F. W. BRADY.

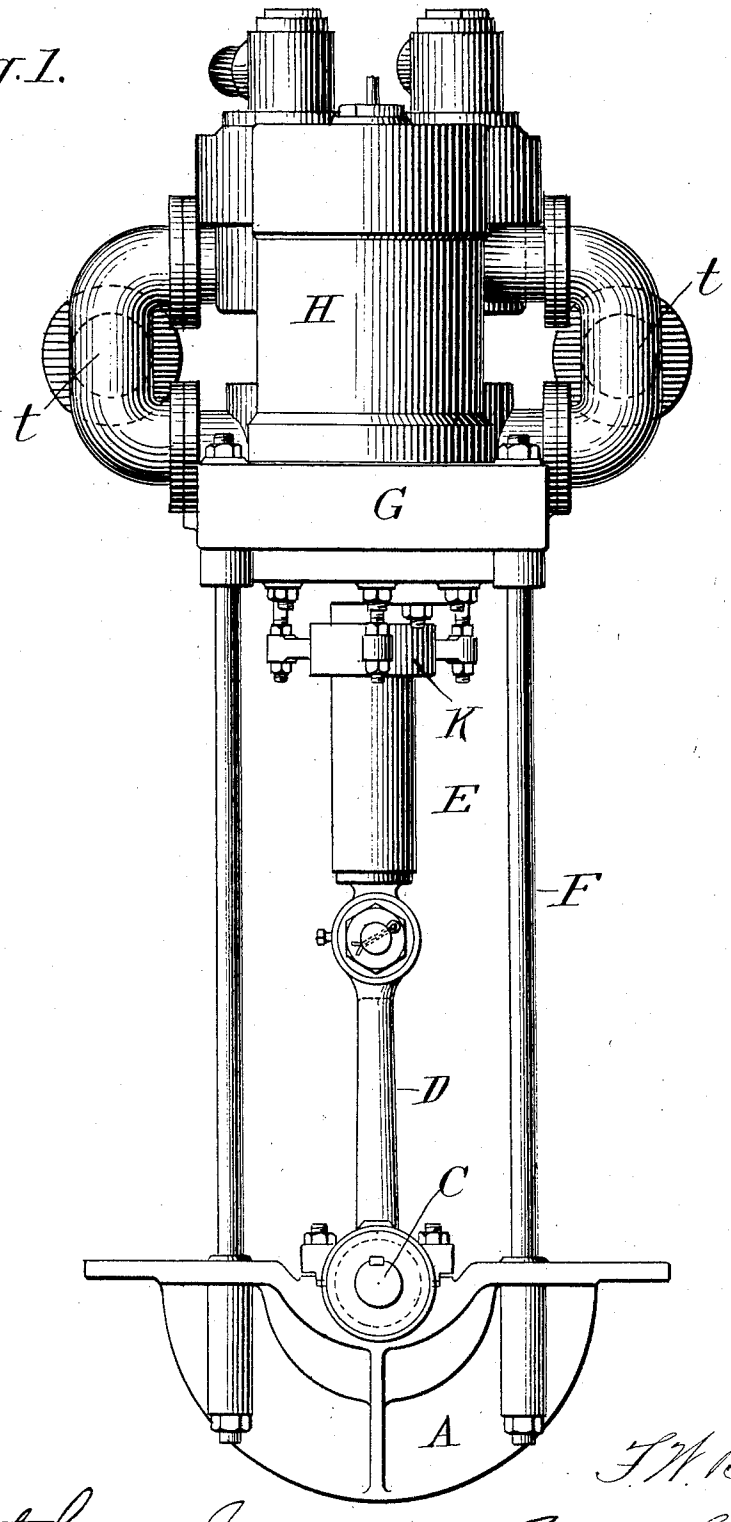
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 23, 1906.

909,531. **Patented Jan. 12, 1909.**

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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INTERNAL COMBUSTION ENGINE.

