No. 793,263. PATENTED JUNE 27, 1905.

F. X. ATZBERGER.

ROTARY GAS ENGINE.

APPLICATION FILED AUG. 5, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

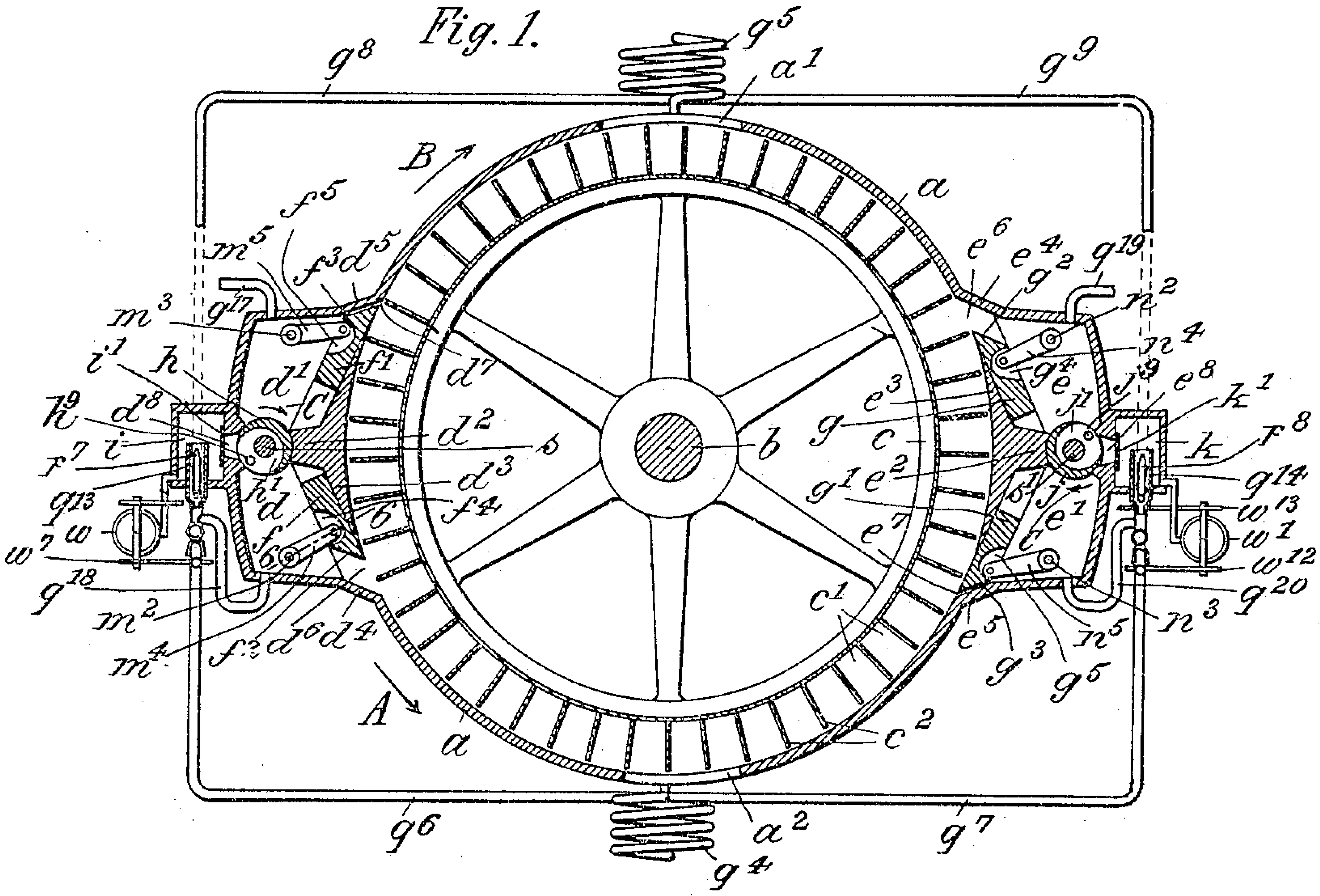
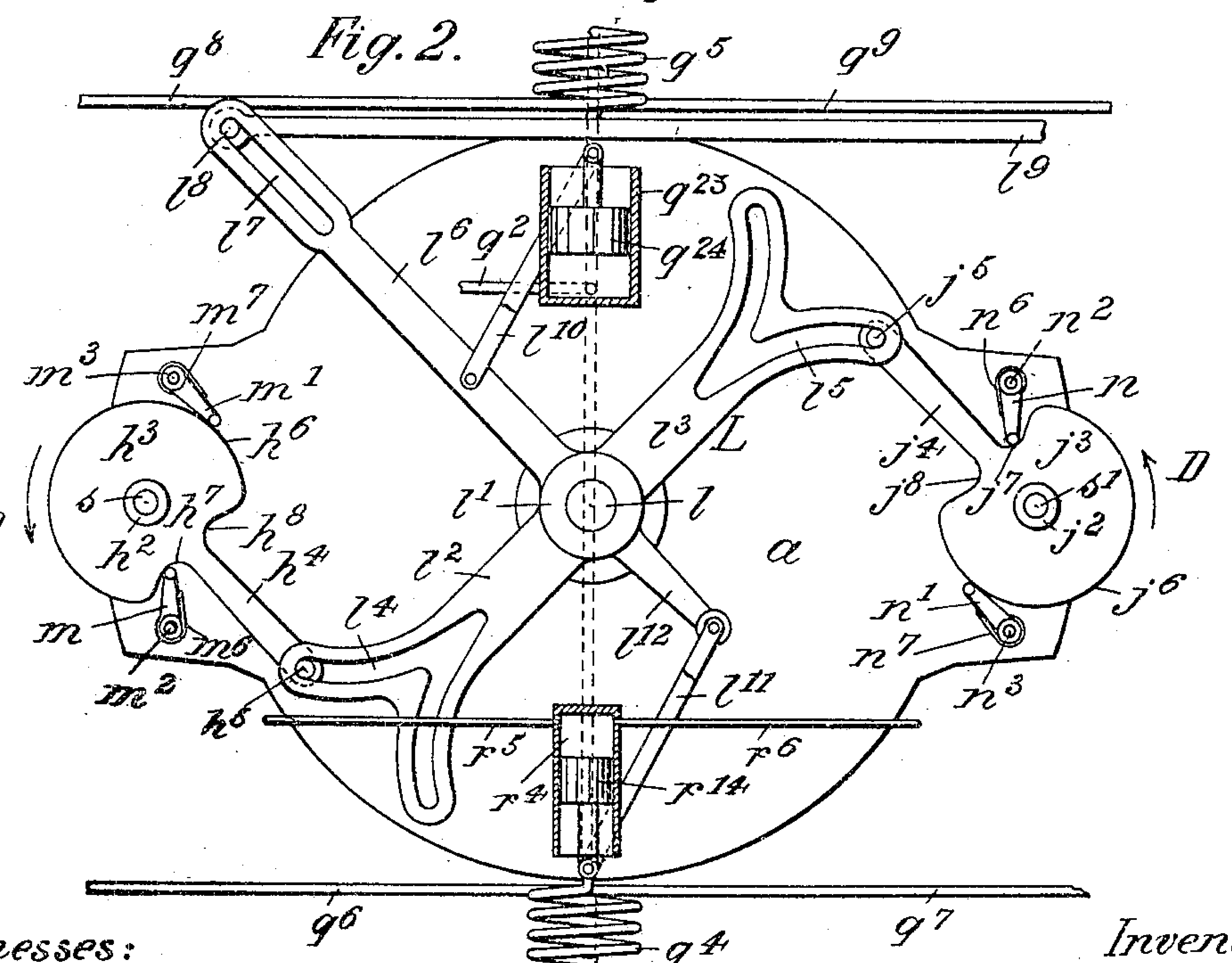


