No. 898,139. PATENTED SEPT. 8, 1908.

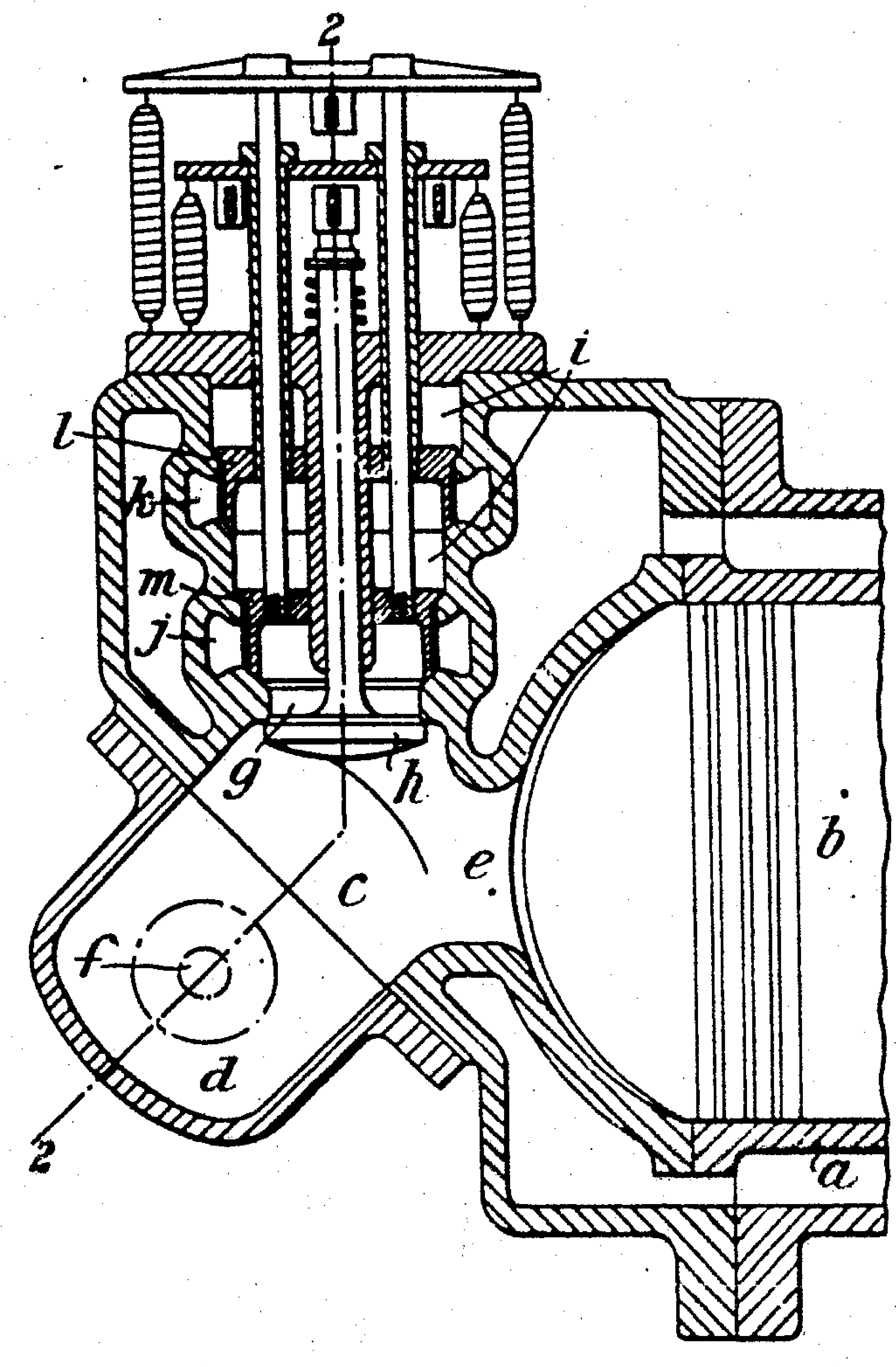
D. ROBERTS.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED NOV. 9, 1907.

