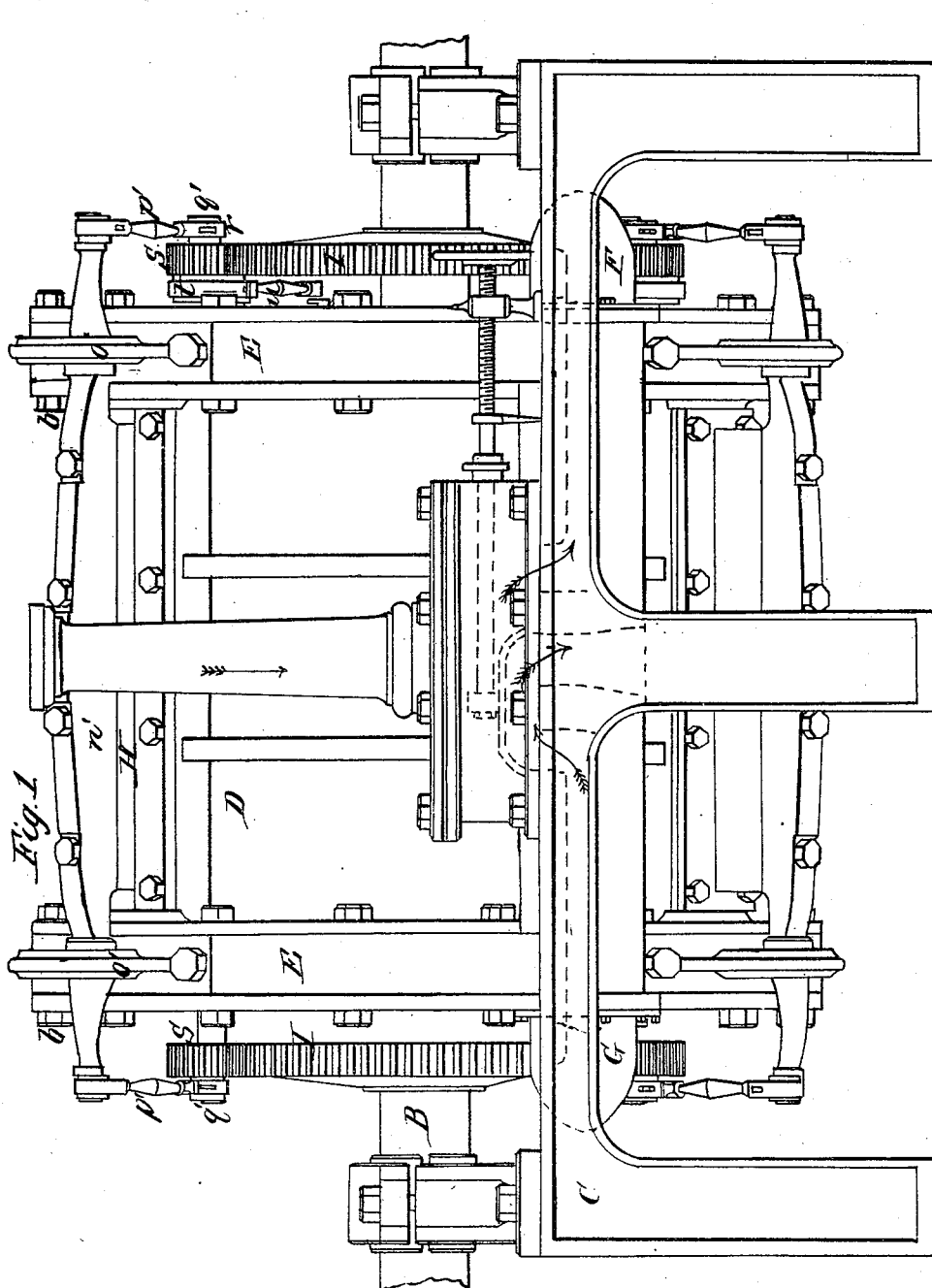


H. G. THOMPSON.
ROTARY STEAM ENGINE.

No. 6,962.