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

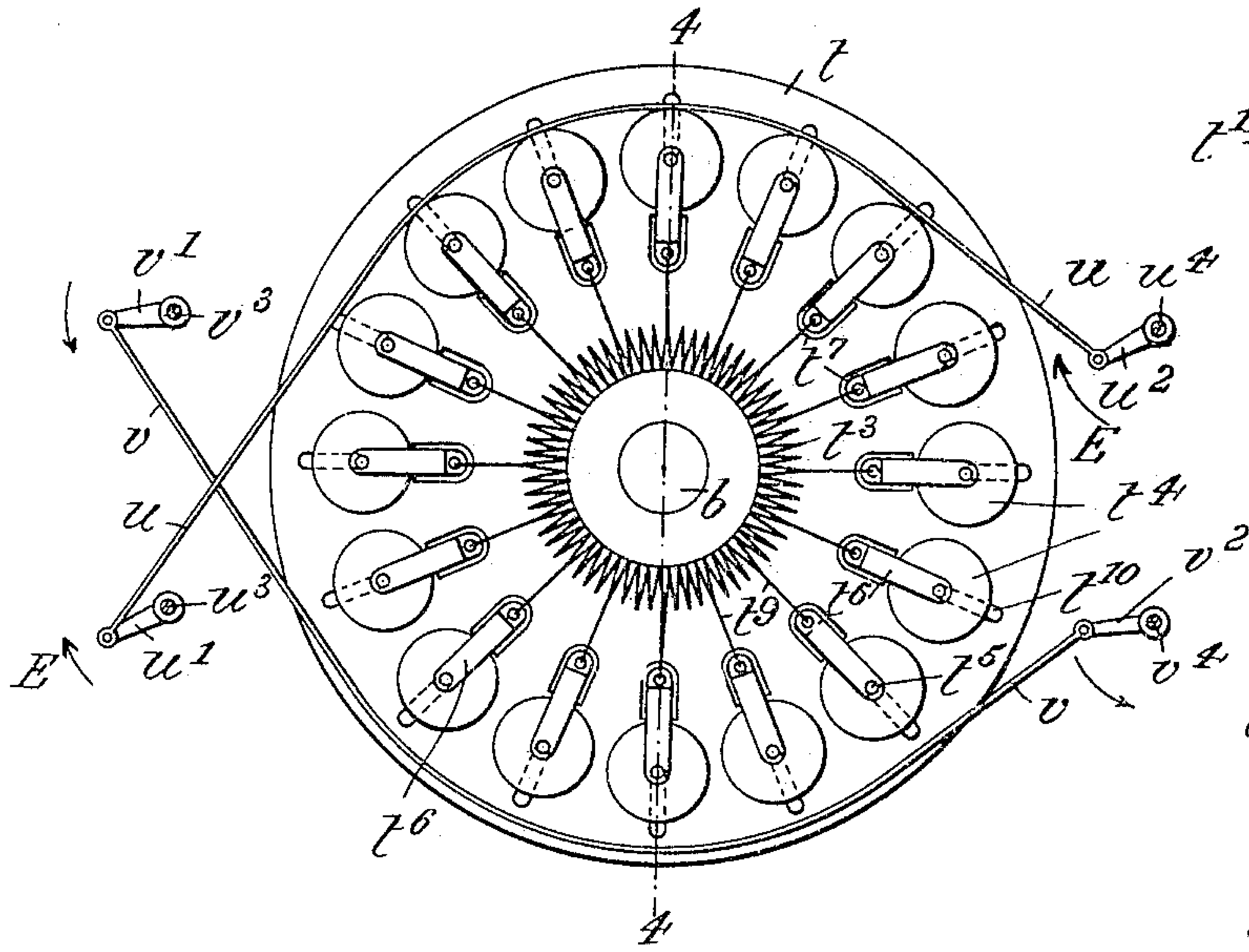


Fig. 4.

