(No Model.)

2 Sheets—Sheet 1.

H. RITTER.

ROTARY ENGINE.

No. 560,368. Patented May 19, 1896.

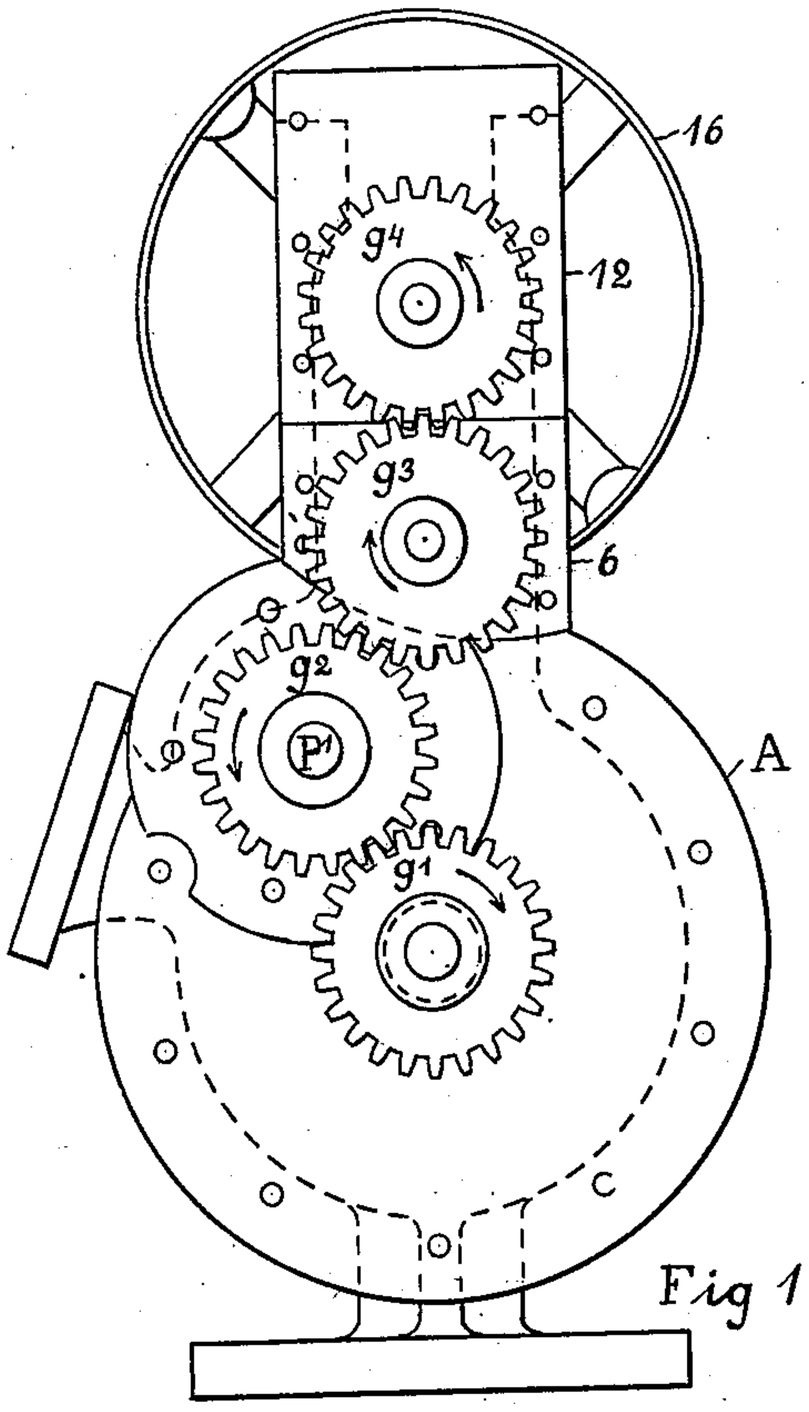

Fig 1

