No. 668,633. Patented Feb. 26, 1901.

J. J. FREELAND.

ROTARY STEAM ENGINE.

(Application filed Jan. 15, 1900.

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

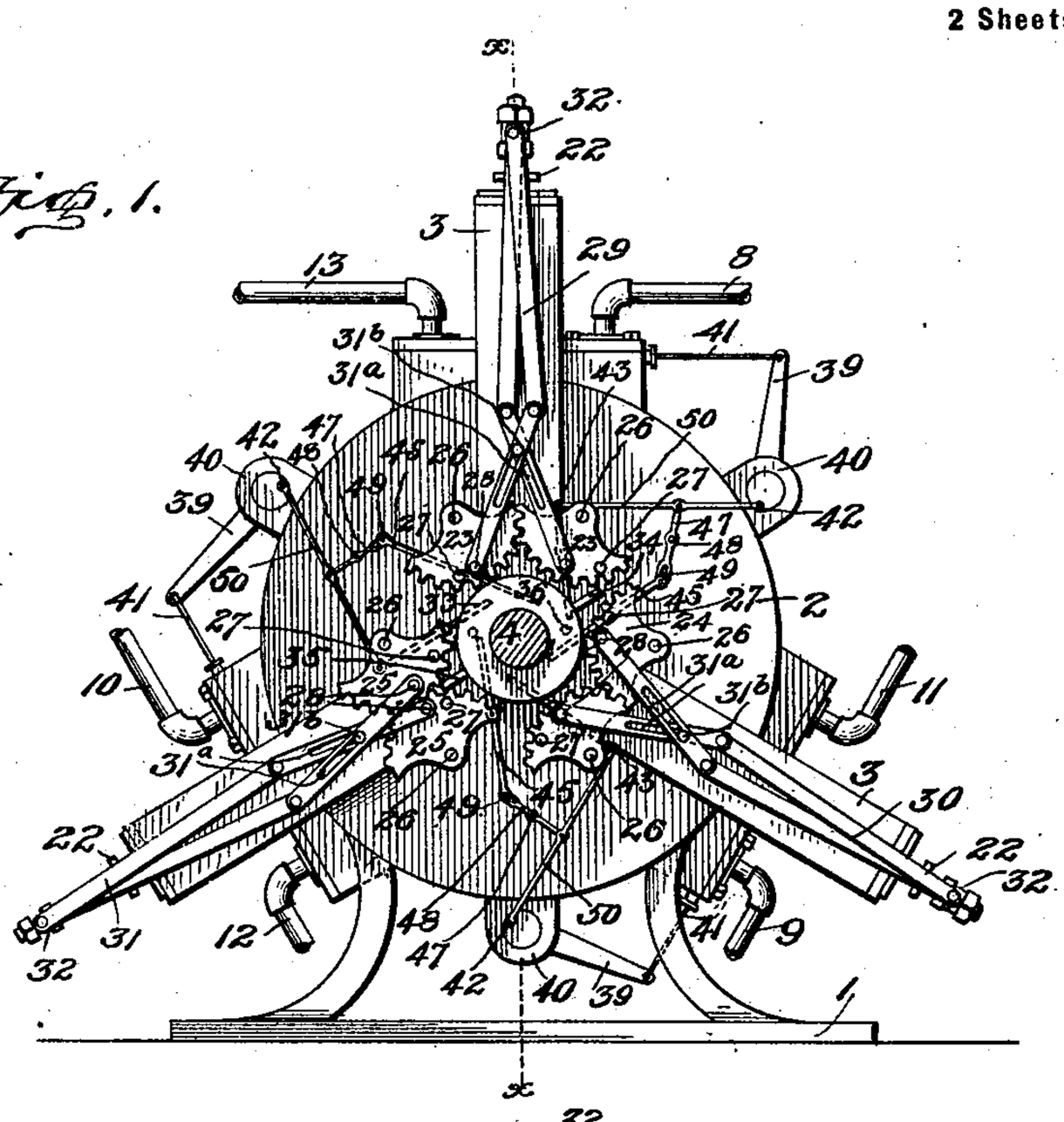
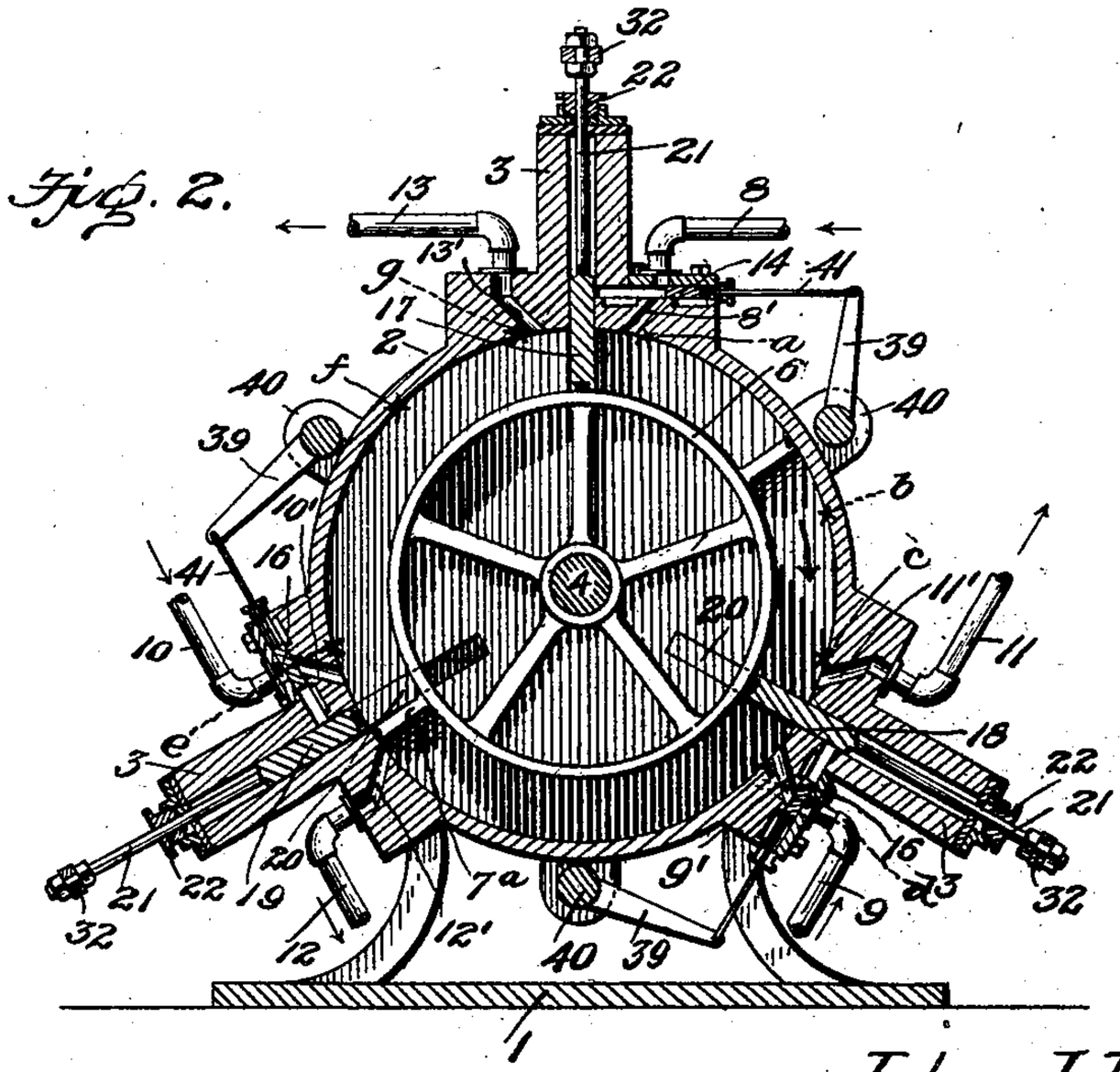