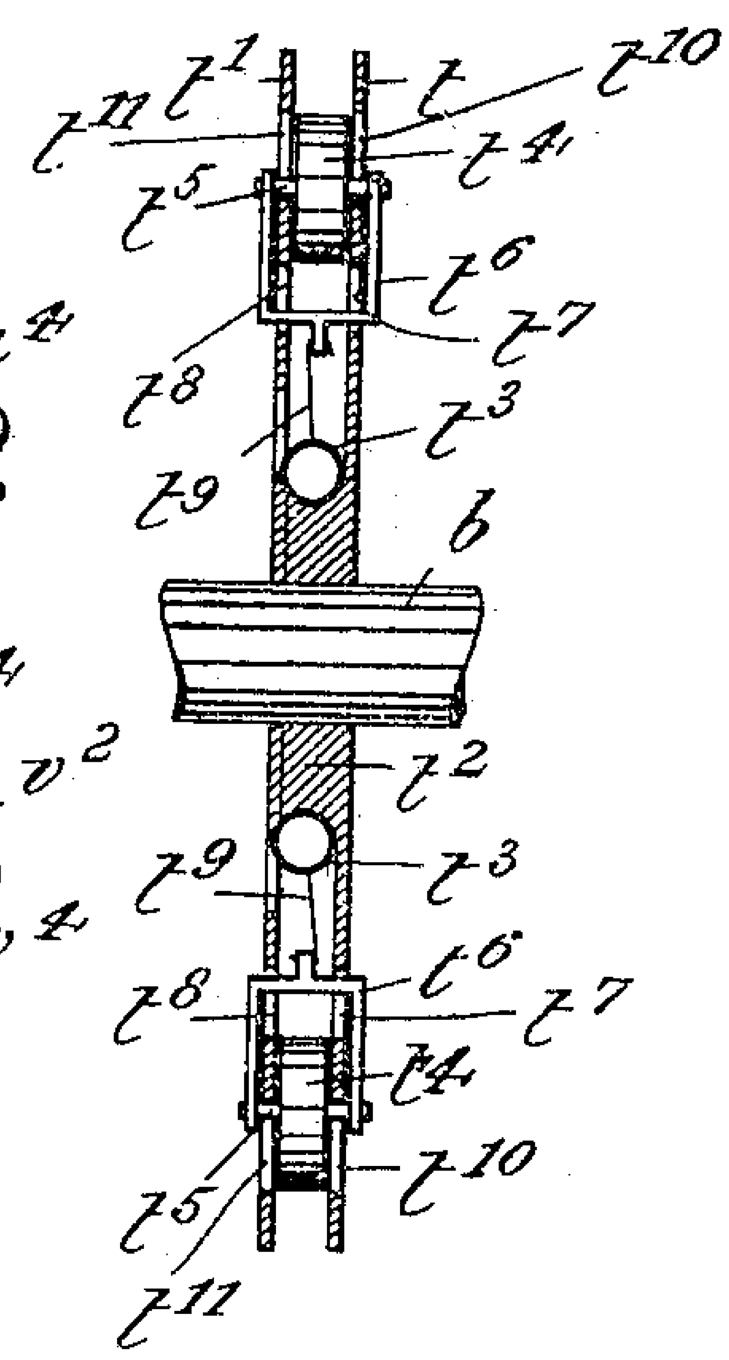
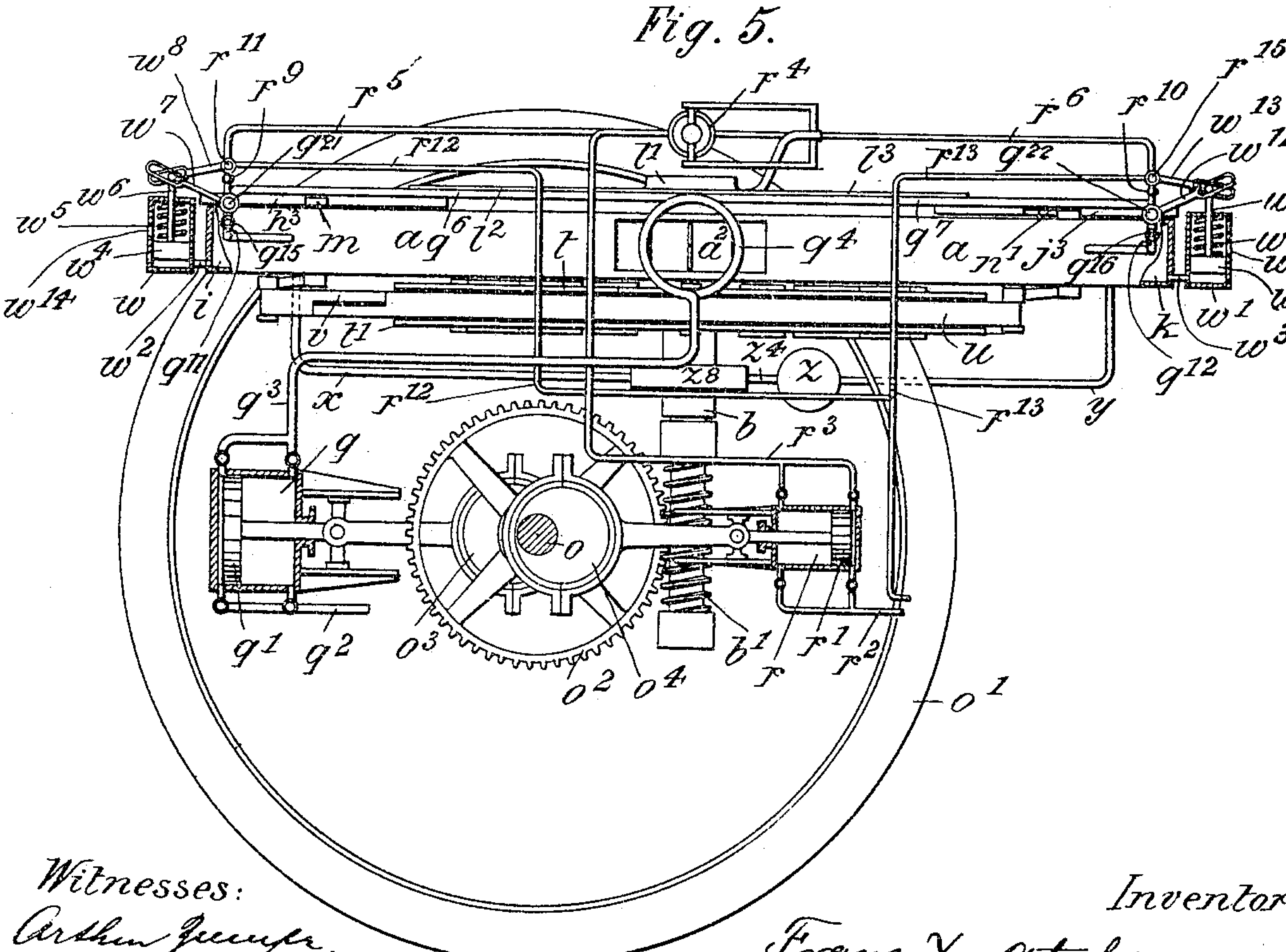


