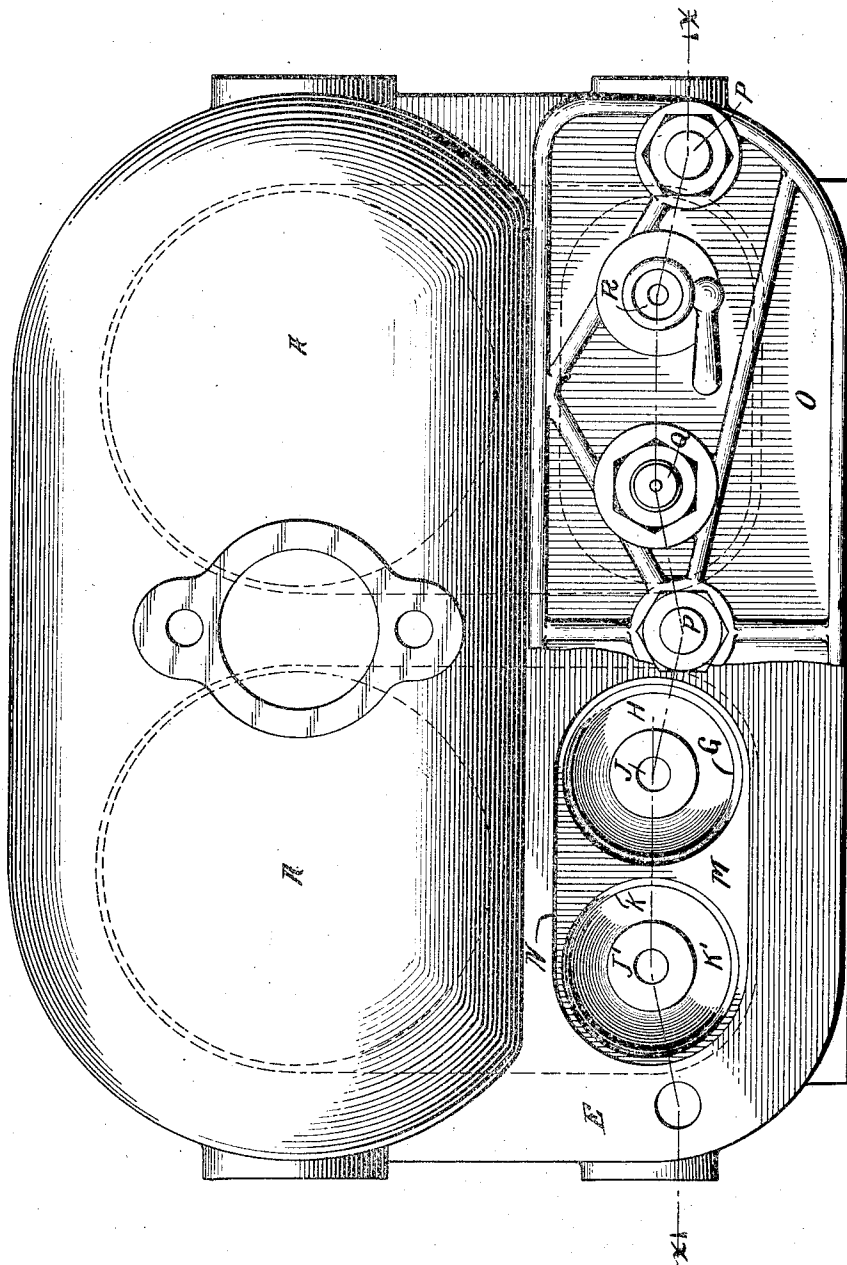


1,037,478.

