No. 786,083. PATENTED MAR. 28, 1905.

J. A. AMBROZ.

ROTARY STEAM ENGINE.

APPLICATION FILED OCT. 7, 1904.

3 SHEETS—SHEET 1.

Fig. 1

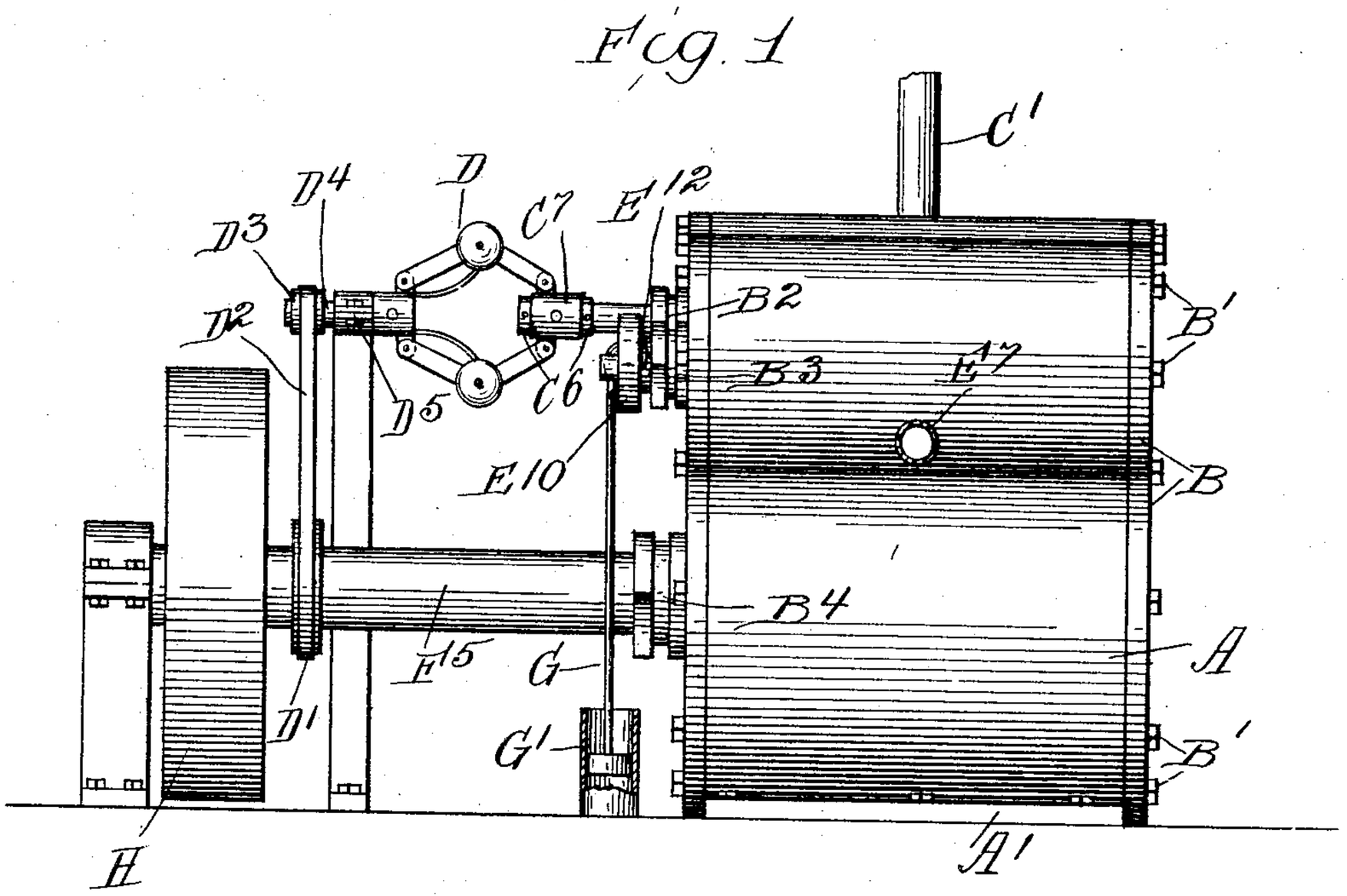


Fig. 9.

