C. W. BAKER.

COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES.

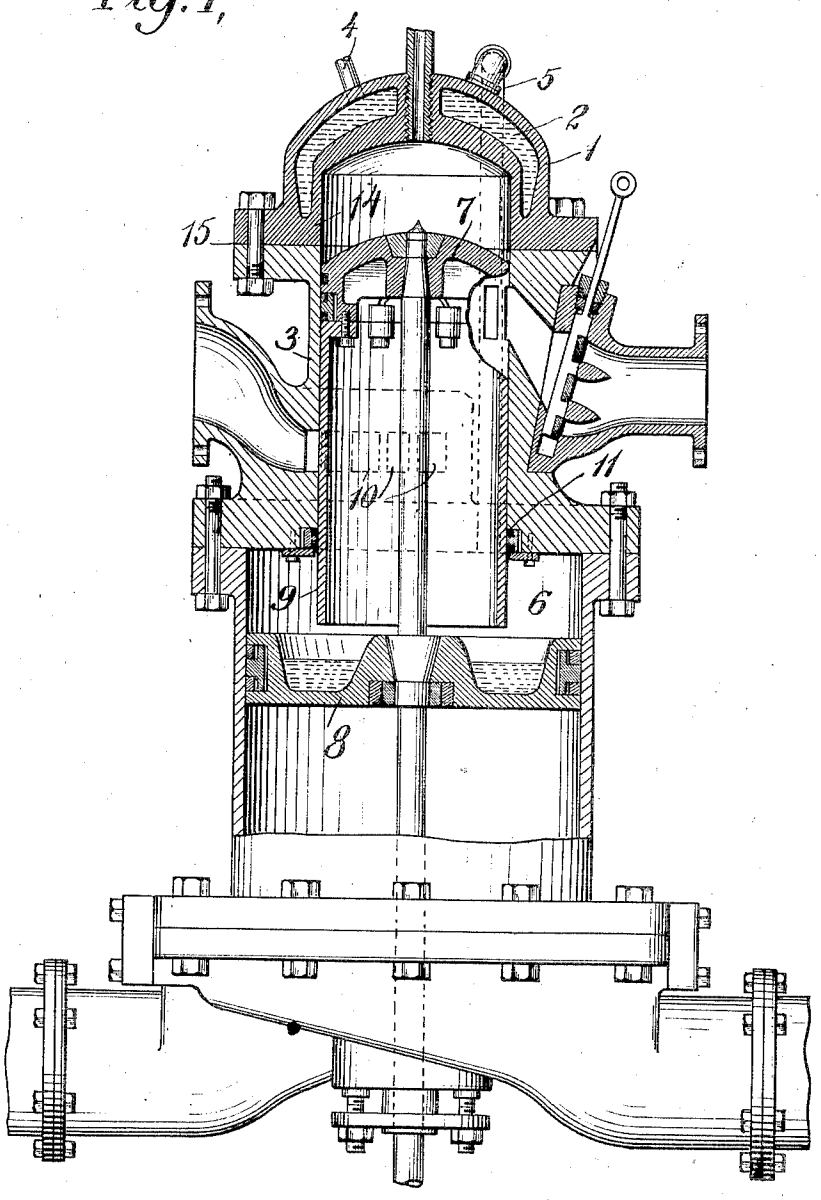
APPLICATION FILED JULY 10, 1912.

1,076,736.

Patented Oct. 28, 1913.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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W. A. Pauling

INVENTOR

Charles Whiting Baker

BY Gifford & Bruce

HIS ATTORNEYS.

