E. & F. W. HEYMANN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 21, 1911.

1,125,530.

Patented Jan. 19, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

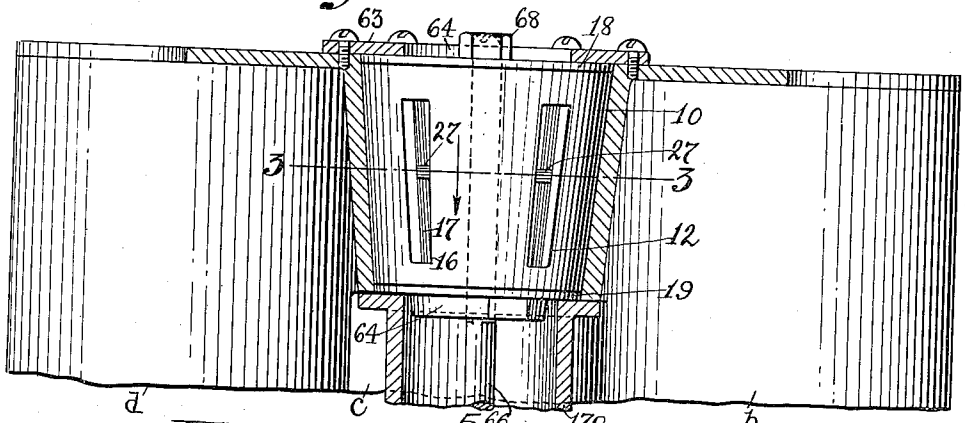


Fig. 2.

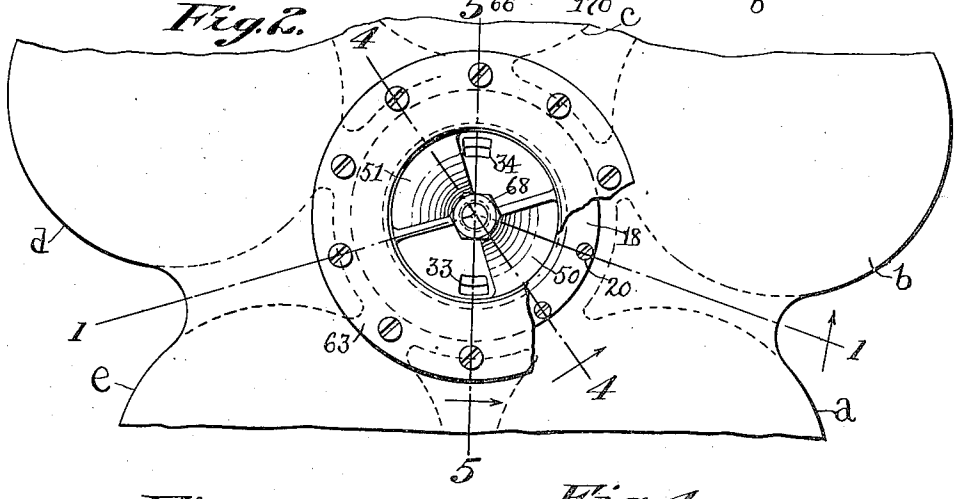


Fig. 3.

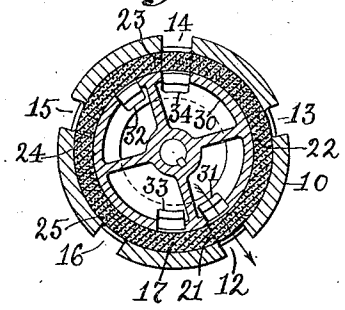
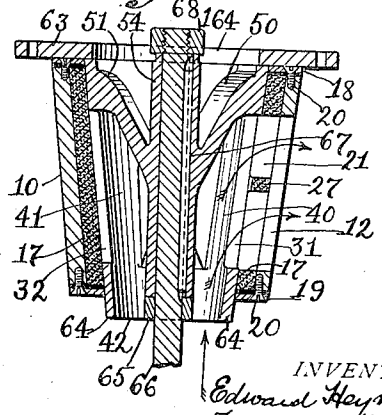


Fig. 4.



WITNESSES:

M. E. Crozier,

J. Murphy.

INVENTORS.

Edward Heymann

Frank W. Heymann

BY Jas. H. Churchill

ATTORNEY.

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2 SHEETS—SHEET 2.