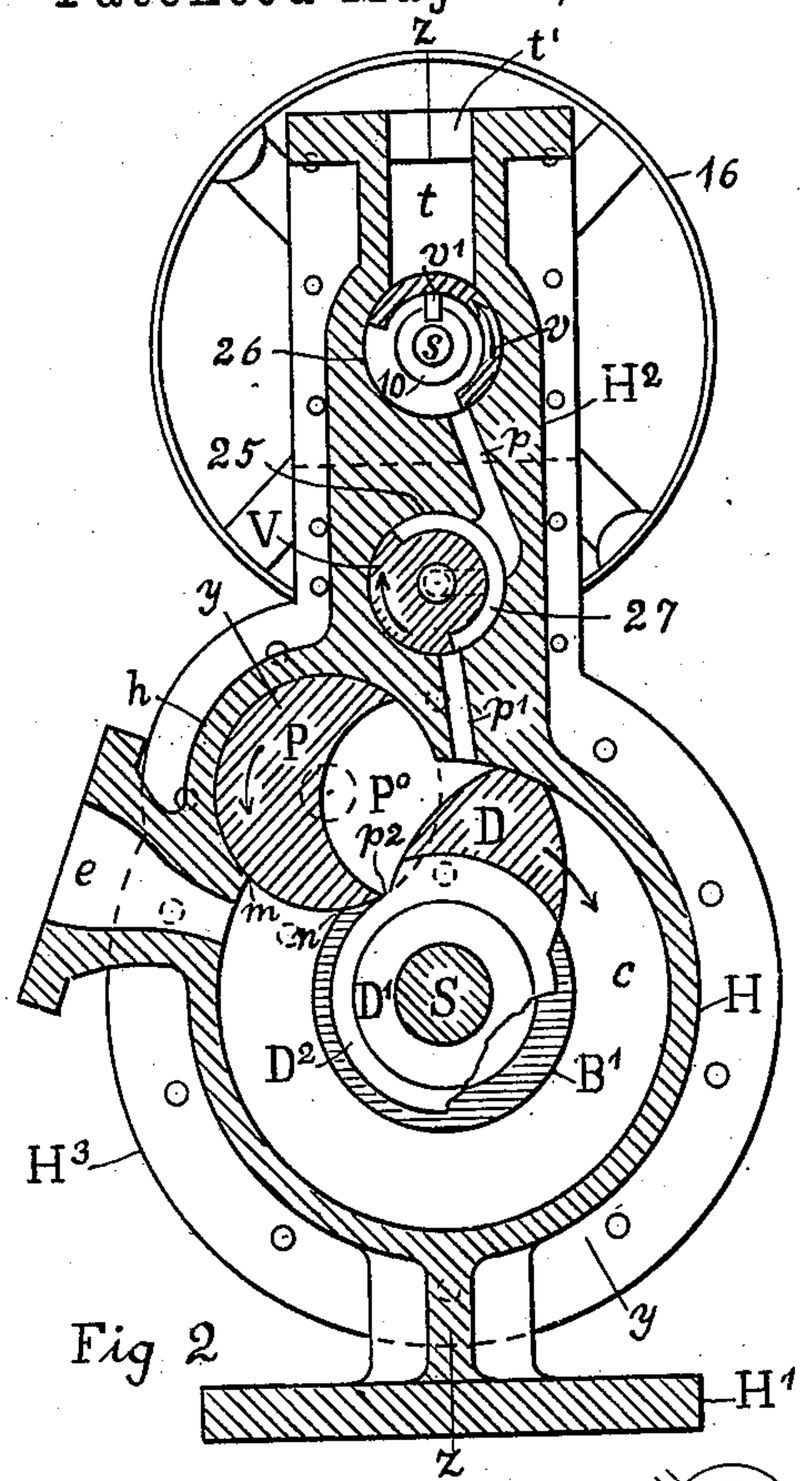

Fig 2

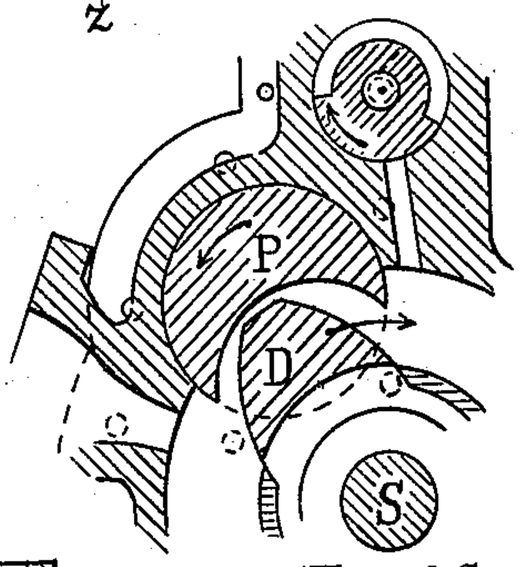

Fig 2a

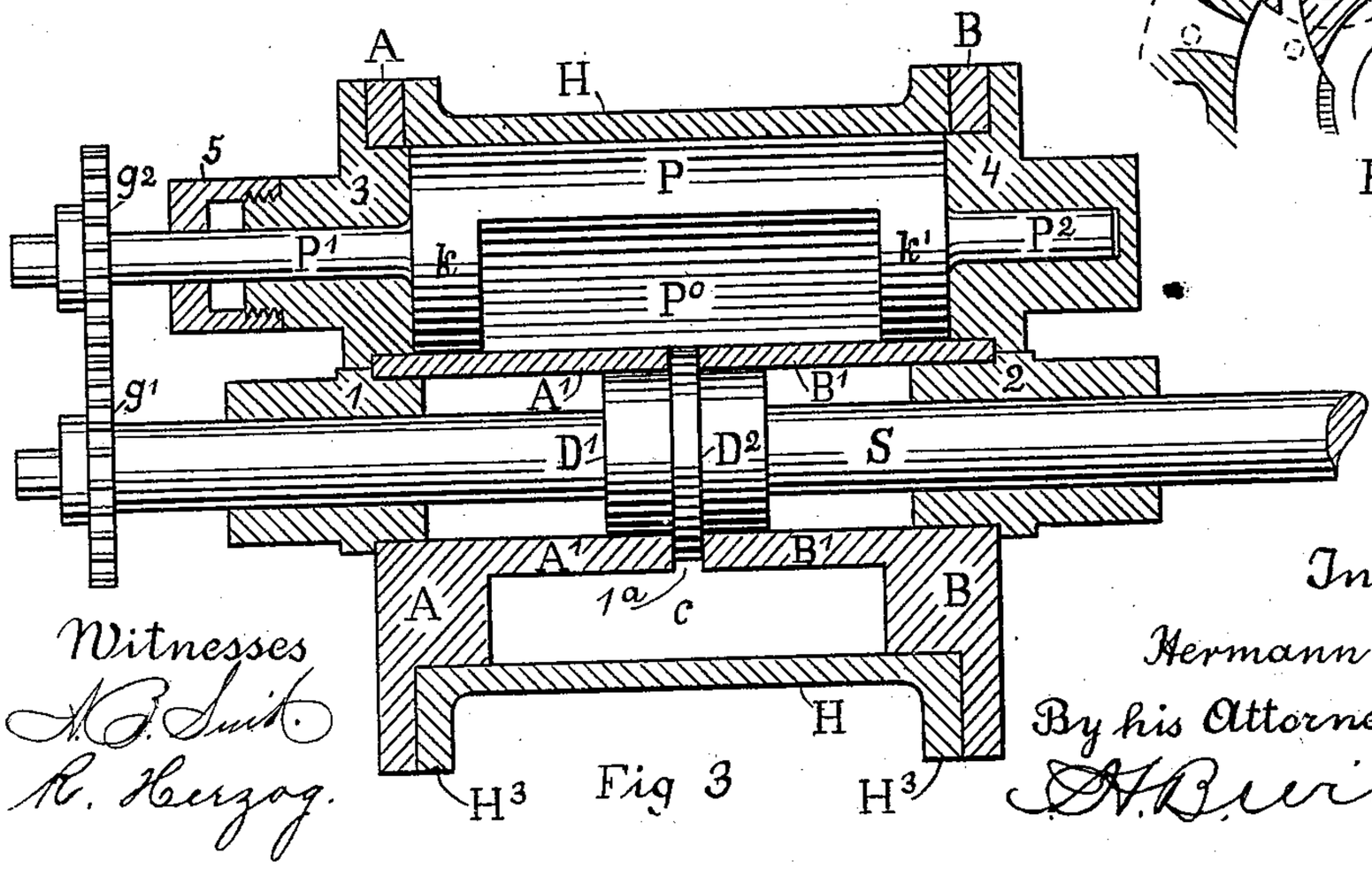

Fig 3

Witnesses
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(No Model.) 2 Sheets—Sheet 2.

H. RITTER.

ROTARY ENGINE.

No. 560,368. Patented May 19, 1896.

