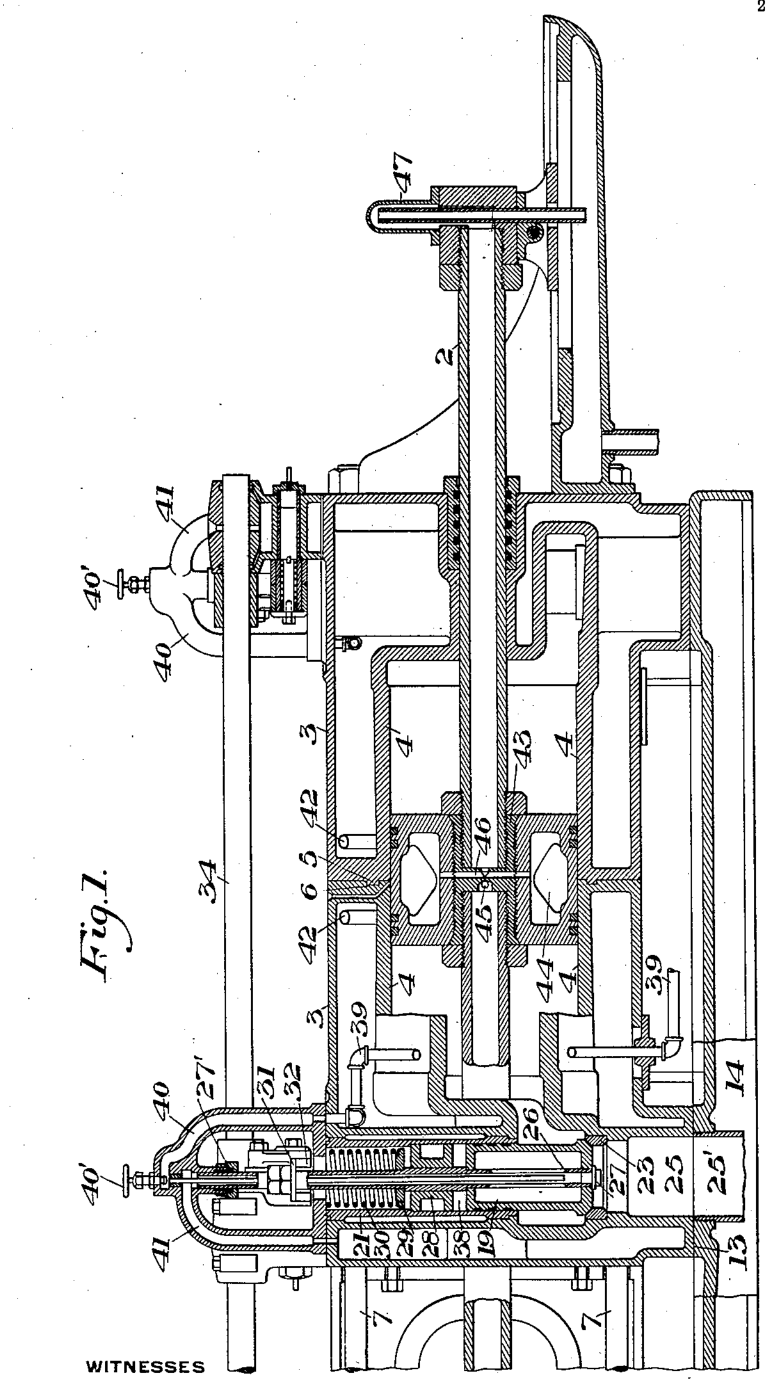
E. GRAY.

MOTOR COOLING SYSTEM.

APPLICATION FILED NOV. 25, 1907.

1,024,474. Patented Apr. 23, 1912.

2 SHEETS—SHEET 1.



WITNESSES

W. W. Swartz

R. A. Balderson.

INVENTOR

Edward Gray

by Bakewell, Byrnes & Parmelee

his attys

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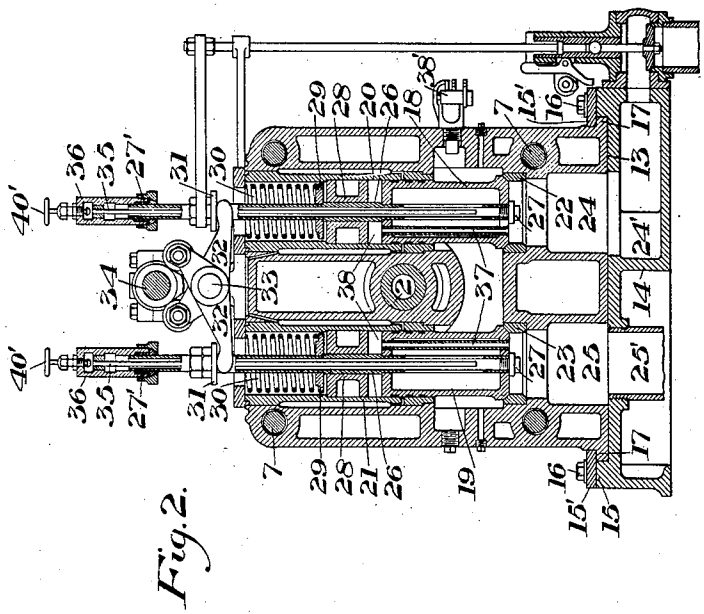

Fig. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

EDWARD GRAY, OF OIL CITY, PENNSYLVANIA, ASSIGNOR TO RIVERSIDE ENGINE COMPANY, OF OIL CITY, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MOTOR-COOLING SYSTEM.

