(No Model.) 2 Sheets—Sheet 1.

G. MURRAY.

PISTON AND CUT-OFF VALVE FOR STEAM ENGINES.

No. 546,594. Patented Sept. 17, 1895.

Fig. 1

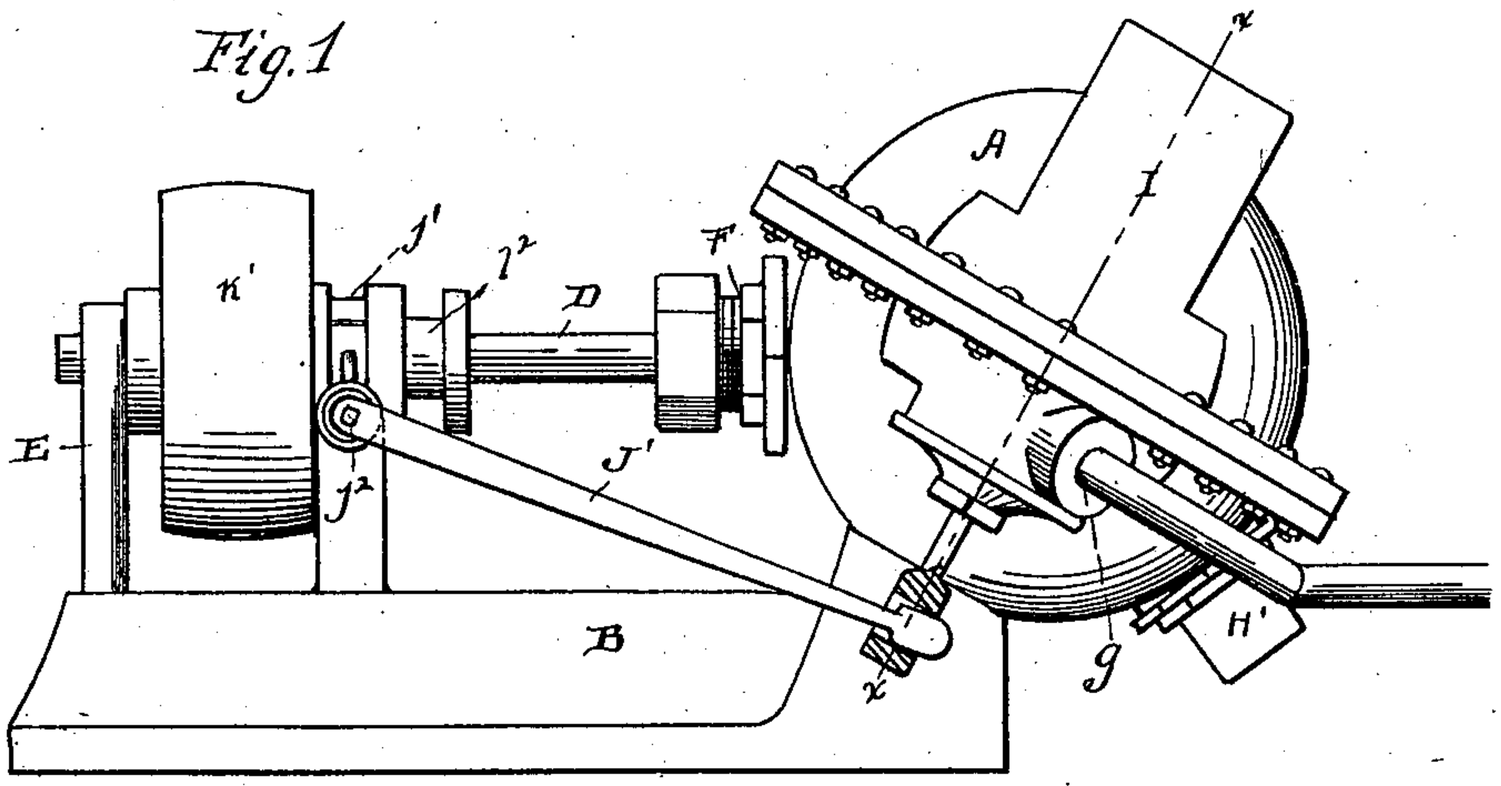


Fig. 2.

Fig. 7.

