W. A. ALLAN.

ROTARY ENGINE.

APPLICATION FILED APR. 6, 1911.

1,010,407.

Patented Dec. 5, 1911.

2 SHEETS—SHEET 1.

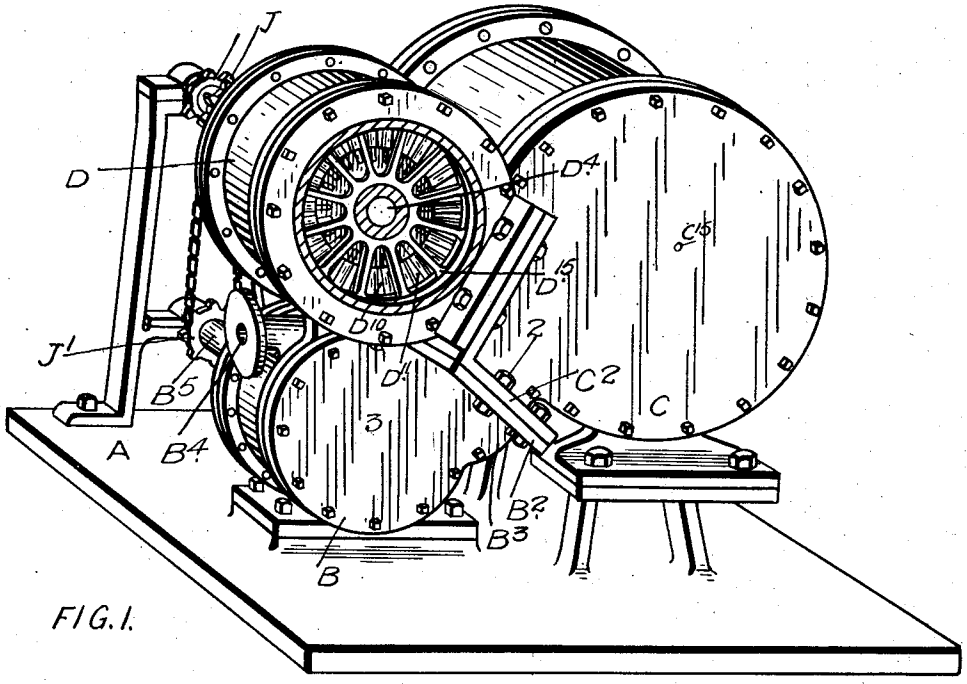

FIG. 1.

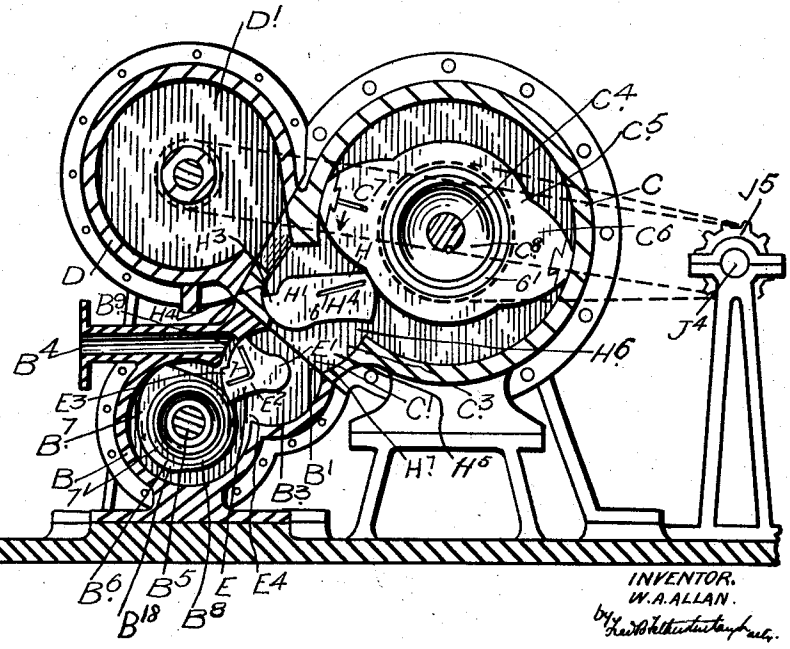

FIG. 2.

WITNESSES.

H. S. Young

C. McCann

INVENTOR.

