A. P. BRUSH.

INTERNAL COMBUSTION ENGINE OF THE V TYPE.

APPLICATION FILED MAY 15, 1915.

1,353,213.

Patented Sept. 21, 1920.

3 SHEETS—SHEET 1.

Fig. 1.

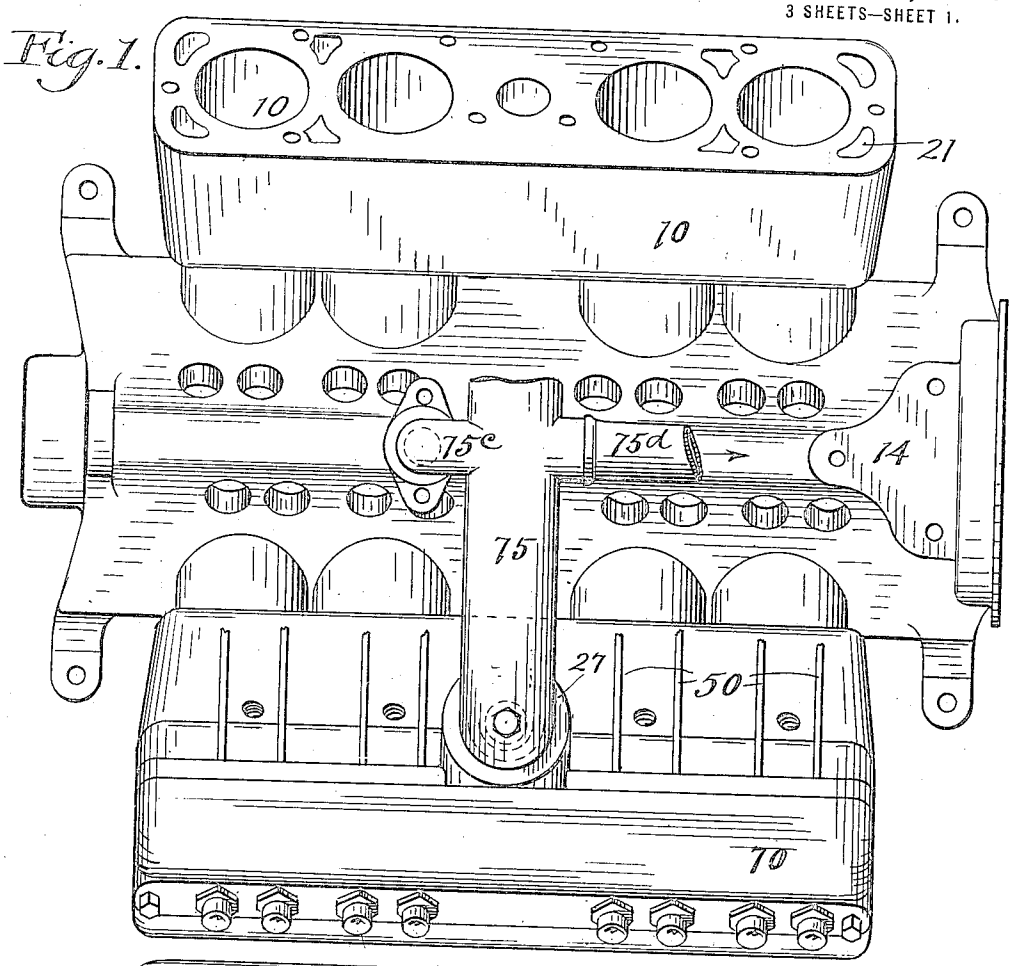
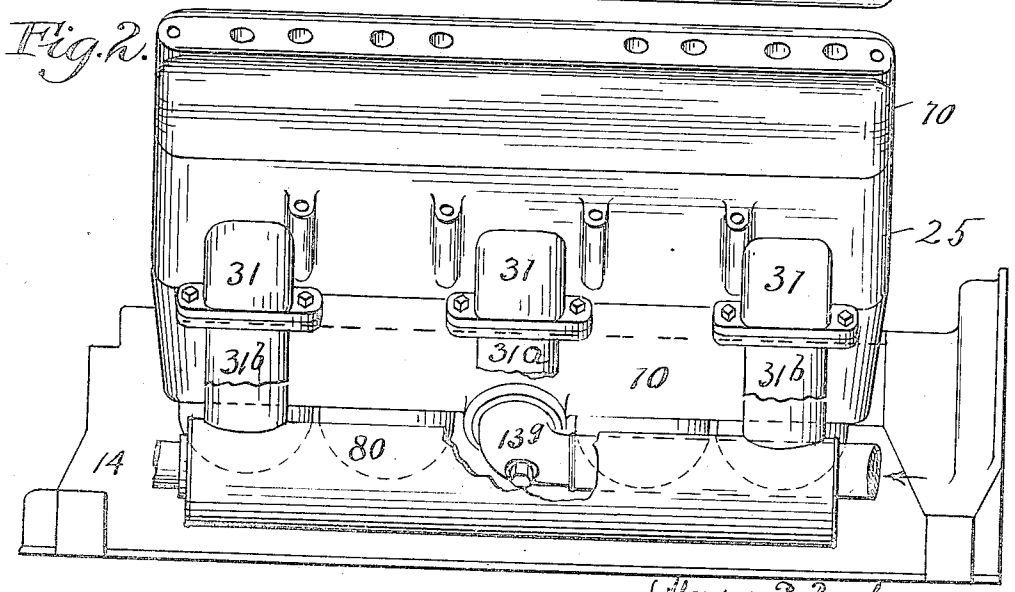