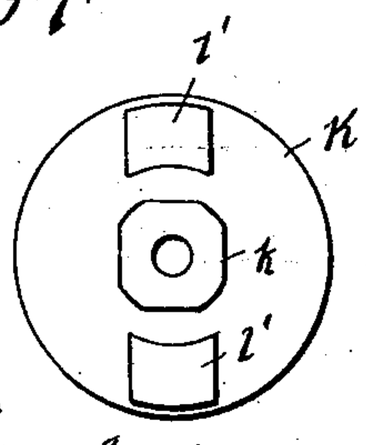
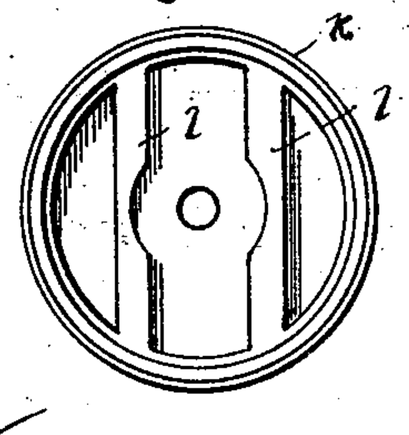


Fig. 8.



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(No Model.) 2 Sheets—Sheet 2.

G. MURRAY.

PISTON AND CUT-OFF VALVE FOR STEAM ENGINES.

No. 546,594. Patented Sept. 17, 1895.

Fig. 3.