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6

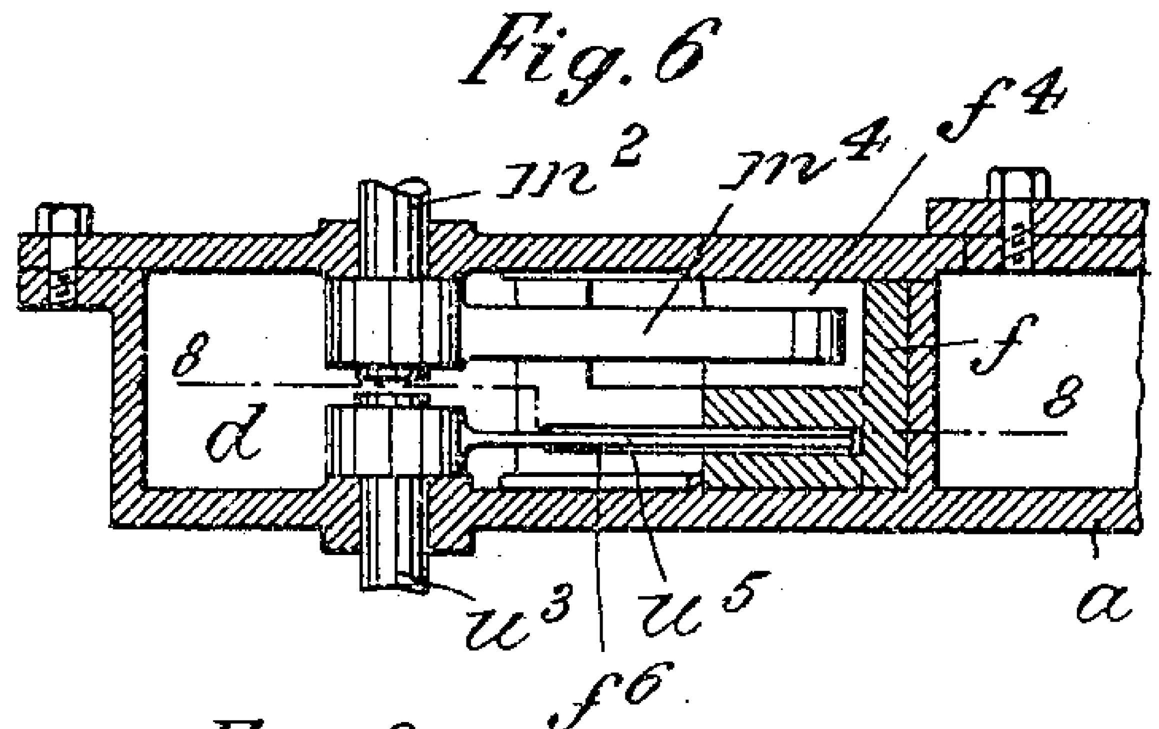


Fig. 7.

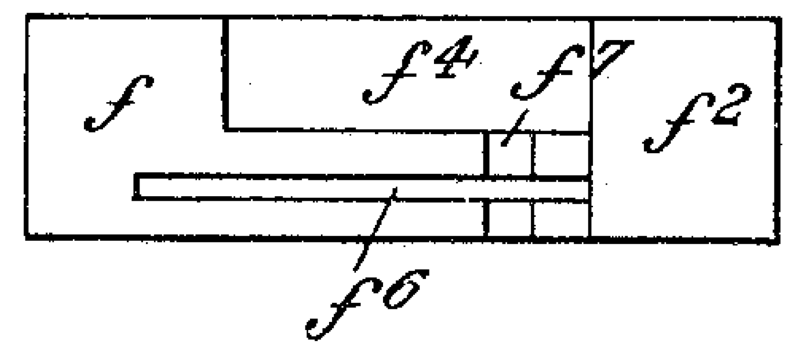


Fig. 8.

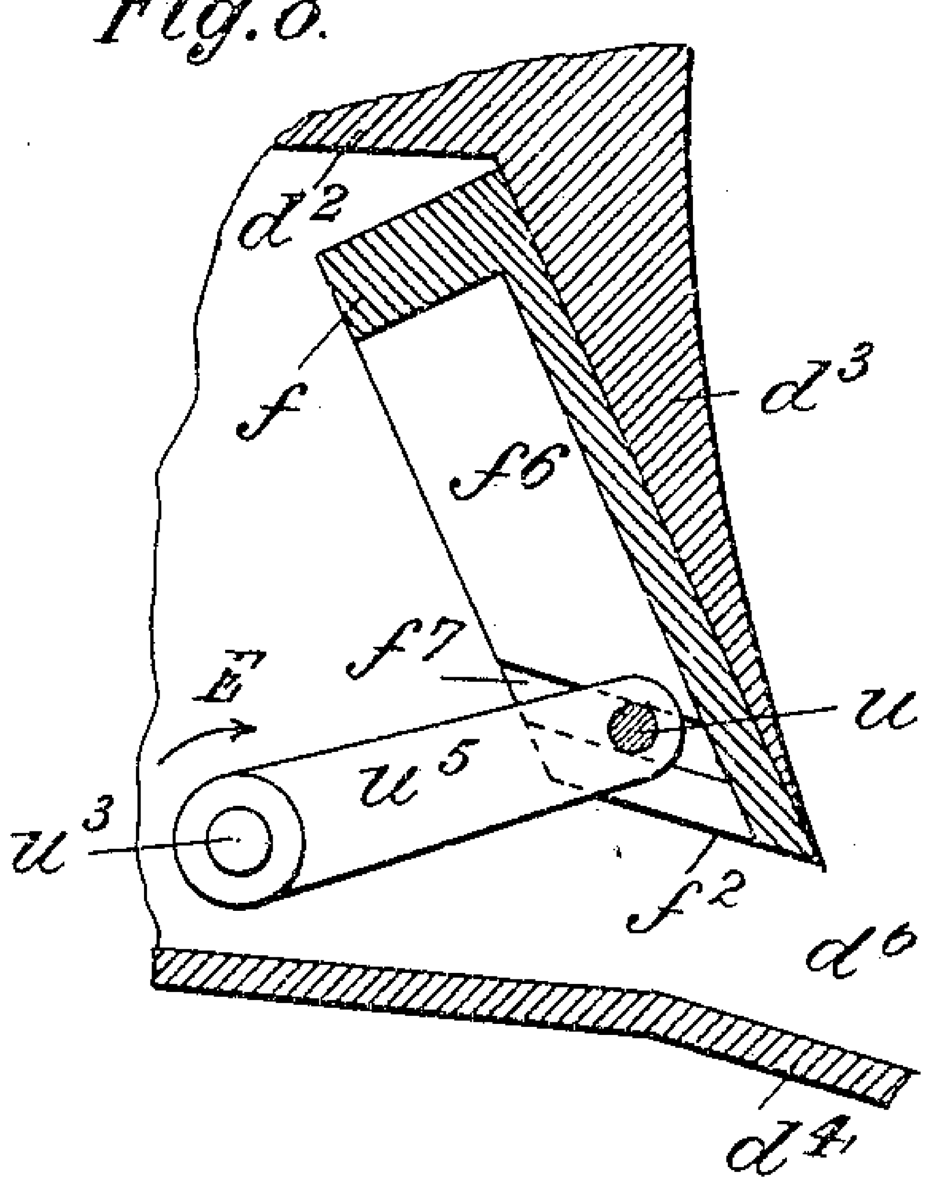


Fig. 9.

