

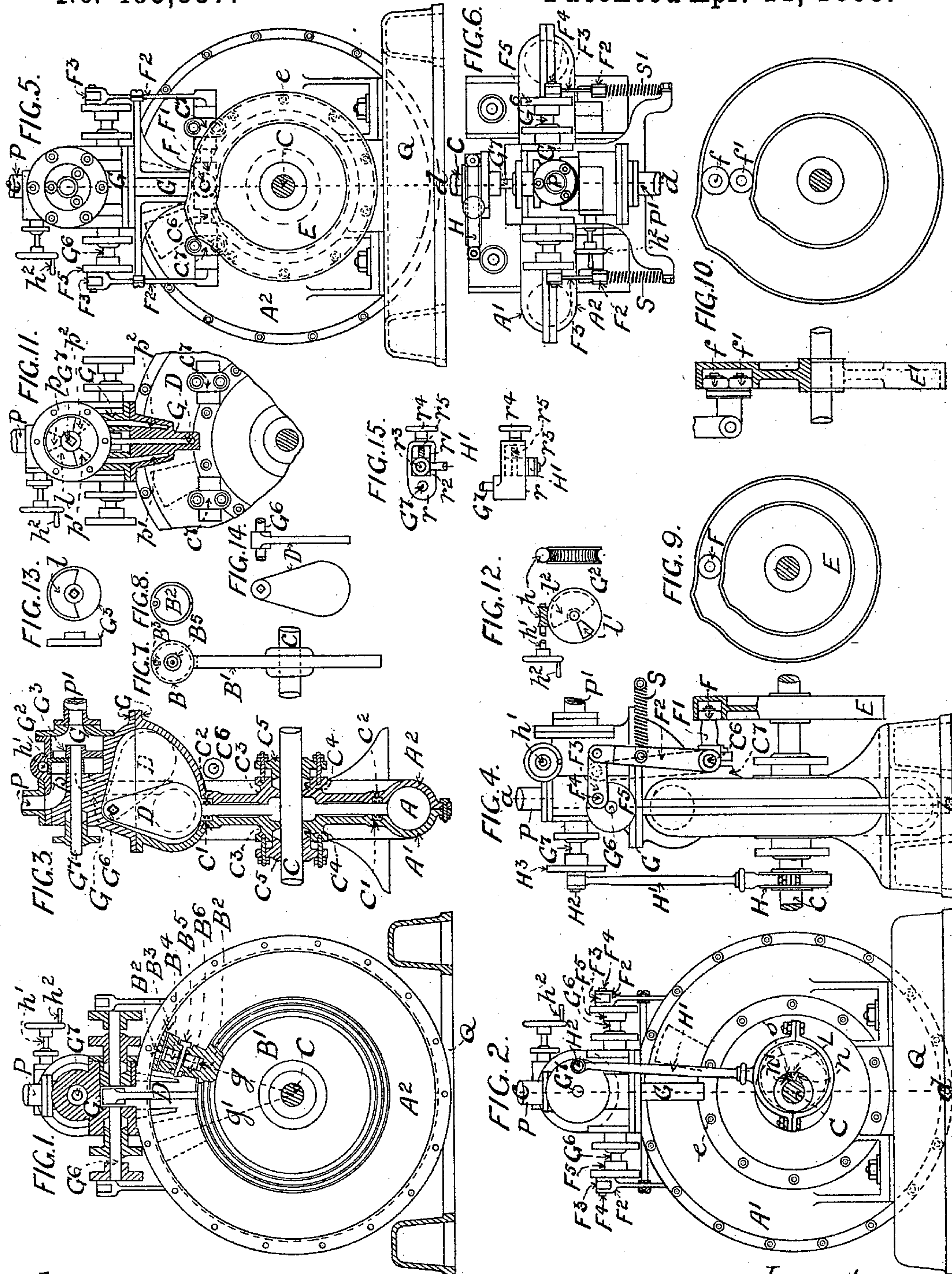
(No Model.)

2 Sheets—Sheet 1.

W. H. MURCH.
ROTARY ENGINE.

No. 495,357.