Fig. 2.



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2 Sheets—Sheet 2.

Fig. 3.

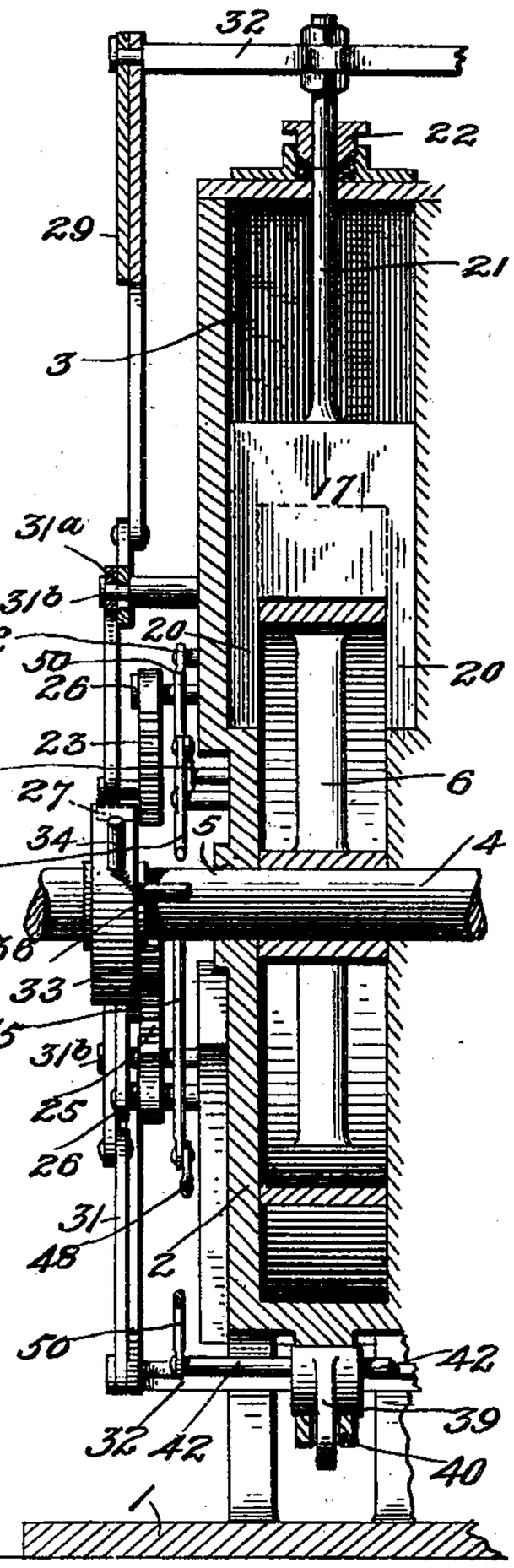


Fig. 4.

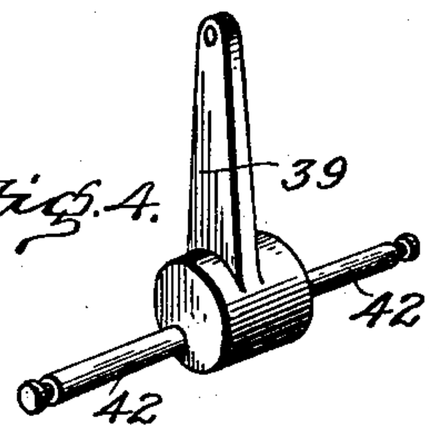


Fig. 5.

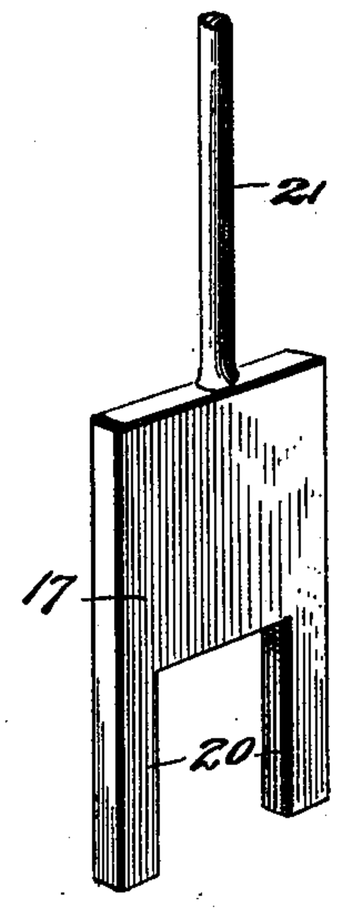


Fig. 6.

