

No. 748,320.

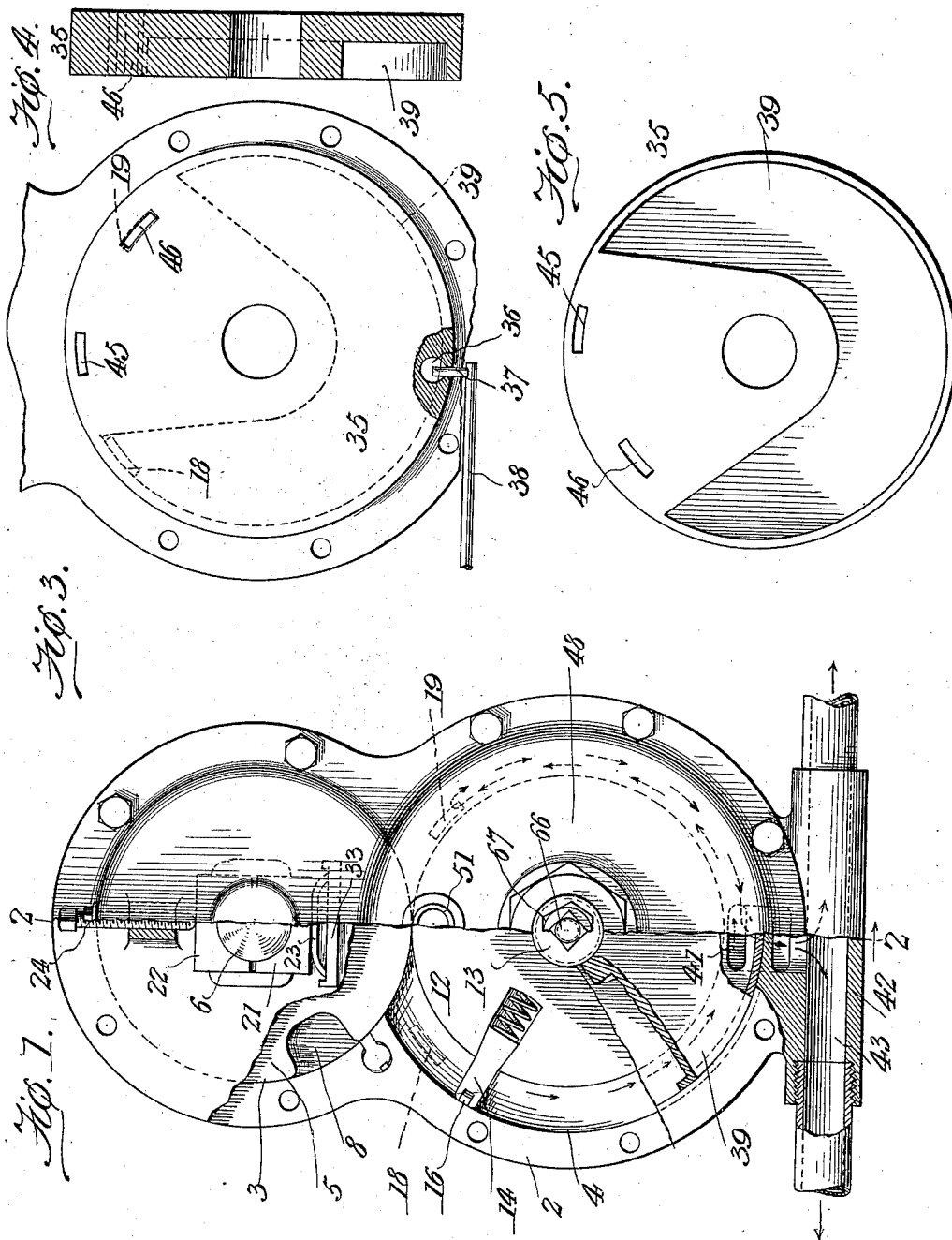
PATENTED DEC. 29, 1903.

F. K. STURDIVANT.
ROTARY ENGINE.

APPLICATION FILED MAY 9, 1903.

NO MODEL.