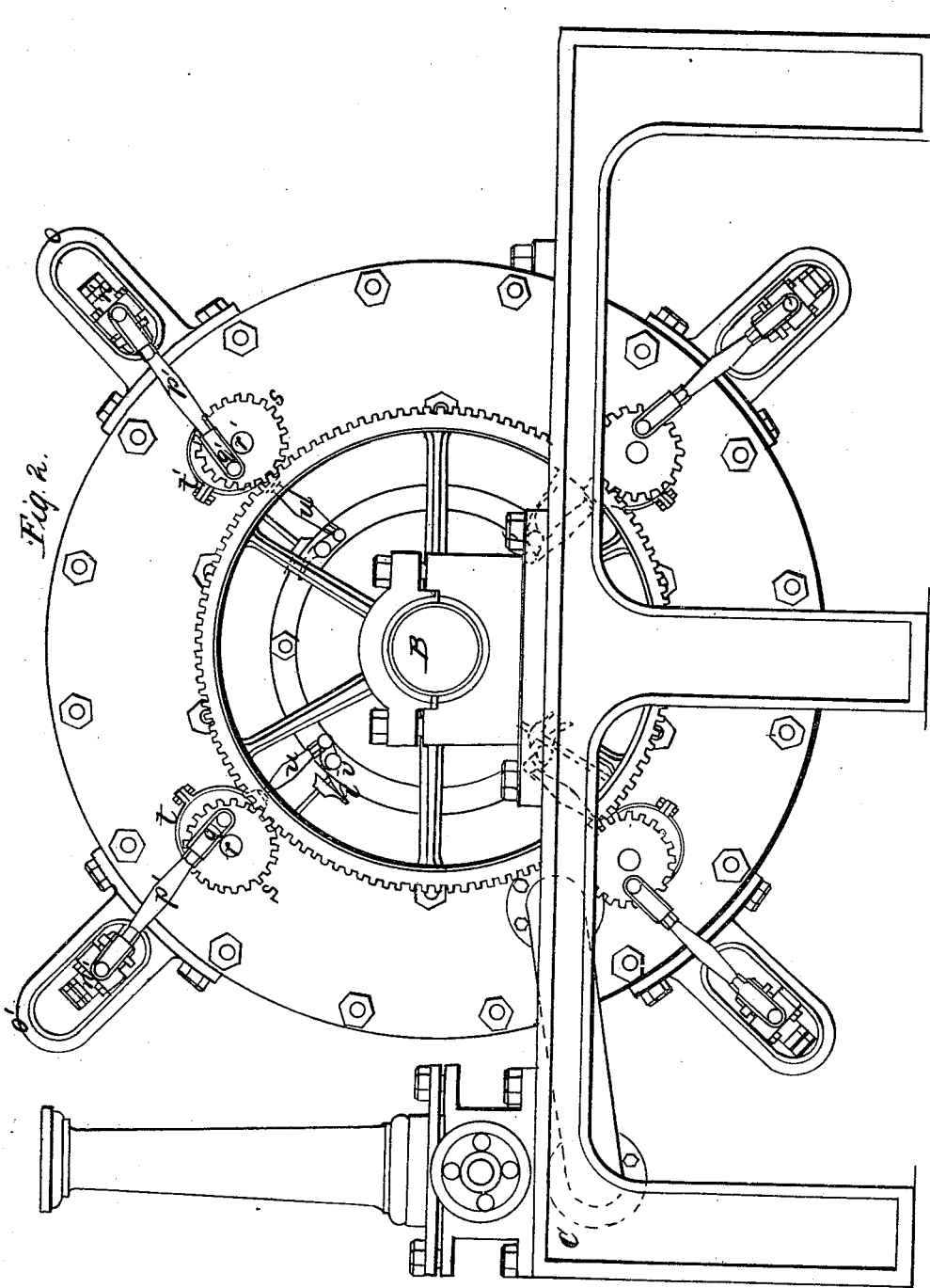
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