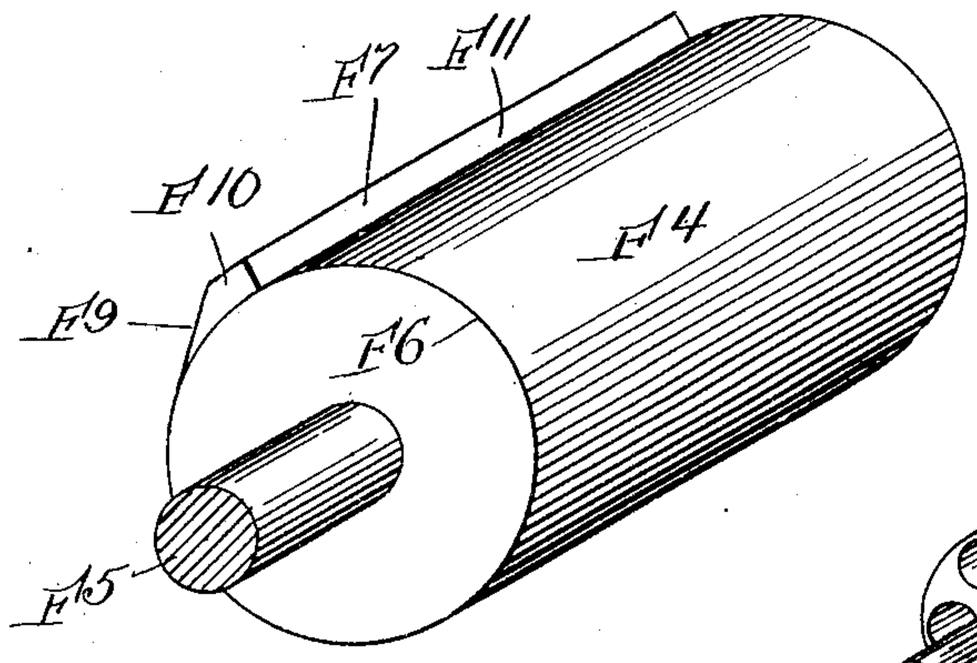
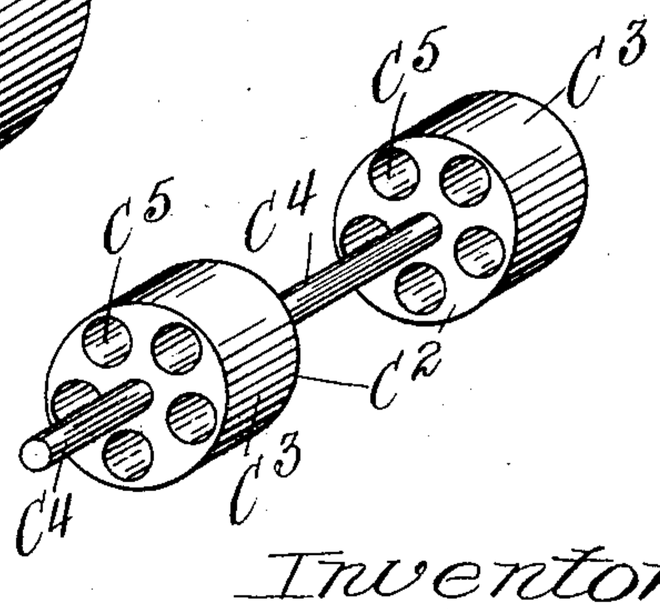


Fig. 10



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3 SHEETS—SHEET 2.