Fig. 2.



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3 SHEETS—SHEET 2.

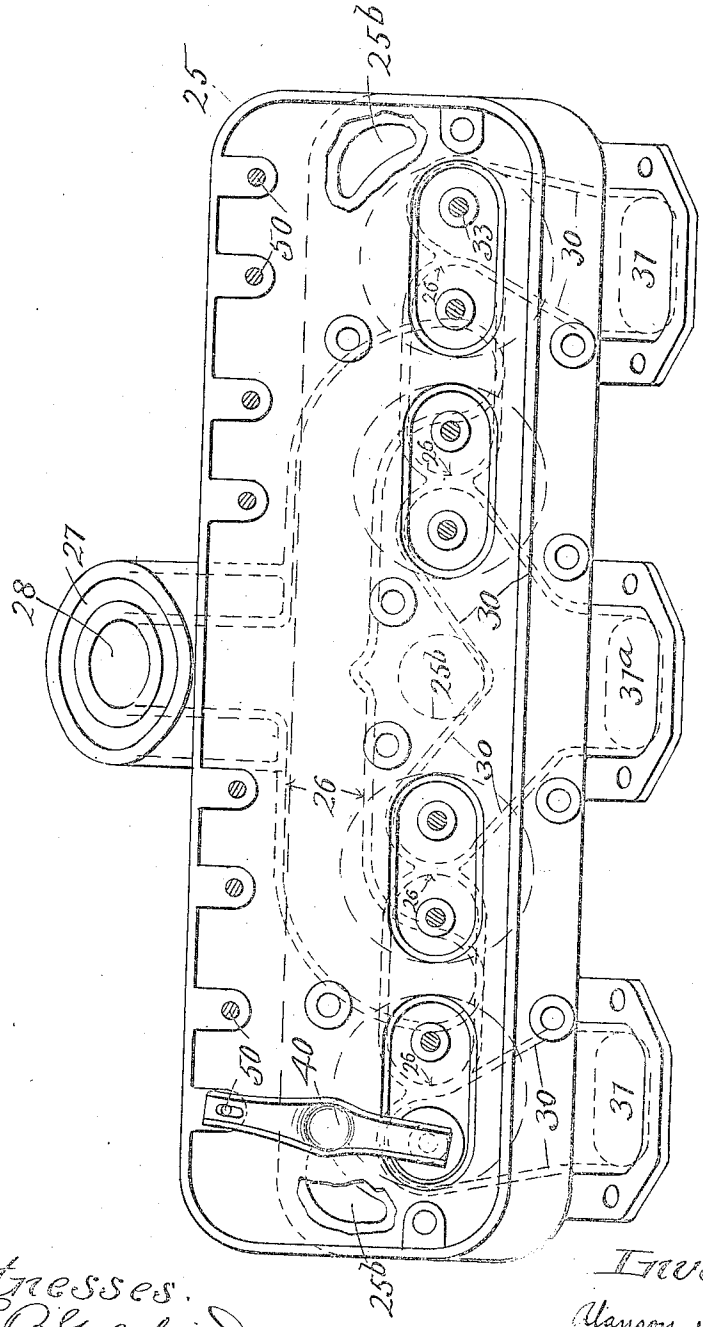

Fig. 3.

Witnesses.