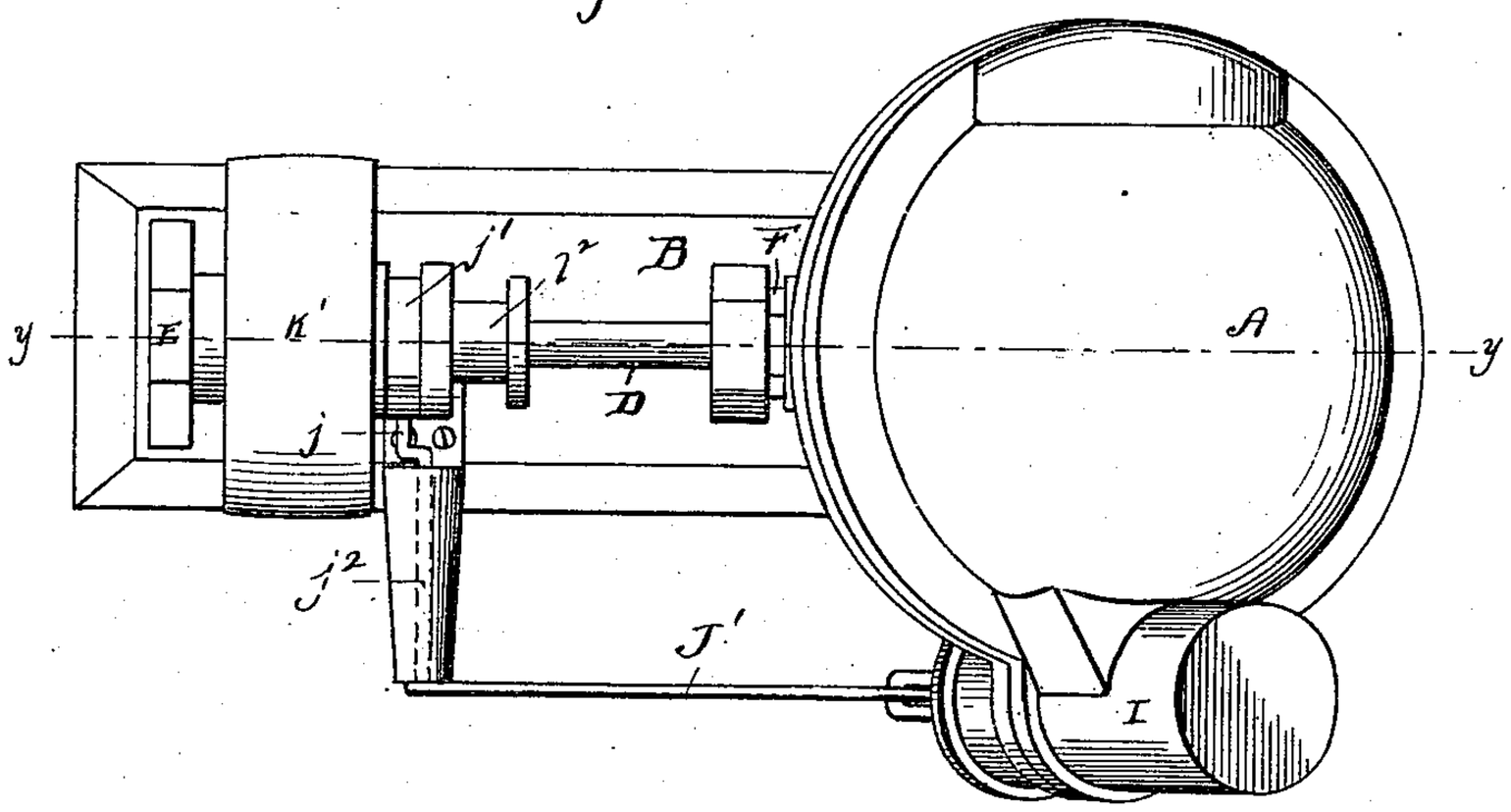


Fig. 4.

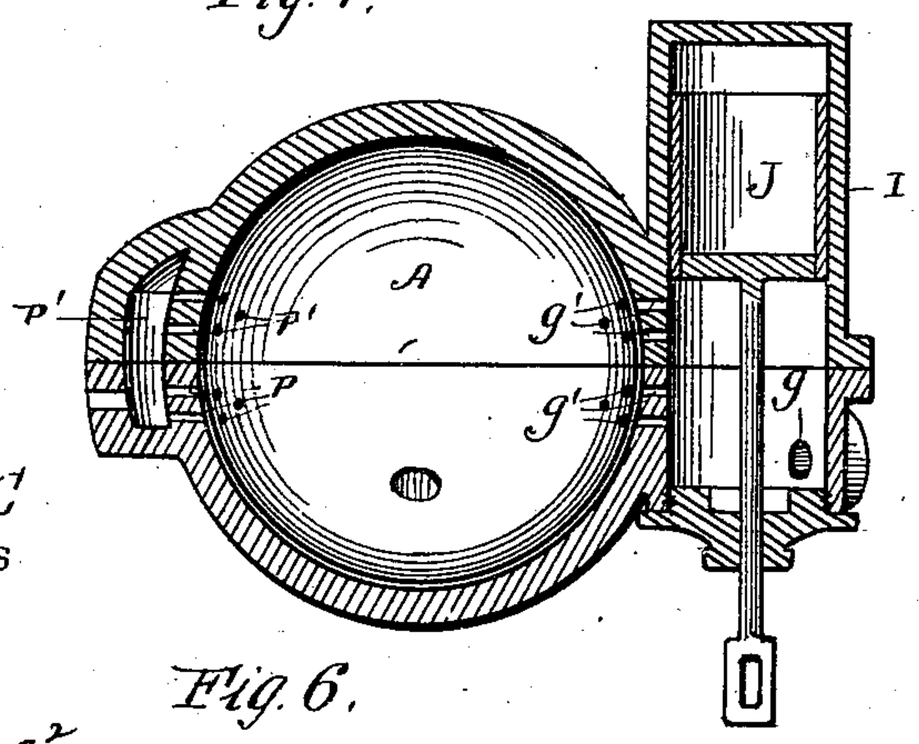


Fig. 5.