Fig. 2

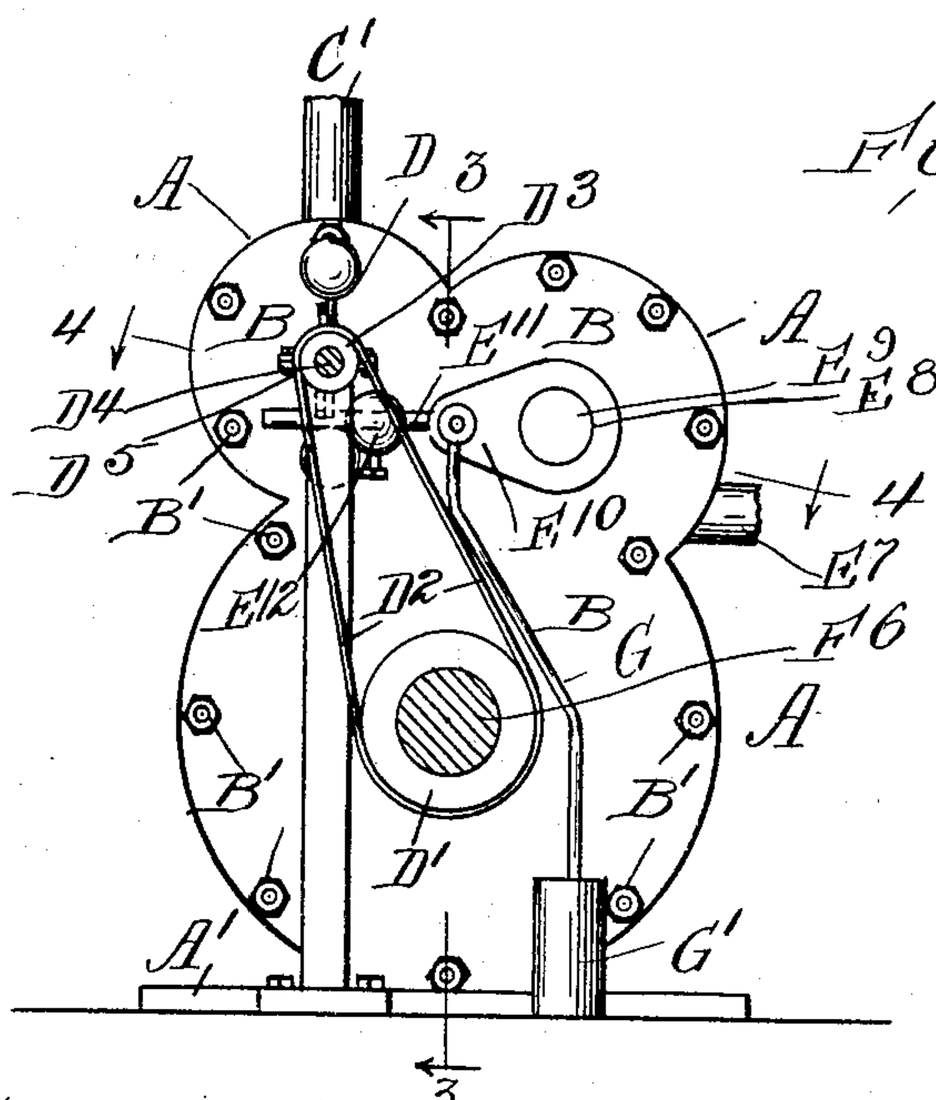


Fig. 5