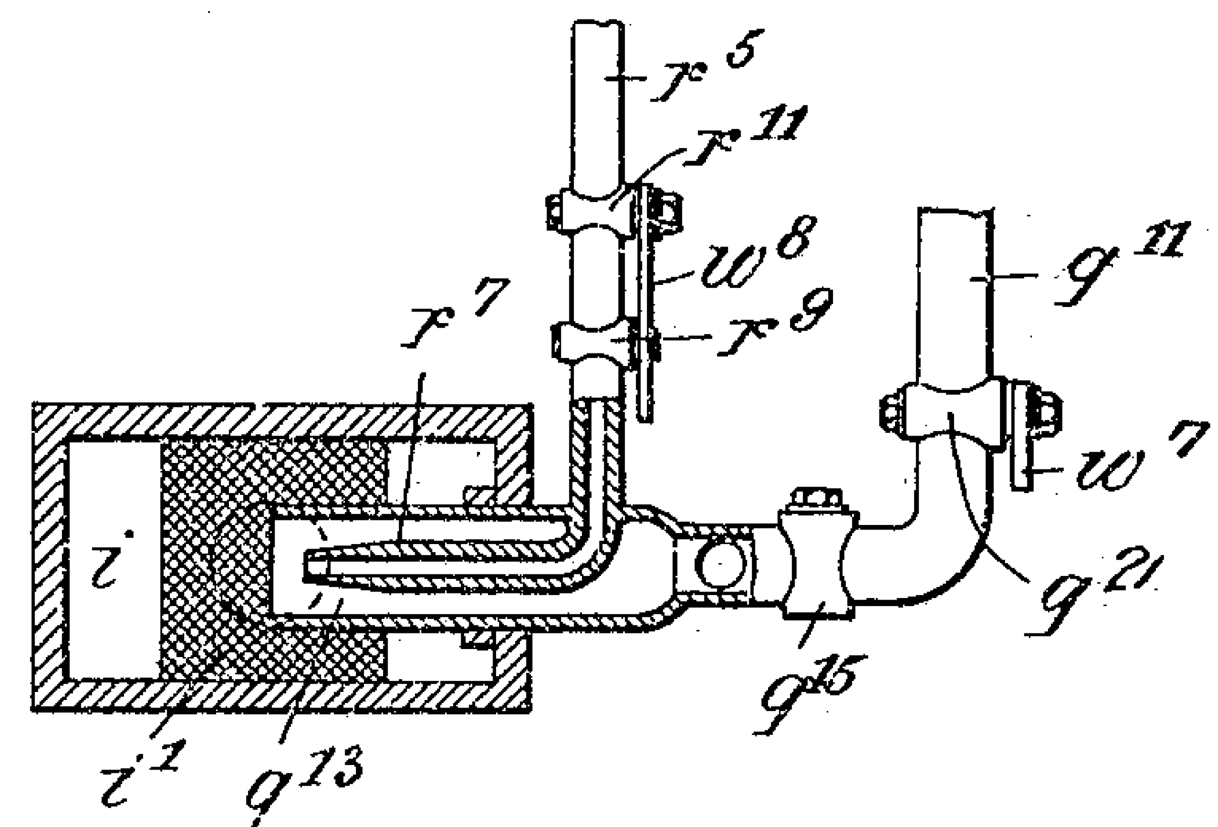


Fig. 10.

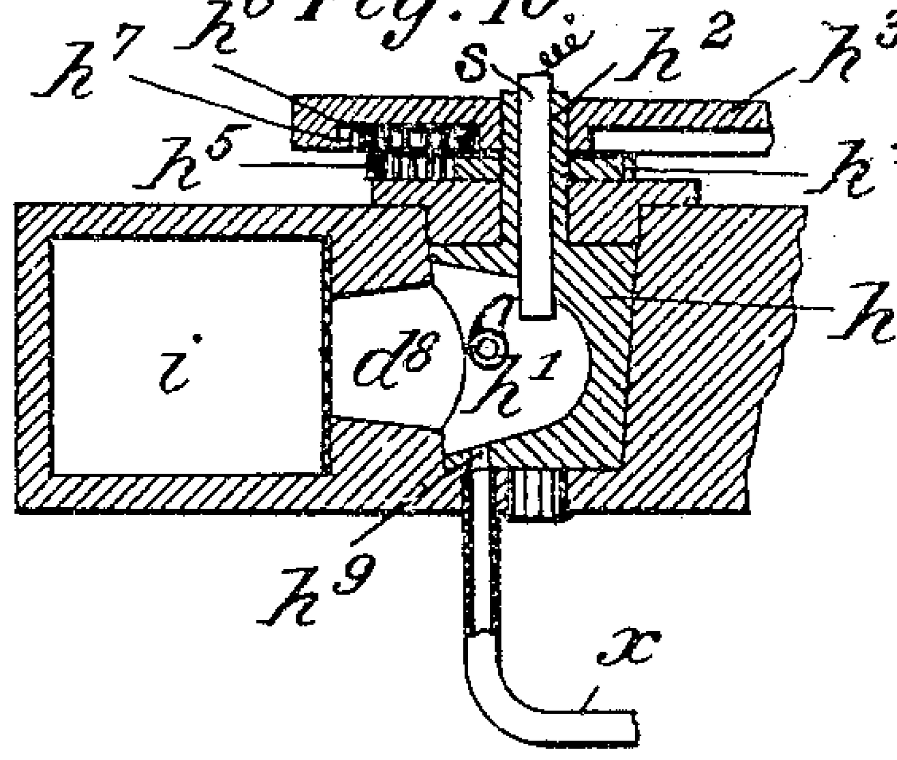
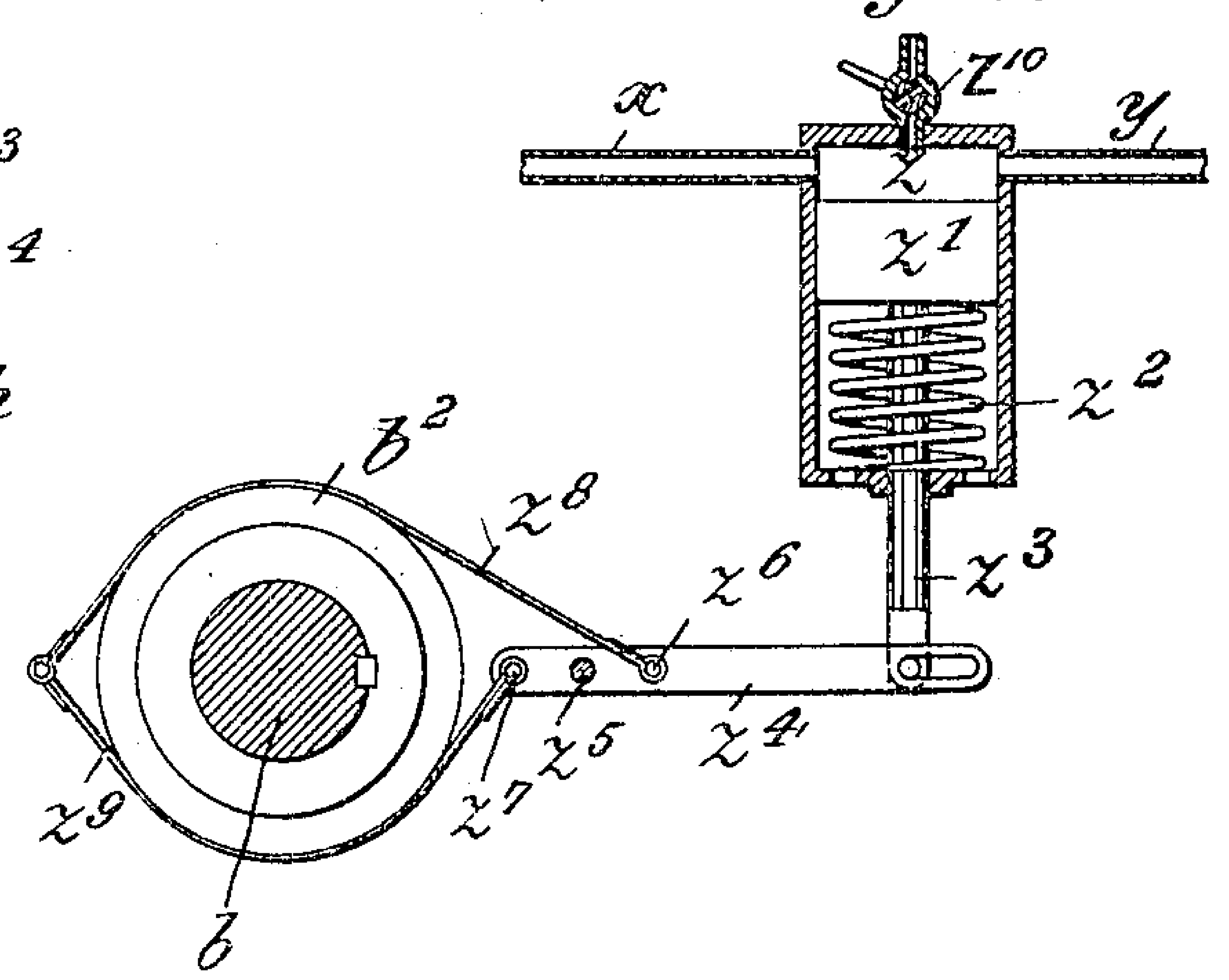