Fig. 5.

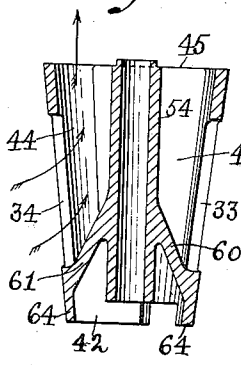


Fig. 5a.

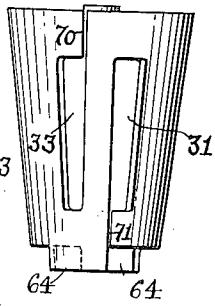


Fig. 6.

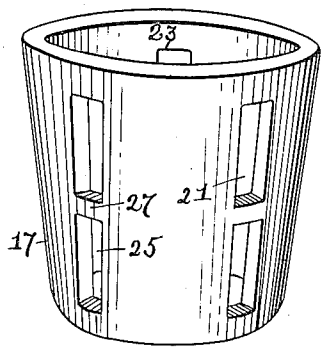


Fig. 7.

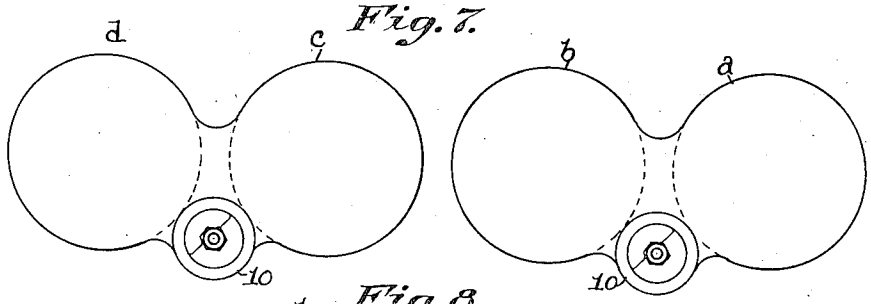


Fig. 8.

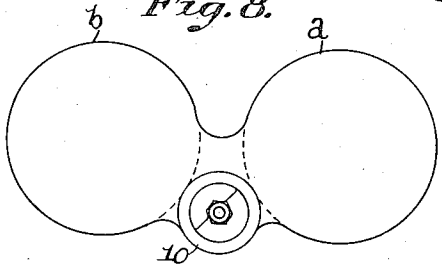
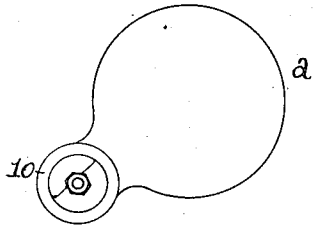


Fig. 9.



WITNESSES:

M. G. Crozier.

J. Murphy

INVENTORS.

Edward Heymann

Frank W. Heymann

BY

Jas. H. Churchill

ATTORNEY.

UNITED STATES PATENT OFFICE.

EDWARD HEYMANN AND FRANK W. HEYMANN, OF BOSTON, MASSACHUSETTS.

INTERNAL-COMBUSTION ENGINE.

1,125,530. Specification of Letters Patent. Patented Jan. 19, 1915.

Application filed December 21, 1911. Serial No. 667,193.

To all whom it may concern:

Be it known that we, EDWARD HEYMANN and FRANK W. HEYMANN, citizens of the United States, and both residing in Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to an internal combustion engine and more particularly to a valve therefor, which is self-lubricating and capable of withstanding the heat of the hot gases discharged from the cylinder, without danger of being burnt out or leaking after long continued use.

The invention is herein shown as embodied in a rotary valve comprising a casing and a hollow valve having inlet and exhaust ports, one of said parts or members being provided with heat-resisting antifriction material to lubricate said parts and insure a tight joint between the valve and its seat, notwithstanding the high heat to which the said parts are exposed. The heat-resisting antifriction material may and preferably will be graphite, and it is preferred to employ the graphite as an inner lining for the valve casing or shell, whereby it forms a seat for the valve proper. These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is an elevation and vertical section taken on the line 1—1, Fig. 2, of a sufficient portion of an internal combustion engine embodying this invention to enable it to be understood. Fig. 2, a plan of the engine shown in Fig. 1. Fig. 3, a cross section of the valve taken on the line 3—3, Fig. 1. Fig. 4, a vertical section of the valve, taken on the line 4—4, Fig. 2. Fig. 5, a vertical section of the valve proper. Fig. 5ª, an elevation of the valve proper. Fig. 6, an elevation of the heat-resisting, antifriction lining shown in Figs. 3 and 4, and Figs. 7, 8 and 9, diagrammatic views to be referred to.

