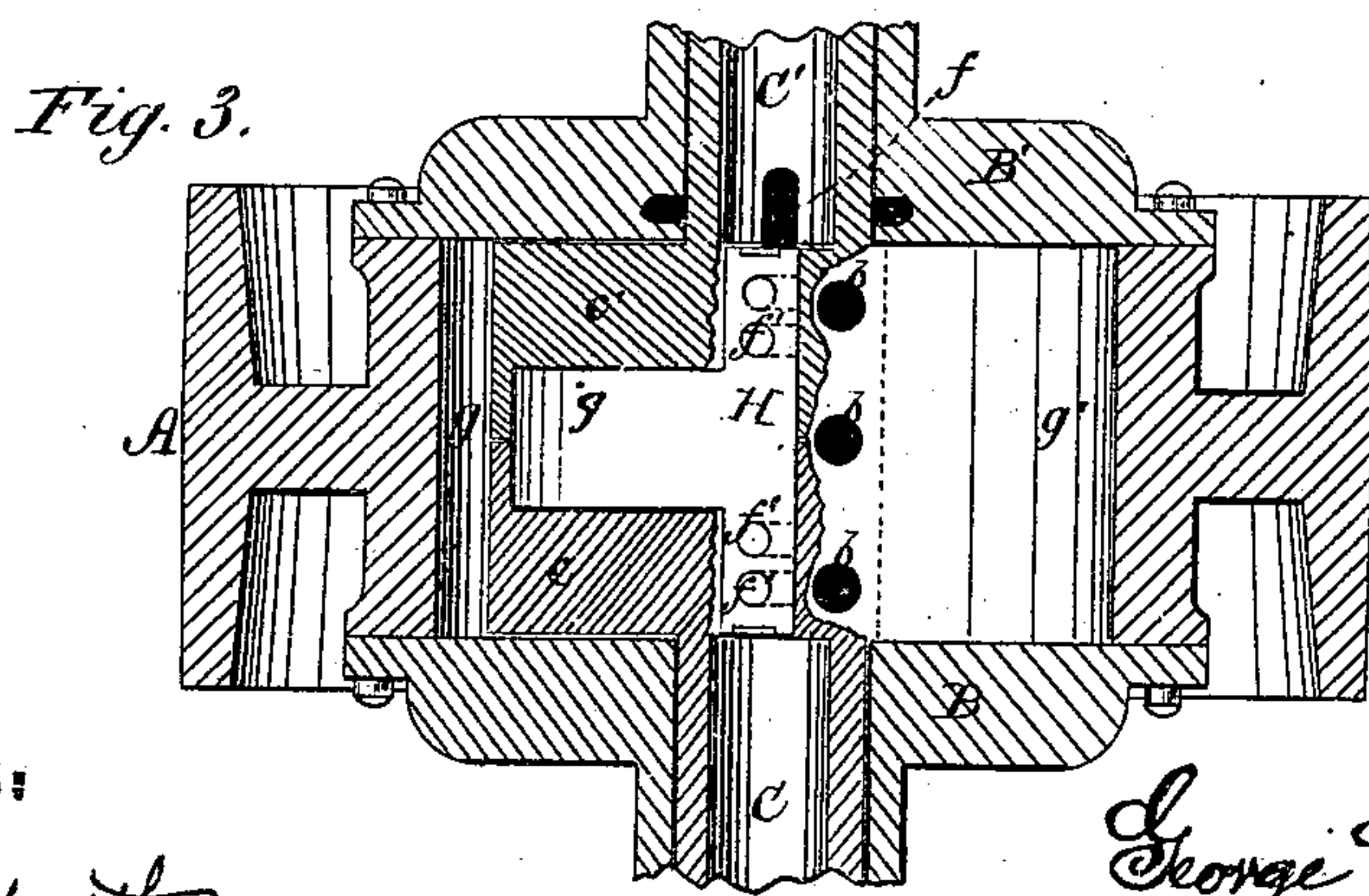
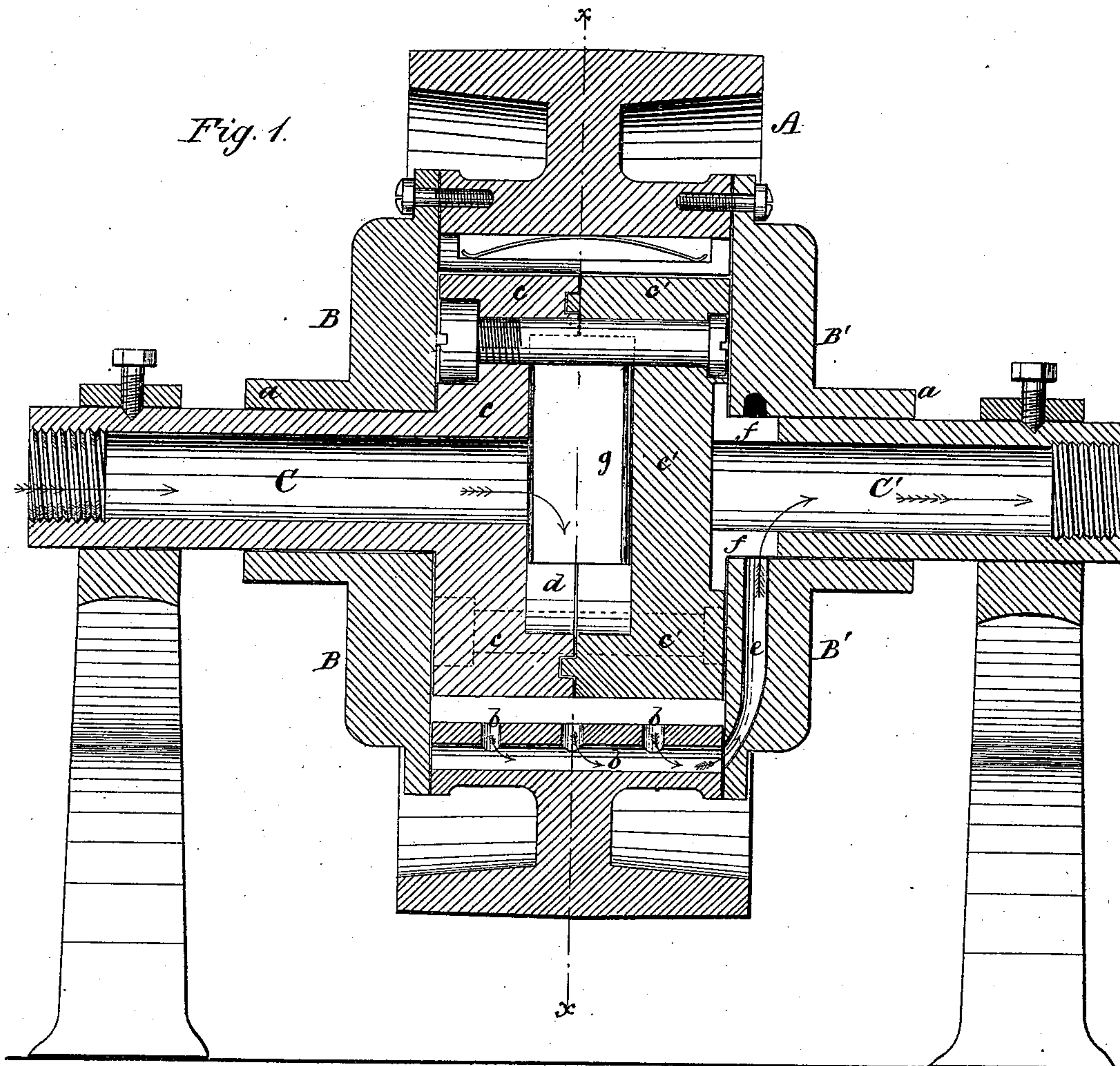