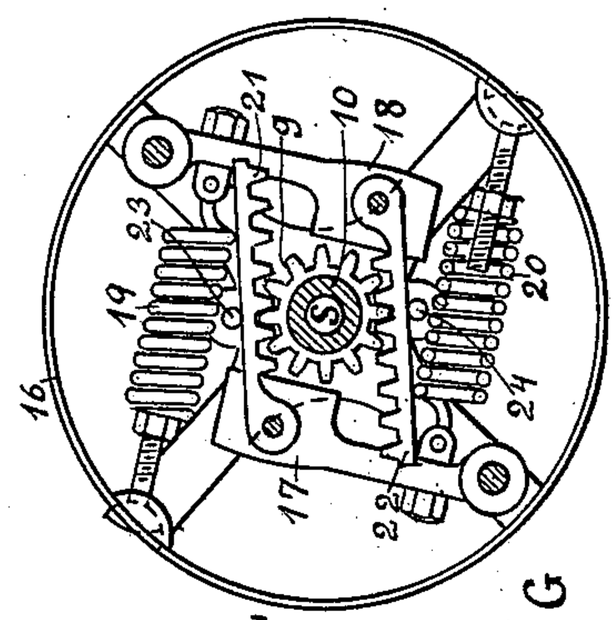

Fig 5

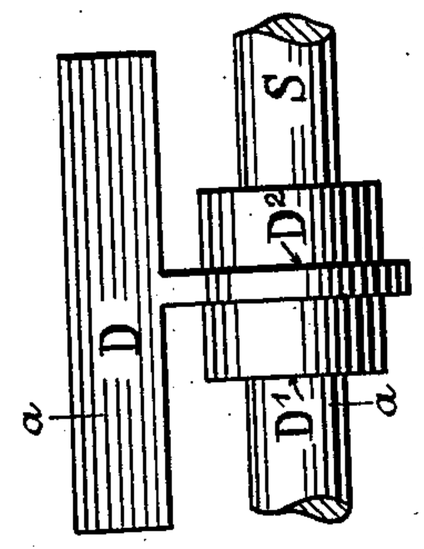

Fig 6

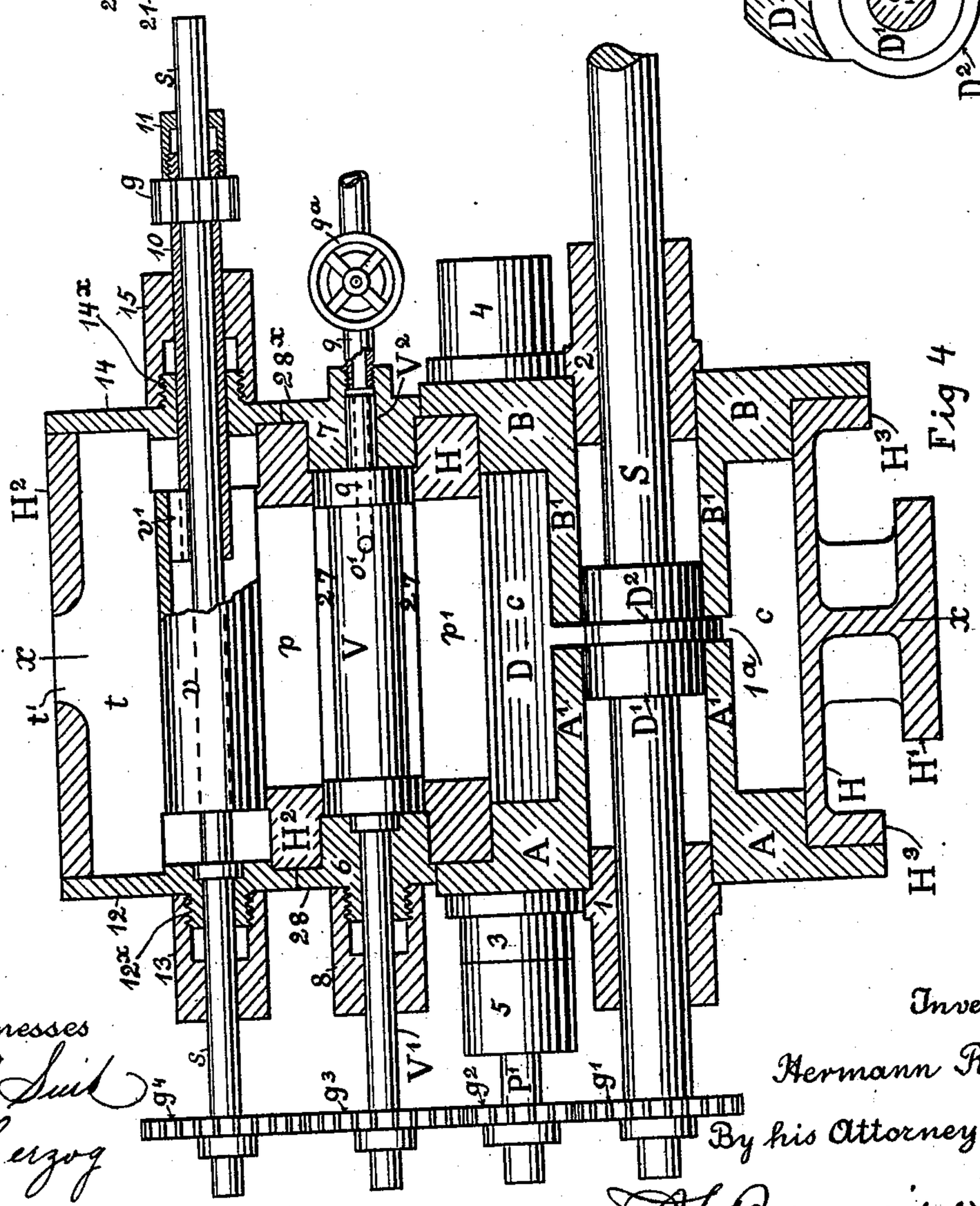

Fig 4

Witnesses
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UNITED STATES PATENT OFFICE.

HERMANN RITTER, OF LIMA, OHIO.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 560,368, dated May 19, 1896.

Application filed January 21, 1896. Serial No. 576,310. (No model.)

To all whom it may concern:

Be it known that I, HERMANN RITTER, a citizen of the United States, residing at Lima, in the county of Allen and State of Ohio, have invented certain new and useful Improvements in Rotary 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.

My invention relates to improvements in rotary engines of that class wherein the piston rotates in a circular channel concentric to the axis of the piston carried on the main shaft of the engine; and the objects are to provide an improved automatic variable cut-off for steam, and to construct an improved rotary engine which has no reciprocating or oscillating parts, thereby producing an engine adapted to and capable of running at a high rate of speed, as will be hereinafter fully specified, and the novelty thereof particularly pointed out in the claims.

I have fully and clearly illustrated my invention in the accompanying drawings, wherein—