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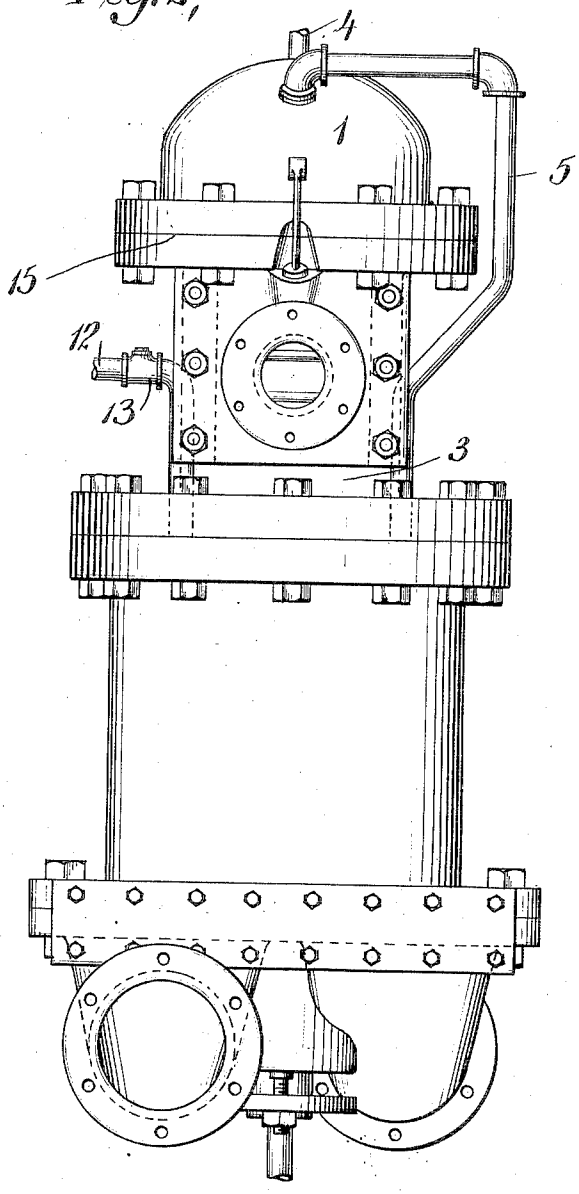
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2 SHEETS—SHEET 2.

Fig. 2,



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UNITED STATES PATENT OFFICE.

CHARLES WHITING BAKER, OF MONTCLAIR, NEW JERSEY.

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

1,076,736. Specification of Letters Patent. Patented Oct. 28, 1913.

Original application filed March 20, 1912, Serial No. 685,045. Divided and this application filed July 10, 1912. Serial No. 708,575.

To all whom it may concern:

Be it known that I, CHARLES WHITING BAKER, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Cooling Systems for Internal-Combustion Engines, of which the following is a specification.

The present application is a division of an application filed by me March 20, 1912, Serial No. 685,045, and the improvement consists in adapting the internal splash cooling system for internal combustion engines shown in my U. S. Patent No. 1,016,603 for use with engines of the two-stroke cycle type, and with other improvements in the construction of internal combustion engines described in said application Serial No. 685,045, and in my application Serial No. 708,574.

My invention is illustrated in the accompanying drawings in which—

Figure 1 is a vertical section through the cylinder of a two-stroke cycle engine having an air compressing cylinder tandem therewith; and Fig. 2, is a side elevation of the same at right angles to the section shown in Fig. 1.

Similar reference numerals indicate similar parts in the several views.

Referring to Fig. 1, it will be seen that the cylinder head 1 is made hollow and provided with a water-jacket space 2, but there is no water-jacket on the barrel 3 of the cylinder, which is cast separate from the head. A limited quantity of cooling water is delivered by the pipe 4 into the jacket space on the head 1 and overflows through the pipe 5 into the space 6 between the oil engine piston 7 and the tandem air-compressing piston 8. By the rapid up and down motion of these pistons the water between them is thrown up and down and is splashed forcibly against the idle faces of these pistons, the barrel of the air-compressing cylinder and the interior surface of the trunk 9 of the upper piston 7 at each stroke. The inner surface of the cylinder 3 absorbs heat from the gases of combustion, and imparts this heat to the outer surface of the splash-cooled trunk of the piston 2, just as in the ordinary construction the barrel of the cylinder, cooled by the water-jacket, absorbs heat from the piston trunk which moves over it, but the direction of heat flow is now reversed. It will be seen that by this method of cooling, the cylinder barrel 3 receives and gives up heat from the same surface and does not have to transmit heat through the cylinder wall, hence differences of temperature and consequent stresses in the cylinder inevitable in the ordinary construction are avoided by this method of cooling. This construction also avoids difficulties heretofore experienced with two-stroke cycle engines in the overheating and burning out of the bridges between the exhaust ports 10 near the bottom of the gas cylinder. In cylinders cast with a water-jacket the cooling effect of the water-jacket cannot reach these bridges, which are exposed at each revolution to the blast of the hot exhaust gases. By my improved construction, however, these bridges are in contact with the splash-cooled trunk of the piston 7 all the time except during the brief interval of exhaust and scavenging. In order to prevent the cooling water from being carried upward between the trunk 9 and the cylinder barrel 3 and escaping through the exhaust ports, I provide packing rings 11 at the bottom of the cylinder barrel. The splashing water is turned into steam by contact with the hot surfaces and is carried off by the pipe 12, Fig. 2, together with a considerable amount of entrained water so that no deposit of solid matter will take place in the cylinder as might occur if all the water were turned into steam. The amount of water fed to the jacket on the head through the pipe 4 is such that a surplus is available for passing off with the steam. The flow of steam and water from the chamber between the pistons is further stimulated by the action of the pistons. By reason of the different diameters of the gas piston 7 and the air piston 8, the steam will be compressed on the upward stroke and expanded on the return stroke.