6 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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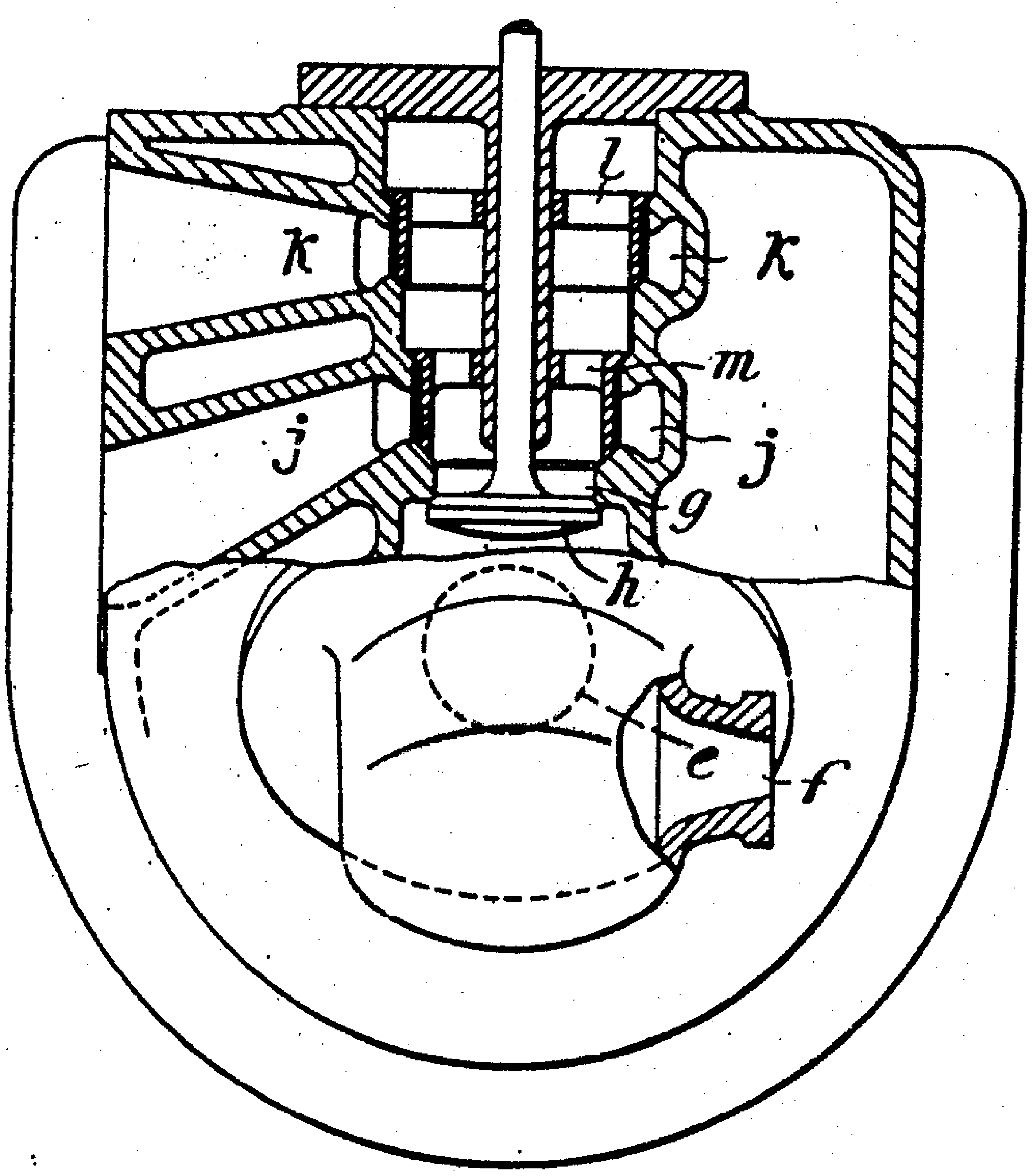
6 SHEETS—SHEET 2.

Fig. 2.



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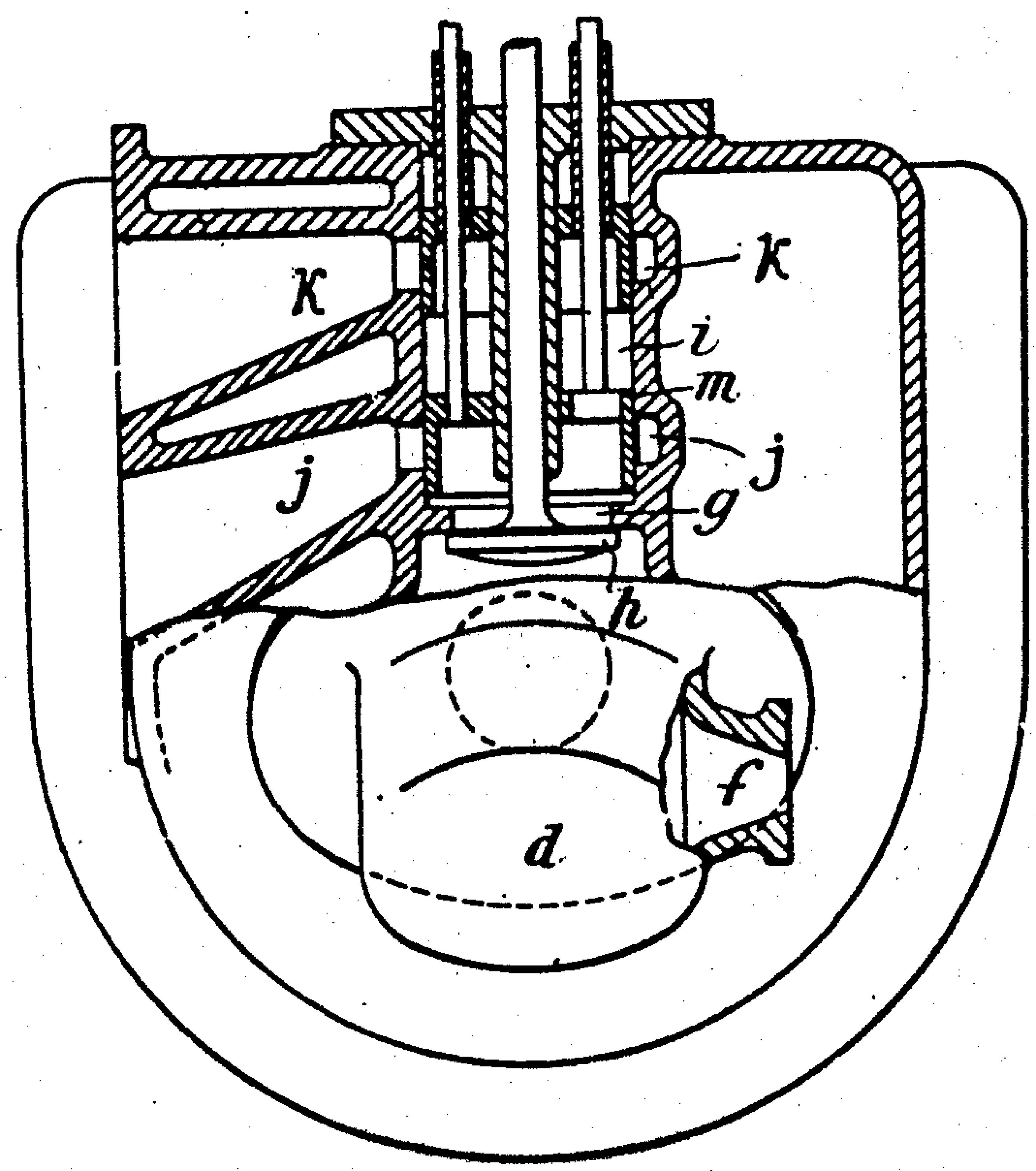
6 SHEETS—SHEET 3.