3 SHEETS—SHEET 1.



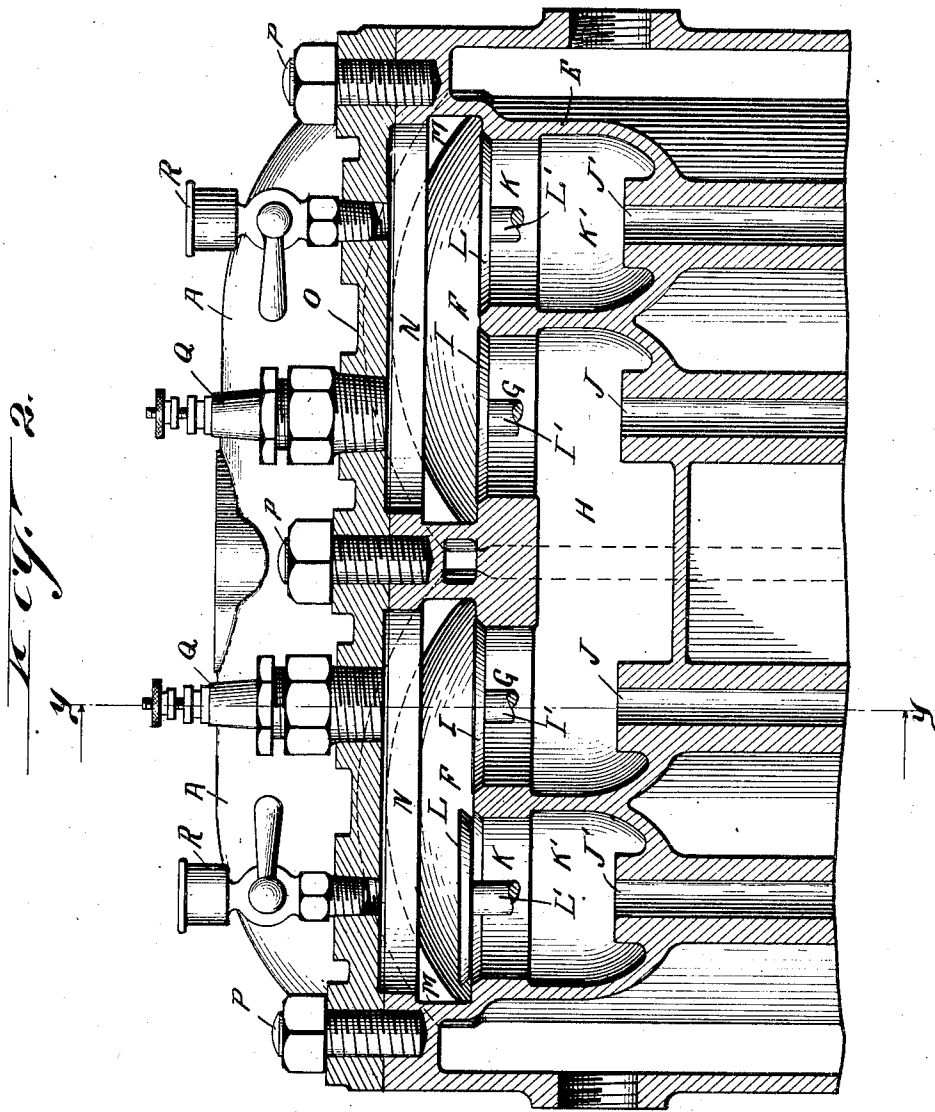
Inventor:

by Edgar O. Hayes
Erwin C. Wheeler
Leverett C. Wheeler & Co.

E. O. HAYES.
 INTERNAL COMBUSTION ENGINE.
 APPLICATION FILED SEPT. 30, 1910.

1,037,478.

Patented Sept. 3, 1912.
 3 SHEETS—SHEET 2.



