

No. 791,695.

PATENTED JUNE 6, 1905.

C. C. HUDSON & C. W. DANIELL.

ROTARY ENGINE.

APPLICATION FILED AUG. 5, 1904.

2 SHEETS—SHEET 1.

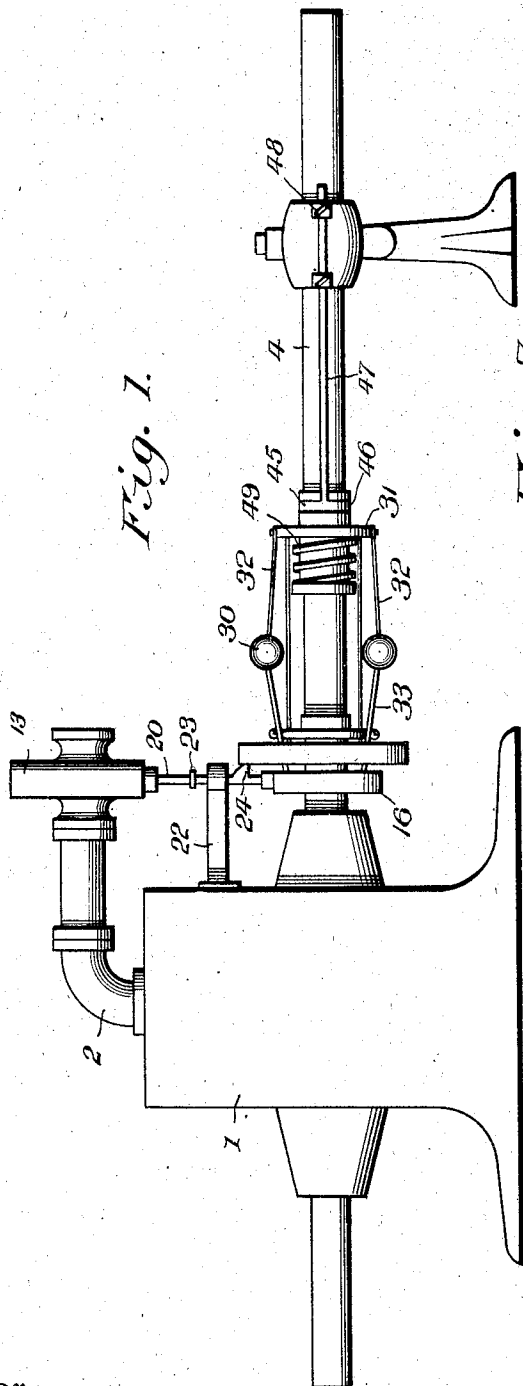


Fig. 1.

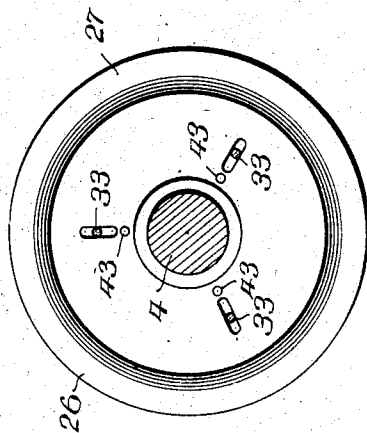


Fig. 7.

Fig. 6.

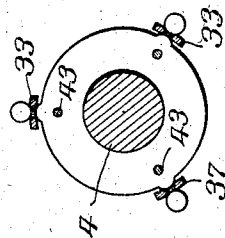
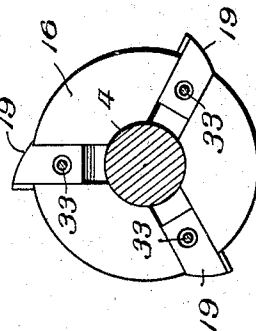


Fig. 5.