Fig.3



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6 SHEETS—SHEET 4.

Fig. 4.

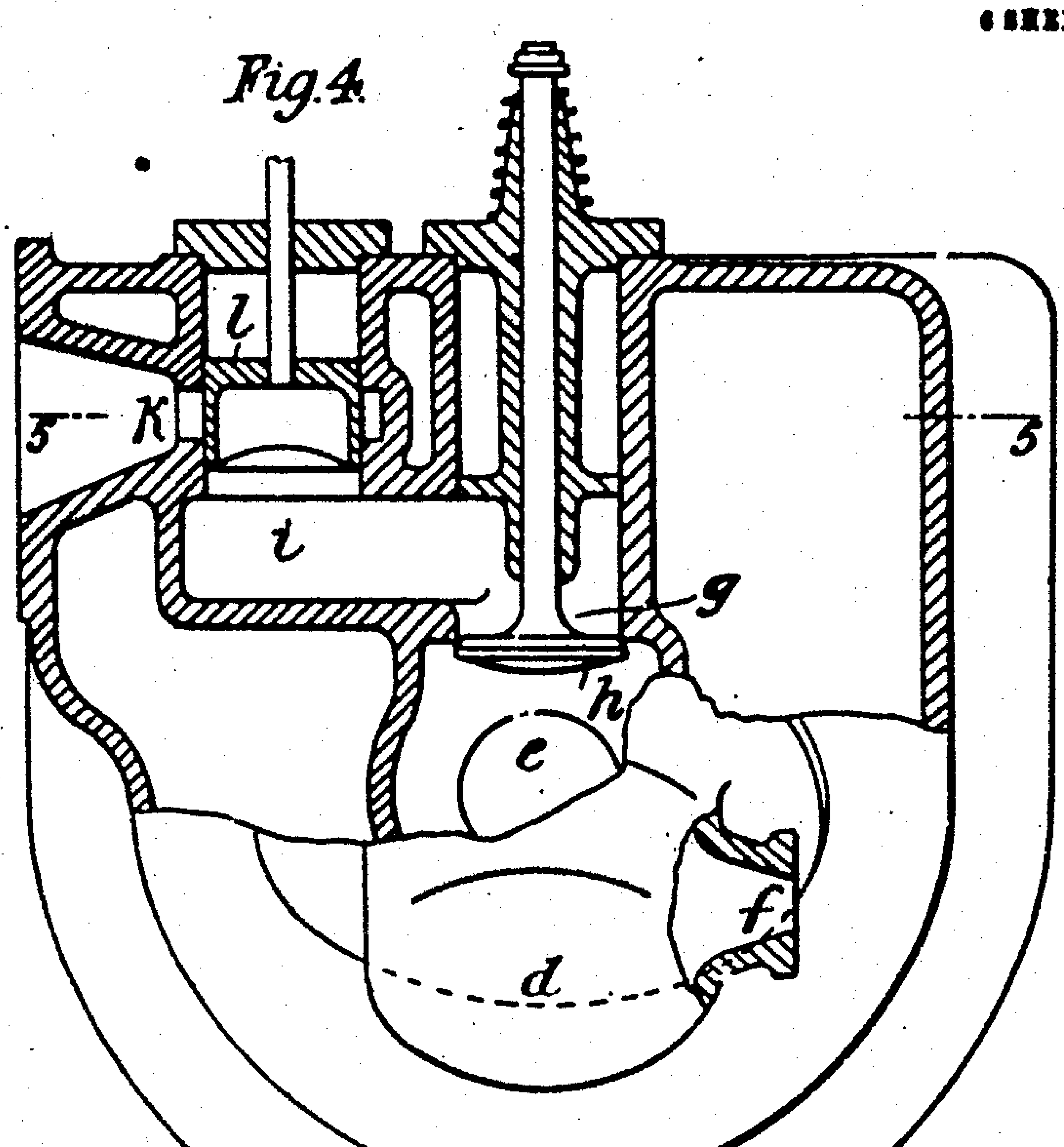
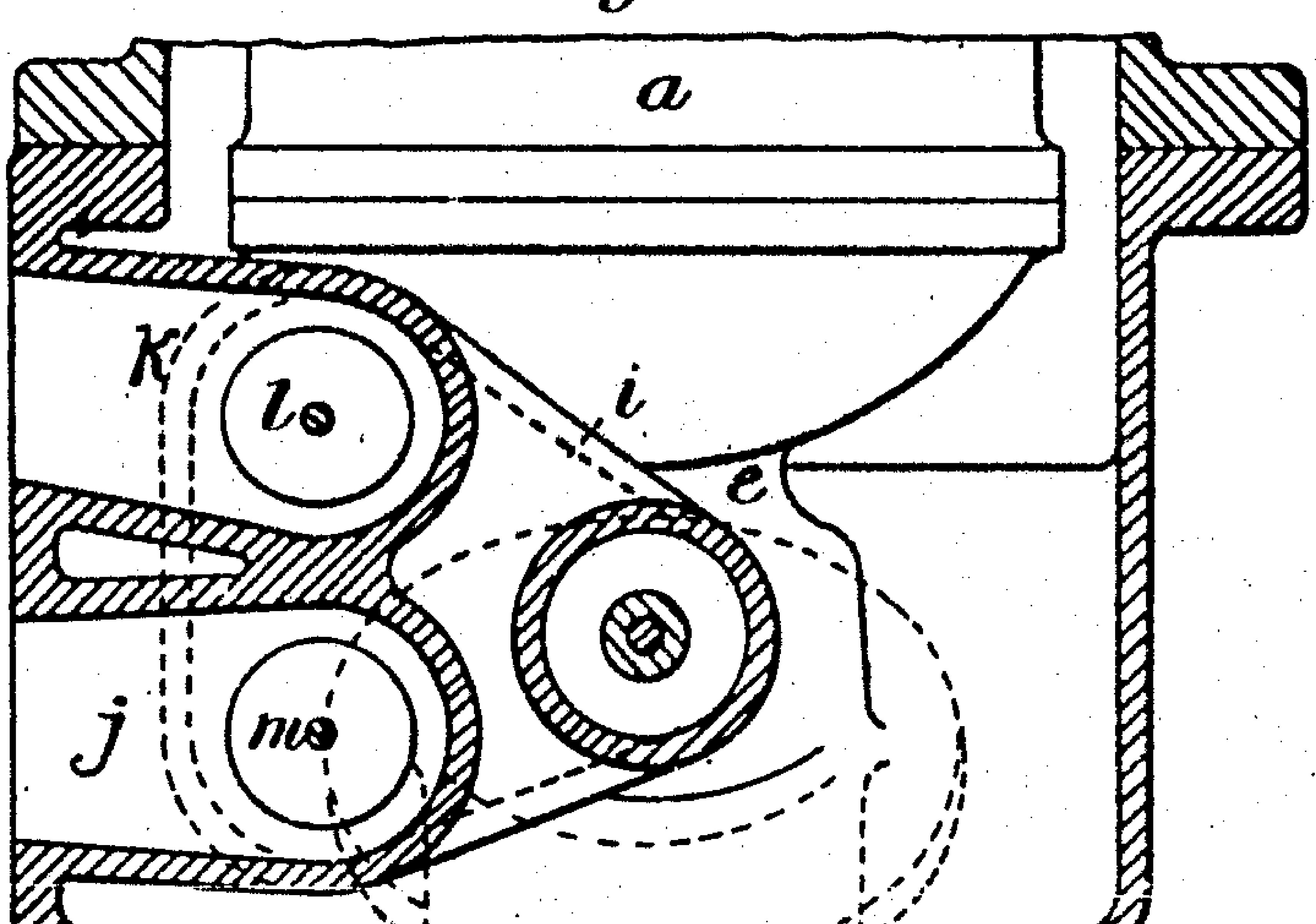