Witnesses

R. L. Farrington
 J. D. Bremer

Inventor

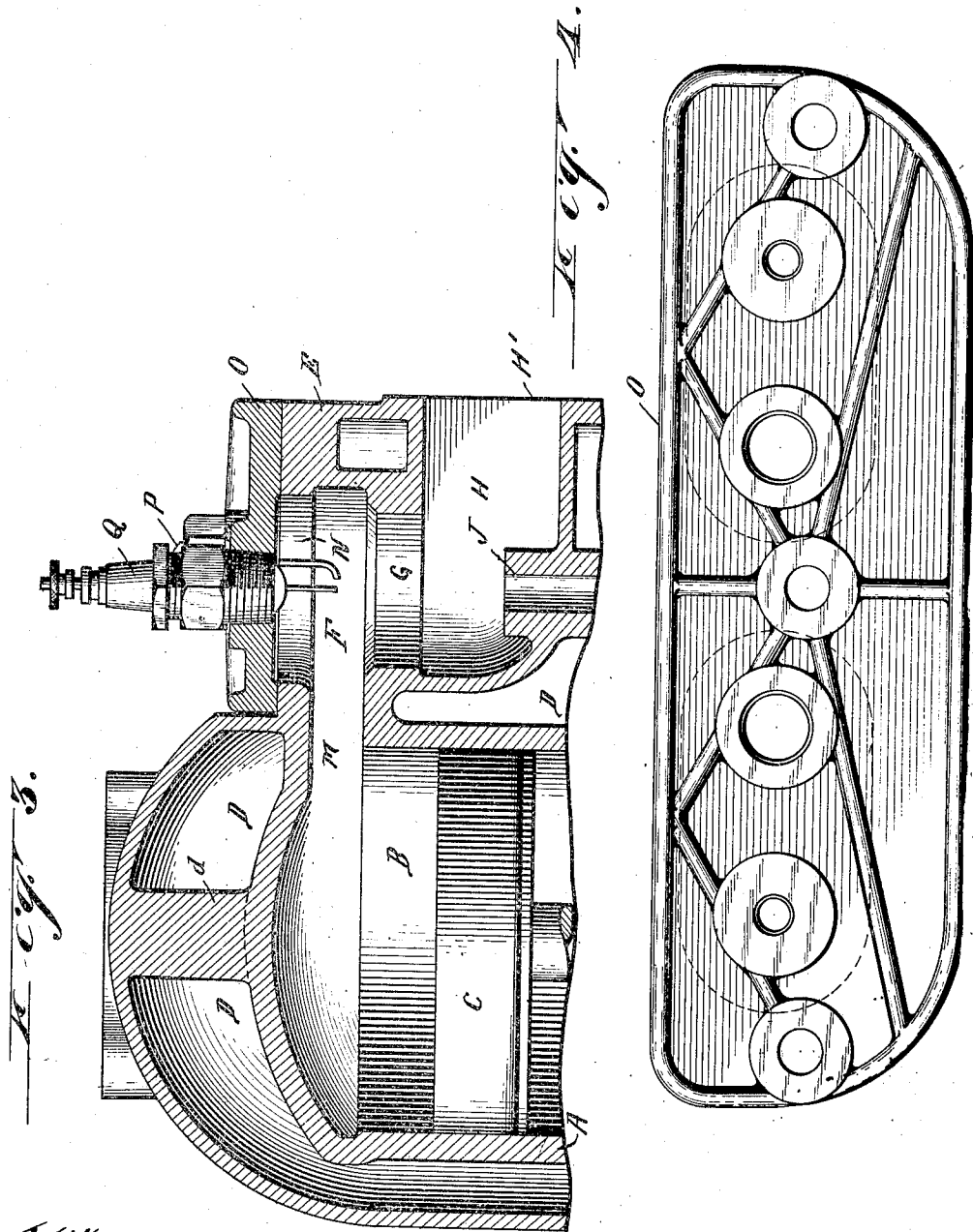
by *Edgar O. Hayes*
Erwin E. Wheeler
Lucretia C. Wheeler *H. W. S.*

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Witnesses

R. F. Harrington
J. D. Bremer

Inventor:

Edgar O. Hayes
by *Ernest Whaler*
Lawrence C. Whaler *Kelly's*

UNITED STATES PATENT OFFICE.