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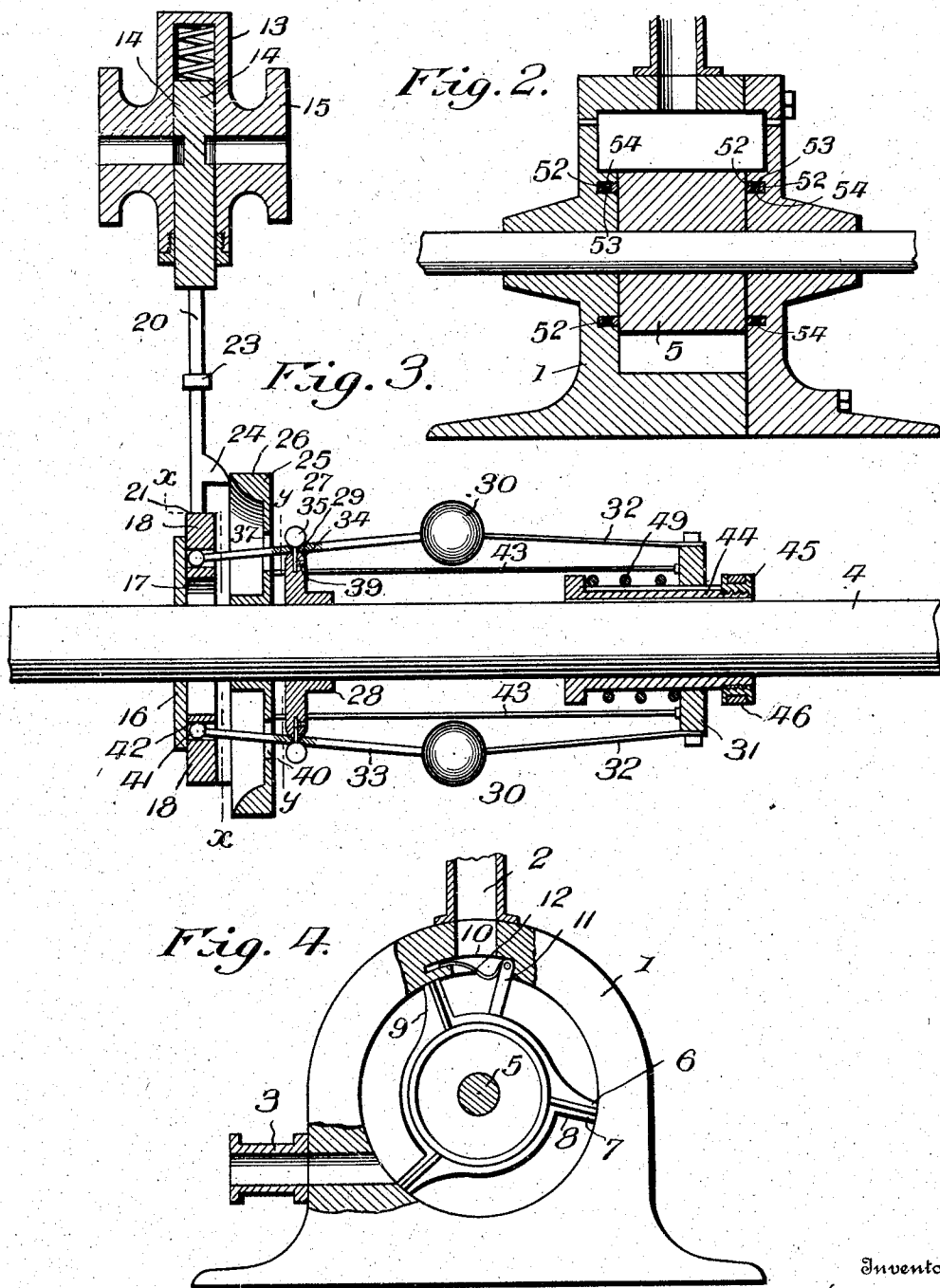
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

CLIFFORD C. HUDSON AND CAMMIE W. DANIELL, OF ATLANTA, GEORGIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 791,695, dated June 6, 1905.

Application filed August 5, 1904. Serial No. 219,688.

To all whom it may concern:

Be it known that we, CLIFFORD C. HUDSON and CAMMIE W. DANIELL, citizens of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

The invention relates to an improvement in engines of the rotary type, comprising, primarily, an improvement in valve-gearing to automatically control the steam supplied by the cylinder.

Rotary engines as heretofore constructed have proven of little practical value, for the reason that they are not economic in the use of steam, and, furthermore, so far as we are aware, none such have been provided with means for instantly and automatically shutting off steam supplied to the cylinder in an emergency, such as breaking of the load-belt or the sudden lightening of the load.

The object of the present invention is to obviate these disadvantages and construct the engine for the economic use of steam and for automatic control of the steam-supply.