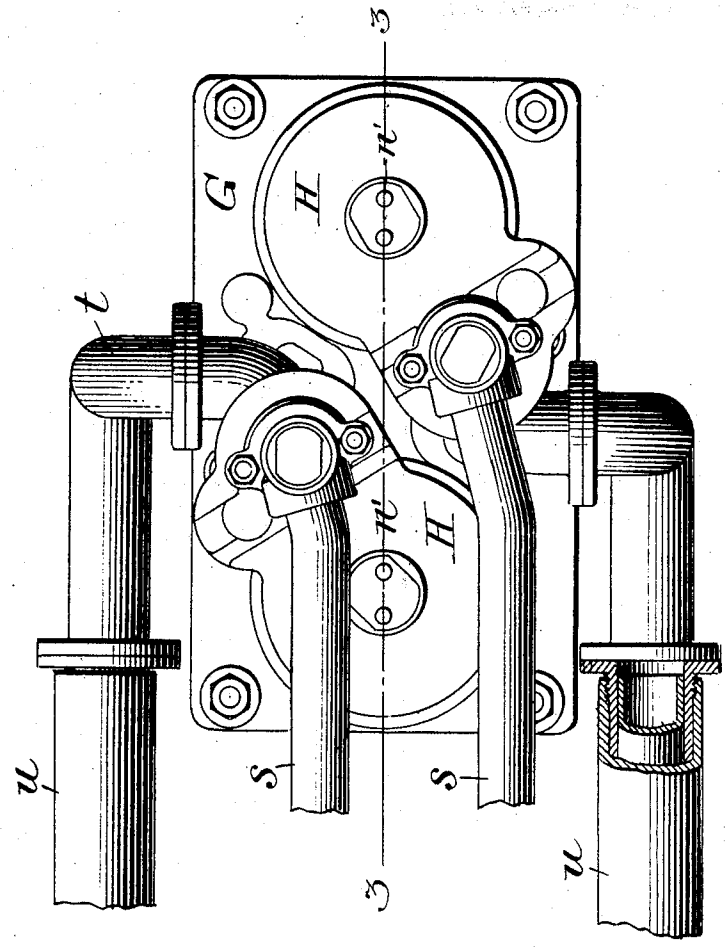
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5 SHEETS—SHEET 2.

Fig. 2.



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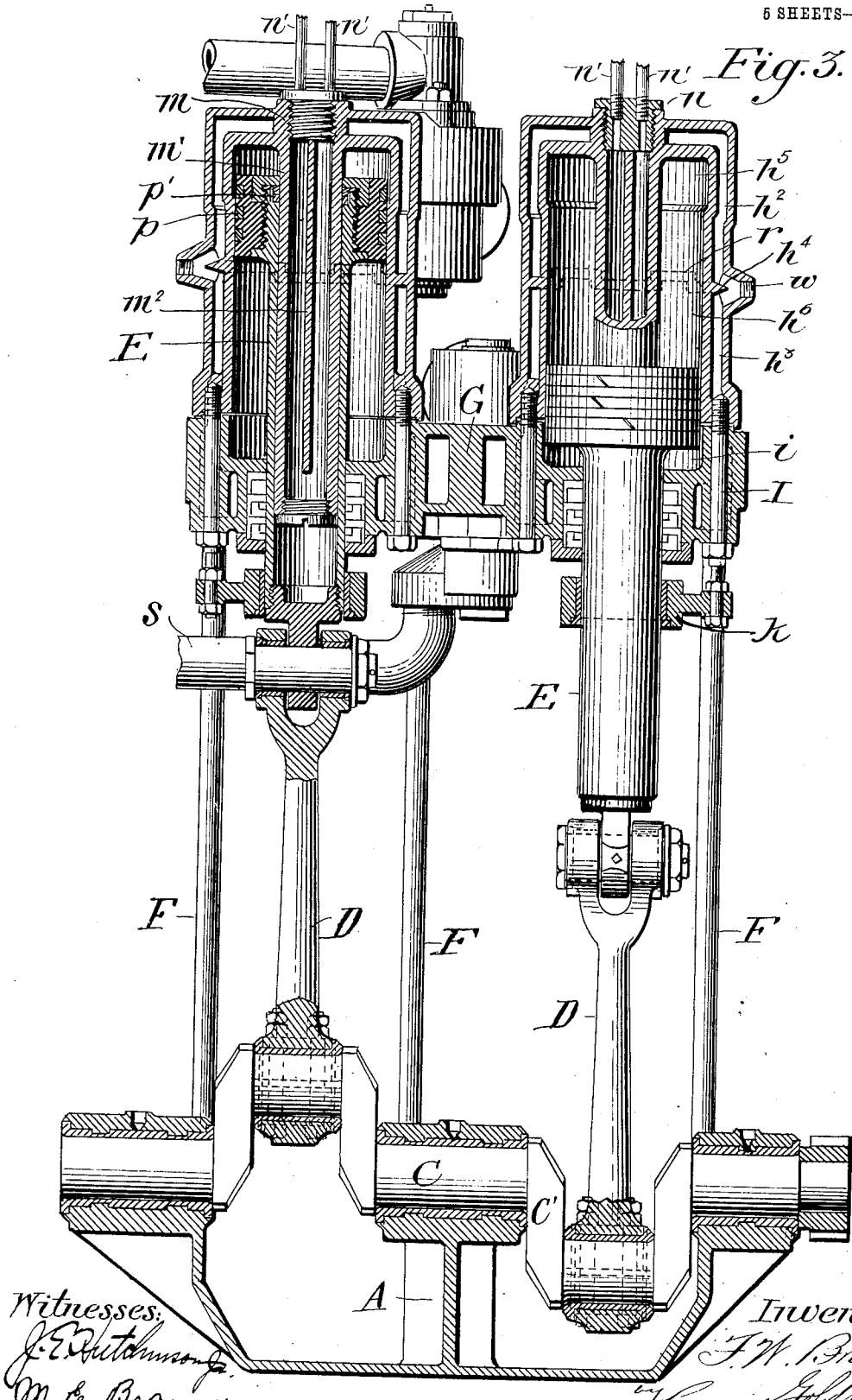
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5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