Patented Apr. 11, 1893.



Witnesses,
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William Edward Davies

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per
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(No Model.)

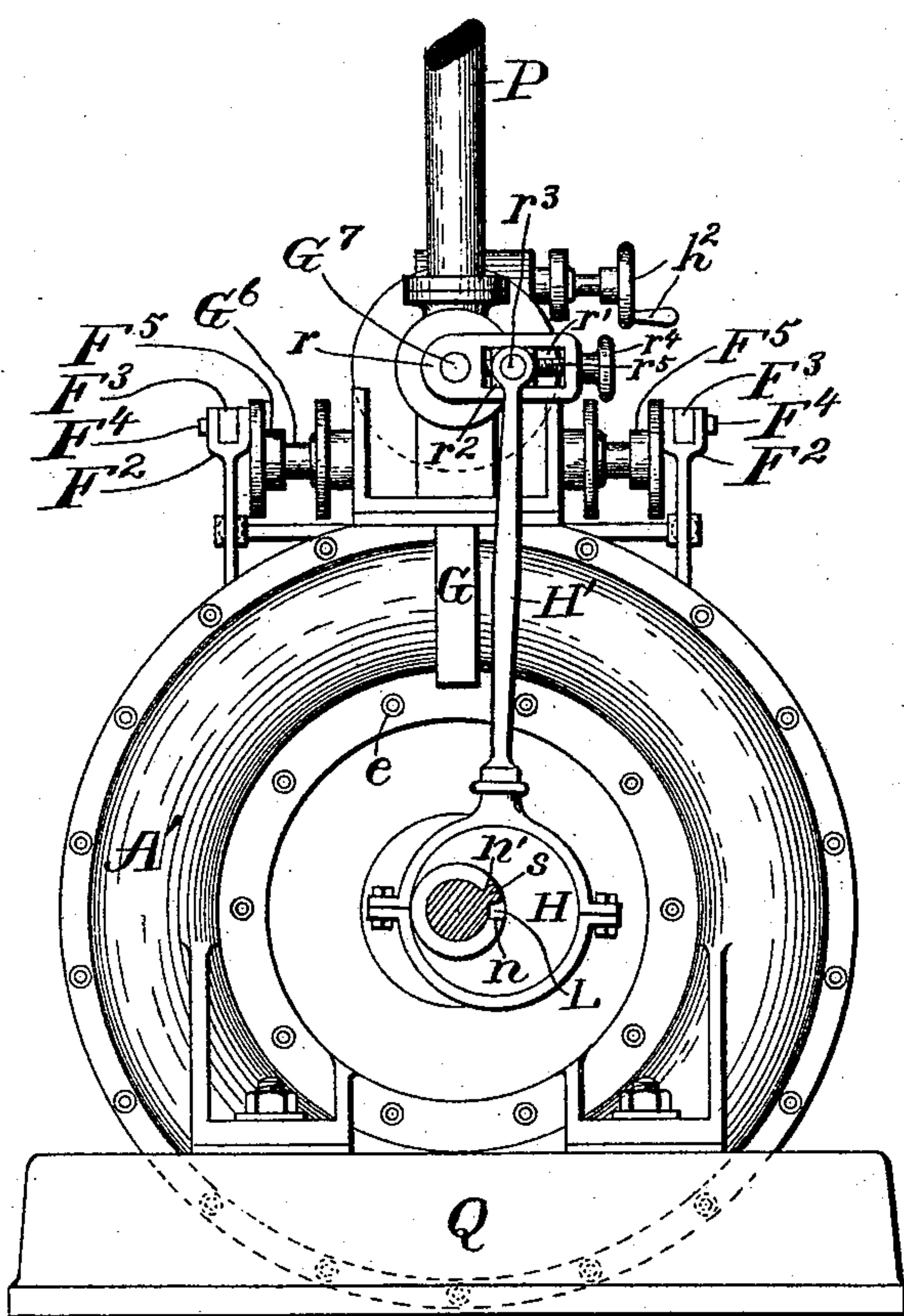
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Fig. 15.^a



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UNITED STATES PATENT OFFICE.