Fig. 5.



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APPLICATION FILED NOV. 9, 1907.

6 SHEETS—SHEET 6.

Fig. 6.

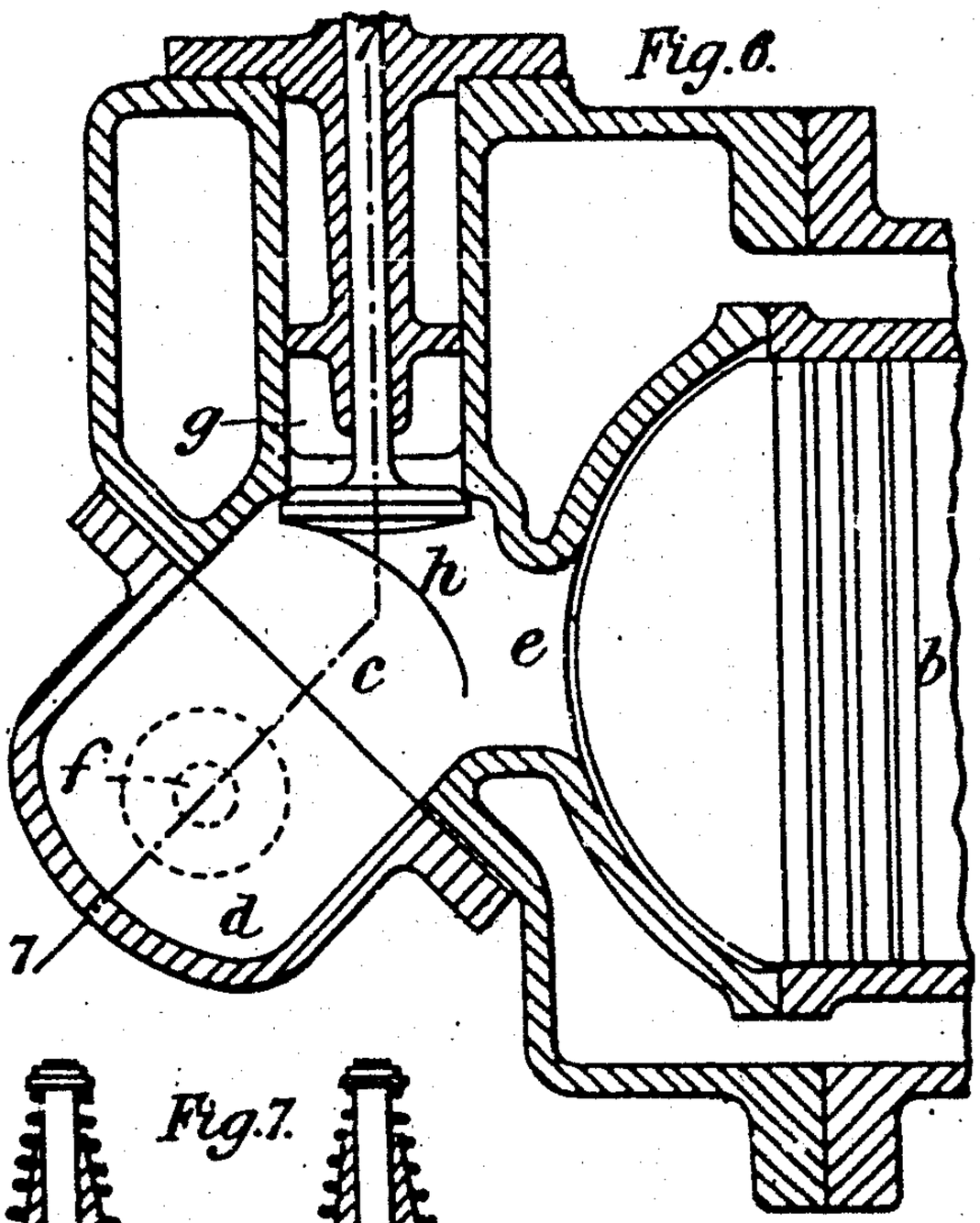
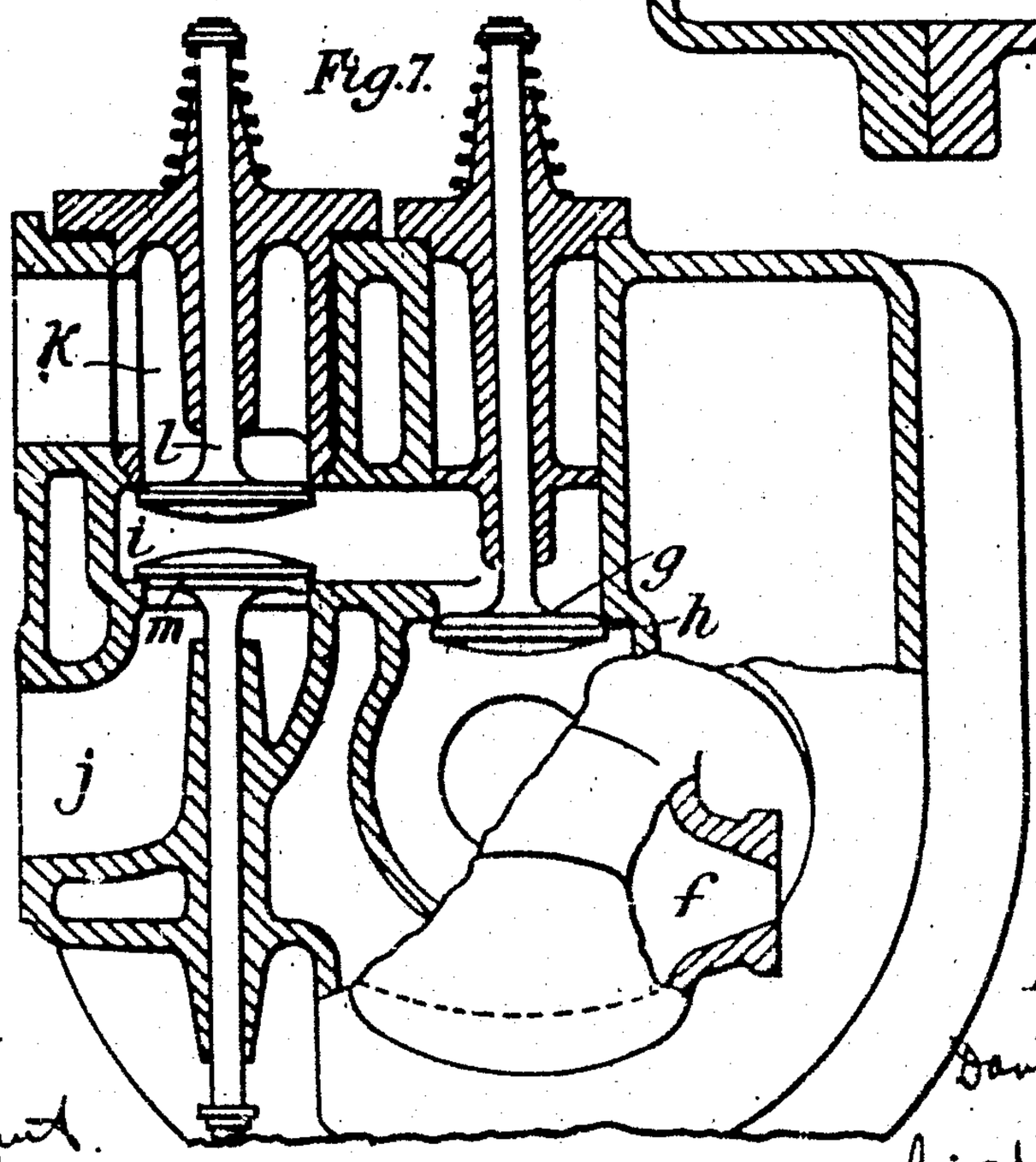


Fig. 7.