EDGAR O. HAYES, OF MILWAUKEE, WISCONSIN.

INTERNAL-COMBUSTION ENGINE.

1,037,478.

Specification of Letters Patent.

Patented Sept. 3, 1912.

Application filed September 20, 1910. Serial No. 584,609.

To all whom it may concern:

Be it known that I, EDGAR O. HAYES, a citizen of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines.

Heretofore it has been the common practice to provide cylinders of such engines with removable end caps, which, when in position, serve to not only close the end of the cylinder, but also the end of the water jacket cavity. In a multiple cylinder engine, one of these caps was provided for each cylinder, and each cap was provided with a spark plug aperture and another aperture for the reception of the priming tube, if primers were employed. Such cylinder heads required to be frequently repacked, as the packing is exposed to the water of the water jacket, and also to the heat radiating from the combustion chamber, and the presence of the water jacket makes it necessary to secure a proper bearing of the cap upon both the inner and outer walls of the jacket, both of which walls therefore require careful machine work. The cap also requires careful fitting and the packing must be of uniform thickness. In a multiple cylinder engine, the provision of such caps with suitable means for securing them in position adds considerably to the expense of the engine, and the repacking of the caps by inexperienced persons is apt to cause serious difficulties in the care and operation of the engine.

The objects of this invention are to provide a form of construction which will allow the cylinder heads to be formed integrally with the side walls and will permit water circulation over the heads or ends of the cylinders.

My invention also has for its object a form of construction which will allow a single capping plate to be used for all the cylinders of a multiple cylinder engine,—such capping plate not being applied to the cylinder proper, but forming the top of an

auxiliary firing chamber, offset from the cylinders and preferably constituting a portion of the mixing chambers or vapor inlet passages; said firing chamber being designed in such a manner as to permit access to the interior of the cylinder in such a manner that carbon deposits may be dislodged and removed without removing the cylinder from the frame of the engine or from the crank case; said firing chamber being further designed to permit the use of large inlet valves and ports of ample capacity leading to the interior of the cylinder, thus securing greater freedom in the admission of vapor to the engine than heretofore.

In the following description, reference is had to the accompanying drawings, in which—

Figure 1 is a plan view of a two-cylinder internal combustion engine embodying my invention, with a portion of the capping plate partially broken away. Fig. 2 is a vertical sectional view, drawn on line $x-x$ of Fig. 1. Fig. 3 is a vertical sectional view drawn on line $y-y$ of Fig. 2. Fig. 4 is a plan view of the capping plate.

Like parts are identified by the same reference characters throughout the several views.

A, A, are the cylinders of an internal combustion engine, each provided with a piston cavity B, piston C therein, and a water jacket cavity D, which extends along the sides and over the upper end or head of the cylinder, as clearly shown in Fig. 3, the head of the cylinder being formed integrally with the side walls and the inner and outer walls of the jacket being formed integrally with each other and connected by suitable integral connecting members d . A valve casing E is located at one side of the set or series of cylinders and is provided with an auxiliary firing chamber F for each cylinder. Each of these firing chambers is connected by a suitable port G with a mixing chamber H, the passage of vapor from the mixing chamber H to the firing chamber F being controlled by a valve I having a stem I', which extends downwardly through the port G and through the mixing chamber H and a tubular guide passage J to the ex-

terior of the casing E, said valve stem being actuated by any suitable means, preferably from the engine cam shaft. It being common to operate the admission valves of an engine from a cam shaft driven by the engine, it is not necessary to illustrate these parts or to describe them in detail. Each firing chamber F is provided with an outlet port K controlled by a valve L having a stem L' extending downwardly through the port K, outlet cavity K' and tubular guide passage J', this valve stem and valve being also preferably actuated from the engine cam shaft.