Figure 1 is an end elevation of the engine, showing the train of gearing between the main shaft and the valves. Fig. 2 is a vertical section taken on the line *x x* of Fig. 4. Fig. 2ª is a detail, partly in section, of the abutment or passage-valve and piston, showing the relation of the parts during the passage of the piston across the abutment. Fig. 3 is a longitudinal vertical section taken on the slanting line *y y* of Fig. 2. Fig. 4 is a vertical section on the line *z z* of Fig. 2. Fig. 5 illustrates a side view and a central sectional view of the governor. Fig. 6 illustrates the piston in a side view, partly in section, on the line *a a* of the adjacent figure, wherein the piston is shown in front elevation with its hub mounted on the main shaft.

Referring to the drawings, wherein like reference-characters designate the same parts in all the figures, H designates the steam-cylinder or outer casing, cast circular in cross-section, and constituting the chest or cylinder in which the piston rotates. The cylinder H is formed with strong annular flanges H^3 at the ends, whereby connection may be made with the heads of the cylinder by means of the usual fastening-bolts. The cylinder H is cast with a strong foot or base piece H′, on which the cylinder and the whole machine is supported.

H^2 designates a vertical extension of the steam-cylinder, rectangular in shape, also formed with lateral flanges, substantially as shown, to fasten it to the head or end pieces, and provided in its interior with valve-chambers, and steam ports or ways leading from one valve-chamber to the other and to the steam-cylinder in which the piston rotates, as will be hereinafter more fully specified.