2 SHEETS—SHEET 1



Witnesses
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Geo. E. Carter

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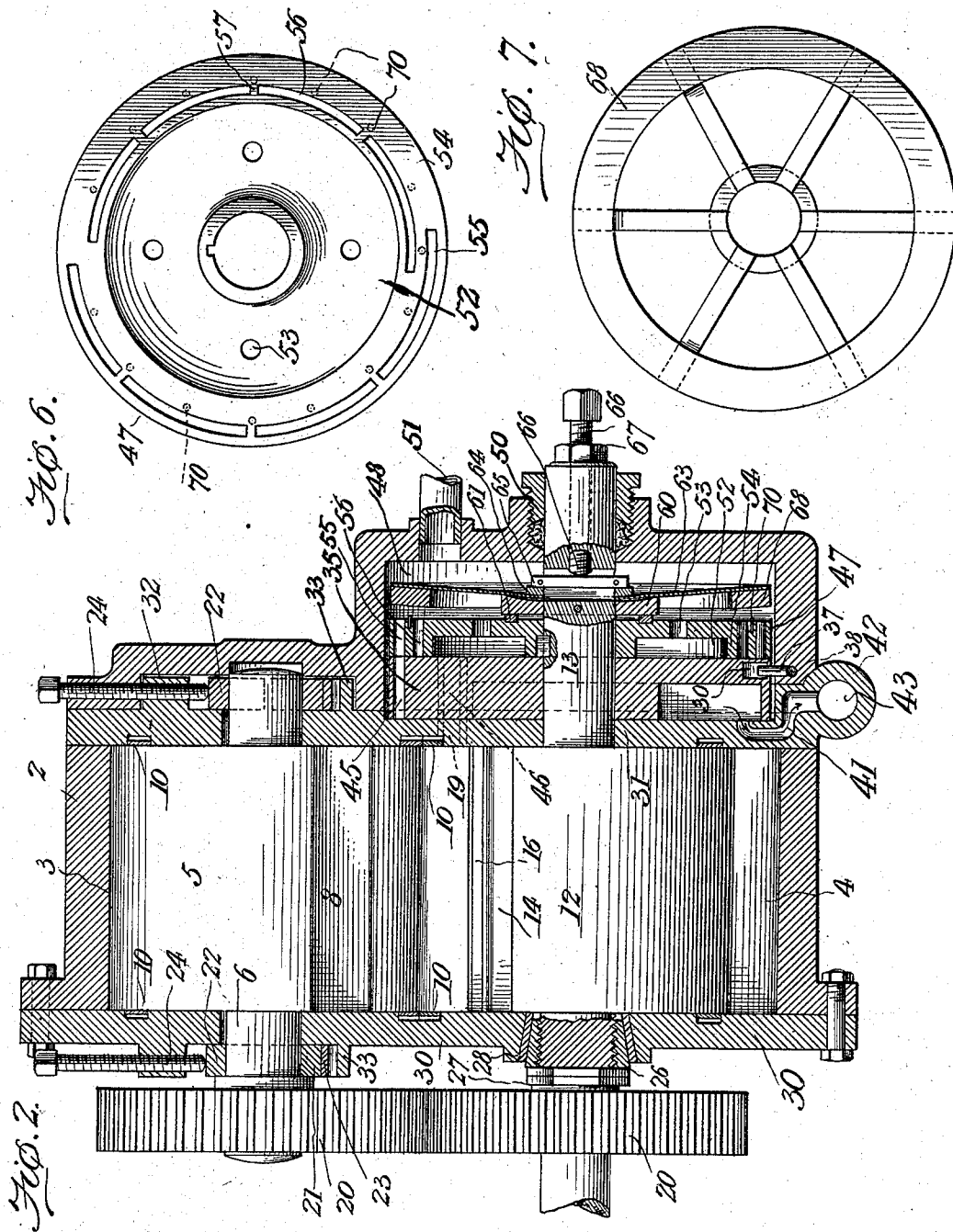
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UNITED STATES PATENT OFFICE.

FRANK K. STURDIVANT, OF BISCOE, NORTH CAROLINA, ASSIGNOR OF ONE-HALF TO JUNIUS R. PAGE, OF BISCOE, NORTH CAROLINA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 748,320, dated December 29, 1903.

Application filed May 9, 1903. Serial No. 156,476. (No model.)