G. C. HALE.
ROTARY ENGINE.

No. 184,862.

Patented Nov. 28, 1876.



WITNESSES:

W. W. Hollingsworth
John A. Kemon

INVENTOR:

George C. Hale

BY

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Fig. 2.

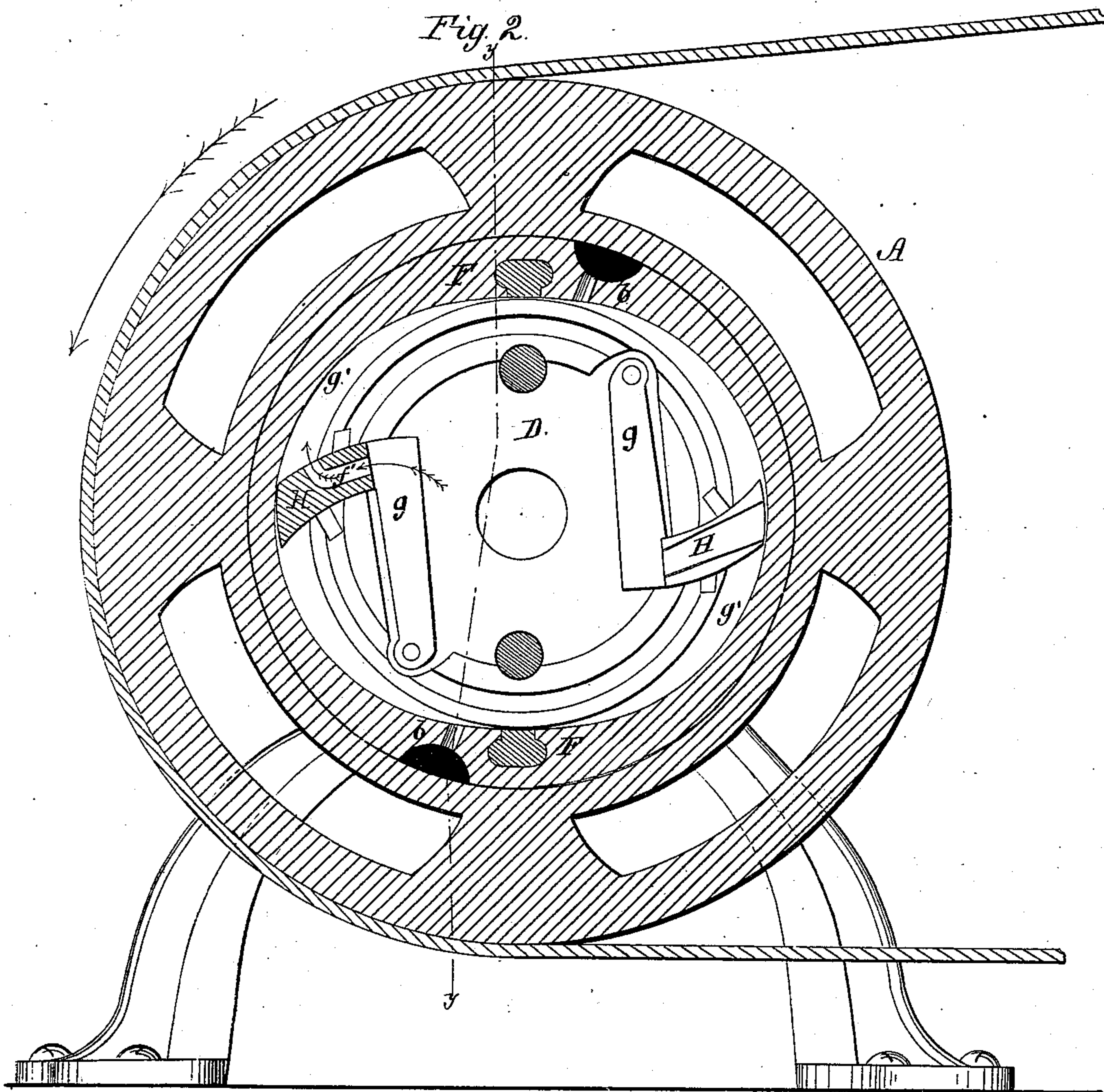
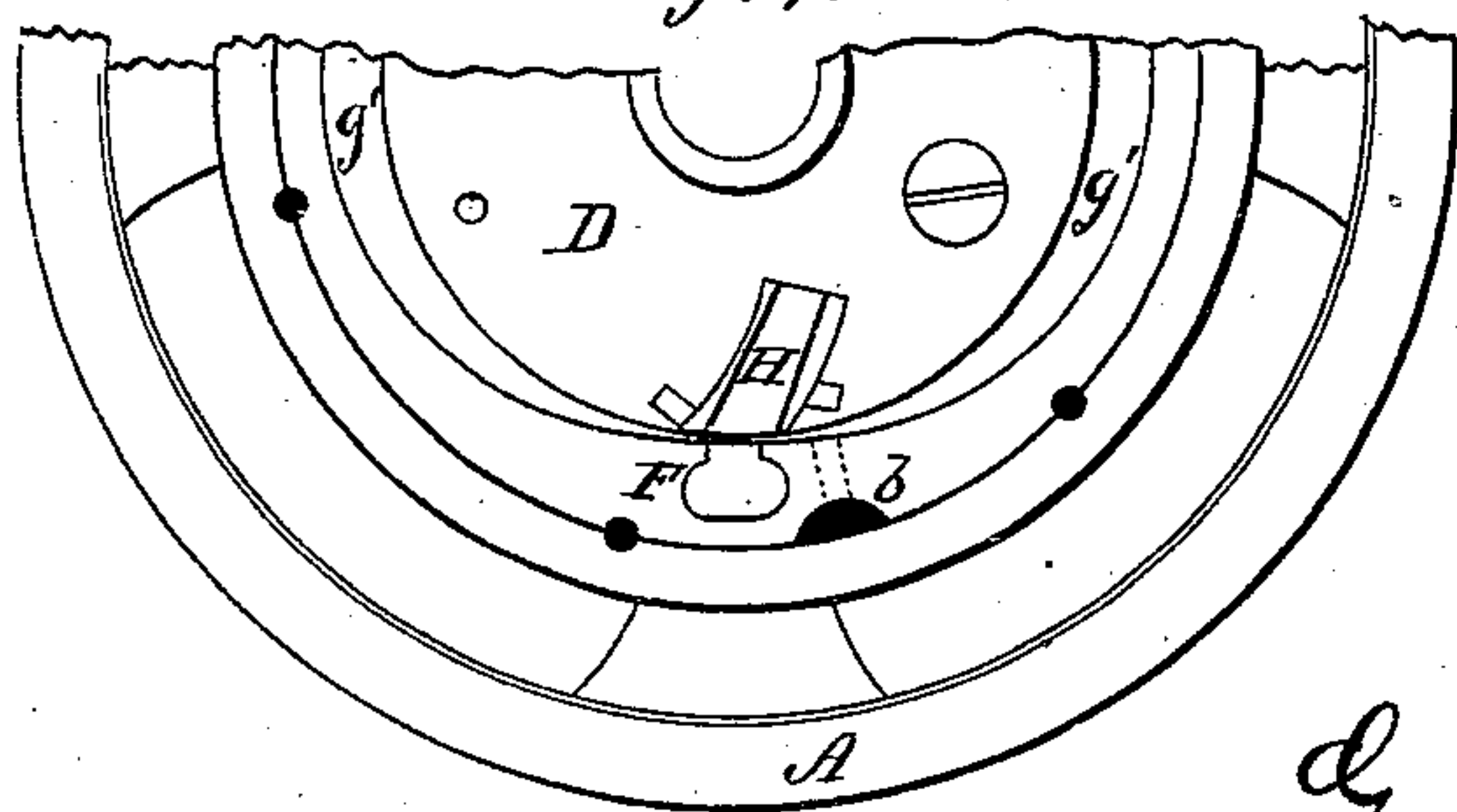