Fig. 4.

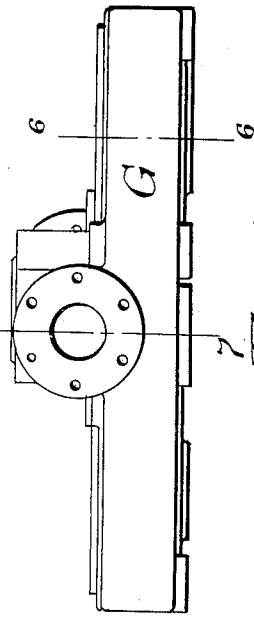


Fig. 5.

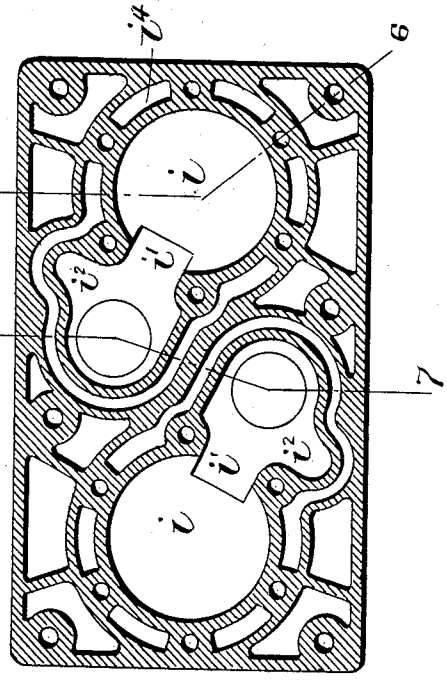


Fig. 6.

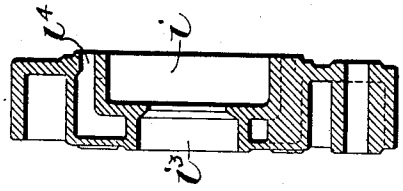
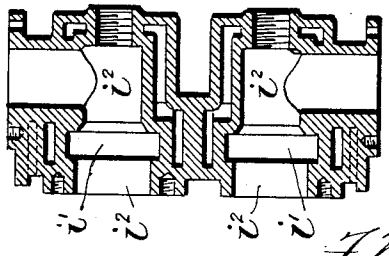


Fig. 7.