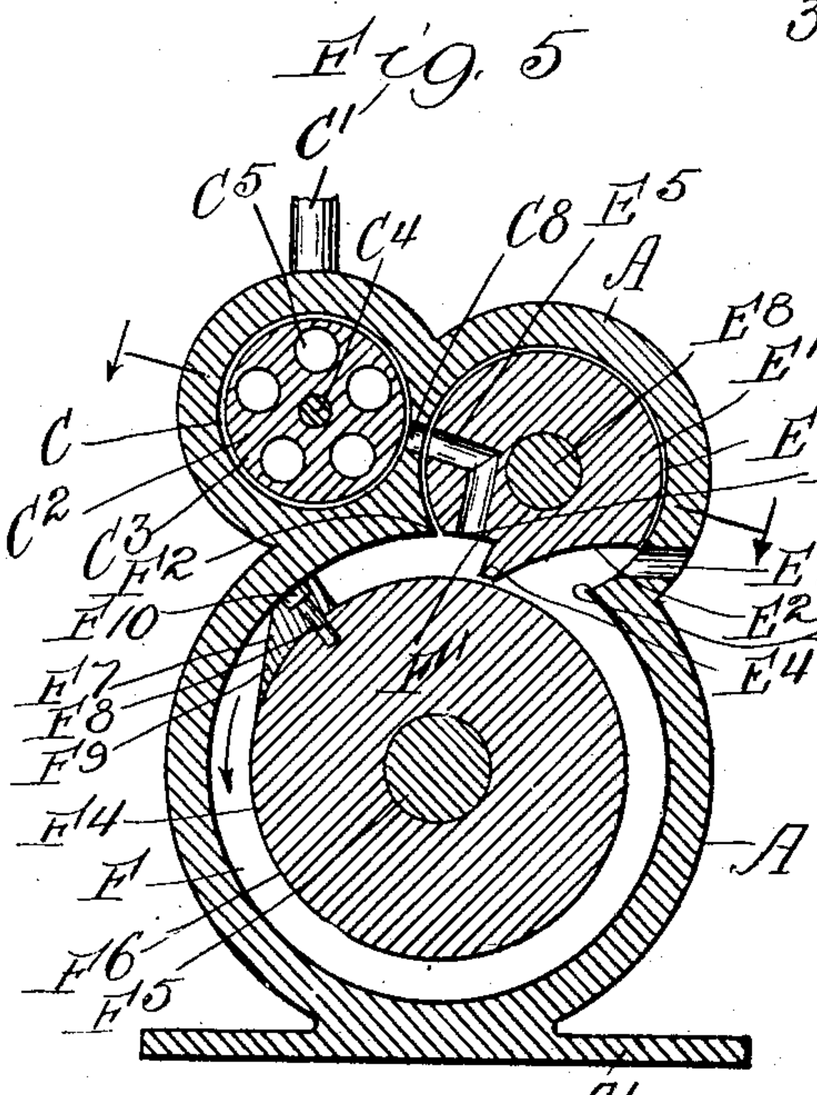
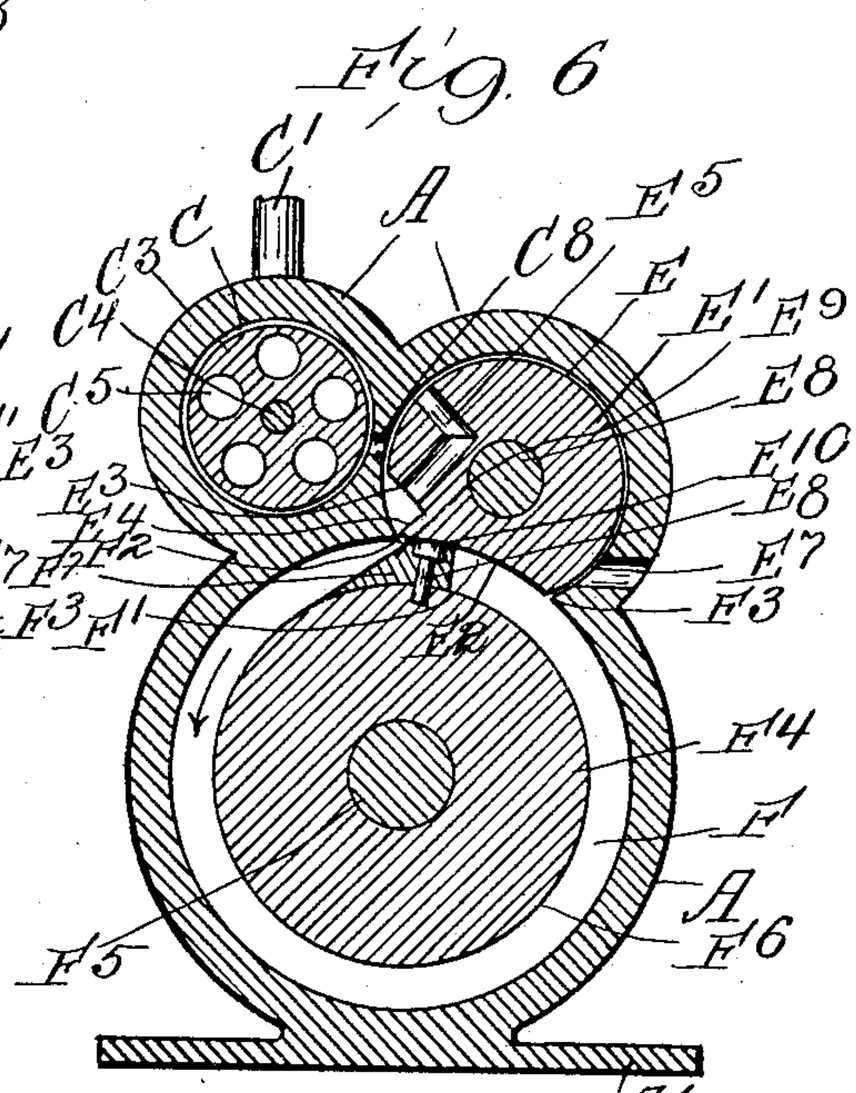