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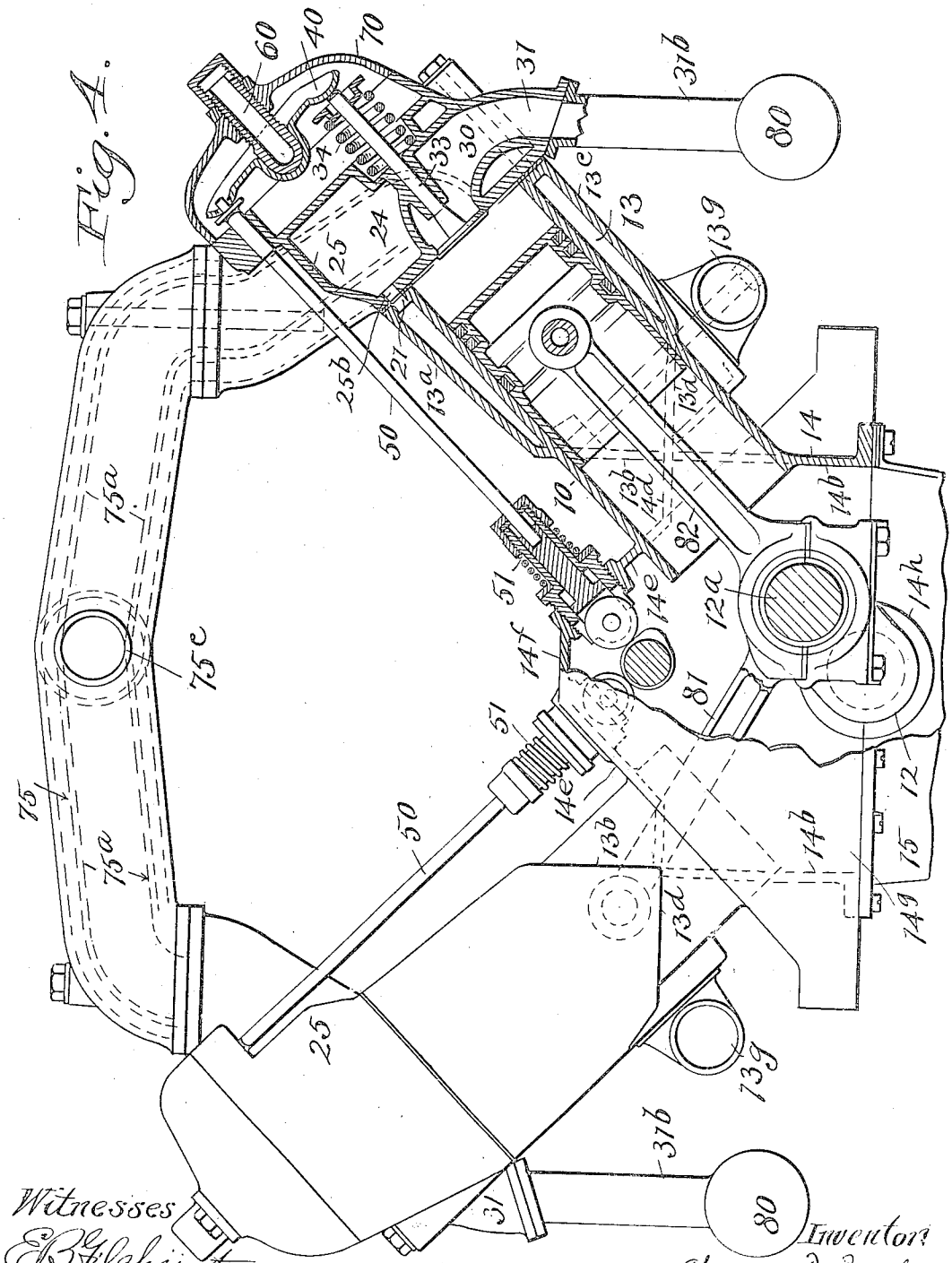
3 SHEETS—SHEET 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE OF THE V-TYPE.