The invention therefore consists in a valve structure arranged to supply the cylinder only when the gate is in receptive position and only for a limited time during the travel of said gate toward the exhaust-port and also in means to automatically and gradually shut off the steam-supply to the cylinder in the accelerated speed of the engine, said means being arranged to automatically lock the supply-valve closed should the engine run away or gain an excessive speed.

The invention also consists in arranging said automatic locking means for the valve so that its movement may be adjusted whereby to limit the speed of the engine as desired.

The preferred arrangement of parts and details of construction are clearly illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an engine constructed in accordance with our invention. Fig. 2 is a longitudinal section through the cylinder, illustrating particularly the arrangement of the packing-rings. Fig. 3 is an enlarged sectional view showing the valve and valve-controlling mechanism, the main shaft

being shown in elevation. Fig. 4 is a section through the cylinder, the piston and coöperative parts being shown in elevation. Fig. 5 is a section on line *xx*, Fig. 3. Fig. 6 is a section on line *yy*, Fig. 3. Fig. 7 is a face view of the locking-disk for the valve, the main shaft being shown in section.

Referring to the drawings, 1 represents the engine-cylinder, formed with the usual inlet 2 and exhaust 3. The main shaft 4 extends through the casing in the usual manner and has affixed thereto within the cylinder a piston-head 5. Said head is provided with fixed radially-projecting gates 6, provided in any desirable number and having suitably-arranged packing ribs or plates 7 seated in the recesses in the gates and bearing against the interior surface of the cylinder to preserve a steam-fit in the usual manner. It is understood, of course, that the piston-head 5 is of considerably less diameter than the cylinder and that the gates project radially from the periphery of said head. The rear walls 8 of the gates, considered in the direction of movement of said gates, are approximately radial of the piston-head, while the front wall 9 inclines gradually toward the periphery of the head, whereby to provide a camway for the operation of the abutment to be described.

The interior surface of the cylinder surrounding the steam-inlet is recessed at 10 to provide for the reception of a gate 11. The gate is hinged near one end wall of the recess and normally presses outwardly across the path of the piston-gate 6. The gate 11, hereinafter termed the "abutment," is of a length to extend to the normal periphery of the piston-head and is maintained in its projected or operative position by a spring 12, arranged in a recess 10, bearing against the gate. The wall of the recess 10, adjacent which the abutment is pivotally mounted, serves as a stop for the opening movement of the abutment 11, as will be seen in Fig. 4. The gates 6 in revolving force the abutment 11 into the recess through the medium of the cam-surface 9, the spring 12 operating to return the abutment to open position immediately succeeding the passage of a gate 6.

Referring particularly to Fig. 3, wherein is

shown the mechanism for controlling the steam-supply valve, it will be seen that we locate a valve-casing 13 in the steam-inlet pipe and arrange within said casing a cylindrical valve 14, adapted for longitudinal movement. The valve is formed with a transverse port 15, arranged in a suitable operation of the valve to register with the bore of the steam-inlet pipe and permit free access of steam to the cylinder. If preferred, however, the valve 14 may be arranged with the ordinary circumferential groove serving to direct the steam around the valve when the latter is in proper position with relation to the steam-pipe. A collar or sleeve 16 is fixed on the main shaft adjacent the cylinder and is formed in its face remote from the cylinder with a plurality of dovetailed camways or recesses 17, such recesses being equal in number to the number of gates on the piston-head. The recesses 17 are arranged radially of the sleeve 16 and are adapted to receive dovetailed cams 18, one being located in each recess. The cams are of a length to fit lengthwise wholly within the recesses and are formed with cam-surfaces 19 on their upper edges, said cam-surfaces being rounded upward from the horizontal in the direction of movement of the cam. A rod 20, secured to and depending from the valve 14, has its lower rounded end 21 in position to normally rest upon the cam 18, or rather in the path of movement of such cam. The rod, which is preferably square in cross-sections, passes through a guide 22, fixed to the cylinder, and is provided with a stop 23 to limit its downward movement. Near the lower end the rod is provided with a laterally-projecting shoe 24, arranged for coöperation with a locking-disk to be described. The stop 23 is arranged to contact with the guide 22 and limit the downward movement of the rod 20, so that the lower operative end of said rod cannot descend below the normal periphery of the sleeve 16, whereby to prevent the end of the rod entering any of the recesses 17 when the cams 18 have been fully withdrawn.