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INTERNAL COMBUSTION ENGINE.

APPLICATION FILED NOV. 9, 1907.

6 SHEETS—SHEET 6.

Fig.8.

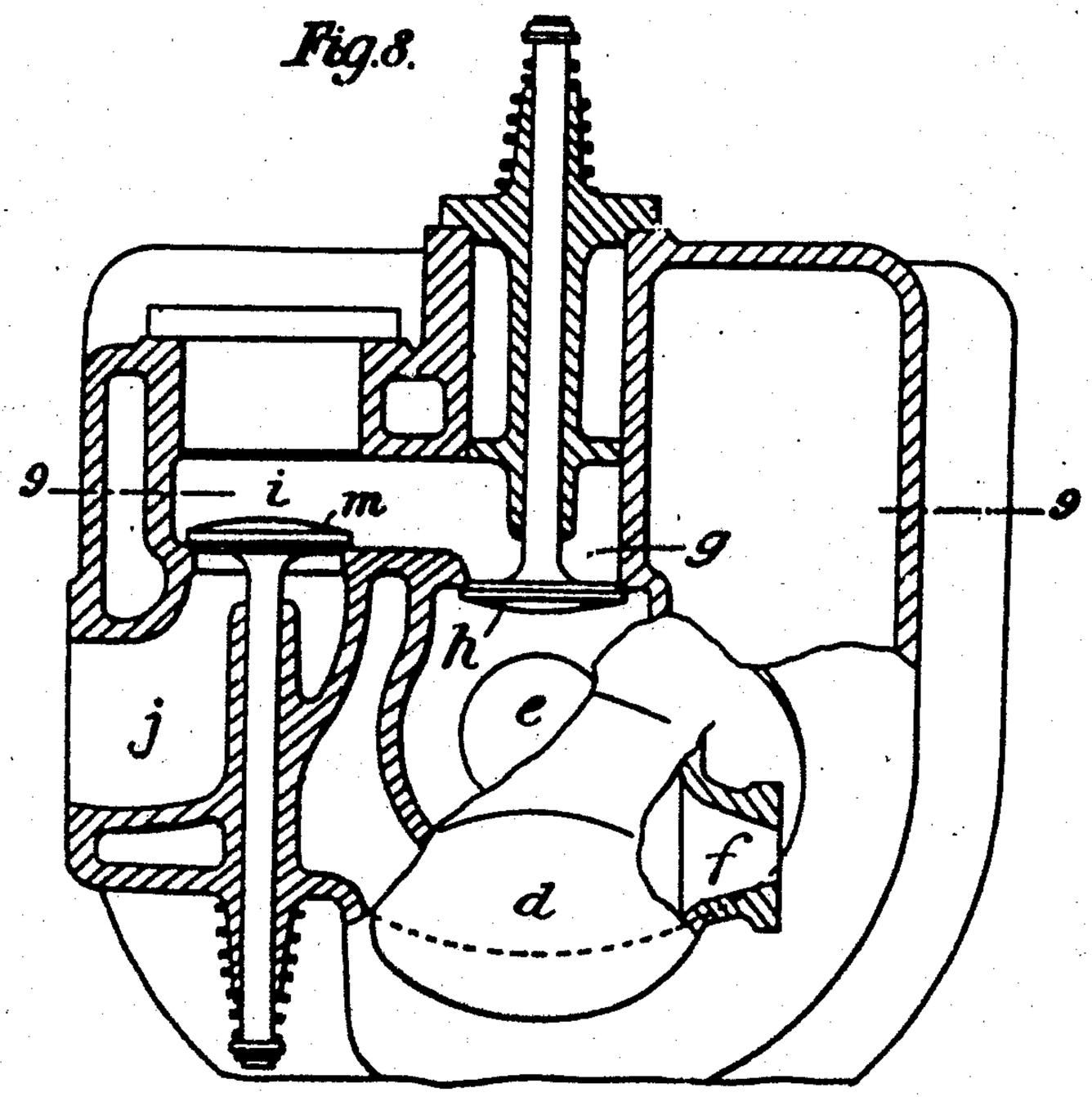
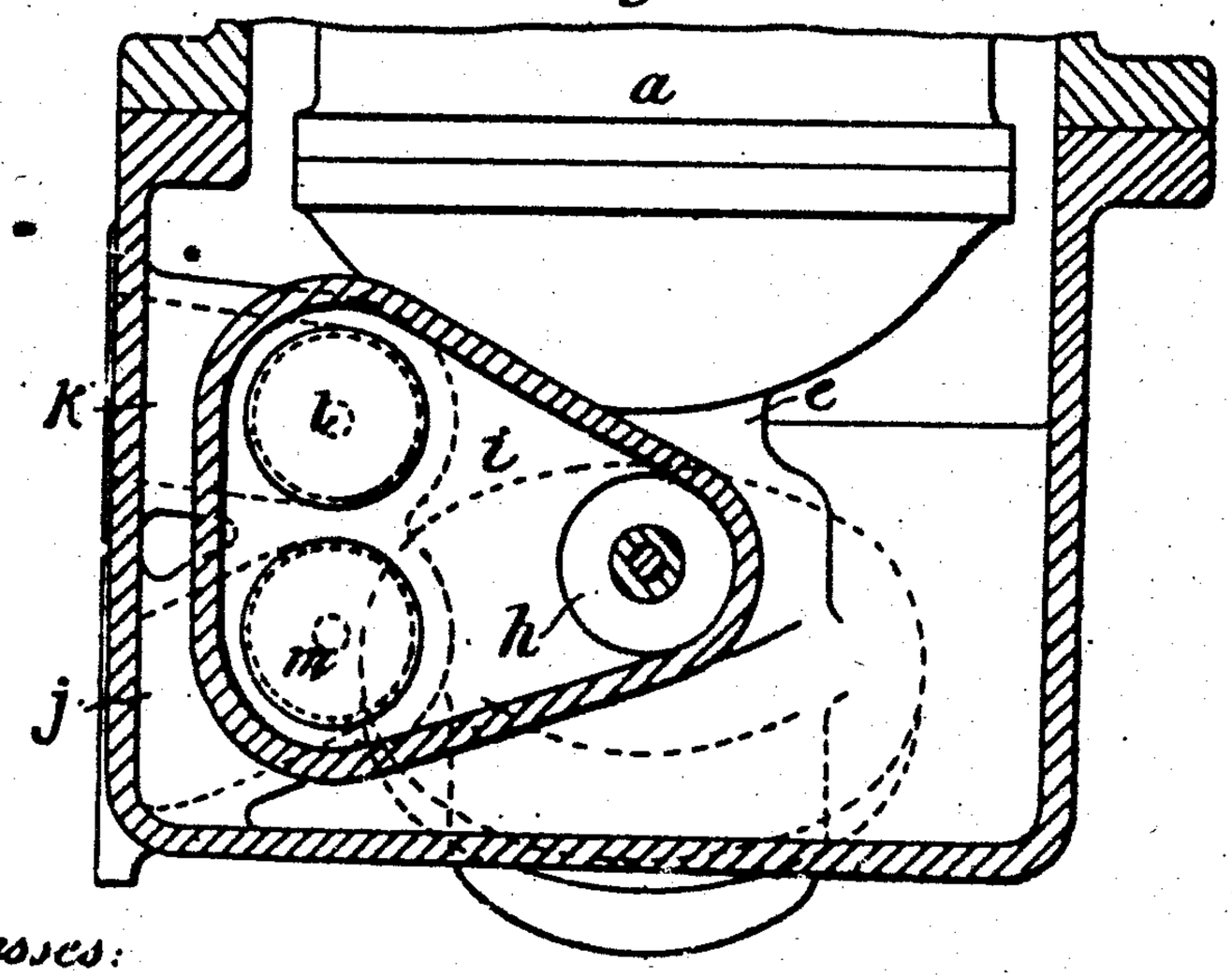