1,353,213. Specification of Letters Patent. Patented Sept. 21, 1920.

Original application filed November 30, 1914, Serial No. 874,607. Divided and this application filed May 15, 1915. Serial No. 28,455.

To all whom it may concern:

Be it known that I, ALANSON P. BRUSH, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented a certain new and useful Improvement in Internal-Combustion Engines of the V-Type, of which the following is a full, clear, and exact description.

This invention relates to internal combustion engines of the V-type. Practically all of the improvements as defined by the claims are not applicable to or useful with V-type engines having only two cylinders whose axes are set at an angle to one another. In fact, the primary purpose of the improvements is to produce a V-type engine having a plurality of cylinders in each row, and particularly adapted for use as the motor for an automobile or aeroplane.

More specifically, the object of the invention is to produce such a multi-cylinder engine of the V-type in a form which is light but strong, and of comparatively small first cost, which shall be highly efficient, and which additionally shall have the parts so arranged that they are conveniently accessible for adjustment and repair.

In the drawings, Figure 1 is a plan view of an eight-cylinder engine with the head plate of one row of cylinders removed; Fig. 2 is a side elevation of the engine with the lower half of the crank case and the crank shaft and some other parts removed; Fig. 3 is a top view of one of the head plates 25; and Fig. 4 is a front elevation of said engine with one-half of the crank case and one of the right hand cylinders shown in section.

The invention is shown in connection with an eight-cylinder engine. Four of these cylinders 10 which are formed without heads, are in one row with their axes lying in the same inclined plane; and the four other cylinders are in another row with their axes in the same inclined plane, which lies at right angles to the first mentioned plane, and intersects it in a line which is coincident with the axis of the crank shaft 12. All of these eight headless cylinders, together with their water jackets 13 and the upper half of the crank case 14 are formed integrally as parts of a single casting.

The upper parts of all of the cylinders are surrounded by water jackets 13, the inner wall of the water jacket for each row (and by inner wall is meant the wall which faces the space between the two rows of cylinders) is formed with its upper part 13^a approximately parallel with the inclined plane which contains the axes of the cylinders in said row; but the lower part 13^b of said inner wall of the water jacket is substantially vertical. The upper part 13^c of the outer wall of the water jacket for each row of cylinders is substantially parallel with the inclined plane which contains the axes of said cylinders, but the lower part 13^d of said outer wall is substantially horizontal and joins the vertical lower wall 13^b referred to between the cylinders. As a result of this, the water jacketed spaces between the cylinders at their lower ends take the form of a right angled V which points directly toward the axis of the crank shaft.

The upper half 14 of the crank case has two vertical side walls 14^b which as shown are downward continuations of the vertical inner water jacket wall 13^b. The top of said upper half of the crank case has two horizontal portions 14^d which are shown as inward continuations of the water jacket wall 13^d; extending from the inner edges of these horizontal portions 14^d of the top wall of said crank case are the inclined walls 14^e, the upper ends of which are joined by the substantially horizontal portion 14^f. The lower ends of the cylinders project slightly into the crank case as shown, and the upper end of said cylinders are open.

The described construction is such that, by the use of suitable cores, the eight headless water jacketed cylinders and the upper half of the crank case may be cast in one piece in a two-part mold.