To avoid the surging of steam back into the space between the pistons from the pipe 12, a check-valve 13 is placed thereon. The steam carried off by pipe 12 is carried to a reservoir and may there be used for power generation in connection with the compressed air produced by the piston 8 by the system described by me in U. S. Patent No. 1,016,603, or it may be condensed and used over again for cooling purposes. In either case, I prefer to feed a small quantity of graphite or some similar solid lubricant with the cooling water since it will effectively lubricate both the piston 8 and the packing rings 11. Moreover, minute particles of graphite-charged water will leak past the packing rings 11. The water will be flashed into steam by contact with the hot cylinder barrel but the graphite will mix with the oil used to lubricate the piston 7 and will aid in its perfect lubrication.

It will be seen that the cooling effect of the piston-trunk 9 on the cylinder barrel 3 is greatest at the lower end where the two are in contact nearly all the time, and least on the upper part of the cylinder, where the cylinder surface is exposed to the hot gases most of the time. The gases are also at highest temperature in the upper part of the cylinder before they are expanded and cooled. To insure the cooling of this upper portion 14 of the cylinder barrel it is cast as part of the head, and the jacket on the head is carried down along it. A further advantage of this method of construction is that the joint 15 between the head and barrel is brought so low that the piston passes over it before high compression pressure is reached and liability to leakage through it is reduced. Also by this construction when the oil engine piston is at the upper end of its stroke it can be exposed for examination by merely removing the cylinder head.

What I claim is:

1. An internal combustion engine comprising a cylinder and a trunk piston reciprocating therein, a second cylinder tandem with the engine cylinder providing a space into which the lower part of the trunk piston is moved in its reciprocations, a piston in said tandem cylinder and means for reciprocating the same, and means for introducing water into the space between said pistons, whereby during the reciprocations of said pistons the water will be splashed for the purposes described.

2. In an internal combustion engine, a cylinder and a trunk piston reciprocating therein, a second cylinder tandem with the gas cylinder, a piston in said second cylinder tandem with the trunk piston and reciprocating therewith, and means for supplying water to the space between the pistons whereby during such reciprocations the idle faces of said pistons and the cylinder surfaces confining the splashing water will be drenched therewith.

3. In a two stroke cycle internal combustion engine, a cylinder and a trunk piston reciprocating therein, a second cylinder tandem with the gas cylinder, a piston in said second cylinder and means for reciprocating the same, means for introducing water into the space between the pistons whereby during the reciprocations of the pistons the water will be splashed into the trunk piston, and packing rings at the bottom of the cylinder in which the trunk piston reciprocates to exclude the water from said cylinder.

4. In a single-acting internal combustion engine of the two-stroke cycle type, a cylinder and a trunk piston reciprocating therein, said cylinder having exhaust ports and said trunk piston adapted in its reciprocations to cover said ports, a second cylinder tandem with the gas cylinder, a piston in said second cylinder and means for reciprocating the same, and means for supplying water to the space between the pistons whereby during the reciprocations of the pistons the water will be splashed into the trunk piston for the purpose described.

5. An internal combustion engine having the cylinder thereof formed in two parts, the upper portion of the cylinder barrel being cast with the head and provided with a water jacket, and the lower portion of the barrel having inlet and exhaust passages and with no surrounding water jacket, a piston reciprocating in said cylinder, a piston tandem with said cylinder piston, and means for introducing water into the space between the two pistons, whereby during the reciprocations of the pistons the water will be splashed for the purpose described.

6. A two-stroke cycle internal combustion engine having a cylinder and a trunk piston reciprocating therein, the barrel of said cylinder being cast without a water jacket, and having exhaust ports and packing below said ports, a piston tandem with said trunk piston, and means for supplying water to the space between the pistons whereby during the reciprocations of said pistons the water will be splashed for the purpose described.

7. In a two-stroke cycle internal combustion engine, a cylinder and a trunk piston reciprocating therein, a single acting air compressing piston tandem with the trunk piston, means for supplying water to the space between the pistons whereby said pistons and the cylinder in which they reciprocate will be cooled by the water splash, and means for drawing off steam and surplus water from said space.

8. In an internal combustion engine, a

cylinder, a trunk piston reciprocating therein, a second piston also reciprocating in said cylinder, and means for admitting water into the space between said pistons, whereby during the reciprocations of the pistons the water between them will be splashed for the purpose described.

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

CHARLES WHITING BAKER.

Witnesses:

M. E. McNINCH,

CHARLES S. JONES.