In Figs. 1 and 2, the invention is shown as embodied in an internal combustion engine comprising five cylinders *a*, *b*, *c*, *d* and *e*. Each of the cylinders referred to, is provided with the usual piston (not shown) and with a single port (not shown) for the admission of the fresh gas and the exhaust of the ignited gases. The admission of fresh gas and the exhaust of the ignited gases from the cylinders is controlled by a rotary valve, which is self-lubricating and capable of resisting the heat of the burnt gases, and of remaining tight for a substantially long time.

In the present instance, we have shown one construction of rotary valve with which we have obtained excellent results. The valve referred to comprises a stationary member and a rotatable member, the stationary member being shown as a metal casing 10 tapering in form and provided with five longitudinally extended slots 12, 13, 14, 15 and 16 (see Fig. 3), which register with the single inlet and exhaust port of the cylinders *a*, *b*, *c*, *d* and *e*. In the embodiment of the invention herein shown, the casing 10 contains within it a heat-resisting and lubricating member 17, which is preferably of substantially pure graphite and made in the form of a lining for the casing and which is secured in fixed relation thereto by clamping rings 18, 19, secured as by screws 20 or otherwise to the top and bottom of the metal casing 10.

The heat-resisting lubricating member 17 is provided with ports 21, 22, 23, 24, 25, which register with the ports 12, 13, 14, 15 and 16. The side walls of each port in the member 17 may be connected by a cross bar 27, which is integral with said member. The lining 17 of graphite or other heat-resisting, lubricating material, constitutes a seat for the valve member, which is herein shown as a rotary valve tapering in form to fit the lining 17.

The valve member herein shown consists of a tapering metal body portion or shell 30 open at its opposite ends and provided with longitudinally extended ports in its body portion, said ports being herein shown as four in number and marked 31, 32, 33, 34 in Fig. 3. Two of the ports as 31, 32, communicate with an open end of the body portion 30 and form gas inlet ports, and the other two ports 33, 34, communicate with the other open end of said body portion and form gas outlet ports. The gas inlet ports 31, 32, communicate with gas inlet chambers or passages 40, 41, within the body portion 30, and in open communication with the gas inlet mouth 42 of the body portion, and the gas outlet ports 33, 34, communicate with chambers 43, 44, which are in open communication with the gas outlet mouth 45 of the

body portion of the valve. The chambers 40, 41 are cut off from the gas outlet mouth 45 by inclined or curved walls 50, 51, which extend downwardly and are connected with a central hub 54, and the chambers 43, 44, are cut off from the inlet mouth 42 by upwardly inclined walls 60, 61, (see Fig. 5), which extend to the hub 54.

The body portion 30 of the valve is made tapering to fit the antifriction seat 17 and may be restrained against upward movement by a top plate 63, which has an opening or port 64, which registers with the outlet port or mouth 45 of the body portion of the valve. The lower portion of the valve body may be provided with projecting lugs or ears 64, which are separated for the passage between them of a cross bar or piece 65 fast on the shaft or stem 66 on which the valve is mounted, said valve being rendered fast on said stem to rotate therewith by a key 67 and secured against longitudinal movement on said stem by the cross bar 65 and a nut 68 on the upper end of said stem.

The valve stem 66 may be rotated by any suitable mechanism (not shown), as it forms no part of the present invention.

In the operation of a four cycle engine or motor, the explosive medium commonly referred to as the fresh gas, is drawn from the carbureter or other suitable source of supply (not shown), through the gas inlet pipe 170 (see Fig. 1), and the inlet port or mouth 42 into the chambers 40, 41, and passes from said chambers through the port 31 or 32 according to which one registers with one of the ports in the valve casing 10. At the beginning of and during the suction stroke of the piston of the motor or engine, the valve is rotated so as to open the port of the casing 10 connected with the cylinder whose piston is making its suction stroke, and at or about the time the piston has completed its suction stroke, the valve has been rotated sufficiently to close the said port, which remains closed during the compression and explosion strokes and is opened on the exhaust stroke by either the port 33 or 34, which uncovers the port in the casing 10 and connects the cylinder whose piston is making its exhaust stroke, with one of the exhaust chambers 43, 44, of the valve body, from which the exhaust gases may pass through the outlet mouth 45 and port 164 in the top plate 63 directly into the atmosphere or through a muffler as now commonly practised.