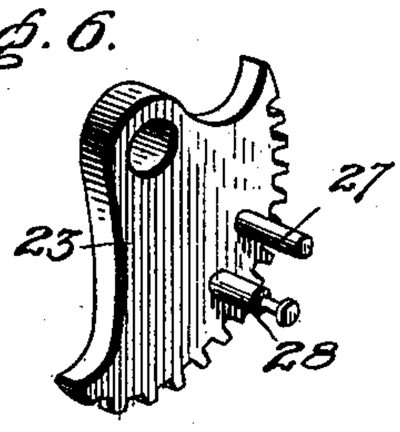


Fig. 8.

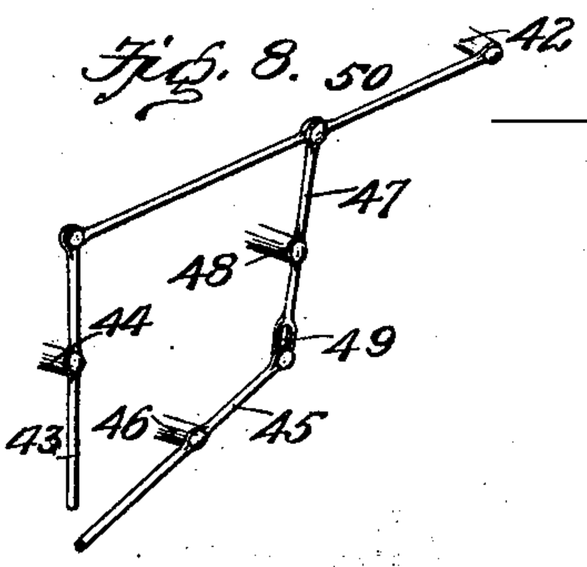
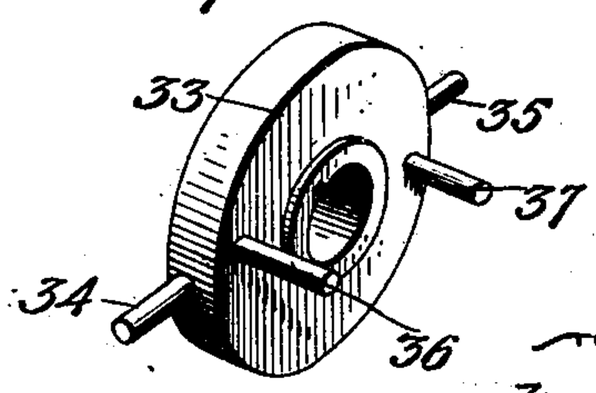


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOHN J. FREELAND, OF WASHINGTON, DISTRICT OF COLUMBIA.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 668,633, dated February 26, 1901.

Application filed January 15, 1900. Serial No. 1,487. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. FREELAND, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Rotary 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.

The invention relates to a rotary steam-engine.

The object of the invention is to provide an engine of this character which shall be simple of construction, durable in use, and comparatively inexpensive of production.

To this end the invention consists in certain features of construction and combination of parts, which will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 is a front elevation. Fig. 2 is a vertical sectional view. Fig. 3 is a similar view taken at right angles to Fig. 2 and on the line $x\,x$ of Fig. 1. Fig. 4 is a detail perspective view of one of the rocker-arms. Fig. 5 is a similar view of one of the impact-heads. Fig. 6 is a similar view of one of the segmental gears. Fig. 7 is a similar view of the trip-head, taken from the rear. Fig. 8 is a detail view of the valve-actuating mechanism.

In the drawings the same reference-characters indicate the same parts of the invention.

In said drawings, 1 denotes the base of the engine, and 2 the cylinder supported thereby. The heads of the cylinder are provided with three equidistant radial chambers 3, the outer ends of which extend radially beyond the periphery of the cylinder.

4 denotes the drive-shaft, journaled in bearings 5 in the heads of the cylinder, and to which is keyed the piston 6, having diametrically opposite disposed wings 7 7^a, which have a steam-tight engagement with the inner walls of the cylinder.

8, 9, and 10 denote steam-inlet pipes, and 11, 12, and 13 denote exhaust-pipes. The steam-inlet pipes communicate with the cylinder through inlet-port 8′, 9′, and 10′, and the exhaust-pipes communicate with the exhaust-ports 11′, 12′, and 13′. Slide-valves 14, 15, and 16 control the admission of steam to the said inlet-ports.