W. A. ALLAN.

by Keith & Whittemore Atty's.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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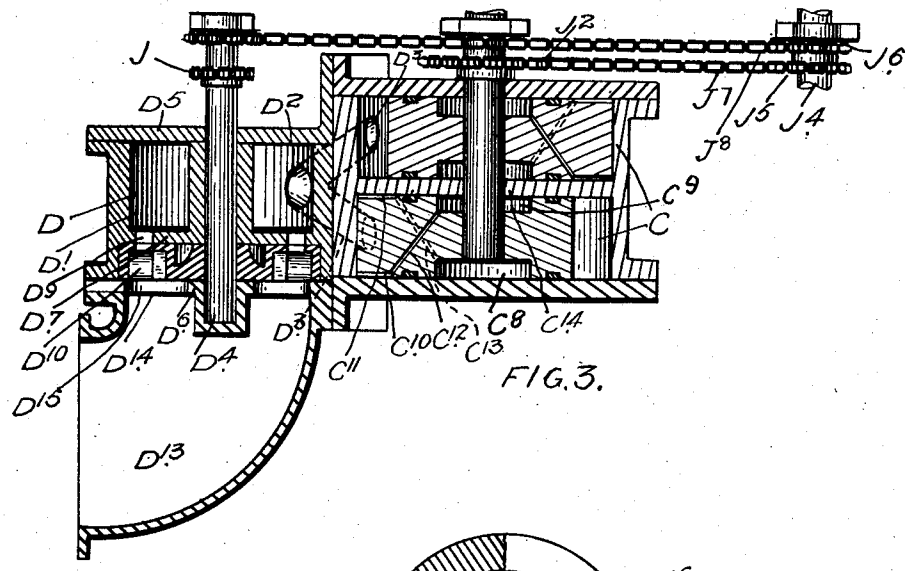

FIG. 3.

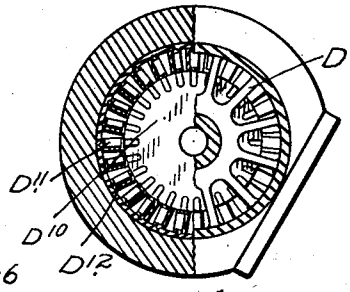

FIG. 4.

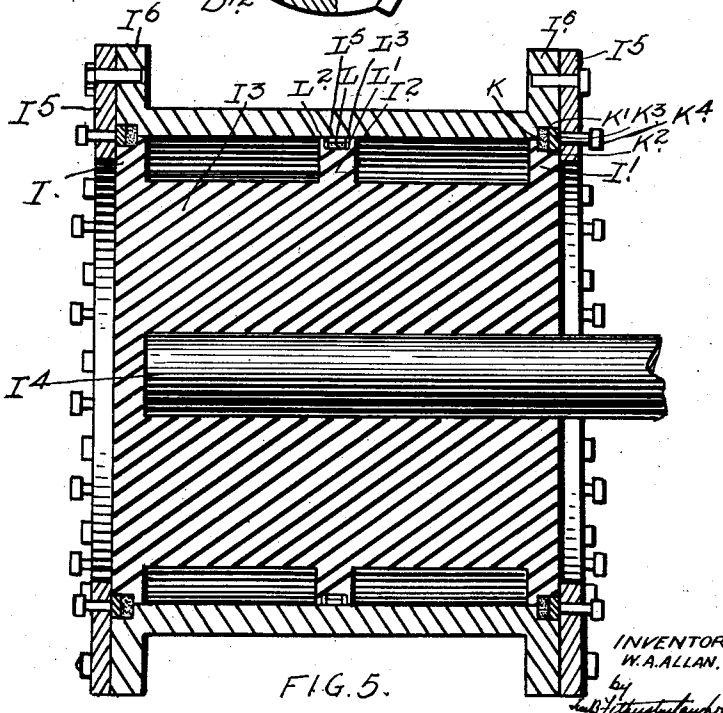

FIG. 5.

WITNESSES.
N. J. S. Young.
P. A. Davis.

INVENTOR
W. A. ALLAN.
by
Lull & Fitzsimmons & Lull
atty.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM ALEXANDER ALLAN, OF TORONTO, ONTARIO, CANADA.

ROTARY ENGINE.

1,010,407. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed April 6, 1911. Serial No. 619,420.

To all whom it may concern:

Be it known that I, WILLIAM ALEXANDER ALLAN, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Rotary Engines, of which the following is the specification.

My invention relates to improvements in rotary engines and the object of the invention is to devise an engine of this class of great efficiency and in which the valves are operated automatically to connect one cylinder unit to the other and it consists essentially of a high pressure, low pressure and turbine cylinder connected together in series and provided with tumbler valves automatically operated to control the passage of the steam and suitable rotors located in the high and low pressure cylinders and mounted on suitable shafts, the said shafts together with the shaft extending through the turbine cylinder being connected by suitable gearing to a main driving shaft as hereinafter more particularly explained by the following specification.

Figure 1, is a general perspective view of my engine. Fig. 2, is a vertical longitudinal section through the engine. Fig. 3, is a horizontal section. Fig. 4, is a side elevation of the turbine cylinder showing part in section. Fig. 5, is a sectional view showing an alternative form of cylinder.