In the present instance, the valve body is shown in Figs. 1 to 5 as provided with two inlet ports arranged diametrically opposite and two outlet ports arranged likewise, with an inlet port and an outlet port on opposite sides of the center of the body portion located in close proximity to each other, as shown in Figs. 3 and 5a, but it is not desired to limit the invention to the particular number and arrangement of ports herein shown, as the number will be varied to suit the number of cylinders in the motor or engine, for the invention is capable of being embodied in an engine or motor having one cylinder as shown in Fig. 9, two cylinders as shown in Fig. 8, or four cylinders arranged in pairs as shown in Fig. 7, or any other desired number of cylinders.

From the above description, it will be seen that the danger of the valve becoming leaky or otherwise defective or inoperative by reason of the high heat of the exploded or exhaust gases, is reduced to a minimum, inasmuch as the seat with which the valve contacts is heat-resisting and self-lubricating and therefore practically indestructible under conditions of use, and in actual practice an internal combustion engine equipped with a rotary valve, such as herein shown, and having a seat of graphite containing less than one per cent. of ash and free from other substances has been run approximately 40,000 miles without showing any signs of wear and without leaking.

While it is preferred to make the seat or lining of such size and area as will contact with substantially the whole of the valve, it is not desired to limit the invention in this respect. So also, it is preferred to secure the lining of heat-resisting, lubricating material to the valve shell or casing, but it is not desired to limit the invention in this respect, as it is evident that it could be attached to the valve proper to move therewith.

The invention is herein shown as embodied in a rotary valve, but it is not desired to limit the invention in this respect, as it could be embodied in other forms of valves with beneficial results.

From the above description, it will be observed, that a plurality of cylinders are controlled by a single valve, which serves to simplify the working parts and reduce the cost of the engine.

Believing ourselves to be the first to provide a valve with means, such as substantially pure graphite or carbon which is heat-resisting and self-lubricating, so as to enable the valve to withstand the high heats of the exhaust gases of an internal combustion engine or motor, it is not desired to limit the invention to the particular construction or form of valve herein shown as embodying the invention.

To avoid any possible distortion of the valve due to uneven contraction and expansion, the valve body 30 may be split longitudinally as at 70, 71, (Fig. 5a), and thus form a split tapered valve which is capable of expanding and contracting without changing the circular form of the valve.

In the present instance, the heat-resisting,

lubricating member is shown as a continuous one-piece tapering member, but it is not desired to limit the invention in this respect, as the member may be made of a plurality of pieces suitably arranged to obtain the results desired.

Claims.

1. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling the admission of explosive medium into said cylinder and the exhaust therefrom of the waste gases, comprising a circular valve casing, a rotary valve movable within said casing, and a heat-resisting, lubricating member interposed between said casing and said rotary valve and consisting of substantially pure graphite, substantially as described.

2. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling the exhaust from said cylinder of the hot gases generated therein, and provided with heat-resisting, lubricating means free from combustible substances and having heat-resisting and lubricating properties for resisting the action of the hot gases as they pass out of said cylinder and for automatically lubricating the valve whereby the said valve may be used for a maximum length of time without extraneous lubrication, substantially as described.

3. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling the exhaust from said cylinder of the hot gases generated therein, and provided with a heat-resisting, lubricating seat consisting of substantially pure graphite, substantially as described.

4. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling the exhaust from said cylinder of the hot gases generated therein, and provided with a substantially pure graphite member to resist the action of the hot gases as they pass out of said cylinder and to lubricate the valve, substantially as described.

5. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling the exhaust thereof and comprising a rotatable member and a seat member, one of said parts consisting of substantially pure graphite having heat-resisting and lubricating properties.

6. The combination with the cylinder of an internal combustion engine, of a rotary valve controlling a gas port in said cylinder and comprising a rotatable member and a seat member, one of said parts consisting of substantially pure graphite having heat-resisting and lubricating properties.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses.

EDWARD HEYMANN.
FRANK W. HEYMANN.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.