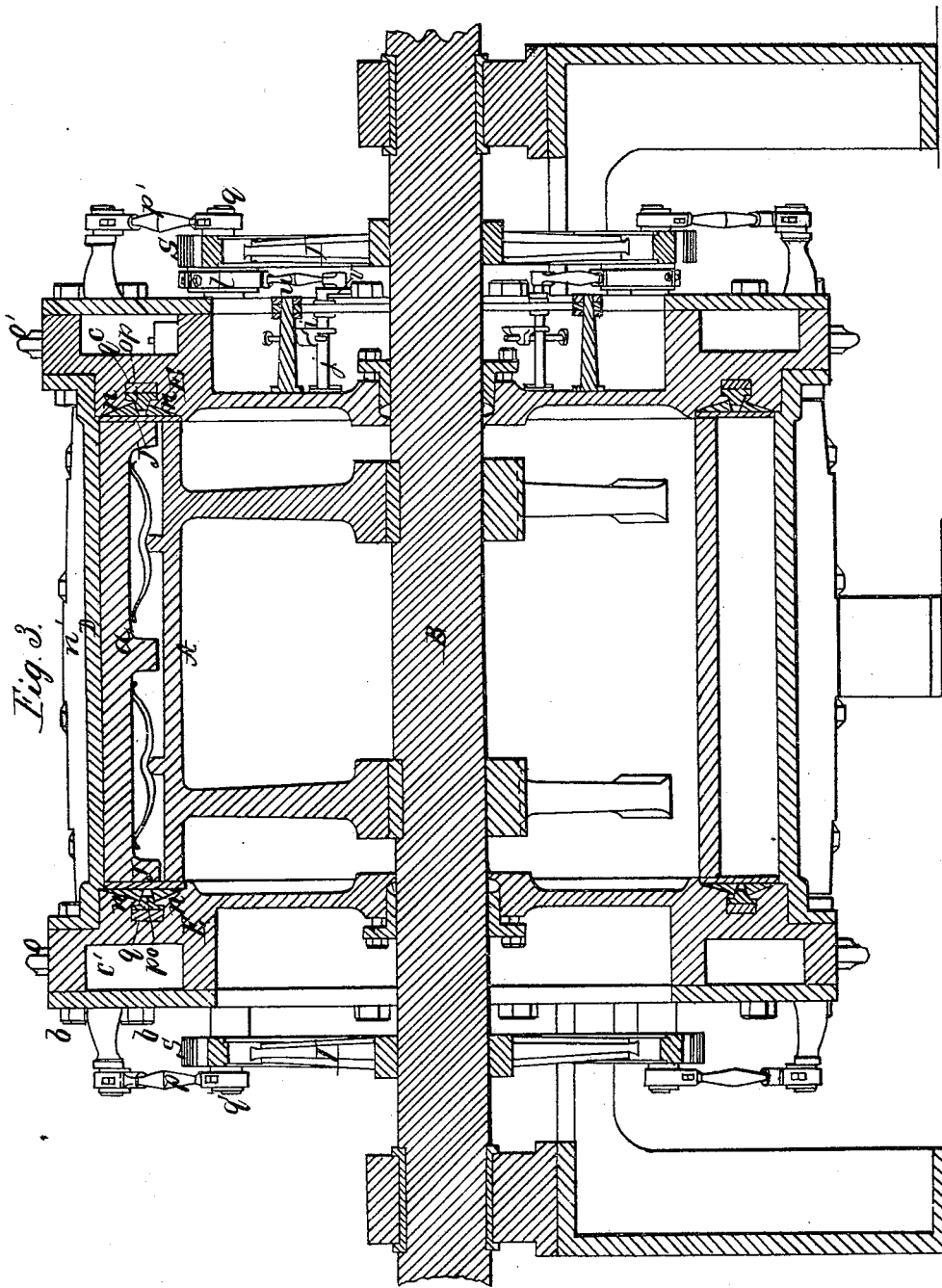
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