Fig. 6



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ROTARY STEAM ENGINE.

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3 SHEETS—SHEET 3.

Fig. 3

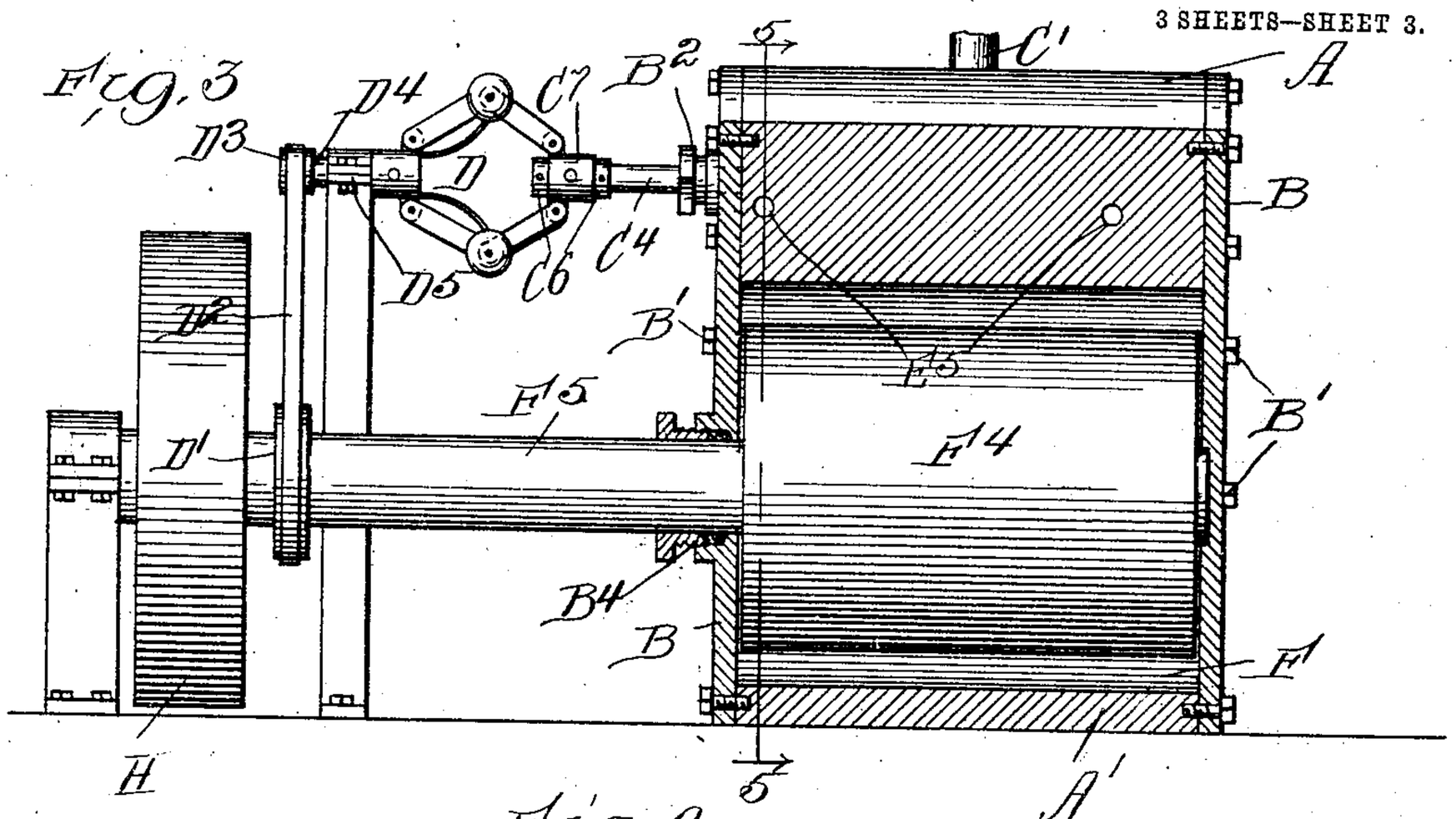


Fig. 4

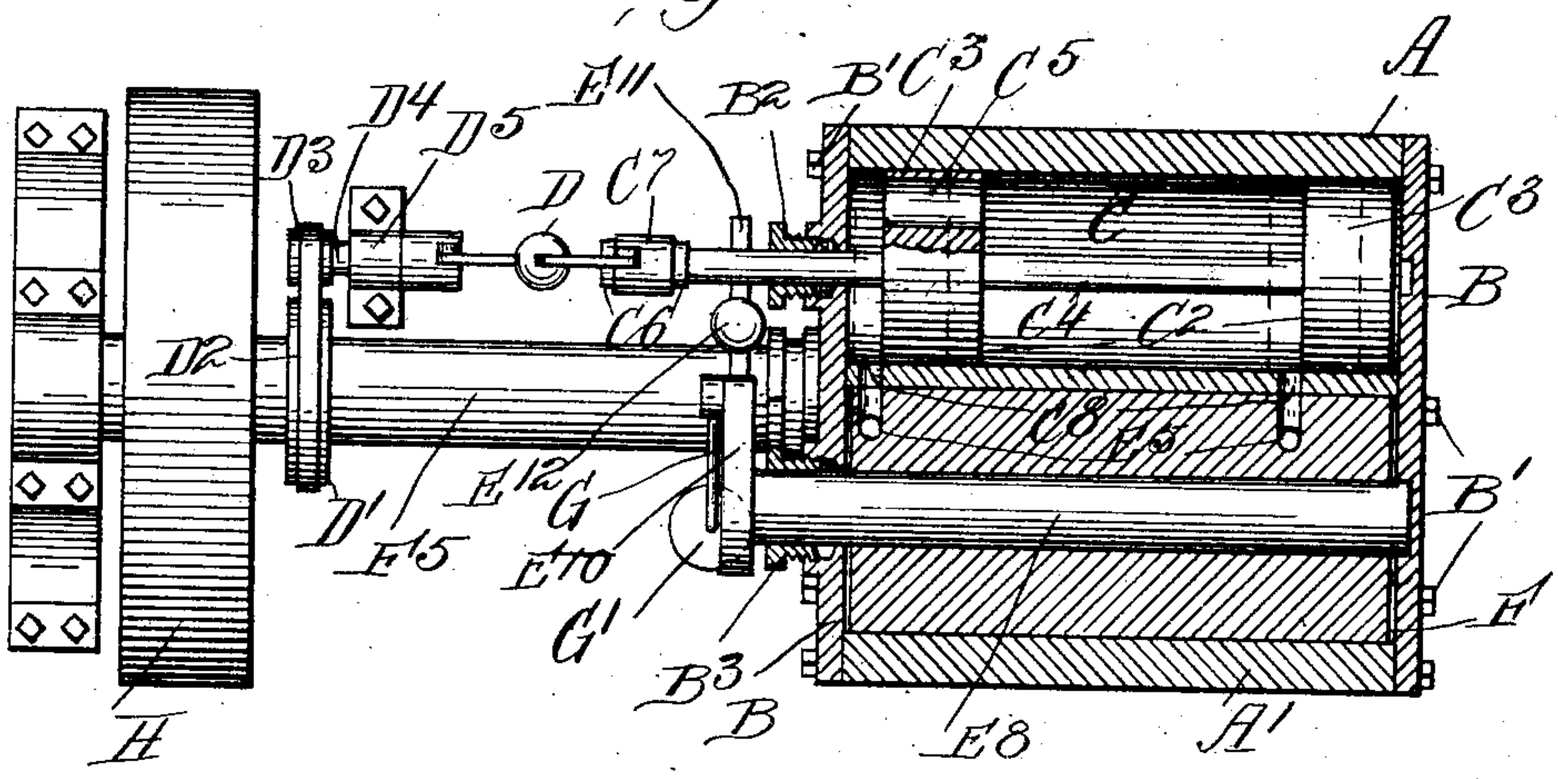


Fig. 7.