A and B designate the opposite heads of the cylinder, which are duplicated in construction and form and have cast integral therewith centrally-disposed and inward-directed cylindrical extensions A′ B′, the extensions being arranged in the center of the cylinder and concentric to the axis thereof, with their inner and approaching ends adjacent to each other with a space, as 1^a, between them, wherein an annular flange on the hub of the piston fits and travels, substantially as shown, to act as a steam-fitting between the ends of the extensions. It will now be perceived that an annular space *c*, constituting a steam-channel, is formed between the extensions and the outer casing, in which the rotating piston travels, as shown in the drawings, the steam-channel being oblong and rectilinear in cross-section.

D designates the piston, preferably consisting of an arm having the contour of an epicycloidal gear-tooth, the end of which sweeps over the interior surface of the steam-cylinder and of such length as to completely fill the steam-channel, as shown in Fig. 4 of the drawings. The hub D′ of the piston is cast integral therewith and journals in the openings of the cylindrical extensions A′ B′, being formed with an annular flange D^2, which fits in and closes the space between the ends of the extensions A′ B′, the annular flange being the same height as the thickness of the extensions and at its connection with the piston is integral therewith. The main shaft S is suitably secured in the hub of the piston by any well-known means, and the said shaft being journaled in bearings 1 2, suitably mounted and secured in the heads of the cylinder in the openings of the cylindrical

2

extensions, as shown in Figs. 3 and 4 of the drawings.

The steam-cylinder and both heads thereof are formed with a circular enlargement, as at *h*, forming a seat for the rotating abutment P, which rotates to open and close the steam-channel of the cylinder. The opening to the abutment chamber or seat is less than the diameter of the abutment, so that it may be kept securely in its seat and rotate therein. The rotative abutment P is formed with a circular cavity P^0 extending therein for the length of the piston, the ends of the cavity being closed by the standing metal, as at *k k'*, between which the piston moves. The seat for the abutment P is a section of a straight cylinder and is bored out after the heads A B have been bolted onto the cylinder and extends entirely through the casing and both heads.

Referring to Fig. 2 of the drawings, it will be seen that in boring out the abutment chamber or seat a circular recess p^2 is cut out of the cylindrical extensions in order to afford a sufficient seat for the rotating abutment, but against the annular flange D^2 of the piston-hub the abutment P has a tangential impact, and at that point the contact may not be entirely steam-tight; but the flange may be quite narrow, and the escape of the steam at that point be thus reduced to a minimum, the object being to maintain the construction of the flange and to prevent the escape of steam from the steam-channel at the point involved. The abutment P is formed or provided with journals P' P^2, arranged in bearings 3 4, suitably arranged and secured in the heads of the steam-cylinder, substantially as seen in Fig. 3 of the drawings, the bearing 3 being provided with a cap 5, through which the journal of the abutment is passed, and which screws on the threaded neck of the bearing-box 3, the cap constituting a stuffing-box for the box and journal. The passage valve or abutment receives rotation from the main shaft by means of a gear-wheel *g'* on the end thereof, which meshes with a gear-wheel g^2 on the end of the journal of the abutment, as shown in Figs. 3 and 4 of the drawings, the rotation being in the direction of the arrow, Fig. 2, and the adjustment and arrangement of the gearing are such that the cavity of the rotating abutment will coincide with the approach and passage of the piston at that portion of the cylinder, and such as to close the steam-channel *c* and bridge it at the points *m* and *n* as soon as the piston has escaped from the cavity. The position shown in Fig. 2 is that indicating that moment in which the piston has just passed through the cavity of the abutment and the steam-channel has been completely closed by the passage valve or abutment. The piston is shown in Fig. 2 as having been moved beyond the steam-port *p'* and the steam being free to act on the piston to drive it through **the steam-channel in the rotative direction** indicated by the arrow, the progression of the piston through the channel driving the old or dead steam out through the port *e* in the steam-cylinder. As the piston moves through the steam-channel in the cylinder the abutment is rotated correspondingly, as indicated by the arrow, serving as an abutment to keep the channel closed at the points *m* and *n*; but as soon as the piston closely approaches the abutment the cavity P^0 therein is presented to admit the free passage of the piston. Fig. 2^a shows the relative position of the piston and the abutment while the former passes through the cavity of the latter.

The vertical extension H^2 of the casing is formed with circular valve chambers or seats 25 26, in which the main valve V and the cut-off valve *v* are respectively arranged. The steam is admitted through the steam-port *l'* and fills the steam-chamber *t*. The steam then passes through the cut-off valve *v* and from thence through the steam-port *p*, thence through the main valve V, then through the steam-port *p'*, from which it enters the steam-channel *c* of the cylinder.