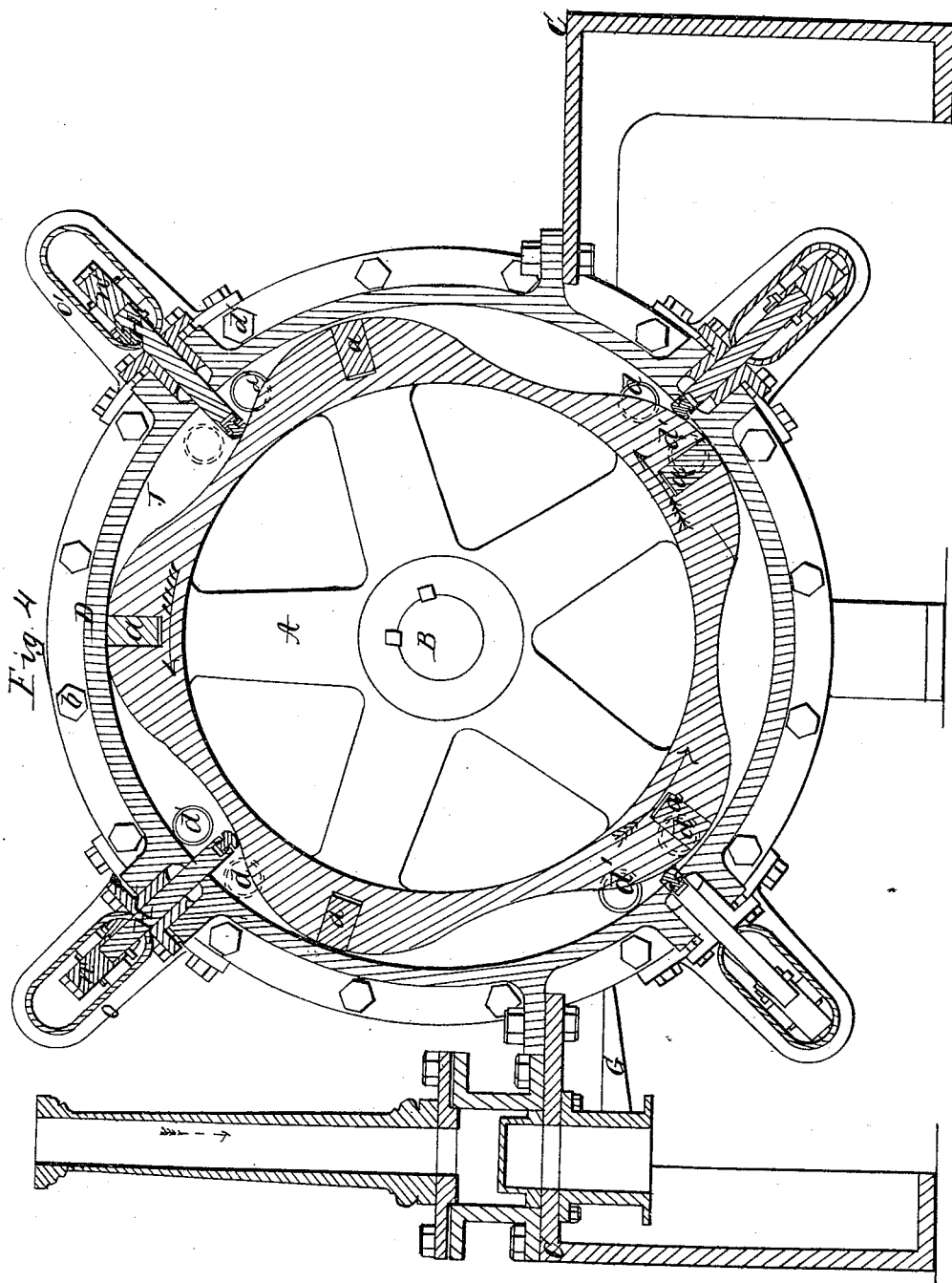
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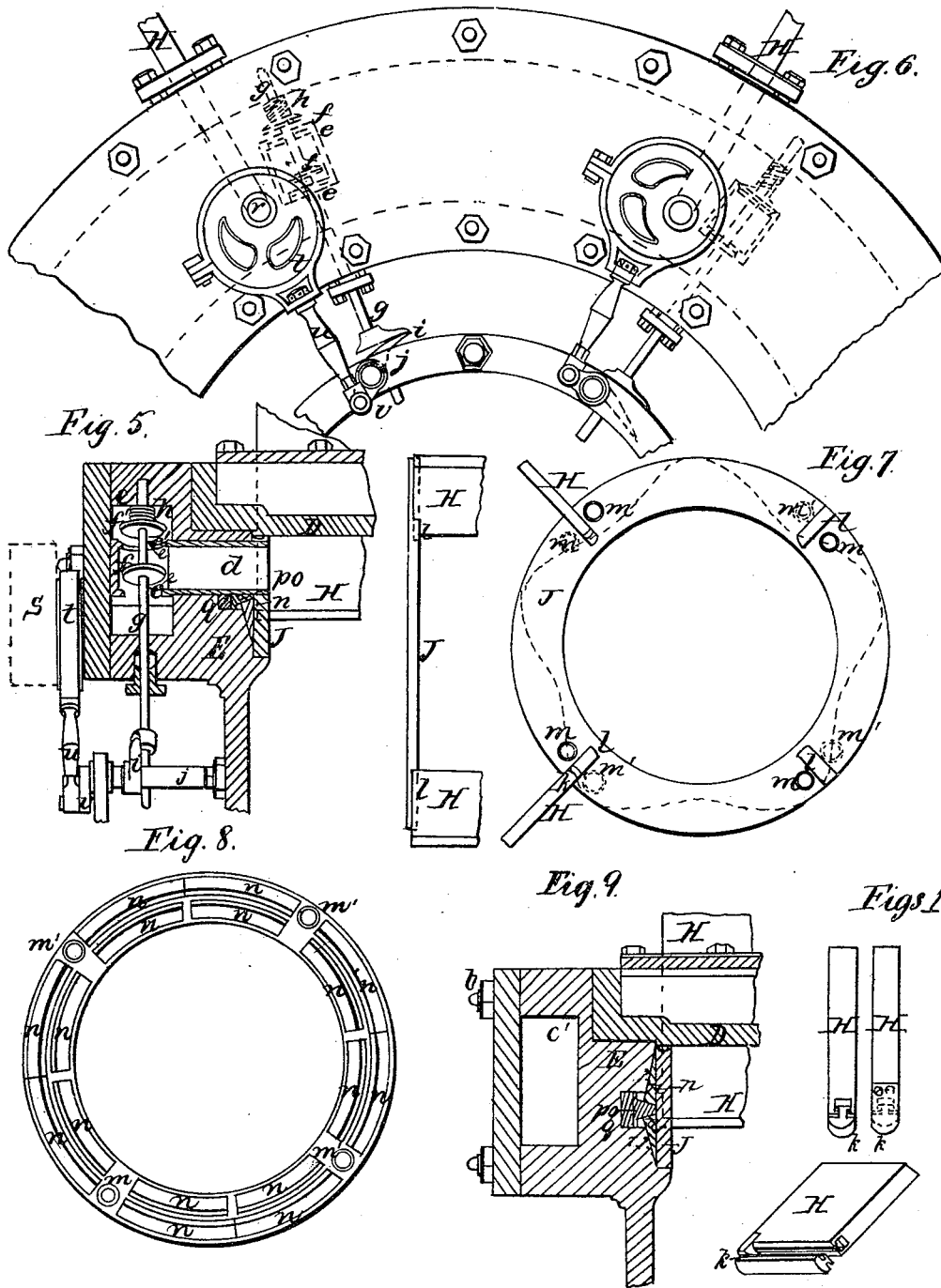
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UNITED STATES PATENT OFFICE.