To all whom it may concern:

Be it known that I, FRANK K. STURDIVANT, a citizen of the United States, residing at Biscoe, in the county of Montgomery and State of North Carolina, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to certain improvements in rotary engines, and has for its principal object to provide an improved means for controlling the admission of steam to and its exhaust from the cylinder of the engine.

A further object of the invention is to provide a novel form of valve for controlling the flow of steam to the cylinder and in connection with this valve to employ a reversing-valve which may be utilized to place one or other of the cylinder-ports in communication with the exhaust, and thus govern the direction of rotative movement of the engine.

A still further object of the invention is to provide in connection with the valve a novel form of governor which to some extent partakes of the nature of a throttle-valve, provision being made for opening or closing the valve to any desired extent and at the same time for automatically controlling opening and closing movement of the valve in accordance with the speed of rotation of the piston.

A still further object of the invention is to provide a novel form of packing for preventing the escape of the steam or other actuating fluid around the main shaft of the engine; and a still further object is to provide a novel form of revoluble abutment having suitable recesses for the reception of the opposite wings or blades, the movement of the piston and the abutment being properly timed in order to bring the recesses into abutment-receiving position during the operation of the engine.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or

sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is a transverse sectional elevation of a rotary engine constructed in accordance with the invention, portions being broken away in order to more clearly illustrate the construction. Fig. 2 is a longitudinal sectional elevation of the same on the line 2 2 of Fig. 1. Fig. 3 is a transverse sectional elevation through the steam-chest, showing the outer face of the reversing-valve in elevation. Fig. 4 is a transverse sectional elevation of the reversing-valve. Fig. 5 is an elevation of the inner face of the reversing-valve. Fig. 6 is a detail view of the steam-valve. Fig. 7 is a view illustrating a modified form of governor-valve.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The engine is mounted on a suitable frame or bed, and its casing 2 comprises a pair of substantially cylindrical chambers 3 and 4, of which the lower constitutes a steam-cylinder, the upper chamber serving to receive a revoluble abutment 5, which is mounted on a shaft 6, extending through suitable openings in the opposite cylinder-heads. The abutment 5 is cylindrical in form and is provided with one or more longitudinally-disposed peripheral recesses 8 for the reception of the wing or wings carried by the piston, and at the opposite ends of said cylindrical abutment are substantially annular grooves, in which are seated packing-rings 10, pressed outward into contact with the cylinder-heads by suitable springs.

The piston-body 12 is cylindrical in form and is secured to a shaft 13, having its opposite ends extending outside the heads of the cylinder, and in suitable radial recesses in said piston are arranged abutment-wings 14, pressed outward by suitable springs 15 and provided with packing-strips 16 for contact with the end walls of the piston.

The cylinder-abutment 5 separates the annular steam-space of the cylinder, and leading into the steam-space at opposite sides of the abutment are two ports 18 and 19, either of which may constitute the steam-entrance

port, while the other acts as an escape-port for the steam or other actuating fluid.

In order to provide for the proper timing of the movement of the piston and the abutment to the end that the recesses of said abutment may be properly presented to the piston-wings, the abutment and piston shafts are each provided with gears 20, or they may be otherwise connected in order to effect proper rotative movement of the abutment. The abutment-shaft after passing through the openings in the cylinder-heads is received in bearings each formed of a block 21 and a cap 22, the block 21 resting on a suitable spring 23, which normally tends to elevate the block and the abutment, while the upper block 22 receives the thrust of a screw 24, which may be adjusted to any desired extent in order to move the abutment toward the periphery of the piston.

The piston is preferably provided with packing-rings at its opposite ends in order to prevent or to lessen the escape of steam, and one end of the piston-supporting shaft 13 is threaded for the reception of a conical collar 26, which may be held in place by one or more jam-nuts 27 on the threaded portion of said shaft. On the top of the collar is placed a tapering sleeve or bushing 28, which fits in a correspondingly-shaped opening in the removable cylinder-head 30 and serves to prevent escape of steam, while the conical sleeve permits of the necessary taking up to compensate for wear.

To that end of the cylinder opposite the head 30 is secured a cylinder-head 31, having a lug 32 provided with a suitable threaded opening for the reception of one of the adjusting-screws of the abutment-shaft and being further provided with a suitable lug or flange 33, on which may be rested one of the abutment-supporting springs.