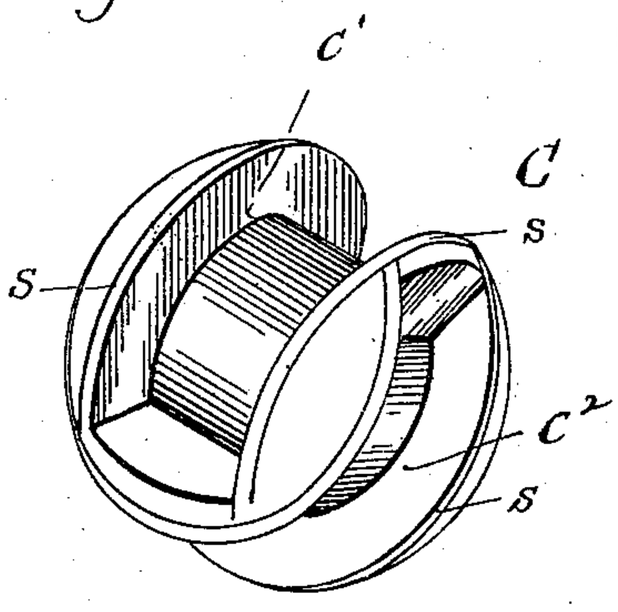
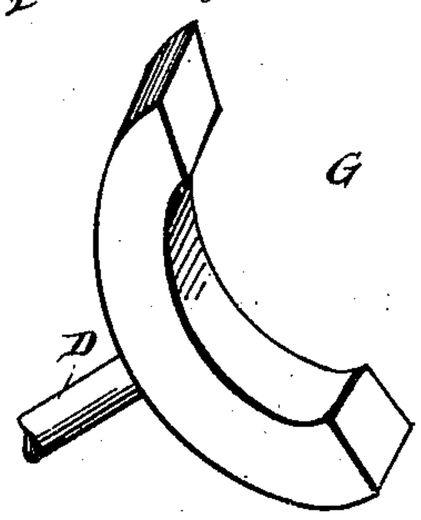


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE MURRAY, OF CAMBRIDGE, MASSACHUSETTS.

PISTON AND CUT-OFF VALVE FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 546,594, dated September 17, 1895.

Application filed December 27, 1894. Serial No. 533,098. (No model.)

To all whom it may concern:

Be it known that I, GEORGE MURRAY, a citizen of the United States, and a resident of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Pistons and Cut-Off Valves for Steam-Engines; and I do 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Figure 1 is a side elevation of the invention. Fig. 2 is a section on line *y y*, Fig. 3. Fig. 3 is a plan view of invention. Fig. 4 is a cross-section on line *x x*, Fig. 1, with rotary piston, &c., removed. Fig. 5 is a perspective view of piston. Fig. 6 is a perspective view of one of the segments. Fig. 7 is an elevation of disk K. Fig. 8 is an elevation of driving-pulley, with disk K, &c., removed.

This invention has relation to certain new and useful improvements in that class of rotary engines described and claimed in my Patent No. 221,599, dated November 11, 1879, the object being principally to provide an improved piston more effective in its operation, all as hereinafter set forth.

With this object in view the invention consists in the novel construction and combination of parts, all as hereinafter described, and pointed out in the appended claims.

Referring to the accompanying drawings, the letter A designates the globe or spherical shell, in which the piston operates, and which is formed in two half-sections, whose meeting edges are annularly flanged to receive securing-bolts. This globe or shell is shown as supported in oblique relation to its bed B.

C designates the rotary piston, which consists of a ball or sphere fitted neatly to the chamber of the globe or shell, and in which are cut two open segmental chambers or channels C′ C². These chambers or channels are of broad form with flanged end walls, the planes of the two chambers being at right angles to each other. Each chamber would extend entirely around the piston were it not for the fact that the walls at the points where the two would intersect are preserved intact, so that the two ends of each chamber are formed by the lateral walls of the other chamber.

D designates the horizontal piston-shaft, which extends into the globe or shell in the wall of which it has a bearing at *a*, being also journaled in a bracket or standard E, supported on the bed. Said shaft is provided with a stuffing-box F where it enters the globe or shell. Within said globe or shell the shaft has a segmental arm G, which is fitted neatly but movably to the chamber or channel C, both its inner and outer surfaces being fitted, the inner face to work upon the bottom of the chamber and the outer face to conform to the piston and permit it to revolve within the shell. Said arm occupies approximately two-thirds the length of the chamber. Working in the groove C² is a similar arm G′, which is carried by a short shaft or post H which extends through the wall of the shell at an oblique angle to the shaft D, its projecting end being received in the chamber of a screw-cap or plug H′, which closes the opening in the shell in a steam-tight manner.

I designates the steam chest or chamber, which is formed upon the shell at one side, having a steam-inlet at *g* and ports *g′* communicating with both sections of said shell.