25 represents what we term a "locking-disk," secured on a shaft 4 adjacent the sleeve 16. The face of this disk next the sleeve is cut away to leave a circumferential flange 26, the inner wall of which is preferably inclined or rounded from the horizontal in an outward and upward direction, as shown at 27 in Fig. 3.

Adjacent the locking-disk, between it and the governor, is arranged a lever-disk 28, having a convex periphery 29. The governor-balls 30 are supported from the usual disk 31 by spring-arms 32; but in place of the usual forwardly-projecting spring-arms for the balls we arrange rods 33, said rods projecting toward the cylinder and having operative engagement with the cams 18. The rods 33 are secured to the periphery of the lever-disk 28, being formed at the point of connection with a concaved depression 34 to fit the convex pe-

riphery 29 of the disk. Immediately opposite depression 34 the rods or levers 33 are formed with a similar concave depression 35. A pin 36, having a ball-head 37, passes through an enlarged opening 38, formed in the levers 33 and joining the depressions 34 and 35. The body of the pin extends into the lever-disk 28 and is secured against displacement by laterally-extending set-screw 39. The levers from their connection with the lever-disk extend forward through slotted openings 40 in the locking-disk and terminate in ball ends 41, seated within enlarged cored-out recesses 42 in the cams 18. As before stated, the cams 18 are equal in number to the piston-gates 6, and therefore a similar number of levers 33 are required, as a single lever is arranged to operate but one cam.

In the operation of the parts described the revolution of the main shaft causes the rod 20 to ride up the incline camway 19 of the cams 18 and move the valve to open position to permit free passage of the steam to the cylinder. An accelerated speed of the engine, however, will spread the governor-balls, moving levers 33 on their pivotal connections with the lever-shaft and move the cams 18 toward the main shaft, thus reducing the upward movement of the rod 20, and hence but partially opening the valve, the extent of opening of said valve depending, of course, upon the extent of projection of the cams beyond the periphery of the sleeve 16. After a certain speed of the engine has been reached the movement of the levers 33 is such that the cams 18 are wholly withdrawn into the recesses 17 and are not contacted by the valve-rod at all. Hence no opening movement of the valve takes place and the speed of the engine gradually checks.

The locking-disk 25 is connected by longitudinally-arranged rods 43 with the governor-disk 31, said rods passing loosely through the lever-disk 28. A spring-sleeve 44 is keyed upon the shaft 4 adjacent the governor-disk, the said disk being by preference keyed upon the spring-sleeve, as shown in Fig. 3.

As the governor-balls spread under extreme speed of the engine the disk 31 moves longitudinally of the shaft—that is, toward the lever-disk 28—and through the medium of rods 43 such movement slides the locking-disk 25 toward the valve-rod 20, the movement continuing until the wall 27 of flange 26 of the locking-disk rides over the incline upper edge of shoe 24 of the valve-rod 20, thus locking the valve in lowered position or closed against the passage of steam.

A collar 45, having threaded connection with the spring-sleeve 44, is circumferentially recessed to receive the bifurcated end of the lever 46, the free end of which is connected to a longitudinally-arranged rod 47, projecting through blocks fixed to a bearing of the main shaft and held in adjusted position by

a set-screw 48. A spring 49 is arranged between the flange end of spring-sleeve 44 and the governor-disk 31. As the tension of spring 49 will to a considerable degree control the longitudinal movement of the governor-disk, and hence the movement of the locking-disk 25, it will be evident that change in the adjustment of said spring tension will alter the time of movement of the governor-disk—that is, if the disk 31 will under a certain speed of the engine move the locking-disk to lock the valve, the adjustment of the tension of spring 49, through longitudinal movement of the lever 46, by arm 47, to decrease the pressure exerted by said spring, the governor-balls will move the locking-disk to locking position under a less number of revolutions of the piston-rod. A reverse movement of the parts to increase the tension of the spring will require a greater number of revolutions of the piston-head to move the locking-disk to locking position, as will be evident.

By the above-described construction we have provided means for so adjusting the parts as to lock the valve closed at any desired speed of the engine, thus giving absolute control.

The engine of our construction, it will be noted, is automatically controlled to govern the speed within certain limits, the steam-supply being absolutely cut off when the engine has reached a predetermined speed. We have thus provided for regulating the speed of the engine in proportion to the load and in stopping the engine in the event of running away.