17, 18, and 19 denote impact-heads mounted to slide in the chambers 3, into the cylinder 2, and across the path of movement of the piston-wings. These heads have a steam-tight engagement in the chambers and with the periphery of the piston when they are brought into contact with the same. Each impact-head is provided at its inner end with guide-arms 20, which when the impact-head is retracted or withdrawn from the steam-space within the cylinder will fill the chamber, and thereby present a smooth flush surface to the ends of the wings. The outer end of each impact-head is provided with a rod 21, the outer end of which extends through a stuffing-box 22 at the outer end of the chambers.

23, 24, and 25 denote three sets of segmental gears, the gears of each set meshing and each gear pivoted upon a stud 26, projecting from the head of the cylinder. Projecting laterally from the face of each gear are a trip-stud 27 and a pivot-pin 28.

29, 30, and 31 denote three sets of pivoted levers of the "lazy-tongs" type. Two of the levers of each set are provided with elongated apertures 31^a, through which projects a pivot-pin 31^b, fixed to the face of the chamber 3. The levers of each set have their inner ends connected to the pivot-pins 28 of the segmental gears and their outer ends pivoted to an arm 32, secured to the outer end of the rod 21 of the impact-head.

33 denotes a trip-head which is fixed to the shaft 4 and is provided with laterally-projected and diametrically opposite trips 34 35, adapted to coact with the trip-studs 27 and actuate the segmental gears. This trip-head is provided with rearwardly-projecting trips 36 37, which are adapted to actuate valve mechanism which I will now proceed to describe.

39 denotes rocker-arms pivoted in bearings 40, projecting at equidistant points from the cylinder. The outer ends of these rocker-arms are connected to the valve-rods 41 of the slide-valves, while the inner ends of the rocker-arms are provided with wrist-pins 42.

To actuate the rocker-arms and operate the valve-rods, I provide three separate systems

of levers. Each system comprises a lever 43, pivoted to a stud 44, projecting from the head of the cylinder and having its inner end projecting into the path of movement of the trips 36 37, a lever 45, pivoted to a stud 46, projecting from the head of the cylinder and having its inner end located within the path of movement of the trips 36 37, and a lever 47, pivoted to the stud 48, projecting from the head of the cylinder and having its inner end joined to the outer end of the lever 45 by the pin-and-slot connection 49. The outer ends of the levers 43 and 47 are pivoted to a link 50, which has its outer end connected to the wrist-pin 42 of the rocker-arm.