Fig.9.



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UNITED STATES PATENT OFFICE.

DAVID ROBERTS, OF GRANTHAM, ENGLAND.

INTERNAL-COMBUSTION ENGINE.

No. 898,189. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed November 9, 1907. Serial No. 401,457.

To all whom it may concern:

Be it known that I, DAVID ROBERTS, a subject of the King of Great Britain, residing at Spittlegate Iron Works, Grantham, Lincolnshire, England, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines in which hydrocarbon fuel is used and to that type of such engine wherein the vaporizer or combustion chamber is formed as an extension of the cylinder and connected to it by a more or less contracted neck or passage. The vaporizer or combustion chamber of such an engine has, in some cases, been divided into two portions, a hot and a cold or water-jacketed part, and, in other cases, has been wholly jacketed. Also the air inlet and exhaust outlet valves have frequently been arranged in one valve-box with a passage common to the valves opening direct into the cylinder proper, and sometimes the two valves have been arranged in separate valve-boxes, each having its own passage opening direct into the cylinder proper; in some cases also they have been arranged with the air inlet-valve opening direct into the vaporizer or combustion chamber and the exhaust outlet-valve in a separate valve-box with a passage opening direct into the cylinder proper. With all the above arrangements the degree of compression that can be used is limited by the large clearance spaces necessitated by such arrangement and also the power and efficiency obtained from a cylinder of given size have been limited, owing to the amount of inert air contained in the above named clearance spaces and various passages and valve boxes outside the vaporizer or combustion chamber, and the large surface in the port and passages exposed to the hot gases during the combustion stroke.

My invention has for its object to enable engines having vaporizers or combustion chambers of the above named type to develop more power with a cylinder of given size and give greater efficiency than hitherto, by obtaining higher compression and introducing a greater proportion of air into the vaporizer or combustion chamber during the end of the compression stroke, and exposing a minimum of surface to contact with the hot gases during the combustion stroke, by doing away with the usual ports and passages between the vaporizer or combustion chamber and the cylinder and air inlet and exhaust outlet valves.

In carrying out my invention I arrange an opening, preferably on the top, of the cold or water-jacketed part of the vaporizer or combustion chamber, which opening acts alternately as the air-inlet and exhaust-outlet and establishes communication through the vaporizer or combustion chamber with the cylinder, the said opening being controlled by a valve (preferably of the mushroom type) which I call a sealing valve, opening inwardly. The above named opening leads outwardly to a chamber in which are arranged an air inlet-port and an exhaust outlet-port, and the opening and closing of each of these ports is controlled by a separate valve which I call a deflecting valve, and which is operated by any suitable means.

The deflecting valves are advantageously what are known as double-beat drop-valves, or they may be of the piston type, and in either case they are preferably arranged one above the other, the upper being the air deflecting valve and the lower the exhaust deflecting valve. These valves may also be of the mushroom type arranged side by side or one above the other.