HENRY G. THOMPSON, OF NEW YORK, N. Y.

VALVE-MOTION CUT-OFF AND STEAM-STOP FOR ROTARY ENGINES.

Specification of Letters Patent No. 6,962, dated December 18, 1849.

To all whom it may concern:

Be it known that I, HENRY GRAHAM THOMPSON, of the city, county, and State of New York, have invented certain new and useful Improvements in Rotary Steam-Engine, and that the following is a full, clear, and exact description of the principle or character which distinguishes them from all other things before known, and of the manner of making, constructing, and using the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation; Fig. 2 an elevation of one end; Fig. 3 a vertical section, passing through and parallel with the axis; Fig. 4 a cross vertical section; Figs. 5 and 6, enlarged sections representing the arrangement of cut-off valves; Fig. 7, face and edge view of one of the packing rings with the steam stops; Fig. 8, outside face view of packing rings with sectional rings for forcing up the same; Fig. 9, enlarged cross section of packing ring and method of forcing up the same; and Fig. 10, sections of steam stops.

The other sections will be referred to in their appropriate places.

The same letters indicate like parts in all the figures.

The engine to which my present improvements are applied is on the general principle of the rotary engine, secured to me by Letters Patent sealed on the twenty-second day of August, one thousand eight hundred and forty-eight, in which the piston wheel rotates within a stationary cylinder; there being one more piston on the steam wheel than there are movable steam stops or abutments.

The first part of my invention, which relates to the form of the periphery of the piston wheel, and the mode of operating the steam stops or abutments, consists in giving the required in and out motions to the steam stops or abutments, by a crank motion for each, the crank arbors being rotated by a pinion or pinion wheels on each, engaging the cogs of a cog wheel or wheels on the shaft of the steam wheel, when this is combined with a piston wheel, the periphery of which is of a form generated by the motion of the steam stops or abutments, and the rotation of the piston wheel, so that the edge of the steam stops, during the rotation of the piston wheel, shall be always in contact

with the periphery of the piston-wheel, and yet not operated by it.

The second part of my invention, which relates to the construction of the steam stops, consists in making their ends with toes or projections extending down on each side of and embracing the sides of the piston wheel, and fitted to grooves in packing rings, or in the inner faces of the cylinder, at the sides of the steam wheel, for the purpose of preventing the steam from passing around through the grooves in the packing rings, &c. to the rear of the pistons.

The third part of my invention which relates to the method of governing the induction of the steam to the cylinder, consists in combining with the rotating steam piston wheel, cut off valves, operated by toes on rock shafts, receiving motion from eccentrics or their equivalents on the crank shafts or arbors that operate the steam stops, that the motions of the valves may correspond with the motions of the steam-stops.

The fourth part of my invention consists in having a continuous or annular chamber, at the side of the steam cylinder, communicating with the steam pipe, and also with the inside of the steam cylinder by appropriate ports, when this is combined with the cut-off valves placed within said chamber for regulating the admission of the steam. And the fifth part of my invention which relates to the method of packing the engine, consists in effecting this end, by means of two metal rings, one of the said rings being placed on each side of the steam piston wheel and between it and the cylinder heads, and forced up by rings of metallic rubber, the said metal rings being grooved radially to receive the ends of the steam stops or abutments, and with holes corresponding with the steam and exhaust ports, whereby I am enabled by the said two rings, to pack the steam piston wheel, the steam and exhaust ports, and the ends of the steam stops or abutments.