The main valve V, Figs. 2 and 4, is a solid cylinder formed with an annular cavity or steam-chamber 27, extending about five-eighths of its circumference, but not reaching quite to either end, the metal of the valve being left standing at the ends, so that the valve will fill the valve-seat at the ends and a steam-tight box be formed between the cavity and the wall of the valve-seat. The valve V is provided with journals V' V^2, mounted in bearings 6 7, fitted in the ends of the valve-seat, which extends entirely through the casing to provide ready means for inserting and removing the valve. The bearing-boxes 6 7 are formed with flanges 28 $28^\times$, which are bolted to the frame or casing. The bearing 6 is provided with a stuffing-box cap 8, arranged on the journal of the valve and screwed onto a threaded extension of the bearing-box, substantially as shown. The bearing-box 7 has an aperture formed therein, which opens into the valve-chamber and has inserted therein an auxiliary inlet-pipe 9, hereinafter more fully specified. On the extended journal V' of the valve V is mounted a gear-wheel g^3, which is in mesh with the gear-wheel g^2 on the journal of the rotating abutment, the valve being thereby rotated by the instrumentality of the main shaft and the intermediate gearing, and the valve being rotated in the direction of the arrow placed thereon.

The upper valve *v*, Figs. 2 and 4, being the variable cut-off valve of the engine, consists of a cylindrical shell having a segment of about three-eighths of its circumference cut therefrom and extending the length thereof, and through the center of the valve is passed the long shaft *s*, which at one end carries the governor and at the other carries the gear-wheel g^4, which is driven by the gear-wheel g^3 of the main valve and the gears in connection with the main shaft. The governor

is shown as separated from the shaft *s* on which it is mounted, in order that it may be fully illustrated.

Referring to Figs. 4 and 5, it will be perceived that on the shaft *s* is fitted a hollow sleeve 10, which carries a small gear-wheel *g* and a cap 11, fitted on the end of the sleeve, constituting a stuffing-box. The sleeve projects a distance into the cut-off valve, substantially as shown, and is connected with the valve by a lug *v'*, which projects from the valve into an open end slot, cut longitudinally in the end of the sleeve, (see Figs. 2 and 4,) the valve being thus rotated by this connection to the sleeve, and the sleeve itself being rotated and variably affected by the governor. The seat or chamber for the cut-off valve consists of a cylindrical hole or way formed through the casing H^2 and has the opposite ends closed by the end plates 12 14, these being provided with suitable flanges by which they are bolted to the casing H^2. (See Figs. 1 and 4.) These flanges are extended upward and close the ends of the steam-chamber *t*, substantially as shown in Fig. 4 of the drawings. On the end plate 12 is formed a threaded projection $12^{\times}$, to which is fitted a stuffing-box 13, which has the shaft *s* projected through it, and forms a bearing for the shaft at that part, and on the opposite head-plate 14 is formed a threaded extension $14^{\times}$, to which a stuffing-box 15 is fitted, having the shaft *s* passed therethrough, as shown, to form a bearing for the sleeve 10. The governor (designated generally by the reference-letter G) consists of a broad rim 16, having a hollow hub *s'* to fit on the end of the shaft *s* and four radial arms projected from the hub to sustain the rim, substantially as seen in the drawings. Adjacent to the ends of two of the arms arranged on the same radii of the wheel are pivotally hung two arms 17 18, oppositely disposed, as shown in Fig. 5 of the drawings, which arms constitute the weights to regulate the action of the governor on the cut-off valve. To restrain the centrifugal tendency of the weights, spiral springs 19 20 are interposed, having one end secured adjacent to the rim of the wheel and the other end suitably secured to the arms adjacent to their pivotal supports, substantially as shown. Near the free end of each weight or arm are pivotally secured the rack-bars 21 22, having their teeth on the inner face of the bars and in mesh with the small gear-wheel or pinion *g*, mounted on the sleeve 10, as shown, and in order to hold the rack-bars in engagement with the gear pins 23 24 are projected laterally from the hub and lie over and on the outer face or edge of the rack-bars. In the sectional view in Fig. 5 of the drawings but one of each of the duplicate parts is shown and the governor is shown detached from its seat on the shaft *s;* but it is apparent that if mounted on said shaft the racks 21 and 22 will come into their proper engagement with the gear *g*, as indicated in the side view in Fig. 5.