J is a cylinder slide-valve which is fitted to work in said steam-chest to regulate the exposure of the ports *g′*. Said valve has a stem which extends through the wall of the chest and is connected to a link J′, whose opposite arm is connected to a rock-lever J², having an arm *j*, which engages the grooved collar *j′* of a governor device.

The governor which I have shown in the accompanying drawings is of the following construction: K is a disk which is attached to the collar *j′* and which is loosely mounted upon the shaft. K′ is a driving-pulley, open at one side to receive said disk. The chamber of the pulley has two transverse bars *l*, between which are received two wedge projections *l′* of the disk K. Said disk also has a central boss *k* around the shaft, around which are placed balls *k′*. A spring L, coiled around the shaft and seating at one end within the hub of the disk and at the other end against a collar *l²* on said shaft, normally holds said disk well within the pulley. The force

of rotation when in operation throws the balls outwardly against the wedging-faces of the projections *l* and forces said disk against the action of the spring, thereby, through the connections, effecting a movement of the slide-valve to limit the exposure of the ports *g'*. The greater the speed of rotation the greater the closing movement of the valve. The force of the governor may be varied by using a greater or less number of balls. P designates the exhaust-ports, and P' the exhaust-chamber and discharge of the engine, said ports being diametrically opposite to the induction-ports.

It will be observed that the construction and connection of the piston is such as to give it a universal rotary movement upon a variable axis—that is to say, the two channels or grooves of the piston being at right angles to each other while the shafts D and H which carry the segments are at an oblique angle to each other it follows that in making a complete rotation there is only a momentary coincidence of the axis of rotation of the piston with the axis of either shaft and that during the remainder of the movement the piston must slide upon the segments as it rotates. The shafts and segments are rotated by the pressure of the channel-walls upon the lateral faces of the segments. It will be observed, therefore, that the shafts D and H are continuously rotated and that the piston has lost motion resulting from its sliding upon the segments as it revolves. The spaces between the ends of said segments and the end walls of the channels form four steam-chambers, which are successively presented to the induction and exhaust ports. At the time each of these chambers commences to take steam the segments are in such position that the chamber is of small area, the size of the chamber gradually increasing, owing to the apparent recession or backward movement of the segments caused by the sliding of the piston thereof, until such time as the chamber is brought to the first exhaust-port, when the segment again advances until the last exhaust is passed. The steam in entering does not strike squarely against the lateral walls of the chamber, but against a corner portion thereof, and this corner portion, which first receives the impact of the steam, is the last portion of the chamber to reach the exhaust, owing to the peculiar movement of the piston, as above described. Since the cut-off occurs some time before the exhaust commences, there is a period in each chamber when the steam is acting by expansion only, this being permitted by the increasing area of the chamber. The edges of the chambers C' C² are usually provided with packings or bushing-rings S.

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

1. In a rotary engine, the piston, comprising a ball or sphere having cut therein two broad segmental channels or chambers in planes at right angles to each other, the shaft having a segment arm working in one of said channels or chambers, and a second and similar segment working in the other of said channels or chambers and fitted to rotate upon a fixed axis, substantially as specified.

2. In a rotary engine, the combination with the globe or shell, its steam chamber, slide valve, governor and exhaust, of the piston consisting of a ball or sphere having cut therein two broad segmental channels or chambers in planes at right angles to each other, the ends of one being formed by the lateral walls of the other, the shaft extending into said globe or shell and having a segment arm fitted to play in one of said channels or chambers, a second and similar segment working in the other of said channels or chambers, and a stem carrying said second segment and rotatably seated in a closed bearing of said globe or shell at an oblique angle to said shaft, substantially as specified.

3. In a rotary engine, the universal piston, comprising a ball or sphere having cut therein two broad open segmental chambers in planes at right angles to each other, the end walls of each chamber being formed by the lateral walls of the other chamber, substantially as specified.

4. In a rotary engine, the combination of the globe or shell, the universal piston consisting of a ball or sphere having cut therein two broad segmental channels or chambers, the rotary shaft having a spherically fitted segment arm working in one of said channels or chambers, a second and similar segment working in the other of said grooves or chambers, the steam chamber, the slide valve, a governor therefor, and an exhaust, substantially as specified.

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

GEORGE MURRAY.

Witnesses:
THOS. F. MURRAY,
JAMES MAHADY.