WILLIAM HENRY MURCH, OF SOUTHAMPTON, ENGLAND.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 495,357, dated April 11, 1893.

Application filed November 27, 1891. Serial No. 413,273. (No model.) Patented in England June 19, 1891, No. 10,404.

To all whom it may concern:

Be it known that I, WILLIAM HENRY MURCH, a subject of the Queen of Great Britain, residing at 7 Waterloo Place, Southampton, in Hampshire, England, have invented a new and useful Rotary Engine, (for which I have obtained a patent in Great Britain, No. 10,404, bearing date June 19, 1891,) of which the following is a specification.

My invention relates to rotary engines.

My engine has been designed so that the power is transmitted direct from the piston to the shaft and it may be adapted for any purpose as an engine operated by steam or other motive power.

My engine can be worked expansively and the degree of expansion varied at will, and it may be started, stopped, or reversed, by simply moving a hand wheel or other suitable device. Its main parts consist of the cylinder or piston-chamber, the piston and its supporting disk, the abutment or resistance valve, and a cam and suitable connections for giving motion to the abutment at a given time, the reversing gear, the "cut off" or expansion valve, and the gear for giving motion to the same, together with suitably connected steam supply and exhaust pipes.

In order that my invention may be clearly understood I will now refer to the drawings hereto attached which illustrate it adapted for use as a reversible steam engine and in which drawings—

Figure 1. is a sectional elevation on the line *a. b.* (see Fig. 4;) Fig. 2. a side elevation; Fig. 3. a central sectional elevation on the line *c, d.* (see Figs. 2. 5. and 6.) Fig. 4. is a front elevation. Fig. 5. is a side elevation. Fig. 6. is a plan on top of Fig. 5. omitting the bed plate. Fig. 7. is an end elevation of the piston and its supporting disk, by itself. Fig. 8. shows the piston packing ring in side elevation, by itself. Fig. 9. is a side elevation of the cam, by itself. Fig. 10. shows respectively in sectional, and side elevation, a modification of Fig. 9. Fig. 11. is a sectional elevation showing more especially the arrangement of the ports and passages. Fig. 12. shows in detail a side, and end elevation of the reversing gear, by itself. Fig. 13. shows a side and end elevation of the cut off or expansion valve by itself. Fig. 14. shows a side

and end elevation of the abutment or resistance valve by itself. Fig. 15. shows in detail a plan and side elevation of the variable expansion gear by itself. Fig. 15^a is a side elevation of my rotary engine, showing the variable expansion gear in position.

The cylinder A. is formed by bolting together two cheeks A' and A². Each cheek has a semi-circular or approximately semi-circular recess in it so that when bolted together they leave an annular space or chamber (forming the cylinder A.) of circular or approximately circular section between them, in which travels the piston B, which projects outward from and at right angles to its supporting disk B'.

The piston B. is connected to the periphery or forms part of the disk B'. which is keyed on or otherwise suitably secured to the main shaft C. The piston is made radial and suitably packed by a spring piston ring B². which is held in position by the pin B³. supported by a junk ring or disk B⁴. and secured to the lugs B⁶. of the piston B. by the bolt B⁵.

The piston disk B' is provided with packing or wearing rings C' and C². seated in suitable recesses in the cheeks A' and A². and they can be adjusted by the screws *e.* from the outside. Slots corresponding to those in the piston disk B'. may be provided upon the face of the rings C' and C². whereby a better joint would be insured. Both cheeks of the cylinder are provided with suitable bearings C³. and stuffing boxes C⁴. and glands C⁵. for the engine shaft C. The cheeks A' and A². are bolted or otherwise secured to a bed-plate Q. which may be extended so as to accommodate additional bearings for the engine shaft C. or for other requirements.

The abutment or resistance valve D. is simply a plate of metal which bears on a facing sufficiently tight to prevent any steam passing from one side to the other of it in the cylinder and it is suitably attached and fitted to a spindle or rocking shaft G⁶. and oscillates at right angles to the piston B. in a case or cover G. The latter may be made in two or more parts for convenience of manufacture and removal, screwed or otherwise suitably fitted together and secured to the cylinder cheeks A' and A².