The operation of the engine is as follows: Assuming the piston to be in the position shown in Fig. 2, the inlet-port 8′ open and the inlet-ports 9′ and 10′ closed, the impact-heads 17 and 18 projected into the cylinder, and the impact-head 19 in its retracted position, steam is admitted through the inlet-port 8′ at the rear of the piston-wing 7 and drives the wing from the point *a* to the point *b* in the circumference of the cylinder. When the piston reaches the point *b*, the trip 36 engages the inner free end of the lever 45 and forces it outwardly and through the intermediate mechanism closes the valve 14 over the inlet-port 8′. From the point *b* to the point *c* the piston-wing is driven by the expansive energy of the steam, and during this movement from the point *b* to the point *c* the trip 34 has engaged the trip-stud 27 of the advance segmental gear 24 and actuated said gear to withdraw the impact-head 18 from the cylinder and out of the path of movement of the advancing piston-wing. After the piston-wing 7 has passed clear of the impact-head 18 the trip 34 engages the trip-pin 27 of the other gear 24 and projects the impact-head 18 into the cylinder at the rear of the wing 7. During the movement of the piston-wing 7 from the point *a* to the point *b* the impact-head 19 had been withdrawn from across the steam-space within the cylinder by the trip 35 engaging the trip-pin 27 of one of the segmental gears 25 to permit the wing 7ª to pass the the impact-head 19. At the instant it passed this head the trip 35 engaged the trip-pin 27 of the other segmental gear 23 and projected the impact-head 19 across the steam-space in the cylinder. At the instant the piston-wing 7 reached the point *b* the valve 16 was withdrawn from over the port 10′ by the pin 37 engaging the inner free end of the lever 43, which, being connected to the rocker-arm 39 by the link 50, rocks said arm to withdraw the valve 16 from over its port. Steam is now admitted through said port at the rear of the piston-wing 7ª and between said piston-wing and the impact-head 19. It will thus be seen that at the instant the steam was cut off from the port 8′ and the piston-wing 7 began to act under the expansive energy of the steam live steam was admitted to the cylinder to drive the piston-wing 7ª by compression from the point *e* to the point *f* in the circumference of the cylinder. As the piston-wing 7ª was moving from the point *e* to the point *f* the piston-wing 7 was moving from the point *b* to the point *d*. In this movement the trip 34 had engaged the trip-pin 27 of one of the segmental gears 24, which through its intermediate mechanism withdrew the impact-head 18 from the steam-space within the cylinder, and at the instant the wing 7 reached the point *d* the trip 36 engaged the inner free end of the lever 43, which through its intermediate connections shifted the valve 15 from over the inlet-port 9′, thus admitting steam through said port to drive the wing 7 by the compression of the steam at the very instant that the steam was cut off from the port 10′, at which instant the wing 7ª was at the point *f* in the circumference of the cylinder, from which point to the point *g* it was driven by the expansive energy of the steam. In the movement of the piston-wing 7ª from the point *f* to the point *a* the impact-head 17 is withdrawn by the trip 35 engaging the trip-pin of one of the segmental gears 23 and actuating the lazy-tongs levers, to which the said impact-head is connected, thus permitting the free passage of the wing 7ª from the point *f* to the point *a*. As it passes under the impact-head 17 the trip 35 engages the trip-pin 27 of the other segmental gear and lowers the impact-head, and immediately after it passes the point *a* the valve 14 uncovers the port 8′ to admit steam into the cylinder between said impact-head 17 and the piston-wing 7ª. By this arrangement it will be noticed that the piston is perfectly balanced, thus taking the steam-load off the shaft and reducing to a minimum the friction, and thereby securing a lighter-running engine and one which will generate a maximum amount of power with a minimum expenditure of steam.

While I have shown and described my invention in connection with a vertical engine—one in which the piston rotates in a vertical plane—I would have it understood that I do not restrict myself to the same, as the engine would work just as well if the piston were arranged to rotate in a horizontal plane.

From the foregoing description, taken in connection with the accompanying drawings, the construction, operation, and advantages of my improved engine will be readily apparent without requiring an extended explanation.

It will be seen that the device is simple of construction, that said construction permits of its manufacture at small cost, and that it is exceedingly well adapted for the purpose for which it is designed. It will also be understood that various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention.

Having thus fully described my invention,

what is claimed, and desired to be secured by Letters Patent of the United States, is—

1. In a rotary steam-engine, the combination with a cylinder provided with a series of sets of steam inlet and exhaust ports, and a rotatable piston, of a series of impact-heads, each of which is mounted to operate in the cylinder between the inlet and exhaust ports of each set, valves for controlling the inlet-ports, a series of sets of operating devices for the valves, a series of sets of operating devices for the impact-heads, and a trip device common to both of said sets of operating devices for operating the same successively and in alternation, whereby live steam is admitted to the cylinder at some point in its circumference at all times and cut off at predetermined points, to drive the piston continuously by pressure of the live steam and intermittently by steam-expansion, substantially as set forth.

2. In a rotary steam-engine, the combination with a cylinder provided with a series of sets of steam-inlets and exhaust-ports, a shaft, and a rotatable piston, of valves controlling the inlet-ports, a series of impact-heads, each of which is mounted to operate in the cylinder between the inlet and exhaust ports of each set, a series of sets of operating devices for the valves, a series of sets of operating devices for the impact-heads, and a rotating element carried by the shaft and carrying two sets of trip devices to actuate both of said sets of operating devices, substantially as set forth.

3. In a rotary steam-engine, the combination with a cylinder provided with inlet and exhaust ports, a shaft, and a rotatable piston, of impact-heads, valves for controlling the inlet-ports, a system of valve-operating levers for each valve, a system of impact-head-operating levers for each head involving lazy-tongs and actuating-gears therefor, and a trip-head carried by the shaft and provided with two sets of trip devices for operating said two sets of levers successively and in alternation, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN J. FREELAND.

Witnesses:
BENJ. G. COWL,
WILBUR HAUER.