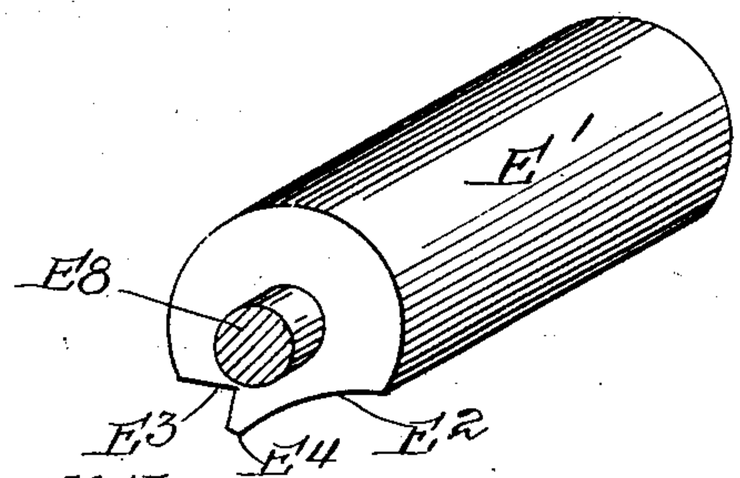
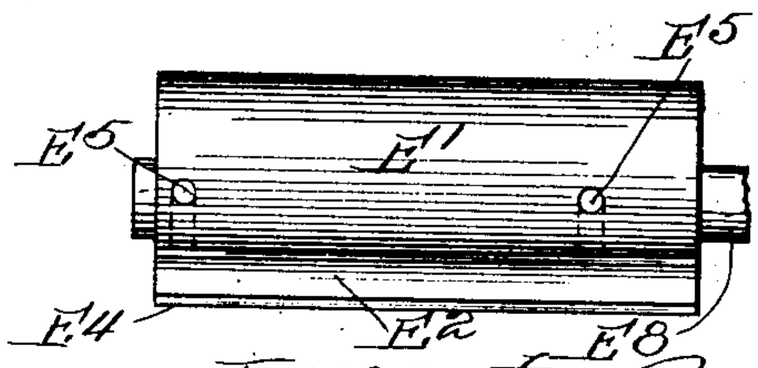


Fig. 8.



Witnesses:
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No. 786,083. Patented March 28, 1905.

UNITED STATES PATENT OFFICE.

JOSEPH A. AMBROZ, OF CHICAGO, ILLINOIS.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 786,083, dated March 28, 1905.

Application filed October 7, 1904. Serial No. 227,556.

To all whom it may concern:

Be it known that I, JOSEPH A. AMBROZ, a citizen of the United States, residing at 5131 Winchester avenue, in the city of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Rotary Steam-Engines, of which the following is a specification.

The object of my invention is to secure simplicity in construction, ease and certainty in adjustment, and the full advantage of the expansion of the steam and perfect balance of the sliding valve. The manner in which I accomplish these objects is described in the following specification, and illustrated in the accompanying drawings, in which —

Figure 1 is a side elevation of the completed engine. Fig. 2 is a left end elevation. Fig. 3 is a longitudinal central vertical sectional elevation through line 3 3, Fig. 2. Fig. 4 is a horizontal sectional view through the line 4 4, Fig. 2. Fig. 5 is a sectional end elevation through the line 5 5, Fig. 3, showing the relative positions of the steam-chest, intermediate cylinder and main cylinder, positions of steam-ports, valves, piston, and exhaust-port. Fig. 6 is the same view, except that the positions of the intermediate valve and piston are changed. Figs. 7 and 8 are two enlarged views of the intermediate cylinder-valve. Fig. 9 is a perspective view of the piston, and Fig. 10 is an enlarged view of the slide-valve.

The same letters refer to the same parts in the several views.

The main body A of the engine, forming the cylinders and base A′ on which it rests, is in one piece and is inclosed at the ends by the heads B, which are secured by bolts B′ onto the body A in the usual way. These heads are provided with suitable bearings B^2, B^3, and B^4 for the slide-valve stem, valve-shaft, and piston-shaft. In the highest part of the body A is a cylindrical steam-chest C, supplied with steam, (from a generator not shown,) which enters through the steam-pipe C′ and passes out through the steam-ports C^8. In this steam-chest is a slide-valve C^2, composed of a valve-stem C^4 and two drums C^3, adjustably secured on said stem. Extending through these drums parallel with the stem are a number of holes C^5, through which the steam has free passage to all parts of the chest and by which the pressure of steam is equally distributed over all parts of the slide-valve. The stem extends through the bearing B^2 and is provided with adjustable collars C^6 and a loose sleeve C^7, secured on said stem between said collars and adapted to be revolved freely on said stem, the said sleeve being linked with a governor D, supported on a shaft D^4, free to rotate in a suitable bearing D^5, said shaft having a pulley D^3, engaged by a belt D^2, driven by a pulley D′ on the piston-shaft. The speed of said governor actuating the loose sleeve C^7 causes the sleeve to alternately thrust and pull the collars C^6, and thereby moves said slide-valve in the steam-chest, the drums C^3 closing and opening the steam-ports C^8, and thereby regulating the passage of steam by the speed of said governor driven by the rotary part of the engine.