The cam E. (secured to the engine shaft C.)

at a given time lifts the roller F. attached to a short arm or fulcrum F'. secured on a rocking shaft C⁶. which works in suitable bearings C⁷. provided on the cheek A². The levers F². secured to the said rocking shaft C⁶. communicate motion to the disks F⁵. by means of the links F³. connected to the crank pins F⁴. provided on the said disks F⁵. which are secured to the abutment spindle or rocking shaft G⁶. so as to withdraw the abutment or resistance valve D. and allow the piston B. to pass and then immediately resume the closed position as shown at Fig. 3. In passing I note that it is possible and convenient if desired to operate the said abutment by a single lever and connections instead of two as above described. The tension springs S. and S'. keep the roller F. against the face of the cam E.

According to a modification of the cam arrangement as shown at Fig. 10. the tension springs S. and S'. may be dispensed with and a suitable adjustment provided for keeping the rollers f. and f'. against the faces of the cam E'.

On the upper part of the abutment case or cover G. a cylindrical chamber G'. is formed in which is arranged the "cut off" or expansion valve G³. and the reversing gear, consisting principally of the disk of metal G². provided with a certain number of teeth on its periphery in which gears an endless screw or worm wheel h, secured to, or forming part of a spindle h', operated from the outside by a hand-wheel h². attached to the said spindle. The said case or cover G. provides suitable bearings, stuffing boxes, and glands, for the spindles or rocking shafts G⁶, G⁷, and h', and further contains three ports or passages p, p', and p². Two of the said ports or passages namely p', and p². lead from the face of the cylindrical chamber G', to the cylinder,—or piston chamber A,—one on each side of the abutment case or cover G, and the third port or passage (hereinafter called the main exhaust port p), leads from the face of the said cylindrical chamber G', to the exhaust pipe P. The reversing disk valve G². is provided with a semicircular slot or passage l². on the opposite side to valve face, by which arrangement communication is established between the main exhaust port p, and the port and passage p². Another port or passage l', cut through the disk G². corresponds with the third port and passage p'. The "cut off" or expansion valve G³. oscillates against the face of the reversing disk valve G². the former having a port or opening l, provided in same, through which steam passes and finds ingress through the port l', (in the reversing disk valve G².) and thence by the port and passage p', into the cylinder or piston-chamber A, between the abutment D, and the piston B, for a given time, regulated by the extent of expansion.

The "cut off" or expansion valve G³ is operated by an eccentric H, which is suitably

secured on the main shaft C. The eccentric rod H', is connected to a crank pin H². provided on a disk H³. which is secured on the spindle or rocking shaft G⁷. the latter (furnished with a suitable bearing and packing gland on the upper part of the case or cover G), passes through the center of the reversing disk valve G² and is suitably attached to the cut off or expansion valve G³. It is obvious that on movement of the eccentric H, an oscillating motion is imparted to the cut off or expansion valve G³.

A variable expansion may be arranged as shown at Figs. 15 and 15^a. Here r, is an arm (which takes the place of the disk H³), provided with a slot r', in which fits a block r². The crank pin r³. is attached to, or forms part of the said block and the latter is moved in the slot r', as desired upon turning the hand wheel r⁴. by reason of a screw thread formed on the spindle r⁵ engaging with a corresponding female thread provided in the block r². The degree of expansion is increased or decreased in proportion to the distance that the block r². and consequently the crank pin r³. is moved from the spindle or rocking shaft G⁷. A pointer may be provided on the block r². to indicate upon a scale marked on the face of the arm the degree of expansion.

The action of the engine is as follows:—Steam is introduced through the supply pipe P', into the chamber G', and the cut off or expansion valve G³. being in the proper position allows steam to pass through the port or opening l, into the port l', provided in the reversing disk valve G². and thence through the port and passage p', into the cylinder A. The force of the steam is then exerted between the abutment or resistance valve D, and the piston B. The latter is thereby caused to rotate taking with it its supporting disk B', and consequently turning the shaft C, which operates the expansion valve G³. by means of the eccentric H,—also the cam E, secured on the said shaft C, which at a given time transmits motion to the abutment D, (as hereinbefore described) so as to withdraw and allow the piston B, to pass and immediately return to its previous position across the cylinder A. The exhaust steam finds egress on the other side of the abutment D, through the port and passage p². and thence through the semicircular slot or passage l². provided on the back of the reversing disk valve G². into the main exhaust port p, and pipe P.