Witnesses

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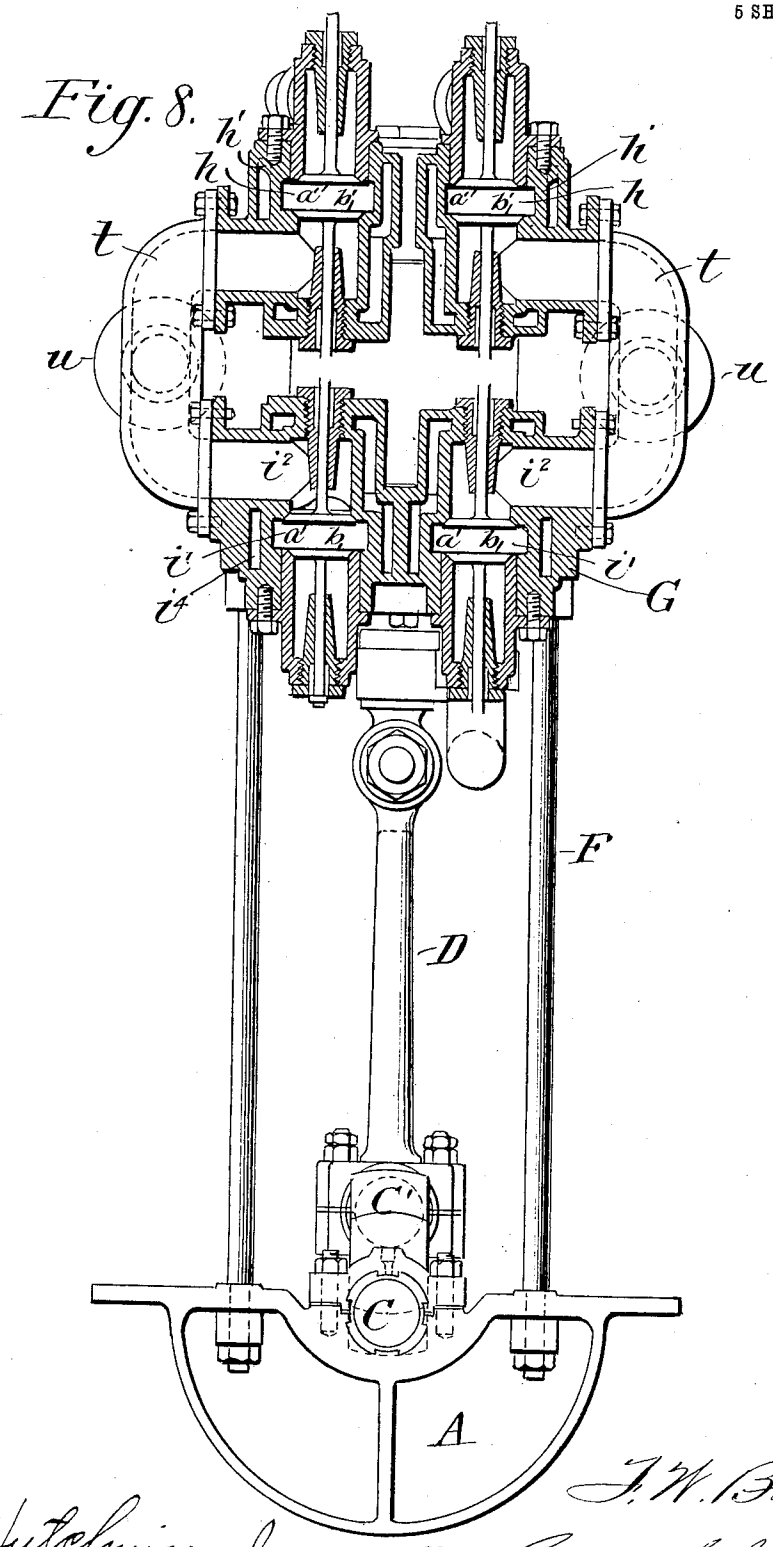
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5 SHEETS—SHEET 5.

Fig. 8.



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UNITED STATES PATENT OFFICE.

FRANCIS W. BRADY, OF NEW YORK, N. Y.

INTERNAL-COMBUSTION ENGINE.

No. 909,531. Specification of Letters Patent. Patented Jan. 12, 1909.

Application filed October 23, 1906. Serial No. 340,132.

To all whom it may concern:

Be it known that I, FRANCIS W. BRADY, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Internal Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The nature of my invention will be understood from the following specification and the accompanying drawings which illustrate and describe a two cylinder double acting internal combustion engine embodying a preferred form of my improvements.

Figure 1 is an end elevation of such an engine, having two cylinders. Fig. 2 is a top plan view of the same. Fig. 3 is a section on the line 3—3 of Fig. 2, but on a slightly larger scale. Fig. 4 is an elevation of the common base plate of the two cylinders. Fig. 5 is a horizontal section of the same. Fig. 6 is a developed vertical section through the line 6—6 on Fig. 4, and in a direction indicated by line 6—6 on Fig. 5. Fig. 7 is a similar view on the lines 7—7, and Fig. 8 is a developed vertical section through the valve chambers.