In order that my invention may be fully understood I will describe it by reference to the accompanying drawings, in which:—

Figure 1 is a longitudinal sectional elevation of the vaporizer and part of the cylinder of a horizontal engine having my invention applied thereto, the cylinder being provided with double beat drop deflecting valves; Fig. 2 is a sectional end elevation on the line 2—2, Fig. 1. Fig. 3 is a view similar to Fig. 1 showing an arrangement wherein the deflecting valves are of the piston type and arranged one above the other. Fig. 4 is a similar view to Fig. 3 showing piston type deflecting valves arranged side by side. Fig. 5 is a section on line 5—5, Fig. 4. Fig. 6 is a longitudinal sectional elevation of the vaporizer and part of the cylinder and illustrating an arrangement of deflecting valves of the mushroom type placed one above the other; Fig. 7 is a section on the line 7—7, Fig. 6. Fig. 8 is a part sectional end elevation of a vaporizer and cylinder having deflecting valves of the mushroom type arranged side by side, and Fig. 9 is a part section thereon on the line 9—9, Fig. 8.

a is the engine cylinder, *b* is the piston and

c and *d* are the water-jacketed and hot parts of the vaporizer respectively.

e is the contracted passage by which the water-jacketed part *c* of the vaporizer is connected to the cylinder *a* and *f* is the oil-inlet.

g is the opening in the part *c* of the vaporizer which opening acts alternately as the air inlet and the exhaust outlet; *h* is the sealing valve opening inwardly and controlling the opening *g*.

i is the chamber in which are arranged the air inlets *k* and the exhaust outlets *j*.

l is the air deflecting valve, and *m* is the exhaust deflecting valve, the said valves being of any of the types and arranged as illustrated in the accompanying drawings.

In engines working on the Otto or four-stroke cycle the valves perform the following functions. The main sealing valve *h* closes the opening *g* in the side of the water-jacketed part *c* of the vaporizer thereby forming a seal during the combustion stroke; this valve also controls the time of completion of the air inlet or induction stroke and the time of commencement of the exhaust or outlet stroke. The air deflecting valve *l* controls the time of commencement of the air inlet or induction stroke and the exhaust deflecting valve *m* controls the time of completion of the exhaust or outlet stroke. With this arrangement of valves the air and exhaust deflecting valves have practically no pressure to resist, and the exhaust valve, if of the double-beat drop type or piston type, is so arranged that as it opens it enters into a chamber above it and immediately beneath the air valve, and thus is practically shielded from the action of the issuing exhaust gases; the maximum pressure due to the explosion or combustion stroke is resisted by the main sealing valve, and, owing to the main sealing valve opening directly into the vaporizer or combustion chamber, the clearance spaces are reduced to a minimum, thereby minimizing the amount of heat lost by conduction to the water jacket and by radiation with the result that increased power and efficiency are obtained.

The main sealing valve *h* and the air and exhaust deflecting valves *l* and *m* may be operated by any of the well-known means so as to give the proper sequence of operations and although my invention is shown applied to a horizontal type of engine, it will be obvious that it may equally well be applied to other types of engines.

Having now fully described and ascertained my said invention and the manner in which it is to be performed, I declare that what I claim is:—

1. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber exterior to but directly communicating with the cylinder, and having a portion of its wall not provided with a water jacket, and other portions provided with a water jacket, said chamber having an aperture on the water jacketed side, communicating with the air inlet and exhaust passages and valves controlling said passages, whereby said aperture serves as the air inlet and the exhaust outlet, substantially as described.

2. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber exterior to but directly communicating with the cylinder, and having a portion of its wall not provided with a water jacket, and other portions provided with a water jacket, said chamber having an aperture on the water jacketed side, communicating with the air inlet and exhaust passages, whereby said aperture serves as the air inlet and the exhaust outlet, and a sealing valve for controlling said aperture, substantially as described.

3. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber exterior to but directly communicating with the cylinder, and having a portion of its wall not provided with a water jacket, and other portions provided with a water jacket, said chamber having an aperture on the water jacketed side, communicating with the air inlet and exhaust passages, valves for controlling said air inlet and exhaust passages, and an independent sealing valve controlling said aperture, substantially as described.

4. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber communicating with the cylinder, and provided with a fuel inlet, and an aperture separate from the fuel inlet, air inlet and exhaust passages connected with said aperture, separate controlling valves for said air inlet and exhaust passages and an independent sealing valve for said aperture, substantially as described.

5. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber communicating with the cylinder, and provided with a fuel inlet, and an aperture separate from the fuel inlet, air inlet and exhaust passages connected with said aperture, separate controlling valves for said air inlet and exhaust passages and an independent sealing valve for said aperture, all of said valves being concentrically arranged, substantially as described.

6. In an internal combustion engine, the combination with the cylinder and piston, of a vaporizing chamber communicating with the cylinder and provided with a fuel inlet and an aperture separate from said fuel inlet a passage communicating with said aperture, air inlet and exhaust passages communicating with said passage, valves in said passage, controlling said air inlet and exhaust passages, and a sealing valve controlling said

aperture, all of said valves being concentrically arranged, substantially as described.

7. In an internal combustion engine, the combination with a cylinder and piston, of a vaporising chamber communicating with the cylinder and provided with a fuel inlet and an aperture separate from said fuel inlet, a passage communicating with said aperture and having separate annular passages communicating therewith and forming parts of the air inlet and exhaust passages, valves working in said passage for closing said annular passages, a sealing valve controlling said aperture and separate actuating means for each of said valves, substantially as described.

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Witnesses:
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