In the accompanying drawings (A) represents the steam wheel, mounted on a shaft (B) that has its bearings in an appropriate frame (C) of any desired construction. The pistons (five in number, but which may be increased or decreased at pleasure) are projections from the circle of the wheel, of a form generated by the rotation of the wheel, and the in and out motions in a radial direction, of the steam stops, as will

be hereinafter described. The pistons thus formed are provided with packing (*a*) at the parts of greatest projection from the center. The piston wheel is surrounded by
 5 a cylinder (*D*) properly secured to the same frame, and its inner periphery is accurately formed, that the pistons in their rotation by means of the packing, may work therein steam tight. The heads (*E, E,*) of the said
 10 cylinder are secured by bolts (*b*) to the flanches of the cylinder, and are each formed with an annular chamber, the one (*c*) constituting what may be termed the steam chest, and the other (*c'*) a continuation of
 15 the exhaust pipe. These annular chambers should be in diameter about equal to the diameter of the steam-chamber, surrounding the piston-wheel, and they may be made by casting them in the cylinder heads, or in
 20 separate rings interposed between the ends of the cylinder and the outer heads, and there secured by the bolts which secure the heads to the cylinder.

The steam ports (*d*) for the admission of
 25 the steam into the cylinder, are formed through the inner face of the chamber (*c*) and the exhaust ports (*d'*) through the corresponding face of the other. The steam and the exhaust pipes (*F* and *G*) should be
 30 so connected as to admit of introducing the steam in the annular chamber (*c'*) and making the other (*c*) the exhaust for the purpose of reversing the engine; but as this makes no part of my present invention, and
 35 will be understood by any competent engineer, it has not been deemed essential to represent an arrangement for this purpose in the drawings.

Within the annular chamber or steam-chest (*c*) are partitions (*e e'*) which cut off
 40 the connection of each of the steam ports (*d*) from the body of the chamber, and these partitions are pierced with ports made with valve seats to receive balance puppet
 45 valves (*f f'*) attached, each set to a valve rod (*g*), the upper end of which works in a hole made in the cylinder head, and surrounded by a helical spring (*h*) to insure
 50 the descent of the valves, and the lower end passing through the inner periphery of the annular chamber to the outside of the cylinder head, and is there properly formed to
 be acted upon by a long toe (*i*) on a rock shaft (*j*) so that when the shaft rocks, the
 55 valves are either opened or closed to admit or shut off the steam.

The arrangement for operating the rock shafts will be hereafter described.

There are four steam stops (*H*), that pass
 60 through radial apertures in the cylinder (if the number of pistons be increased or decreased, the number of stops must also be increased or decreased, but the number of stops must always be one less), with their
 65 inner edge made with elastic or other pack-

ing, adapted to the surface of the pistons, that as they (the pistons) rotate, and the stops move in and out, the surfaces may always be in contact and steam tight. The stops are made of greater length than the
 70 piston wheel, and at (*K, K,*), they are formed with projecting toes which embrace the ends of the pistons, and always extend within the periphery of the piston wheel; and the ends, as well as the projecting toes
 75 of the stops, are adapted to slide in recesses (*l*) made in a packing ring of metal (*J*), which is interposed between each end of the piston wheel, and the annular chamber
 80 (*e e'*) the said rings being also provided with holes (*m*) and (*m'*) corresponding with the steam and exhaust ports. Between each ring and each of the heads, are two
 85 sectional metal rings (*n, n,*) which, in their cross section, are wedge formed in opposite directions, and fitted to corresponding recesses in the heads. The space between these two rings is also wedge-formed to receive a
 90 flanch (*o*) of a corresponding form, on the face of a sectional ring (*p*), and back of this ring is a sectional ring (*q*) of metallic rubber (but for which other elastic substance may be substituted) fitted to a recess
 95 in the cylinder head, that the tension of the said rubber ring in forcing the ring (*p*) inward, shall force the two rings (*n, n,*) apart, one inward and the other outward, and these, by their wedge form, press the ring
 100 (*J*) against the face of the wheel. The same arrangement is made on each side. In this way, when the heads of the cylinder are screwed up to their places, the ends of the piston-wheel, the steam and exhaust ports,
 105 and the ends of the steam ports will be completely packed by the two rings of metal, and the extension of the toes of the steam stops within the periphery of the piston wheel, will effectually prevent the passage
 110 of the steam from one side of the pistons to the other, through the recesses of the packing rings, in which the ends of the steam stops work. Outside of the cylinder, the steam stops are secured each to the cross head (*n'*),
 115 which slides in appropriate ways (*o'*), and which has at either end a connecting rod (*p'*) that take hold of cranks (*q' q'*) in short arbors (*r, r*) one on each side, the said arbors having their bearings in brackets secured to the cylinder heads. And on each
 120 arbor (*r*), there is a pinion (*s*), the cogs of which engage the cogs of a wheel (*I*) on the main shaft (*B*), the diameter of the cog wheel being as many times larger than the pinions, as there are pistons on the piston wheel, so that each pinion shall rotate, and
 125 with it the crank that operates the steam stop connected therewith, as many times for each rotation of the piston wheel as there are pistons on the wheel, that each steam
 130 stop may be moved in and out for the pas-