The lower portion of the head 31 is somewhat reduced in thickness and is faced to form a seat for a reversing-valve 35, said valve being of the construction best shown in Figs. 3, 4, and 5 and comprising a disk having at its lower edge an opening 36 to receive a pin 37, carried by a suitable rod 38, which may be moved to shift the position of the valves and reverse the direction of rotative movement of the piston. The disk-valve 35 is mounted loosely on the main shaft 13, and its face is recessed, as indicated at 39, to form an exhaust-space, which may communicate with one or other of the cylinder-ports 18 19. In the lower portion of the disk the exhaust-space communicates with a port 41, leading to an enlarged boss 42, having a passage 43 for the exhaust-steam, one or both ends of the boss being connected in any suitable manner with a pipe to convey the exhaust away from the engine. The valve 35 is further provided with two transversely-extending ports 45 and 46, which pass completely through from side to side of the valve

and are so arranged that one or other may register with the cylinder-ports 18 19 in order to permit the entrance of steam to one side of the cylinder and its escape from the opposite side thereof. It will be noted that the ports 45 and 46, as well as the ports 18 19, are arranged at different radial distances from the axis of rotation, this being principally for the purpose of preventing any accidental escape of steam when the steam-valve is operated.

The reversing-valve 35 and steam-valve 47 are both arranged within a steam-chest 48, formed by a suitable casing, which may be bolted or otherwise secured to the cylinder-head or main body of the cylinder, said casing being provided with a suitable stuffing-box and gland-nut, as 50, for the passage of one end of the main shaft 13 and being further provided with a steam-supply pipe 51, connected to a boiler or any other suitable source of supply for a fluid under pressure.

The steam-valve 47 is in the form of a disk keyed or otherwise rigidly secured to the shaft 13 and provided on its inner face, or that face adjacent to the reversing-valve 35, with an annular recess 52 in free communication with the steam-space of the steam-chest through the medium of openings 53 in order that the valve may be balanced, and thus avoid unnecessary friction due to the pressure of steam on the outer face of the valve. The annular flange 54, which forms the periphery of the disk-valve 47, is provided with two transversely-extended ports 55 and 56, each of which extends for rather more than half the circumference of the valve, there being suitable webs 57 extending across each of the ports in order to strengthen the structure. These two ports are disposed at different radial distances from the axis of rotation, corresponding to the distances at which the cylinder-ports are disposed, and during the rotative movement of the shaft and steam-valve one of such ports will be in communication with the cylinder-port through the corresponding port of the reversing-valve, and as the ports 55 and 56 are arranged at different radial distances from the axis of rotation there will be little or no danger of leakage of steam. Both the steam-valve and the reversing-valve are of less diameter than the internal diameter of the steam-chest in order to permit the passage of steam between the exterior of the valve and the inner walls of the chest to thereby lessen the frictional resistance to the movement of the valve.

The number of ports 55 and 56 may be increased in accordance with the number of piston-wings, and as only one of such piston-wings is shown in the present instance but a single set of ports is necessary.

To the main shaft is secured a collar 60, slightly spaced from the steam-valve, a packing-ring 61 being introduced between the two in order to prevent the entrance of steam.

The area of this collar is approximately equal to the area of the annular flange of the steam-valve less the area of the steam-ports, and as this collar is rigidly secured to the main shaft
 5 pressure of steam on the outer face of the collar will not be transmitted to the valve proper and friction on the valve will be materially lessened, the pressure on the inner and outer faces of the valve being approxi-
 10 mately the same.

The outer face of the collar 60 is dished or of concave form and receives the central portion of a diaphragm 63, said diaphragm being retained in place by a movable collar 64,
 15 which is engaged by a transverse bar 65, passing through a diametral slot in the main shaft and engaged by an adjusting-screw 66, adapted to a threaded opening in the end of the shaft, a suitable jam-nut 67 being employed to lock the screw in adjusted position.
 20

The diaphragm is formed of thin elastic metal and is provided at its outer edge with a ring 68 of sufficient width to cover both of the steam-ports. This ring is normally
 25 moved in the direction of the outer face of the valve by the diaphragm, but is held from contact therewith by means of a series of pins or lugs 70, so that there will always be a passage for steam between the outer face of the
 30 valve and the ring, the area of the space being adjustable manually in order to increase or decrease the speed of the engine and being further adjustable automatically by fluctuations in the speed of rotation of the shaft
 35 13. The fixed collar 60 and the adjustable collar 64 are of such shape with relation to the diaphragm that when slight pressure is exerted on the movable collar the diaphragm will be clamped and the ring 68 will be moved
 40 in the direction of the valve, while increase in pressure will result in slight outward movement of the ring, the outer edge of the fixed collar forming a fulcrum for that portion of the diaphragm with which it engages, so that
 45 the position of such ring may be adjusted in order to alter the area of the space through which the steam is admitted from the chest to the ports.