Referring to Fig. 1, the yoke frame A, which is to be supported on a suitable foundation, serves as support for the bearings of the shaft C and this shaft is provided with cranks C′ to which are attached the lower ends of the pitmen D, which pitmen connect at their upper ends with the hollow piston rods E.

Mounted on the yoke frame A are the vertical posts F which support the common base plate G. Two cylinder bodies H are secured to the common base plate G by bolts I (see Fig. 3) and these bolts I support a guide ring K for the hollow piston rod E. Though two cylinder bodies are here shown, it will be understood that any desired number of cylinder bodies may be supported on a single base plate. This common base plate, which is preferably a casting, contains two recesses i which form, when the parts are assembled, the lower portions of the combustion chambers of the cylinders. There are also formed in this common base plate the ports i' communicating with the chambers i; the valve chambers i^2 containing the inlet and exhaust valves a and b; recesses i^3 adapted to form a stuffing box for the piston rod; and chambers i^4 which coact with similar chambers in the cylinder bodies to form a water jacket. The two cylinder bodies H are alike, and a description of one will serve for both. Each is a casting cylindrical in general outline closed at the upper end and having an off-set portion containing the cylinder port h and the valve chambers h' for the inlet and exhaust valves a' and b'. The cylinder body is formed with double walls affording an intermediate space to form a water jacket. This intermediate space is separated into two portions h^2 and h^3 by the staggered rib r which extends around the cylinder across the intermediate space between its walls, as shown in Fig. 3. This rib serves to divide the water jacket into two chambers, one of which surrounds the upper portion of the cylinder and the upper valve chamber, while the other surrounds the lower portion of the cylinder and, in conjunction with the chambers i^4, in the common base plate, the lower valve chamber and the outside of the hollow piston rod. Water is supplied to or withdrawn from this water jacket through a port w and a tapered projection h^4 is formed on the rib r and extending into the water inlet, thus serving to divide the entering water into two streams, one for each chamber of the water jacket. It will be observed that the cold water is admitted at the central portion of the cylinder chamber, and in order to prevent the existence of a complete horizontal section which is not water-cooled, and consequent cracking of the cylinder by the rib r the rib is staggered in the manner shown in Fig. 3 in dotted lines.

The upper end of the interior of the cylinder body is enlarged to form a chamber h^5 so that when the parts are assembled the interior of the cylinder is composed of a lower chamber i, a chamber h^6 in which the piston reciprocates and an upper chamber h^5. Between the two walls of the cylinder body at the upper end, is cast a cylindrical connecting piece m, which is extended downwardly, concentric with the axis of the cylinder to form a projection m', hollow on the inside and divided by the partition m^2 into two chambers, which communicate with one another at the lower end. This projection m' may be integral with the cylinder walls, as shown, or formed of a separate piece properly secured in place. Set into the

upper end of this projection is the plug n, which is provided with two passages adapted to receive the water pipes n' and communicating with the two chambers in the hollow projection m'. By this construction a circulation of water may be maintained within the hollow projection. The hollow piston rods E surround the projections m' and are provided with packing rings p engaging the interior surface of the piston chamber and packing rings p' engaging the cylindrical projection m'.

It will be understood that when the parts are assembled the cylinder bodies are secured in place above the respective chambers i in the common base plate by means of the bolts I as shown.

Air is supplied to the four inlet ports by the pipes s and the products of combustion are exhausted through the pipes t provided with mufflers u.

By this construction I am able to produce a strong and compact double acting internal combustion engine of a small number of parts, in which the piston and other parts are efficiently cooled.

What I claim, and desire to secure by Letters Patent, is:—

1. In an internal combustion engine, a piston having a central orifice, a hollow piston rod extending from one face of the piston and having its hollow interior registering with the central orifice of the piston to form a continuation thereof, and a pitman connecting the hollow piston rod to the crank-shaft of the engine, in combination with a hollow projection extending from the end of the cylinder opposite the other face of the piston into the chamber formed by the central orifice in the annular piston and the hollow interior of the piston rod, the said projection being closed at its free end, and means for setting up a circulation of cooling fluid in the interior of said hollow projection to cool the piston and piston rod; substantially as described.

2. In an internal combustion engine, a piston having a central orifice, a hollow piston rod extending from one face of the piston and having its hollow interior registering with the central orifice of the piston to form a continuation thereof, and a pitman connecting the hollow piston rod with the crank shaft of the engine, in combination with a hollow projection extending from the end of the cylinder opposite the other face of the piston into the chamber formed by the central orifice in the piston and the hollow interior of the piston rod, the said projection being closed at its free end and divided into a plurality of passages, and connections whereby a cooling fluid may be passed into one of the passages within the hollow projection and out of another to set up a circulation therein and cool the piston and piston rod; substantially as described.