Fig. 4.



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GEORGE C. HALE, OF KANSAS CITY, MISSOURI, ASSIGNOR TO HIMSELF
AND FREDERICK C. WHITE, OF SAME PLACE.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. 184,862, dated November 28, 1876; application filed
November 17, 1876.

To all whom it may concern:

Be it known that I, GEORGE C. HALE, of Kansas City, in the county of Jackson and State of Missouri, have invented a new and Improved Rotary Steam-Engine; and I do hereby declare that the following is a full, clear, and exact description of the same.

The object of my invention is to effect an improvement in that class of rotary steam-engines whose case or cylinder is made to revolve around a stationary circular head or disk, to which the pistons are attached. In my improvement the pistons proper are hinged within a stationary disk having hollow trunnions, and the cylinder revolves around it. The induction-ports are in the piston-heads, and the cut-off is effected by the automatic movement of the pistons themselves. Thus the necessity of supplementary steam-valves is avoided, the number of working parts reduced to a minimum, and the compactness of this class of engines considerably increased.

In the accompanying drawings, forming part of this specification, Figure 1 is a vertical central cross-section of my improved engine. Fig. 2 is a central side sectional elevation thereof. Fig. 3 is a detail sectional view, with the piston-heads in plan. Fig. 4 is a detail sectional view, showing the positions of the pistons when passing the abutments, and the steam-induction ports in the piston-heads thereby closed.

The steam-cylinder of the engine is formed of the annular portion A and flat circular heads B B'. The former has its periphery constructed slightly crowning to adapt it for the application of a belt in the same manner as to an ordinary pulley; or it may be toothed, and thus converted into a spur driving-gear. The heads are bolted to the part A, and provided with central hollow tubular projections a, constituting the bearings of the rotary cylinder on the hollow trunnions C C', forming the shaft of the stationary piston-disk or part D. (In some cases I propose to utilize these tubular projections or pulleys a for the application of bands or belts, for operating the governor, or for other purpose.) The said disk is constructed in two parts, c c', which are bolted together and recessed on their contiguous or