Somewhat lower than the steam-chest C and parallel with it is an intermediate valve-cylinder E, which receives steam from the steam-chest through the ports C^8 within. This cylinder is a rotatable valve E′, having a longitudinal curved recess E^2 and a longitudinal angular recess E^3, said recesses forming a lip E^4 on said valve. Extending from the recess E^3 through the valve in the form of a right angle are two steam passage-ways E^5, so located in said valve as to register with the steam-ports C^8, and to thus admit steam into the angular recess E^3 and exclude it by the rotation of said valve. The valve E′ has a central shaft E^8, which extends through the bearing B^3. On the end E^9 of this shaft is a crank E^{10} and an extended lever E^{11}, having an adjustable slide balance-weight E^{12}. Pivotally attached to the crank E^{10} is a connecting-rod G, having a plunger adapted to be moved in the dash-pot G′, which is secured to the base A′ of the main body A. Below the cylinder E and parallel with it is a main cylinder F, connected with the cylinder E by a longitudinal steam-port F′, by which steam is admitted from the recess E^3 in the valve E′

into the cylinder F and through which it passes into the curved recess E^2 and exhaust-pipe E^7, as shown in Fig. 5. The width of the steam-port F′ extends from the point F^2 to the point F^3, Fig. 5. In this cylinder is a rotatable piston F^4, having a central shaft F^5, which extends through the bearing B^4 in the head B and supports a fly-wheel H and pulley D′, by which the governor-belt is driven. The main periphery F^6 of the piston is much less in diameter than that of the cylinder, and the space between these is filled with steam when engine is running. On this piston and secured thereto by bolts F^8 is a longitudinal projection F^7, having a face forming a tangent F^9 to the periphery F^6. The top F^{10} of this projection fits the diameter of the cylinder F, and the right-angular face F^{11} receives the driving power of the steam.

When constructed as described and shown, its operation is as follows: Before the steam enters the cylinder C through the steam-pipe C′ the valve C^2 is in the position shown in Fig. 4. The valve E′ in the cylinder E is also in the position shown in Fig. 5. The position of these two valves leaves the steam-ports C^8 and E^5 open for the passage of steam into the main cylinder F through the port F′ and against the face F^{11} of the projection F^7 on the piston F^4 and against the lip E^4. This lip is held stationary under steam-pressure and weight of the crank E^{10}, lever E^{11}, weight E^{12}, connecting-rod G, and plunger, which rests in the dash-pot G′. The steam-pressure on the face F^{11} causes the piston F^4 to rotate in the direction of the arrow, Figs. 5 and 6. As the piston revolves the tangent surface F^9 comes in contact with the lip E^4 of the valve E′, and thereby partly rotates said valve to the position shown in Fig. 6. This movement of the valve E′ closes the steam-ports C^8, E^5, and F′ and also closes the exhaust-port E^7, as shown in Fig. 6. When the valve E′ and piston F^4 are in the position here shown, the inverse curve E^2 forms part of the internal diameter of the cylinder F. When the projection F^7 passes the lip E^4, the weight E^{12} on the lever E^{11}, connected to the shaft E^8 drops, thereby partly rotating the valve E′ and opens the steam and exhaust ports again, the drop of the weight being cushioned by the plunger in the dash-pot, as shown in Fig. 2. As the speed of the piston F^4 increases under a full head of steam the governor D, operated by the belt D^2 on the pulleys D′ and D^3, gradually draws the shaft C^4 and valve E′, thereby partly closing the ports C^8, as shown by the dotted lines in Fig. 4, cutting off the supply of steam and, as the speed decreases, the governor pushes the valve and opens the ports, and thus regulates the speed.

It is obvious that various kinds of governors may be used to regulate the sliding-valve motion. Therefore I do not limit myself to the kind shown.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, the combination of a main body A having attached heads B, and a supply-pipe C′ and exhaust-pipe E^7, a cylindrical steam-chest C within said main body and said heads B, entered by the supply-pipe C′ and having steam-ports C^8, a slide-valve C^2 within said steam-chest composed of a central shaft C^4 and two drums C^3, affixed on said shaft, said drums having apertures C^5, said shaft extending through one of the heads B, a governor D supported in suitable bearings and connected with the shaft C^4 by a sleeve C^7, secured on said shaft by two collars E^6, means for rotating said governor and thereby moving said slide-valve over and from the ports C^8 in said steam-chest C, an intermediate cylinder E within said main body and heads B, connected with the steam-chest C by the ports C^8, and having an exhaust-port E^7, and a longitudinal steam-port F′, a cylindrical rotatable valve E′ within said cylinder E, having a central shaft E^8 supported in suitable bearings in the heads B, a longitudinal curved recess E^2 and a longitudinal angular recess E^3 in said valve and a lip E^4 formed by the relative positions of said recesses, and ports E^5, extending through said valve into the recess E^3 and registering with the ports C^8 as the valve is rotated, a main cylinder F within said main body and heads, said cylinder being connected with the cylinder E by the port F′, a rotatable piston F^4 within the cylinder F, having a central shaft F^5 supported in suitable bearings in the heads B, a longitudinal projection F^7 forming part of said piston, said projection having a face F^9 forming a tangent with the periphery of the cylindrical part F^6 of said piston and also a radial face F^{11}, and a top F^{10} adapted to fit the internal periphery of said main cylinder and curved recess E^2 in the valve E′ and to engage the lip E^4 thereby rotating the valve E′ and closing the ports C^8, E^5, E^7 and F′, a crank E^{10}, rod G and dash-pot G′ attached to and connected with the shaft E^8 and a lever E^{11} and weight E^{12} attached to and connected with said shaft, the said crank, connecting-rod, dash-pot, lever and weight being adapted to rotate said valve E′ in the opposite direction and to thereby operate the said ports in the cylinders E and F and to thereby admit steam into the cylinder F against the face F^{11} of the projection F^7 and to thereby cause said piston F^4 to rotate, substantially as and for the purposes specified.