The mixing chamber H in a two-cylinder engine may be so formed that a single chamber will serve for both cylinders, the vapor and hydro-carbon liquid admitted to, and vaporized in said chamber, (or preparatory to its admission to the chamber,) being delivered from this chamber through one or the other valve ports G, as the valves controlling said ports open and close. It will of course be understood that such valves will open and close in alternation.

The firing chamber F communicates with the interior of the cylinder B through an elongated slot M, which serves as an outlet port for the firing chamber or an admission port for the cylinder. This slot M has a length corresponding substantially to the diameter of the cylinder and it is located at the upper end of the cylinder, so that when the piston C is in a raised position, it may be scraped, together with the upper end of the cylinder by means of a suitable tool inserted through the firing chamber.

The casing E is provided with an opening N in its upper wall for each firing chamber, said opening being of such size as to expose both of the valves I and L. A single capping plate O covers the respective openings N and preferably covers the entire upper surface of the casing E, to which it is secured by bolts P. This capping plate is provided with apertures to receive the spark plugs Q and the priming cups and tubes R, said spark plugs and priming tubes being of any ordinary construction. It is obvious that by removing the capping plate, access will be afforded to the firing chamber and also to the valves I and L, as well as to the interior of both cylinders B. It is also obvious that any damage caused by the repeated removal and replacement of spark plugs and priming tubes will not injure any portion of the engine, other than the capping plate, which can readily be replaced by another plate. The casing E may, if desired, be provided with water circulation passages or cavities communicating with the water jacket of the engine cylinders, but it is not necessary that these passages should extend through the upper wall of the casing, and therefore the capping plate requires to be packed only

with a view of forming a tight joint around the openings N.

While I have described the cavity H as constituting a mixing chamber, it is not material to my invention whether this cavity comprises the mixing chamber proper, or a portion thereof, or whether it is merely an outlet for an additional mixing chamber secured to the inlet end H' of this cavity. Neither do I intend by any of the terms and expressions herein used, to exclude from the scope of my invention any mechanical equivalents for the parts shown and described, the terms and expressions used in the foregoing description and in the appended claims being used as terms of description and not of limitations.

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

1. In an engine of the described class, a plurality of integrally formed cylinders, cylinder heads and firing chambers provided with ducts for the passage of combustible fluid between said chambers and cylinders, said firing chambers having openings in the upper portion thereof all located in a common plane, in combination with a single removable cap common to all the firing chambers, and means for securing said cap in place to close said chambers.

2. In an engine of the described class, a plurality of cylinders, cylinder heads, water jackets surrounding said cylinders and cylinder heads, and open topped firing chambers cast integrally, said cylinders and firing chambers being provided with open ducts for the passage of combustible fluid, in combination with a single removable cap common to all of said chambers, and means for securing said cap in place above said chambers and in a position closing the openings in the top thereof.

3. In an engine of the described class, a plurality of cylinders, cylinder heads, water jackets surrounding said cylinders and cylinder heads, and open topped firing chambers cast integrally, said cylinders and firing chambers being provided with open ducts for the passage of combustible fluid, in combination with a single removable cap common to all said chambers, provided with a spark plug aperture for each of said firing chambers, and means for securing said cap in place above said chambers and in a position closing the openings in the tops thereof.

4. In an engine of the described class, a plurality of cylinders, cylinder heads, water jackets surrounding said cylinders and cylinder heads, and open topped firing chambers cast integrally, said cylinders and firing chambers being provided with open ducts for the passage of combustible fluid and valved admission ducts for the delivery of combustible fluid thereto, in combination

with a single removable cap common to all of said chambers, and means for securing said cap in place above said chambers in a position closing the openings in the tops thereof, said firing chambers being located substantially upon the same plane with the upper end of said cylinders, whereby, when said cap is removed, a suitable tool may be inserted for the purpose of cleaning the piston heads 10 and the walls of said cylinders.

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

EDGAR O. HAYES.

Witnesses:

LEVERETT C. WHEELER,
I. D. BREMER.