In the drawings like letters of reference indicate corresponding parts in each figure.

A is the engine base on which is mounted the high pressure cylinder B and the low pressure cylinder C and the turbine cylinder D. The high pressure cylinder B is provided with a port B′ and the low pressure cylinder with a port C′ by which the steam exhausts from the high pressure into the low pressure cylinder C. The cylinder B is provided with flanges B^2 and the cylinder C with flanges C^2 connected together by bolts 2 thereby connecting the high and the low pressure cylinder together. The high pressure cylinder B is also provided with a cylindrical extension B^3 between the cylinder proper and the port B′. The cylindrical extension B^3 forms a valve casing for the valve E designed to control the admission of live steam into the high pressure cylinder from the inlet pipe B^4.

B^5 is a high pressure cylinder shaft on which is mounted the rotor B^6 provided with a cam-like extension B^7. The sides of the rotor are provided with suitable metallic rings B^8.

B^9 is a segmental enlargement in the cylindrical portion B^3.

E is a tumbler valve provided with end trunnions E′ journaled in the heads 3 of the cylinder B. The valve E is formed by a segmental body E^2 fitting a cylindrical portion B^3 and a segmental enlargement E^3 designed to extend into and fit the enlargement B^9 when the valve is thrown up into this cut-off position.

It will be readily seen that when the live steam enters through the inlet B^4 into the cylinder B that it will drive the rotor B^6 in the direction of the arrow, the steam expanding between the valve and cam-shaped enlargement B^7 of the rotor.

B^{18} is a supplemental enlargement. As the rotor B^6 revolves the enlargement B^8 first contacts with the tubular valve E closing the same thereby allowing the steam to expand between the valve E and the enlargement B′. The cam-shaped enlargement B^7 then passes the exhaust opening E^4, and contacts with the tumbler valve E completely raising the same by swinging it on its trunnions until the enlargement E^3 fits into the segmental recess B^9 thus allowing the expanded steam to expand from the high to the low pressure cylinder. As the enlargement B^7 comes in contact with the valve it closes the port B^4 and the port E^4 remains permanently open allowing the steam to exhaust into the low pressure cylinder C, through the ports E^4, B′, C′ and extension B^3.

C^3 is an extension of a low pressure cylinder forming a valve casing between the low pressure cylinder and the port C′.

C^4 is a shaft of the low pressure cylinder. C^5 is a rotor mounted thereon and provided with diametrically opposed cam-shaped projections C^6 and C^7.

It will be noticed on referring to Fig. 3 that the low pressure cylinder is of double form. It will of course be understood that the high pressure cylinder would necessarily be also of double form, each portion of the high pressure cylinder being connected to a respective portion of the low pressure cylinder and each being provided with ports and valves such as I have described. To insure that the outer ends and sides of the rotors C^5 are properly oiled I provide recesses C^8 and C^9 concentric with the shaft C^4.

C^{10} and C^{11} are channels leading along the face of the outer portion of the rotor C^5.

C^{12} and C^{13} are diagonal passages leading from the channels C^{10} and C^{11} respectively to the recesses C^8 and C^9. The recesses C^8 and C^9 are designed to contain oil which is fed through a suitable oil hole C^{15} located in the head of the cylinder. It will be readily understood that as the rotors revolve the oil carries downwardly by centrifugal force through the passages C^{12} and C^{13} into the channels C^{10} and C^{11} thereby serving to feed the oil to the contacting face of the rotor and the cylinder head.

D′ is a steam chamber formed in the turbine member D.

D^2 is a port leading from the chamber D′ and connected by the double armed passage way D^3 to each portion of the low pressure cylinder.

D^4 is the turbine shaft extending through the heads D^5 and D^6 of the turbine member and the center partition D^7 and sleeve extending between the head D^5 and the partition D^8. The partition D^8 is provided with ports D^9 leading into the turbine member D^{10}.

D^{11} is a turbine carried on the shaft D^4 and provided with the usual form of turbine buckets D^{12}.

D^{13} is the exhaust pipe of the turbine member connected to the turbine chamber D^{10} by the openings D^{14} formed by the spider D^{15} and D^6.

H is a tumbler valve provided with trunnions H′ journaled in the heads of the cylinder C and the partition C^{14}. The tumbler valve H comprises a minor portion H^3 concentric to the center of the trunnion H′ and a major portion or wing H^4, the outer end of which is also concentric to the center of the trunnion.

H^6 is an extension of the low pressure cylinder comprising a minor portion H^{41} into which the minor portion H^3 of the valve fits and a major portion H^7 into which the major portion H^4 of the valve fits.