It will be perceived from the foregoing description of the governor and its connection and relation to the cut-off valve that its action on the valve will be as follows: As the governor rotates the centrifugal action of the weights increases with the increase of revolution, and they are correspondingly moved outward and draw the racks with them, and these being in mesh with the gear *g* on the hollow sleeve 10 the gear is correspondingly rotated, and the valve *v* thereby advanced to produce an earlier cut-off. In Fig. 2 the cut-off valve is shown as taking up about five-eighths of a circle. Therefore the latest cut-off would be in that case at about three-eighths of a revolution. However, for better starting the engine a longer period of admission of steam is desirable, and for this purpose the small auxiliary steam-inlet pipe 9, heretofore referred to, is arranged in the head 7 (see Fig. 4) and a hole *o* is formed lengthwise through the valve where it meets another hole *o'*, drilled radially. This steam way or port affords means for admitting steam directly into the cavity of the main valve, and thereby permitting the latest cut-off to be effected at about five-eighths of a revolution. After the engine is started the steam entering through the inlet-pipe 9 is cut off by shutting the valve 9^a suitably arranged therein.

In the foregoing description of my invention I have omitted such details as packing-strips of the piston, the usual recesses for relieving the steam-pressure on the valves, &c., and in the drawings the fastening-bolts in the flanges of the casing are indicated only in Figs. 1 and 2.

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

1. In a rotary engine, the combination of a cylindrical outer casing, opposite heads closing the ends of the casing and formed with central inwardly-projecting cylinders having their inner ends adjacent to and in alinement with each other, a shaft projected through the cylindrical projections of the heads, a piston mounted on the shaft to traverse the steam-space between the said cylinders and the casing, and the hub of the piston being formed with an annular flange to close the space between the adjacent ends of the cylinders, a rotary abutment actuated by the shaft of the piston to close the steam-channel in the casing, and ports to admit and discharge the steam, substantially as described.

2. In a rotary engine, the combination with the cylindrical casing, having steam inlet and outlet ports, the piston and the rotating abutment, of the rotating main valve V, and an auxiliary inlet-pipe 9 opening into the valve, substantially as and for the purpose specified.

3. In a rotary engine, the combination of the cylindrical steam-casing formed or provided with a vertical extension, and having cylindrical chambers for a rotating abutment, a main valve and a cut-off valve, and steam-inlets to the valves and casing, and a dis-

charge-port, of heads to close the ends of the casing formed with central cylindrical extensions, reaching inward with their ends adjacent to each other, a shaft projected through the heads, a piston on the shaft to rotate through the steam-channel in the casing and formed with a flange to close the space between the extensions of said heads, a rotating abutment in the abutment-chamber having a cavity to permit the passage of the piston, a main valve in the chamber made therefor, a cut-off valve in the chamber therefor, and gearing whereby the piston, the abutment and the valves are rotated in operative sequence substantially as described.

4. In a rotary engine, the combination with the cylindrical steam-casing formed or provided with a vertical extension and having cylindrical chambers for a rotating abutment and rotating main and cut-off valves, and steam ways or ports to the valves and casing, and a discharge-port, of heads to close the ends of the casing formed with central cylindrical extensions reaching inward with their ends adjacent to each other, a shaft projected through the heads, a piston on the shaft to rotate through the channel in the casing and formed with a flange to close the space between the extensions of the heads, a rotative abutment in the abutment-chamber having a cavity to permit the passage of the piston, a main valve in the chamber made therefor, a cut-off valve in the chamber therefor, a governing mechanism to regulate the cut-off valve, and gearing whereby the piston, the abutment and the valves are rotated in operative sequence, substantially as specified.

5. In a rotary engine, and in combination with the cut-off valve thereof, of a governor, comprising a wheel, two arms constituting the weights of the governor, pivotally connected to opposite arms of the wheel, springs connected to the weight-arms, rack-bars pivotally connected to the free ends of the weights, a gear-wheel to engage the rack-bars, a hollow sleeve for the gear-wheel, having connection with the valve, and a shaft for the governor projected through the said sleeve and valve, substantially as described.

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

HERMANN RITTER.

Witnesses:
R. STONE,
GEO. FELTZ.