The crank shaft is mounted in suitable bearings which are carried by the upper half of the crank case. The lower half 15 of the crank case may be made of sheet metal and may be bolted to the upper half. The crank shaft 12 has four crank pins 12^a. Each crank pin is associated with a pair of cylinders, one in each row; that is to say, the connecting rods 81—82 of an associated pair of directly opposed cylinders engages with each crank pin. The cylinders of one row are opposed to the cylinders in the other row in the sense that the axis of any cylinder in one row, and the axis of its corresponding

cylinder in the other row, lie in the same vertical plane which is at right angles to the axis of the crank shaft.

The cylinders as shown are formed without heads, but the upper ends of all the cylinders of each row are subsequently closed by a single head plate 25 bolted thereto. The two head plates 25, as shown, are exactly alike, and they are, therefore, interchangeable by merely turning them end for end. A description of one head plate and its associated parts will therefore answer for both.

Within each head plate are four cored out inlet ports 26, and four cored out exhaust ports 30,—one inlet and one exhaust port for each cylinder; and these ports extend through the lower wall of the head plate in order that they may communicate with said cylinders. All of the ports in the head plate are surrounded by water circulating space 24 into which water flows from the water jacket 13 through the holes 21 and 25^b formed respectively in the upper end of the water jacket and the lower wall of said head plate. Projecting from the inner side of each head plate and preferably in a nearly vertical direction is an extension which is constructed in such wise as to form two concentric tubes 27, 28, the outer of which, 27, communicates with the said water circulating space. The four inlet ports are merged together within the head plate, and they communicate with the inner of these tubes 28.

A combined fuel inlet manifold and water outlet manifold extends between and is connected at its ends to the two projections referred to. This combined manifold consists of two concentric tubes, namely, an inner tube 75^a which communicates with the inner tube 28 of the projection, and an outer tube 75 which connects with the outer tube 27 of the projection. The inner tube of this combined manifold has a rearwardly extended projection 75^c to which may be connected a carbureter for supplying the required explosive mixture. The outer tube 75 of this combined manifold has a forwardly projecting tubular extension 75^d which is to be connected with the radiator (not shown), which is usually associated with internal combustion engines. Those exhaust ports 30 of each head which are associated with the two end cylinders lead respectively to short exhaust tubes 31, which project outward from the outer side of the head and are located equal distances from the ends of said head. The two exhaust ports associated with the two middle cylinders are merged together and communicate with an exhaust tube 31^a which projects outward from the outer side of said head at a point midway between the ends thereof.

An exhaust manifold 80 is provided for each row of cylinders. It is located outside of said row and beneath the overhanging part thereof, and is therefore out of the way, and not in a position where a person seeking to adjust the carbureter or any of the mechanism which may be disposed within the V-shaped space between the two rows of cylinders, is liable to touch it and be burned as a result thereof. Each exhaust manifold is connected with the three exhaust tubes 31—31^a substantially as shown, by the tubes 31^b.

Water is conducted to the water jackets 13 of each row of cylinders through a common inlet pipe 13^g which is located outside of and beneath the overhanging part of the row of cylinders, and connects with the lower end of the associated water jacket through an opening in the outer wall thereof and about midway between the ends of the row.

The valve mechanism shown is generically of familiar form, and is known as the overhead type. Each inlet and exhaust port is provided with an inwardly opening valve for engagement with the valve seat formed at the inner end of said port. Each valve has a stem 33, and is associated with a spring 34 which acts to draw the valve to the closed position. Each valve stem is engaged at its upper end by one end of a rocker 40, whose other end engages with a valve operating rod 50. Each rocker is fulcrumed about midway between its ends, and in the particular construction shown the fulcrums for all these rockers are studs 60 carried by a cap plate 70 which is removably secured to the upper end of the head plate. The lower end of each valve operating rod is adjacent to the upper end of an endwise movable tappet 51 which projects through an inclined part 14^e of the crank case and into engagement with a cam 17^a on the cam shaft 17. The valve mechanism as shown embodies important features of novelty which are not, however, important to the invention which this patent is designed to cover. The novel characteristics of the valve mechanism are made the subject matter of another application Serial No. 29,743 filed May 22, 1915, which, like this application, is a division of my application Serial No. 874,607, filed November 30, 1914.