3. In an internal combustion engine, a cylinder body closed at its upper end, a base plate closing the lower end of said cylinder body, a hollow projection extending downwardly from the upper end of the cylinder and closed at the lower end, a hollow piston and piston rod surrounding the projection the said piston rod extending through the base plate, and means for creating a circulation of water in the hollow projection to cool the piston and piston rod; substantially as described.

4. In a double acting internal combustion engine, a cylinder body made of a single casting containing a chamber in which the piston reciprocates and a chamber beyond the path of movement of the piston forming a portion of one combustion chamber, a base-plate closing the end of the cylinder body and containing a chamber forming a portion of the other cumbustion chamber, inlet and exhaust ports and passages in the cylinder body and inlet and exhaust ports and passages in the base-plate; substantially as described.

5. In an internal combustion engine, a cylinder body made of a single casting containing a chamber in which the piston reciprocates and a chamber beyond the path of movement of the piston forming a portion of one combustion chamber, and a base-plate closing the end of the cylinder body and containing a chamber forming a portion of the other combustion chamber; substantially as described.

6. In a double acting internal combustion engine, a cylinder body made of a single casting containing a chamber in which the piston reciprocates and a chamber beyond the path of movement of the piston forming a portion of one combustion chamber, a base-plate closing the end of the cylinder body containing a chamber forming a portion of the other combustion chamber, and registering recesses in the cylinder body and base-plate adapted to form water jackets for the combustion chambers; substantially as described.

7. In a double acting internal combustion engine, a cylinder body made of a single casting containing a chamber in which the piston reciprocates and a chamber beyond the path of movement of the piston forming a portion of one combustion chamber, a base-plate closing the end of the cylinder body and containing a chamber forming a portion of the other combustion chamber, inlet and exhaust ports and passages in the cylinder body, inlet and exhaust ports and passages in the base-plate, and registering recesses in the base-plate and cylinder body adapted to form water jackets for the combustion chambers and the

ports and passages in the base-plate; substantially as described.

8. In a double acting internal combustion engine, a cylinder having double walls, the intermediate space between said walls being adapted to form a water jacket, a circumferentially extending partition near the longitudinal center of the cylinder dividing said water jackets into separate chambers surrounding the respective combustion chambers, and means for supplying a separate current of water to each of said water jacket chambers; substantially as described.

9. In a double-acting internal combustion engine, a cylinder having double walls, the intermediate space between said walls being adapted to form a water-jacket, a circumferentially extending partition near the longitudinal center of the cylinder dividing said water jackets into separate chambers surrounding the respective combustion chambers, and means for supplying a separate current of water to each of said water jacket chambers from a single inlet; substantially as described.

10. In an internal combustion engine a cylinder having double walls, the intermediate space between said walls being adapted to form a water jacket, a partition dividing said space into two chambers, a water inlet spanning said partition, and a projection on said partition extending into the water inlet to divide the entering water into two streams, one for each chamber; substantially as described.

11. In an internal combustion engine, a foundation supporting an engine shaft, a plurality of pitmen on said shaft, a single base-plate supported from the foundation, a plurality of cylinders secured to said base-plate, a plurality of hollow piston rods connected to said pitmen and extending through the base-plate into the respective cylinders, an annular piston secured to the end of each piston rod, a hollow projection extending downwardly from the upper end of each cylinder engaging the interior of its piston and piston rod and closed at its lower end, and means for creating a circulation of water in each hollow projection; substantially as described.

12. In an internal combustion engine, a foundation supporting an engine shaft, a plurality of pitmen on said shaft, a single base-plate supported from the foundation, a plurality of cylinders secured to said base-plate, a plurality of hollow piston rods connected to said pitmen and extending through the base-plate into the respective cylinders, an annular piston on each piston rod, a hollow projection extending downwardly from the upper end of each cylinder engaging the interior of its piston and piston rod and closed at its lower end, means for creating a circulation of water in each hollow projection, and registering recesses in the base-plate and the respective cylinder bodies adapted to form water jackets; substantially as described.

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

FRANCIS W. BRADY.

Witnesses:
LEW C. MOORE,
AUG. TREADWELL, Jr.