The engine is reversed in the following manner:—On movement of the hand wheel h².—attached to the spindle h',—motion is transmitted to the reversing disk valve G². by the worm wheel h,—secured to or formed on the said spindle h',—engaging with the teeth provided on the periphery of the said disk valve G². whereby the position of the port l', in the reversing disk valve G². is moved so that it corresponds with that of the port p². The course of the steam is thus changed. Consequently the engine is caused to work in the op-

posite direction; simultaneously, the position of the semicircular port or passage l^2 ,—on the back of the reversing disk valve G^2 ,—is changed so as to put the port p' in communication with the main exhaust port p , or vice versa, upon moving the hand wheel h^2 , in the opposite direction. Upon reversing the engine, equal expansion is secured by the following arrangement: On the boss of the eccentric H , I provide a slot L , so as to allow the shaft C , to turn and carry the piston B , from the position g , to g' (see Fig. 1), or vice versa, without changing the position of the "cut off" or expansion valve G^3 . When the feather or stop s , secured to the shaft C , comes either in contact with the shoulders n , or n' ,—on the boss of the eccentric H , the latter is carried round in the direction in which the engine is started and gives the required motion to the "cut off" or expansion valve G^3 . To stop the engine by the hand wheel h^2 , the port l' , on the reversing disk valve G^2 , is placed between the ports and passages p' and p^2 , so as not to communicate with either port or passage. An indicator may be provided to show position of the port l' .

Two or more engines may be coupled together, the steam being expanded in the cylinders as hereinbefore described, or steam may be used at high pressure in one cylinder and then expanded in one or more cylinders of suitable size.

Suitable fittings and arrangements for the steam jacketing, lubrication, and governing of my engine will be provided.

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

1. In a machine of the character described, the combination with an annular chamber or cylinder, a piston revolving in said chamber, a disk attached to said piston, a shaft secured to said disk and turning therewith, a resistance valve to close said annular cylinder, means for moving said resistance valve out of the path of the piston and for returning it to its place to close the cylinder, of ports opening into the cylinder on each side of the resistance valve D , an oscillating valve G^3 having

openings for admitting steam into one of the ports, and for opening the other into the exhaust pipe, a rock shaft upon which the said oscillating valve is mounted, an eccentric on the main shaft connected with the said rock shaft to oscillate the valve, a reversing disk G^2 loosely mounted upon the rock shaft, adjacent to the valve, and having openings therein, which by turning the said disk can be caused to register with the said steam ports, and means for turning the said disk to cause the steam to be admitted on either side of the resistance valve D , substantially as and for the purposes described.

2. In a machine of the character described, the combination with an annular chamber or cylinder, a piston revolving in said chamber, a disk attached to said piston, a shaft secured to said disk and turning therewith, a resistance valve to close said annular cylinder, means for moving the said resistance valve out of the path of the piston and for returning the said valve to its place to close the cylinder, of ports opening into the cylinder on each side of the resistance valve D , an oscillating valve G^3 having openings for admitting steam into one of the ports and for opening the other into the exhaust pipe, a rock shaft upon which the said oscillating valve is mounted, an eccentric on the main shaft connected with the said rock shaft to oscillate the valve, a reversing disk G^2 loosely mounted upon the rock shaft adjacent to the valve, and having worm teeth around the periphery thereof, and openings therein which by turning the disk can be caused to register with the said steam ports, a worm wheel mounted upon a shaft h' and meshing with the teeth upon the periphery of the disk G^2 , the shaft h' having a hand wheel h^2 by means of which the said shaft and disk may be turned to cause steam to be admitted on either side of the resistance valve D , substantially as and for the purposes described.

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