2. In a rotary engine, the combination of a main body A and heads B, said body having a suitable inlet and exit for the passage of steam, a cylindrical steam-chest entered by said steam-inlet and having steam-ports C^8, a cylindrical slide-valve within said steam-chest adapted to slide over said steam-ports and regulate the passage of steam therethrough, a

number of holes extending through the body of said valve adapted to admit the free passage of steam through said valve to all parts of the steam-chest and to equalize the steam-pressure on said valve, means for operating said valve and regulating thereby the passage of steam through the said ports, an intermediate cylinder within said main body parallel with and adjoining said steam-chest and connected therewith by the ports C^8, said intermediate cylinder having a longitudinal steam-port for the passage of steam therefrom and an exhaust-port for the passage of steam through said main body, a rotatable cylindrical valve within said cylinder pierced with steam-ports adapted to correspond and register with the steam-ports C^8, said valve also having a longitudinal recess into which the steam-ports in said valve open, and a longitudinal curved recess in said valve adapted to open and close said exhaust-port as said valve is rotated, a longitudinal lip on said valve formed by the said longitudinal recesses in said valve, said lip being adapted to open and close the longitudinal steam-port in said cylinder as said valve is rotated therein, means for rotating said valve in said cylinder and thereby regulating the passage of steam therefrom and through said exhaust passage-way, a main cylinder within said main body parallel with and adjoining said intermediate cylinder and connected therewith by the longitudinal steam-port in said intermediate cylinder, a cylindrical rotatable piston within said main cylinder adapted to admit the passage of steam into said cylinder between the periphery of said piston and the periphery of said cylinder, a longitudinal projection forming part of said piston, having one of its faces tangential to the periphery of said valve and adapted to engage the longitudinal lip on the valve in the intermediate cylinder and to thereby move said lip and rotate said valve and close said longitudinal steam-port, said projection having a radial face, adapted to allow the release of said lip and thereby open said steam-port and to receive the full pressure of steam, said piston being revolved thereby and means for supporting said piston in said main cylinder, substantially as described and for the purposes specified.

3. In a rotary engine, the combination of a main body A and heads B with a cylindrical steam-chest and a cylindrical slide-valve, said steam-chest having a suitable steam-inlet and steam-ports, means for operating and regulating the movements of said slide-valve, and an intermediate cylinder adapted to receive the steam from said steam-chest, and having a suitable steam-port and an exhaust-port, and a rotatable valve within said cylinder adapted to control and regulate the passage of steam through said steam-port and exhaust-port, said valve having a longitudinal lip adapted to close and open said steam-ports, means for rotating said valve, a main cylinder having a steam-port adapted to receive steam from the intermediate cylinder, a rotatable piston arranged within said main cylinder, having a projection adapted to fit said cylinder and to engage the said lip, and thereby rotate said rotatable valve and close said port and permit said valve to immediately reverse its motion and open said port and thereby admit steam into said main cylinder and against said projection, thereby rotating said piston, and suitable means for supporting said piston in said cylinder, substantially as and for the purposes specified.

4. In a rotary engine, the combination of a main body A and heads B, having a suitable steam inlet and exit, and a steam-chest and slide-valve, with an intermediate cylinder connected with the said steam-chest by suitable steam-ports and with the exit in said main body and a rotatable valve arranged within said cylinder, said valve having suitable passage-ways for the admission and exit of steam, and a lip adapted to be moved and to thereby open and close said steam-port and to open and close said exit through said main body, and means for rotating said valve and a main cylinder connected with said intermediate cylinder by a steam-port, said port being opened and closed by said intermediate valve, and a cylindrical piston arranged and suitably supported in said cylinder, said piston having a longitudinal projection on its periphery adapted to fit said cylinder and to engage and move said lip on said valve and thereby close said steam-port, and to receive the full pressure of steam from said port as said projection passes said lip and thereby permits said valve to be rotated in the reverse direction and thereby open said port for the admission of steam against said projection and to open the exhaust-port and permit the escape of steam from said cylinder.

5. In a rotary engine, the combination of a main body A and heads B, said body having a steam-chest and valve and suitable steam-inlets and steam-ports and means for operating said valve and an intermediate cylinder connected with said steam-chest by said ports, and having a steam-port and exhaust-port for the passage of steam from said cylinder and a rotatable valve arranged in said cylinder having steam passage-ways and a longitudinal lip adapted to close and open said port, and a curved recess adapted to open said exhaust-port and means for rotating said valve, with a main cylinder connected with said intermediate cylinder by said steam-port, and a cylindrical rotatable piston suitably supported in said main cylinder, said piston having a longitudinal projection adapted to fit the diameter of said cylinder, and to engage and move said lip and thereby rotate said valve

and close said steam-port and to release said lip and thereby open said steam-port and admit steam into said cylinder against said piston and said projection and to thereby rotate said piston, and mechanism connecting said piston with the slide-valve in said steam-chest, and regulating the passage of steam through said chest, intermediate cylinder and valve and main cylinder and speed of said piston, substantially as and for the purposes specified.

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Witnesses:
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