sage of each piston. And, as the periphery of the piston wheel is generated by its rotation, and an in and out radial motion corresponding with the motions of the steam-stops, it follows, as a consequence that if the parts are accurately fitted and proportioned, that, as the piston wheel rotates, the steam stops will move in and out, and continue in contact with the periphery thereof, and yet not be operated thereby, so that the only friction between the periphery of the piston wheel and the steam stops will be due to the elasticity and pressure of the packing interposed.

As the cross-heads of the steam stops have connecting rods attached at each end, there must be a corresponding arrangement of cranks, crank arbors, pinions and cog-wheel at each end of the cylinder, this being essential to the proper working of the steam stops, although it may be effected by an arrangement at one end only, but in a less perfect manner. At the end of the engine, where the balance valves are situated, the crank arbors (*r*) are each provided with an eccentric (*t*) and connecting rod (*u*), which takes hold of the arm (*v*) of that rock shaft, which operates the balance valves that govern the steam port by the side of the corresponding steam stop. The position of the eccentric, relatively to the crank, must be such that as each piston passes any one of the several steam stops, the balance valves shall be open, that as the piston passes the port next to the stop, the steam may enter the cylinder, and when the piston has made a given portion of its motion toward the next stop, that the valves may descend to cut off the steam, and permit the steam within to act expansively. In this way, by varying the relative positions of the eccentric and crank, the valves can be made to cut off the steam, at any portion of the piston's motion between the several stops.

When the engine is reversed, the periods of the opening of the cut-off valves will be amply sufficient for the steam to exhaust, particularly as the full power of the engine is but seldom required for the reverse motion.

Although I have described the use of balance puppet valves for governing the ad-

mission of steam to the cylinder, I do not wish to confine myself to the use of such valves, as single puppet or slide valves may be substituted, without changing the principle of my invention; and I have only described and represented balance puppet valves for the reason, that, in my judgment, they are the best adapted to the purpose contemplated by me.

Having thus described the principles or characteristics of my inventions, which distinguish them from all other things before known and described; and represented the manner of constructing and using the same, and some of the modifications of which it is susceptible, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The method of operating the steam stops or abutments, by a crank motion derived from the rotation of the piston wheel, substantially as described, when this is combined with the rotating piston wheel, the form of the periphery of which is such as would be generated by its rotation and the motions of the steam stops, substantially as described, that the steam stops may always in their motions, be in contact with the periphery of the piston wheel, and not operated by such periphery, as described.

2. I claim making the ends of the steam stops with projections or toes that embrace the sides of the piston wheel, and extend within the periphery thereof, substantially as described, when this is combined with the grooves or recesses in the packing ring, or any equivalent substitute therefor, substantially as described, whereby the steam is prevented from passing from one side to the other of the pistons, through the grooves or recesses in which the ends of the stops slide, as described.

3. I also claim, in combination with the herein described method of operating the steam stops the employment of cut-off valves, operated by eccentrics (or their equivalents) on the crank arbors that operate the steam stops, substantially as described.

HENRY G. THOMPSON.

Witnesses:

REUNE MARTIN,
JESSE PAYNE, Jr.