To provide for effective packing of the piston-head, we recess the side walls of the cylinder in circular form, as at 50, and seat therein two rings 51 and 52, the former of which seats against the bottom or outer wall of the recess, while the inner projects beyond the mouth of the recess and bears against the piston-head, being provided with suitable packings at its bearing-point. Springs 53 are arranged intermediate the rings 51 and 52, being held in place by pins 54, serving to maintain the necessary frictional contact between the ring 52 and the side of the piston-head.

Having thus described the invention, what is claimed as new is—

1. In a rotary engine, a movable piston-head, a valve arranged in the steam-inlet pipe, means in constant connection with and operated by the engine-governor within defined limits of speed of the engine to control the position of said valve, and means operated by the governor for locking the valve closed when the speed of the engine exceeds the maximum limit.

2. In a rotary engine, a movable piston-head, a shaft movable with the head, a valve in the steam-inlet pipe, a sleeve on the shaft, cams movable radially of the sleeve, to change

the position of the valve, and means carried by the governor to control said cam.

3. In a rotary engine, a main shaft, a valve arranged in the steam-inlet pipe, a sleeve mounted on the main shaft, cams radially movable in the sleeve, a governor for the engine, rods projecting from the governor and connected to said cams, and a locking-disk connected to and operated by the governor to lock the valve in closed position.

4. In a rotary engine, a main shaft, a valve arranged in the steam-inlet pipe, a sleeve fixed on the main shaft, cams movable radially in the sleeve, a governor for the engine, means connecting the governor and cams, a locking-disk operated by the governor, to engage and lock the valve in closed position, and means to alter the operation of the governor with respect to said locking-sleeve.

5. In a rotary engine, a main shaft, a valve arranged in the steam-inlet pipe, a rod depending from said valve, a sleeve fixed on the main shaft, cams radially movable of the sleeves to cooperate with said valve-rod, a governor for the engine, means connecting said governor and cams, a locking-disk arranged contiguous the sleeve and connected to the governor, and a shoe on the valve-rod to be engaged by said locking-disk.

6. In a rotary engine, a main shaft, a valve arranged in the steam-inlet pipe, a rod depending from said valve, a sleeve fixed upon the main shaft, cams movable radially of the sleeve, a governor for the engine, rods connecting the governor and cams, a locking-disk arranged adjacent the cam-sleeve, a governor-disk, means connecting said governor-disk and locking-disk, a spring-sleeve movable on the shaft, a spring intermediate said spring-sleeve and governor-disk, and means to adjust said spring-sleeve to alter the tension of said spring.

7. A rotary engine, comprising a cylinder, a piston having fixed gates opposite within the cylinder, a movable abutment pivoted within the cylinder across the steam-inlet thereof, a valve arranged in the steam-inlet pipe, a main shaft fixed to the piston, a sleeve fixed on the main shaft, cams movable radially of the sleeve, a governor for the engine, and means connecting said governor and cams to operate the cams to open the valve immediately succeeding the passage of a piston-gate beneath the steam-inlet of the cylinder.

8. In a rotary engine, a main shaft, a steam-inlet pipe, a valve arranged in the steam-inlet pipe, a sleeve fixed to the main shaft, cams movable radially in said sleeve, a governor for the engine, a lever-disk fixed to the shaft, levers extending from the governor and connected to said lever-disk, the forward ends of the levers loosely engaging the cams, and a locking-disk intermediate the sleeve and lever-disk, and connected to the governor.

9. In a rotary engine, a main shaft, a steam-inlet pipe, a valve arranged in the steam-inlet pipe, a sleeve fixed to the main shaft, cams movable radially in said sleeve, a governor for the engine, a lever-disk fixed to the shaft, levers extending from the governor and connected to said lever-disk, the forward ends of the levers loosely engaging the cams, a locking-disk intermediate the sleeve and lever-disk, said locking-disk being connected to and operated by the governor, and means to alter the operation of the governor with respect to the speed of the engine.

10. In a rotary engine, a main shaft, a steam-inlet pipe, a valve arranged in said pipe and

normally closed, means carried by the main shaft for periodically opening said valve, a governor for the engine, levers projecting from the governor and connected to said valve-opening means, and a lever-disk fixed on the main shaft and formed with a convex periphery to receive said levers.

In testimony whereof we affix our signatures in presence of two witnesses.

CLIFFORD C. HUDSON.
Cammie W. DANIELL.

Witnesses:

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SAM A. OZBURN.