Fig. 11.



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No. 793,263. Patented June 27, 1905.

UNITED STATES PATENT OFFICE.

FRANZ X. ATZBERGER, OF NEW YORK, N. Y.

ROTARY GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 793,263, dated June 27, 1905.

Application filed August 5, 1904. Serial No. 219,600.

To all whom it may concern:

Be it known that I, FRANZ X. ATZBERGER, a citizen of the United States, residing at New York city, Manhattan, county and State of New York, have invented new and useful Improvements in Rotary Gas-Engines, of which the following is a specification.

This invention relates to a rotary gas engine or turbine more particularly adapted for propelling motor-vehicles, though it may also be used for other purposes.

The engine is economical, may be readily reversed, and automatically regulates the volume of the charge to be exploded.

In the accompanying drawings, Figure 1 is a horizontal section, partly broken away, of my improved gas-engine; Fig. 2, a plan, partly in section, thereof, the parts being shown in the same position as in Fig. 1; Fig. 3, a plan of the speed-regulator; Fig. 4, a section on line 4 4, Fig. 3; Fig. 5, a side view, partly in section, of the engine, showing it applied to the traction-wheel of an automobile; Fig. 6, an enlarged cross-section on line 6 6, Fig. 1; Fig. 7, a side view of the slide-valve; Fig. 8, a cross-section on line 8 8, Fig. 6; Fig. 9, a detail of the mixing-chamber and adjoining parts; Fig. 10, a detail section through one of the valve-plugs, showing it in its central position; and Fig. 11, a detail of the brake.

The letter a represents the cylinder of a rotary gas engine or turbine, within which is mounted upon shaft b a rotary piston c. This piston is provided at its periphery with a number of pockets or compartments c', separated from one another by partitions or blades c^2. Cylinder a is adapted to communicate with two pair of explosion-chambers d d' and e e', arranged diametrically opposite each other. The chambers d d' are separated from each other by an intervening partition d^2 and from cylinder a by a curved plate d^3, which tapers toward both ends. Between the ends of plate d^3 and the outer diverging walls d^4 d^5 of chambers d d' there are formed two gas-ports d^6 d^7. The plate d^3 forms a guide for slide-valves f f', adapted to close ports d^6 d^7, respectively. These valves are provided with inclined ends f^2 f^3, which are parallel to the walls d^4 d^5. In similar manner chambers e e' are provided with an intervening partition e^2, a tapering plate e^3, diverging outer walls e^4 e^5, gas-ports e^6 e^7, and slide-valves g g', having inclined ends g^2 g^3.

Within an opening of partition d^2 is mounted a rotary valve-plug h, provided with a recess h' and an upper hollow stem h^2, Fig. 10. The plug h is so constructed that its recess h' is by a perforation d^8 in permanent communication with a mixing-chamber i. In like manner partition e^2 is provided with a valve-plug j, having recess j', and an upper hollow stem j^2, the recess j' communicating by perforation e^8 with a mixing-chamber k. The means for providing the mixing-chamber with the elements that constitute the explosive charge, such as gasolene and compressed air, will be hereinafter described. The relative position of the plugs and slide-valves is such that if the explosive charge is admitted into the diametrically opposite chambers d e slide-valves f g are opened, while slide-valves f' g' are closed, Fig. 1. If the explosive charges contained within chambers d e are exploded in manner hereinafter described, they will produce a pair of gas-jets that pass through ports d^6 e^6 and impinge against piston-blades c^2. Thus the gas-jets act upon piston c in such a manner as to produce a rotation of the same in the direction of the arrow A, Fig. 1. By providing two diametrically opposite gas-jets the engine is balanced and friction of shaft b is reduced. If it is desired to reverse the engine, the plugs h j are turned in the direction of the arrows C, Fig. 1, so as to establish communication between the mixing-chambers i k and explosion-chambers d' e'. Simultaneously valves f' g' are opened, while valves f g are closed. The explosions will now force gas-jets through ports d^7 e^7 against piston-blades c^2, so as to cause a rotation of the piston in the direction of the arrow B, Fig. 1.

In order to simultaneously operate the plugs and valves, I have devised the following construction, though other constructions may be used for the same purpose: Upon the hollow stem h^2 of plug h, that projects beyond chambers d d', is loosely mounted a cam h^3, which is adapted to oscillate through an angle of ninety degrees. Between cam h^3 and plug h means are provided for imparting a rotation to plug h opposite to that of cam h^3. These means are shown to consist of a gear-wheel h^4, fast on stem h^2 and meshing into a gear-wheel h^5. To gear-wheel h^5 is rigidly connected a gear-wheel h^2, that meshes into the internal toothed rim h^7 of cam h^3. The dimensions of the gear-wheels are such that while cam h^3 makes a rotation of ninety degrees the plug will make a like rotation. In like manner stem j^2 is provided with a cam j^3, while plug j and cam j^3 are connected by a reversing-gear of the construction above described. (Not shown.)