When the engine revolves at a normal
 50 speed, the ring will retain the position to which it is adjusted by means of the screw 66; but when the speed increases above the normal the ring 68 will naturally seek to assume a position in direct alinement with the center of rotative movement of the diaphragm to
 55 which it is attached and will thus be moved in the direction of the steam-valve in order to reduce the steam area and to correspondingly reduce the speed of the engine.

60 The diaphragm may be formed of a series of radiating strips of spring metal or may be in the form of a solid sheet, as preferred, the strip construction being illustrated in Fig. 7.

Having thus described the invention, what
 65 is claimed is—

1. In a rotary engine, a cylinder, a piston disposed therein, a shaft secured to the piston,

a revoluble steam-valve carried by the shaft and having ports for controlling the admission of steam to the cylinder, an adjustable
 70 ring for controlling the volume of steam passing through said ports, and a yieldable means for supporting said ring.

2. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston,
 75 a revoluble ported steam-valve, an adjustable ring for controlling the volume of steam passing through the valve, a yieldable means for connecting said ring to the shaft, and means for adjusting said ring.
 80

3. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston, a revoluble ported steam-valve, a ring for
 85 controlling the volume of steam, and a yieldable connection between the ring and the shaft.

4. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying said piston, a revoluble ported steam-valve, a ring for controlling the volume of steam passing through
 90 the valve-ports, a diaphragm carrying the ring, a pair of collars carried by the shaft and between which the central portion of the diaphragm is clamped, and means for adjusting one of said collars.
 95

5. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston, a revoluble ported steam-valve carried by the shaft, a ring for controlling the volume of steam passing through the valve-ports, a diaphragm carrying the ring, a diaphragm-clamping collar supported by the shaft and engaging the central portion of the diaphragm in a vertical plane differing from that in which the ring is normally disposed, and means for
 100 adjusting said collar.
 105

6. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston, a revoluble ported steam-valve carried by the shaft, a ring for controlling the volume of steam passing through the valve, a diaphragm carrying the ring, a fixed collar carried by the shaft and having a recessed outer face, a movable collar mounted on the shaft and serving to clamp the diaphragm against the
 110 fixed collar, a diametral bar extending through a slot in the shaft and engaging the movable collar, and an adjusting-screw adapted to a threaded opening in the shaft and bearing against said bar.
 120

7. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston, a revoluble ported steam-valve, and a centrifugal governor comprising a ring-like valve, a yieldable means for securing the said
 125 valve to the shaft, the point of attachment between the shaft and the securing means being in a plane different from that in which the ring is disposed.

8. In a rotary engine, a cylinder, a piston
 130 disposed therein, a shaft carrying the piston, cylinder inlet and escape ports arranged at different radial distances from the center of rotation of the shaft, a reversing-valve having

controlling-ports disposed in similar manner, said valve having a recessed face forming an exhaust-space, an escape-pipe in communication with the exhaust-space, and a revol-
5 ble steam-valve having ports also disposed at different radial distances from the axis of ro-
tative movement of the shaft.

9. In a rotary engine, a cylinder, a piston disposed therein, a shaft carrying the piston,
10 cylinder-ports disposed at different radial distances from the center of rotation of the shaft, a reversing-valve having ports corresponding to those of the cylinder and provided with a recessed inner face forming an exhaust-
15 space, means for adjusting the position of the

reversing-valve, a revoluble ported steam-valve having elongated ports arranged at distances from the center of rotation corresponding to the ports of the cylinder, and a steam-chest inclosing both valves, the diameter of 20
the valves being less than the internal diameter of the steam-chest, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in 25
the presence of two witnesses.

FRANK K. STURDIVANT.

Witnesses:

FRANK PAGE,
WM. G. LUCH.