It will be understood that the rotor C^5 rotates in the direction indicated by the arrow and that as it rotates the extensions C^6 and C^7 contact with the major portion or wings H^3 of the valve H. It will be understood that the pressure of steam entering from the high pressure cylinder always holds the valve up against the rotor C^5 as shown. It will thus be seen that as the rotor revolves the wing H^4 is forced downwardly thereby closing the port H^5 preventing the further admission of steam from the high pressure cylinder the communication between the turbine steam chamber D′ and the low pressure cylinder being always open so as to allow the steam to exhaust from the upper side of the low pressure cylinder into the turbine member. As the steam is forced into and through the turbine member it impinges on the blades of the turbine thereby obtaining the residue of power from the steam which is taken up to the turbine shaft.

J is a sprocket gear mounted upon the turbine shaft.

J′ is a sprocket gear mounted upon the high pressure shaft B^5.

J^2 is a sprocket mounted upon the low pressure shaft C^4, such sprocket gear J^2 being twice the size of the gears J.

J^4 is the main driving shaft provided with sprockets J^5 and J^6.

J^7 and J^8 are sprockets connecting the high and the low pressure shafts to the main driving shaft J^4. It will be seen by this arrangement that the driving power of the high and the low and the turbine members is all conveyed to the main shaft J^4. The tumbler valves H and E are provided with oiling grooves 6 and 7 such as shown and the rotors of the high and the low pressure cylinders are both provided with metallic packing rings 6′ and 7′.

From this description it will be seen that the steam fed through the port D^4 drives the rotor B^6 of the high pressure cylinder and the steam passing into the low pressure cylinder beneath the valve located between the high and the low pressure cylinder, likewise the exhaust steam from the high pressure cylinder drives the rotor C^5 which operates the valve H after which the steam exhausts from the low pressure cylinder into the turbine member through which it passes to the exhaust D^{13}.

In Fig. 5, I show a modified form of low pressure cylinder in which the heads I and I′ and the center partition I^2 are formed integral with the rotor I^3 mounted upon the shaft I^4. I^5 are annular plates bolted to the flanges I^6 of the cylinder and extending over the heads I and I′, the joint being packed by soft packing K held in the opposing annular recesses K′ and K^2, such soft packing being held therein by an annular metallic packing K^3 held against the soft packing by adjusting screws K^4 threaded into the plates I^5 against the rings K^2. The joints in the center part and the entire periphery of the cylinder is packed by soft packing L held in the groove L′ and secured in place by end packing metallic rings L^2 and L^3 and a peripherical ring L^5. By this means it will be seen that the cylinder is thoroughly packed.

It will be understood that the valve H acts as a dividing wall so as to direct the exhaust steam from the high pressure cylinder into the low pressure cylinder and from the low pressure cylinder into the turbine cylinder.

It will be understood that as the high and

low pressures are arranged in pairs they are so set in relation one to the other that one of each of them is always under a complete head of steam. It will also be understood that the relation between the high and low pressure rotors must be such that when the steam exhausts from the high pressure into the low pressure the wing of the low pressure rotor must just pass the high pressure exhaust so as to receive the full force of the incoming steam to aid in driving the low pressure rotor and supplementing the expansion of the steam.

What I claim as my invention is,

1. In a rotary engine, a high and low pressure cylinder and a turbine cylinder connected in series by suitable ports, winged rotors mounted on suitable shafts in the high and low pressure cylinders, an inlet port for the high pressure cylinder, an exhaust port from the turbine member, tumbler valves designed to control communication between the high and the low pressure cylinders and the turbine cylinder operated by the wings of the revolving rotors, a turbine member mounted upon a suitable shaft in the turbine cylinder, a main driving shaft and driving connections between the shafts of the high, low and turbine cylinders and the main shaft, as and for the purpose specified.

2. In a rotary engine, the combination with the high and low pressure cylinders, the winged rotors thereof mounted on suitable driving shafts, of a cylindrical extension to the low pressure cylinder having a segmental enlargement, steam ports leading into such extension and the segmental enlargement of such extension, a tumbler valve pivoted in the cylinder extension and provided with a segmental enlargement fitting the segmental enlargement of the extension and designed to rest upon the rotor, as and for the purpose specified.

3. In a rotary engine, the combination with the high pressure cylinder and the wing piston thereof, the low pressure cylinder and the wing piston thereof, and the turbine cylinder, and ports extending between the high and the low pressure cylinder and the low pressure cylinder and the turbine cylinder, of a swingable dividing wall extending from a point in the low pressure cylinder between the aforesaid ports and the wing piston whereby the steam is directed from the high pressure into the low pressure cylinder and from the low pressure cylinder into the turbine cylinder.

WILLIAM ALEXANDER ALLAN.

Witnesses:
H. PRESTON,
M. EGAN.