Above cylinder a there is loosely mounted upon a stud l a starting and reversing lever L, having a hub l' and a pair of diametrically-placed arms l^2 l^3. These arms are provided with V-shaped slots l^4 l^5, adapted to engage pins h^5 j^5, mounted upon arms h^4 j^4 of cams h^3 j^3, respectively. The lever L has a third slotted arm l^6, the slot l^7 of which is engaged by a pin l^8 of a shipping-rod l^9, which may be operated in suitable manner. The size and shape of the slots l^4 l^5 are such that a rotation of the lever L through ninety degrees will likewise cause the cams h^3 j^3 to rotate through the same angle. The cams h^3 j^3 are provided with convex sections h^6 j^6 and a pair of concave sections h^7 h^8 and j^7 j^8, respectively. Cam h^3 is engaged by two arms m m', rigidly mounted upon spindles m^2 m^3. The spindle m^2 passes through the upper wall of chamber d and carries at its lower end a lever m^4, that engages a corresponding recess f^4 of slide-valve f, Figs. 1 and 6. The spindle m^3 passes through the upper wall of chamber d' and carries at its lower end a lever m^5, that engages a recess f^5 of slide-valve f'. In like manner the cam j^3 is engaged by two arms n n', the spindles n^2 n^3 of which are provided with levers n^4 n^5, engaging recesses g^4 g^5 of valves g g', respectively. Arms m m' are held against cam h^3 by springs m^6 m^7, while arms n n' are held against cam j^3 by springs n^6 n^7. Figs. 1 and 2 show the parts in the position for rotating piston c in the direction of arrow A, Fig. 1. It will be seen that arms m n engage the concave sections h^7 j^7 of cams h^3 j^3, while the arms m' n' engage the convex cam-sections h^6 j^6. Owing to the position of arms m m' n n' slide-valves f g are opened, slide-valves f' g' are closed, and the explosive charge is admitted through recesses h' j' of plugs h j into explosion-chambers d e, respectively. If it is desired to reverse the engine, shipping-rod l^9 is moved to the right, Fig. 2, to turn the lever L through ninety degrees. This will cause the cams h^3 j^3 to be turned through a like angle in the direction of the arrows D, Fig. 2. Plugs h j are thus rotated by the reversing-gear above described in the direction of the arrows C, Fig. 1, to establish communication between mixing-chambers i k and explosion-chambers d' e', respectively, while the chambers e f are shut off. Simultaneously with the rotation of plugs h j the slide-valves f f' g g' have altered their position, because arms m n will now contact with the convex sections h^6 j^6 of cams h^3 j^3 to close valves f g. At the same time the arms m' n', influenced by their springs m^7 n^7, have entered the concave sections h^8 j^8 of cams h^3 j^3, thereby opening valves f' g'. The explosions now taking place will rotate the piston in the reverse direction. After the gases have acted upon the blades c^2 they escape through exhausts a' a^2 of cylinder a. To stop the engine, the lever L is brought into its central position, so as to be in alinement with the cams h^3 j^3. In this position the arms m m' n n' rest against the convex sections h^6 j^6 of cams h^3 j^3, so that all the four slide-valves f f' g g' are closed.

The means for supplying gas, gasolene, &c., and compressed air to the mixing-chambers may be of any suitable construction. I have shown the gas-engine applied to the traction-wheel of an automobile, Fig. 5, which is adapted to operate the air and gas pumps in the following manner: Upon axle o of traction-wheel o' is mounted a worm-wheel o^2, that is in engagement with a worm b', fast on shaft b of piston c. Upon axle o are further mounted a pair of eccentrics o^3 o^4, of which the eccentric o^3 operates the plunger q' of an air-pump q, while the eccentric o^4 operates the plunger r' of a gasolene-pump r. The pump q delivers the air from a pipe q^2, communicating with an auxiliary pump hereinafter described, to a pipe q^3, that communicates with a pair of coils q^4 q^5, placed opposite the exhausts a^2 a', respectively, to preheat the compressed air. From coils q^4 a^5 the heated air passes through pipes q^6 q^7 and q^8 q^9 to a pair of inlet-pipes q^{11} q^{12}. To pipe q^{11} is connected a nozzle q^{13}, opening into mixing-chamber i, while to pipe q^{12} is connected a nozzle q^{14}, opening into mixing-chamber k. The pipes q^{11} q^{12} are provided with back-pressure valves q^{15} q^{16}, respectively. The pump r receives the gasolene, &c., from a suitable reservoir (not shown) by pipe r^2 and delivers it through pipe r^3 to the cylinder of an auxiliary gasolene-pump r^4. From pump r^4 the gasolene is led by pipes r^5 r^6 to gas-nozzles r^7 r^8, contained within the compressed-air nozzles q^{13} q^{14}, respectively. Pipes r^5 r^6 are also provided with back-pressure valves r^9 r^{10}.

To insure a thorough mixing of the explosive charge, I provide screens i' k' between the mixing-chambers i k and the openings d^8 e^8, respectively.

The mixture within the explosion-chambers may be ignited by any suitable device, which does not form part of my invention. I have shown electric igniters s s' of well-known construction, which are operated in the usual manner, such igniters being inserted through the hollow stems h^2 j^2 into the recesses h' j' of plugs h j.

The engine works in such a manner that gasolene and compressed air are permanently fed into the explosion-chambers. Within these chambers the charge is exploded at short intervals—say once during each rotation of the piston. The moment an explosion takes place gas-jets are forced through the ports against the blades of the piston to rotate the latter. During the explosion the inflow of air and gasolene is stopped by the automatically-closing back-pressure valves. In order to insure a complete consumption of the explosive mixture, I have provided additional compressed-air-supply pipes q^{17} q^{18} and q^{19} q^{20}, communicating with pipes q^{11} q^{12}, respectively, and opening into explosion-chambers d' d e e' at a distance from the gas-entrance.

The speed of the engine is regulated in the following manner: Upon shaft b are mounted beneath cylinder a a pair of disks t t', of which disk t is provided with a hub t^2, encircled by a coiled endless spring t^3, Fig. 3. A series of centrifugal rollers t^4, having axles t^5, are placed between disks t t'. The axles t^5 turn in forked bearings t^6, adapted to move in corresponding radial slits t^7 t^8 of disks t t' and connected to spring t^3 by wires or rods t^9. The axles t^5 pass through slits t^{10} t^{11} of disks t t' in order to prevent lateral displacement of the rollers. Thus it will be seen that the rollers t^4 will move radially outward against the action of spring t^3 when the engine is running, the distance of displacement depending upon the speed of the engine. Intermediate the disks t t' and near their periphery enter a pair of straps u v, which are adapted to be engaged by the rollers t^4. The ends of straps u are connected to levers u' u^2 of spindles u^3 u^4. The spindle u^3 projects through the bottom of explosion-chamber d and is provided at its upper end with a lever u^5, having a pin u^6, Figs. 6 to 8. The lever u^5 is free to swing within a corresponding slot f^6 of slide-valve f, while the pin u^6 engages a slot f^7 of the valve. As the construction of the mechanism for operating the valves f f' g g' is alike, only that for operating valve f is shown in Figs. 6, 7, and 8. Thus the spindle u^4 passes through the bottom of explosion-chamber e and influences valve g in the same manner as described in relation to valve f. When the engine runs too fast, the rollers t^4 will move radially outward to correspondingly displace strap u. By this action the spindles u^3 u^4 will be turned in the direction of the arrows E, Figs. 3 and 8. This rotation will cause an outward movement of slide-valves f g, so as to reduce the area of the ports d^6 e^6 and correspondingly diminish the volume of the gas-jet blowing against blades c^2. In like manner the ends of strap v are connected to levers v' v^2 of spindles v^3 v^4. The mechanism described for setting valves f g is duplicated for valves f' g', so that if the engine when reversed runs too fast the rollers will displace strap v, and thus reduce the area of ports d^7 e^7.