1,024,474. Specification of Letters Patent. Patented Apr. 23, 1912.

Original application filed April 8, 1907, Serial No. 366,896. Divided and this application filed November 25, 1907. Serial No. 403,590.

To all whom it may concern:

Be it known that I, EDWARD GRAY, of Oil City, Venango county, Pennsylvania, have invented a new and useful Motor-Cooling System, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a partial longitudinal vertical section of a double-acting tandem engine constructed in accordance with my invention, and Fig. 2 is a cross section of the same through the valves.

My invention relates to gas or combustion engines, and particularly to the cooling of the cylinder and valves.

This application forms a divisional part of my copending application, Serial Number 366,896, filed April 8, 1907, for gas engine.

In the drawing, which shows the valve and cooling systems for the valve and cylinder jackets, as arranged in connection with a tandem double-acting engine, 2 represents a sectional through-piston rod of tubular form, extending through stuffing boxes in the ends of the cylinder and through the cylinders, each cylinder being composed of halves 3, 3. Each cylinder half is preferably cast in one piece and may be of various shapes, but is preferably of squared or angular form in cross section, but of course provided with a cylindrical bore. Each half is preferably cast with the jacket for the circulation of cooling fluids between the outer wall 3 and the inner wall 4. These jackets continue into the heads of the cylinder, as hereinafter described. The joint between the inner ends of the two halves may be made in divers ways, but is preferably formed by providing a circular tongue 5 upon one half, which enters a corresponding annular recess 6 formed in the other half near the bore. These inner faces of the two halves are preferably plane surfaces at right angles to the axis of the cylinder, and the tongue and groove joint may be packed in several ways, preferably by placing an annular ring of corrugated copper in the bottom of the groove, or this may be a ground joint. Each cylinder half is bored out like the other, the diameter of the bore being alike, so that the piston and piston rings will travel smoothly over the joint. The two parts of the cylinder may be held together in any desirable manner, but preferably by four through bolts extending through flanges or projections on each half. Where the external contour of the cylinder is in square or rectanguler form, as herein described, the through bolts 7 will preferably extend through registering holes in the corner of the castings outside of or separated from the water jacket spaces. In the form shown, with the cylinder halves in the form of cubes, the long bolts run through the four corners from one end of the complete cylinder to the other. The lower portion of each cube is machined to a flat surface, as shown at 13, to rest upon a similarly machined surface on a cylinder base 14, hereafter described. This cylinder base is preferably provided with side ribs 15, which act as guides for the cylinder halves when slid endwise. The cylinder may also be clamped in place by removable plates 15′, secured by bolts 16, extending into the cylinder base. The lower edges of the cylinder cubes are preferably provided with outwardly projecting flanges 17, which extend beneath the plates 15′.

The above described parts are claimed in the parent case Serial Number 366,896, and I will now describe the particular features to be covered herein.

The inlet and outlet valves 18 and 19 in each end of the cylinder extend through valve casings 20 and 21, which, in turn, extend vertically through the hollow jackets in the head portions of the cylinders. The valve seats 22 and 23 preferably consist of removable bushings fitted into ports 24 and 25, which open into the lower portion of the cylinder bore through the end and on line with or below the lowest part of the cylinder bore. The valve seats are preferably below the lowest line of the cylinder bore so that all dirt is swept out with each stroke, thus avoiding the necessity of drips for that purpose. Each valve proper is preferably in the form of a hollow cylinder closed at both ends and with packing, preferably packing rings, encircling its upper end, which move over the interior of the valve casing. The diameter of the valve body is made a little smaller at the upper end than at its seat, so that the amount of power required to open this valve for the escape of

the spent gases is very much less than is required to open the ordinary valve. The valve tubes 26 are hollow and closed at their lower ends preferably by caps 27, and reciprocate at the upper end within packed bushing 27′ in the water arch. These valve tubes are slotted near their lower ends so as to allow cooling fluid to circulate into the valve bodies. Above the valve within the casing is provided a packing sleeve 28, above which the hollow valve tube is provided with a plate 29, against which presses a spring 30. Above the spring and the top of the cylinder, the valve tube is provided with a tappet 31, operated from lever 32 on rock pin 33, actuated from a revolving cam shaft 34. This cam shaft preferably extends above the cylinders and preferably centrally thereof.

A stationary water pipe 35 extends down within and telescopes reciprocatingly with the hollow valve tube with circulating space between, and connects at its upper end into and is guided by the upper end of water arch 36. The hollow valve body is provided with through tubes 37, which connect the valve port with the space 38 between the valve body and the packing sleeve 28. Ignition is effected by spark plug 38′.