inner sides to form a steam chest or chamber, d, and the hollow trunnions or shaft-sections C C' are formed in one piece with the respective halves c c' of said disk. The above-named parts—to wit, the outer periphery of the cylinder A, heads B, disk D, and shaft C C'—are arranged concentrically, and the steam-induction passage is through trunnion C, the exhaust through trunnion C', as indicated by arrows. The inner periphery of the cylinder A is of oval form, there being two fixed abutments, F, one opposite the other, and each suitably provided with packing, to form a steam-tight joint with the hollow piston-disk D as the cylinder revolves around it. An exhaust-port, b, is formed in each abutment at one side of its center, and said port communicates with the trunnion C' by the passages e e in the head B' and coincident openings f in the trunnion. The effective action of the steam is between the aforesaid abutments of the revolving cylinder and the piston-heads H of the stationary disk D. The piston-heads or pistons proper are nearly rectangular in cross-section, and arranged tangentially to the axis of the disk, and work in and out through transverse slots in the periphery of the latter, being for this purpose provided with arms g, by which they are pivoted within the disk, and thus adapted to vibrate in the arc of a circle of about half the radius of the disk.

The outer side or edge of the piston-heads H is constructed upon a curve coincident with the periphery of the disk, so as to present a smooth surface and have as little friction as practicable with the inner periphery of the cylinder A B B' as it revolves. The piston-heads have perforations f', which open on the side and form ports, by which the steam passes from chamber d into the space g' between the disk and cylinder and the pistons and abutments, Fig. 2. These ports are constantly open to the chamber d, but intermittently closed to the spaces g, the cut-off being effected by the rim of the disk D, when the piston-heads H pass the abutments F, and are thus pushed back into the disk, as shown in Fig. 4, for, as will be perceived, the piston-heads always work in contact with the inner periphery of the cylinder, being pressed outward by the

steam acting against the inner sides of the piston-heads. Hence the degree of pressure and friction of the piston-heads with the cylinder A B B' will always correspond with the initial steam-pressure in the chamber *d* of the disk. To provide for free access of steam to the piston-heads H, their arms *g* are made narrower than the chamber *d*, so that the steam passes on each side of the arms *g*, as will be readily understood. Suitable packing is applied to take up the wear and form a tight joint between the sides of the piston-heads and the parts of the disk D and heads B B' with which they work in contact.

From the foregoing description it will be apparent that my improved engine may be utilized, when placed in proper position in relation to machinery to be driven, by placing a belt on the cylinder A, as upon an ordinary pulley, and admitting steam to the chamber *d*, having first set the disk D with the pistons between the abutments F. The steam will enter through trunnion C, pass through ports *f'* in the piston-heads, and, filling the spaces *g'*, exert a pressure between the piston-heads and abutments. The former being attached to a fixed part, D, and the latter to a movable part, A B B', the latter—*i. e.*, the cylinder—is necessarily caused to revolve around the other at a rate of speed corresponding to the pressure. The steam is cut off from spaces *g'*, and hence has no action against the piston-heads when the abutments F are passing them, since the piston-heads are then pushed in and the ports closed by the contiguous wall of the slots, in which the piston-heads work in and out. The exhaust from spaces *g'* is effected simultaneously just before the piston-heads reach the center of the abutments, or, in other words, as they pass the ports *b*, which lead out through the cylinder A B B' and trunnion C', as before explained. Imme-

diately upon the exhaust taking place the pistons pass the abutments, the ports *f'* are again opened, and the steam acts as before, thus maintaining the revolution of the cylinder A B B' and the effective work of the engine.

It is obvious the number of the cylinder-abutments and the pistons may be increased as judgment or necessity may dictate.

Having thus described my invention, what I claim as new is—

1. In a rotary engine, the revolving cylinder, composed of an annular portion, A, having its periphery constructed as described, and the circular heads B B', provided with tubular projections or bearings, in combination with the hollow stationary disk, the hollow trunnions C C', and the hinged pistons having side ports, as shown and described.

2. In a rotary engine, in combination with the cylinder having the abutments F, the hollow disk D and the swinging pistons H *g*, pivoted within the steam-chamber, and working steam-tight in peripheral slots in the disk D, also provided with ports *f'*, opening on the side, whereby they are alternately opened and closed as the piston-heads work in and out, substantially as shown and described.

3. In a rotary engine, the circular head B', having exhaust-ports *e*, the trunnion C', having a coincident opening, and the part A of the cylinder, having exhaust openings and passages in the abutments, said passages opening laterally, and communicating with the passage in the head, as shown and described, to provide for escape of exhaust steam, as specified.

GEORGE C. HALE.

Witnesses:

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F. C. WHITE.