When the described engine is in operation the cooled water enters the water jackets 13 through the water inlet pipes 77, and flows into the water circulating spaces in the head plates, and thence through the outer tubes 27 and 75 to a suitable radiator or water cooling device. This water will be heated as it passes through the water jackets 13 and will be fairly hot when it passes out of the head plate. The explosive mixtures of air or gasolene spray or vapor will be drawn through the inner tube 75^a which,

as before stated, will be surrounded by hot water and will be heated by that hot water. The explosive mixtures will, therefore, be heated before they enter the inlet ports, and this will materially assist in vaporizing the gasolene and otherwise preparing said mixture for more complete and quick combustion within the cylinders.

Having described my invention, I claim:

1. An internal combustion engine, two rows of water jacketed cylinders, each row containing a plural number of cylinders and having the upper half of the crank case formed integrally with said two rows of water jacketed cylinders,—the water jacket for each row of cylinders having a substantially vertical lower inner end and a substantially horizontal lower outer end.

2. A plural cylinder internal combustion engine of the V-type which has two rows of cylinders and the upper half of the crank case formed as integral parts of the same casting, each row of cylinders having a water jacket, the upper part of which embraces all of the cylinders and which has a substantially vertical lower inner end and a substantially horizontal lower outer end, and the upper part of the crank case having side walls which are substantially vertical and having a top wall which at each side is substantially horizontal, the said horizontal and vertical walls of the crank case being integrally connected with the said horizontal and vertical walls of the water jacket, and said water jacket being also formed integrally with the same casting which includes the cylinders and crank case.

3. In an internal combustion engine of the V-type, the combination of two rows of inclined headless water-jacketed cylinders combined with two removable head plates one for each row of cylinders, each head plate containing cored out inlet passages having a single fuel inlet thereto through the inner edge of said head plate and containing cored out exhaust passages having discharge outlets through the outer edge of said head plate, and containing also cored out water circulating space having a water outlet through the inner edge of said head plate,—there being passageways which connect said water circulating space in each head plate with the water jacket space in the associated row of cylinders, and said single fuel inlet and said single water outlet being separated from each other by a heat conducting partition through which the heat of the outgoing water may be transmitted to the incoming gases.

4. In an internal combustion engine of the V-type, the combination of two rows of inclined headless water-jacketed cylinders, combined with two removable head plates one for each row of cylinders, each head plate containing cored out inlet passages having a single fuel inlet thereto through the inner edge of said head plate and containing cored out exhaust passages having discharge outlets through the outer edge of said head plate, and containing also cored out water circulating space having a water outlet through the inner edge of said head plate,—there being passageways which connect said water circulating space in each head plate with the water jacket space in the associated row of cylinders, two fuel inlet manifold pipes which are respectively connected over the fuel inlets of said two head plates and extend therefrom upward and toward one another, said manifolds being connected adjacent their highest points, two water outlet pipes which are connected over the water outlets of said two head plates and extend therefrom upward and toward one another said two pipes being connected adjacent their highest points, the said water outlet pipes being separated from the two fuel inlet manifold pipes by a single heat conducting partition.

5. In an internal combustion engine of the V-type, the combination of two rows of oppositely inclined headless water jacketed cylinders, and two head plates which are alike and may be substituted one for the other, each head plate containing cored out inlet and exhaust ports and water circulating space surrounding said ports, the said exhaust ports discharging through the outer wall of said head, and said head having on its inner side a projection formed of two concentric tubes of which the inner tube communicates with the inlet ports and the outer tube communicates with the water circulating space within said head.

6. In an internal combustion engine of the V-type, the combination of two rows of oppositely inclined headless water jacketed cylinders, and two head plates which are exactly alike and may be substituted one for the other, each head plate containing cored out inlet and exhaust ports and water circulating space surrounding said ports, the said exhaust ports discharging through the outer wall of said head, and said head having on its inner side a projection formed of two concentric tubes of which the inner tube communicates with the inlet ports and the outer tube communicates with the water circulating space within said head, a fuel intake manifold connected with said inner tube, and a water tube which is connected with the outer of said tubes and surrounds the intake manifold.

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

ALANSON P. BRUSH.

Witnesses:
E. L. THURSTON,
A. J. HUDSON.