The cooling water is fed through pipe 39 into channel 40 in water arch 36, whence, after its volume is regulated by throttle valve 40′, it flows down within the stationary pipe through the slots of the valve tubes into the valve body. It then circulates within the valve body and flows upwardly and within the valve tube to the outlet channel 41, in the water arch which leads into the cylinder jacket. The water thus flows first through the valve which needs the most efficient cooling, and then to the jacket that extends around the cylinder head and the cylinder.

The cylinder base 14 is one rigid piece of metal extending under all the cylinders holding them firmly in place and yet permitting them to move longitudinally when expansion and contraction makes it necessary during operation. It may be fastened to any suitable foundation by means of bolts extending into the foundation through its sides in line with bolts 16, and is provided on its upper side with holes that register on close-fitting surfaces with inlet port 24 and exhaust port 25, and water pipe 39, before described; inlet port 24 connecting with conduit 24′, which connects within the cylinder base with all the inlet ports of all the cylinders and also with any suitable fuel mixer 48 on the outside. The exhaust port 25 connects with pipe 25′ which conveys the exhaust gases to the exterior. The water outlets from the jackets are shown at 42.

In order to cool the piston rod and pistons, I form the piston rod in hollow sections, each of which is screwed into the piston. The piston is preferably provided with a threaded steel core 43, around which the piston body is cast, this body having an annular cavity 44. The piston rod sections are screwed into the steel cores, and four or more cross holes 45 and 46 are bored through the center of the piston and staggered relatively to each other. These holes provide four or more openings which compel the water to flow from one section of the piston rod out into the piston cavity, and thence one-quarter of the way around the back through the hole into the other piston rod section. Trap 47 will keep the water in the pistons, at a proper level; and by means of a pet cock below the center line of the piston rod at the water inlet side or at its outlet there will always be drainage of the piston and piston rod sufficient to prevent breakage by freezing, which has not been done heretofore.

The advantages of my construction result from the peculiar arrangement of the valves and cooling system for the valves and cylinder.

It is very advantageous to be able to lift vertically from above both the inlet and exhaust valves, their casings, the cam shaft and other connections, for it is customary to have traveling cranes placed above engines of medium and larger sizes. It is also a well known fact that carbon from burned oil and other dirt accumulates within a gas, oil, or combustion engine which is usually taken out periodically by means of a drip cock inserted through the bottom of the bore, but the drip cock leaves a pocket which fills with oil or products that often keep afire and cause back-firing. All this is avoided in my engine. The valve system is simple, easily accessible and efficient in its water-cooling connections, and it is obvious that the direction of its flow may be reversed from the manner described.

Many changes may be made in the form and arrangement of the engine valves and cooling system without departing from my invention.

I claim:

1. A gas engine having a cylinder made in two sections, a cylinder head formed integrally with each of said sections, a water jacket within each cylinder head and surrounding its cylinder section, a hollow valve in each cylinder head, there being an inlet to each of said valves and an outlet from each of the cylinder sections, a closed water circulating connection between each of the valves and their respective cylinder heads, the arrangement being such that water is first circulated through the valves and then through the respective cylinder sections; substantially as described.

2. A double-acting gas engine having a

cylinder made in two sections, a cylinder head formed integrally with each section, a water jacket within each of the cylinder heads and surrounding the adjacent cylinder sections, a hollow inlet and exhaust valve in each cylinder head, a water arch above each of said valves, each of said water arches having an inlet, there being a water circulating connection between each of the arches and the interior of their respective valves and between the interior of the valves and the water jacket of their cylinder heads, a water outlet leading from each of the cylinder jackets, the arrangement being such that water is first circulated through the valves and then through the respective jackets within the cylinder heads; substantially as described.

3. A gas engine having a water jacketed cylinder made in sections, a cylinder head integral with each end section, hollow valves within each cylinder head, a stationary water arch above each cylinder head, a stationary water pipe extending from the water arch into the body of each valve, a water inlet pipe connected to each water arch, a connection between each water arch and its respective cylinder jacket, and means to control the circulation of water through each water arch and the stationary pipe within the valve; substantially as described.

4. A gas engine having a jacketed cylinder, a water arch having a circulating connection with a cylinder jacket, a hollow valve arranged to control communication between a port and the cylinder, a valve stem connected to the hollow valve and extending within the water arch, said valve stem having openings through the walls thereof communicating with the interior of the valve, and a stationary pipe connected to the arch and extending into the hollow valve stem, said pipe having a connection with the water supply pipe; substantially as described.

5. A gas engine having a jacketed cylinder, a water arch having a circulating connection with a cylinder jacket, a hollow valve arranged to control communication between a port and the cylinder, a valve stem connected to the hollow valve and extending within the water arch, said valve stem having openings through the walls thereof communicating with the interior of the valve, a stationary pipe connected to the arch and extending into the hollow valve stem, said pipe having a connection with the water supply pipe, and a valve for controlling the flow of the water from the water supply pipe; substantially as described.

In testimony whereof, I have hereunto set my hand.

EDWARD GRAY.

Witnesses:
N. M. CAVANAUGH,
WM. M. PARKER,