In order to prevent the pressure within the explosion-chambers from becoming excessive after the slide-valves have been partly closed, I have provided a pair of cylinders w w', which communicate at their bottom by pipes w^2 w^3 with the mixing-chambers i k, respectively. Within cylinder w is fitted a piston w^4, influenced by a spring w^5. The piston-rod w^6 of piston w^4 engages a pair of levers w^7 w^8. The lever w^7 is connected to a three-way cock q^{21} of air-pipe q^{11}, while the lever w^8 is connected to a three-way cock r^{11} of gasolene-pipe r^5. If the pressure in the mixing-chamber i becomes excessive, it will raise piston w^4 against action of spring w^5 to partially turn cocks q^{21} r^{11}. By the turning of the three-way cock q^{21} part of the air will escape into the atmosphere, while by turning the three-way cock r^{11} part of the gasolene delivered through pipe r^5 will enter a pipe r^{12}, to be reconveyed to the gas-reservoir. (Not shown.) In like manner cylinder w' is provided with a piston w^9, influenced by a spring w^{10} and having a piston-rod w^{11}, that engages levers w^{12} w^{13}. Lever w^{12} is connected to a three-way cock q^{22} of air-pipe q^{12}, while lever w^{13} is connected to a three-way cock r^{15} of gasolene-pipe r^6. If, therefore, the pressure in mixing-chamber k becomes excessive, air will partly escape through three-way cock q^{22}, while the gasolene will be partly returned to the reservoir through pipe r^{13}. Should the pressure in the mixing-chamber grow abnormally great, the pistons w^4 w^9 will be lifted to such an extent as to uncover openings w^{14} w^{15} of cylinders w w', so that the mixture may escape into the open air.

In order to start the engine before the pumps q and r are in action, I have provided an auxiliary air-pump q^{23} and an auxiliary gas-pump r^4. Air-pump q^{23} has a piston q^{24}, which is connected by forked link l^{10} to arm l^6. The pump q^{23} communicates with pipe q^2 of pump q, so that during the normal operation the air drawn by pump q passes through pump q^{23}, so that the latter is always charged with air. The auxiliary gas-pump r^4 is provided with a piston r^{14}, which is by link l^{11} connected to an arm l^{12} of lever L. During the normal operation of the engine the gasolene passes through pump r^4, as already stated, so that the latter is always charged with gasolene. Before starting the engine the lever L is in its central position, while the pistons q^{24} r^{14} assume their extreme outward position. If now the rod l^9 is shifted to either of its end positions in order to start the engine in one or the other direction, gasolene and air will be simultaneously compressed by the advancing pistons q^{24} r^{14}, respectively, so that sufficient pressure is created for starting the engine.

To automatically set a brake after the engine has been stopped, I may use the construction shown in Figs. 1, 5, 10, and 11. Plugs h and j are provided with perforations h^9 j^9, which are adapted to register with pipes x y when plugs h j are in their central position. Pipes x y open into a cylinder z, having a piston z' influenced by a spring z^2. The piston-rod z^3 of piston z' engages a brake-lever z^4, fulcrumed at z^5 to the frame of the engine. To lever z^4 are connected at z^6 and z^7 the ends of a pair of brake-straps z^8 z^9, that engage a brake-disk b^2 of shaft b. It will be seen that after the lever L has been brought into its central position the explosion-chambers will through openings h^9 j^9 communicate with pipes x y, so that the pressure within the explosion-chambers after the slide-valves have been closed will be transmitted to cylinder z in order to depress piston z', Fig. 11, and set the brake. By opening a valve z^{10} of cylinder z the brake may be released.

What I claim is—

1. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a mixing-chamber, a recessed valve-plug adapted to establish communication between the mixing-chamber and either one of the explosion-chambers, and an igniter within the valve-plug recess, substantially as specified.

2. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a mixing-chamber, a recessed valve-plug adapted to establish communication between the mixing-chamber and either one of the explosion-chambers, valves controlling communication between the explosion-chambers and the cylinder, and an igniter within the valve-plug recess, substantially as specified.

3. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers having ports and communicating with the cylinder, a partition between the explosion-chambers, a recessed valve-plug mounted therein, an igniter within the valve-plug recess, a mixing-chamber, valves within the explosion-chambers and controlling the ports, and means for simultaneously setting the valve-plug and valves, substantially as specified.

4. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a partition between the explosion-chambers, a recessed valve-plug mounted therein, a mixing-chamber, valves controlling communication between the explosion-chambers and the cylinder, a cam operatively connected to the valve-plug, and arms engaging the cam and operatively connected to the last-mentioned valves, substantially as specified.

5. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a mixing-chamber adapted to be connected with either of the explosion-chambers, valves controlling communication between the explosion-chambers and the cylinder, a strap operatively connected to the valves, and a spring-influenced centrifugal roller adapted to engage the strap, substantially as specified.

6. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a mixing-chamber adapted to be connected with either of the explosion-chambers, valves controlling communication between the explosion-chambers and the cylinder, a strap operatively connected to the valves, a centrifugal roller adapted to engage the strap, and a spring-influenced slidable bearing in which the roller is journaled, substantially as specified.

7. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a partition between the explosion-chambers, a recessed valve-plug mounted therein, a mixing-chamber, valves controlling communication between the explosion-chambers and the cylinder, means for operating the valve-plug and the last-mentioned valves, a cylinder communicating with the mixing-chamber, an inclosed spring-influenced piston, and a three-way air and gas cock operatively connected to said piston, substantially as specified.

8. In a rotary gas-engine, the combination of a cylinder with a bladed piston, a pair of explosion-chambers communicating with the cylinder, a partition between the explosion-chambers, a recessed valve-plug mounted therein, a mixing-chamber, valves controlling communication between the explosion-chambers and the cylinder, means for operating the valve-plug and the last-mentioned valves, a cylinder adapted to communicate with the recessed valve-plug, an inclosed spring-influenced piston, a brake-strap operatively connected thereto, and a brake-disk engaged by the strap, substantially as specified.

Signed by me at New York city, (Manhattan,) New York, this 3d day of August, 1904.

FRANZ X. ATZBERGER.

Witnesses:

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