No. 820,238. PATENTED MAY 8, 1906.

A. L. MOSS.

EXPLOSION TURBINE.

APPLICATION FILED MAR. 17, 1905.

4 SHEETS—SHEET 1

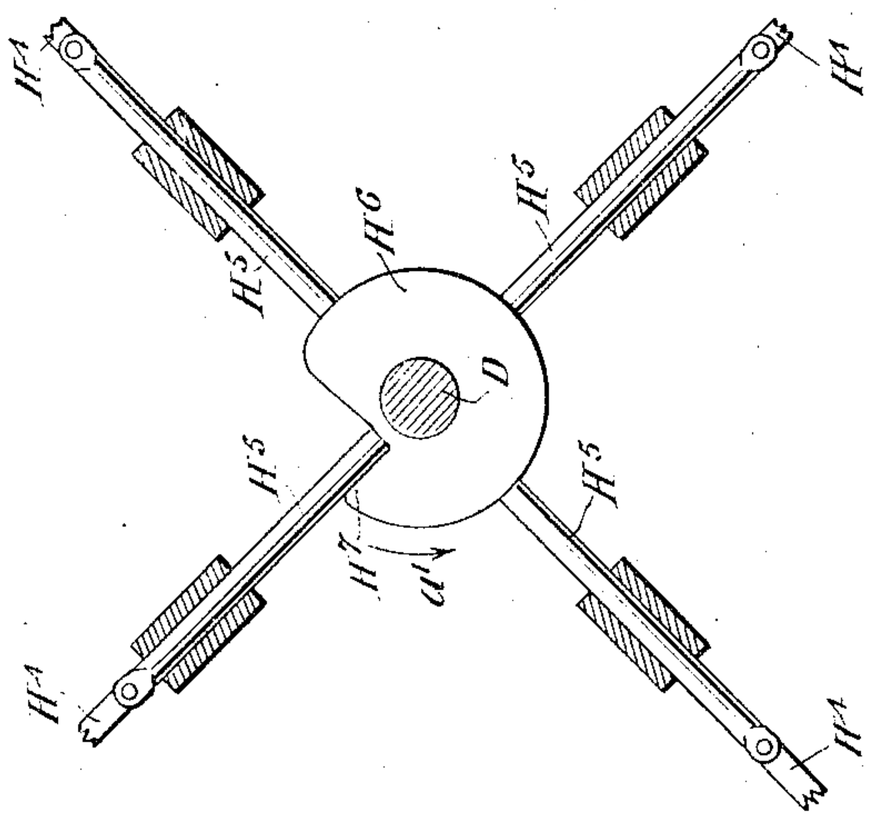

Fig. 2.

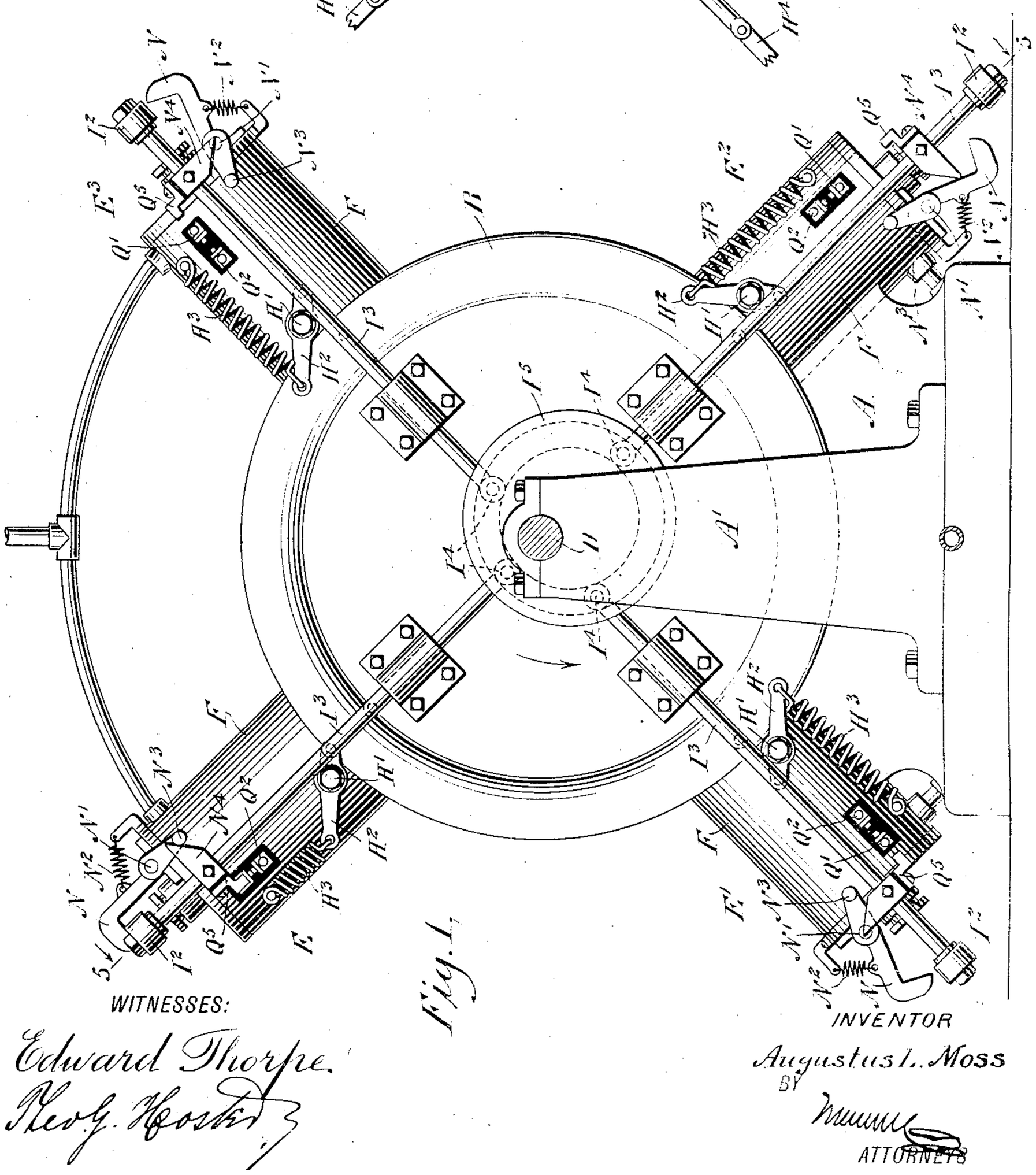

Fig. 1.

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Fig. 3,

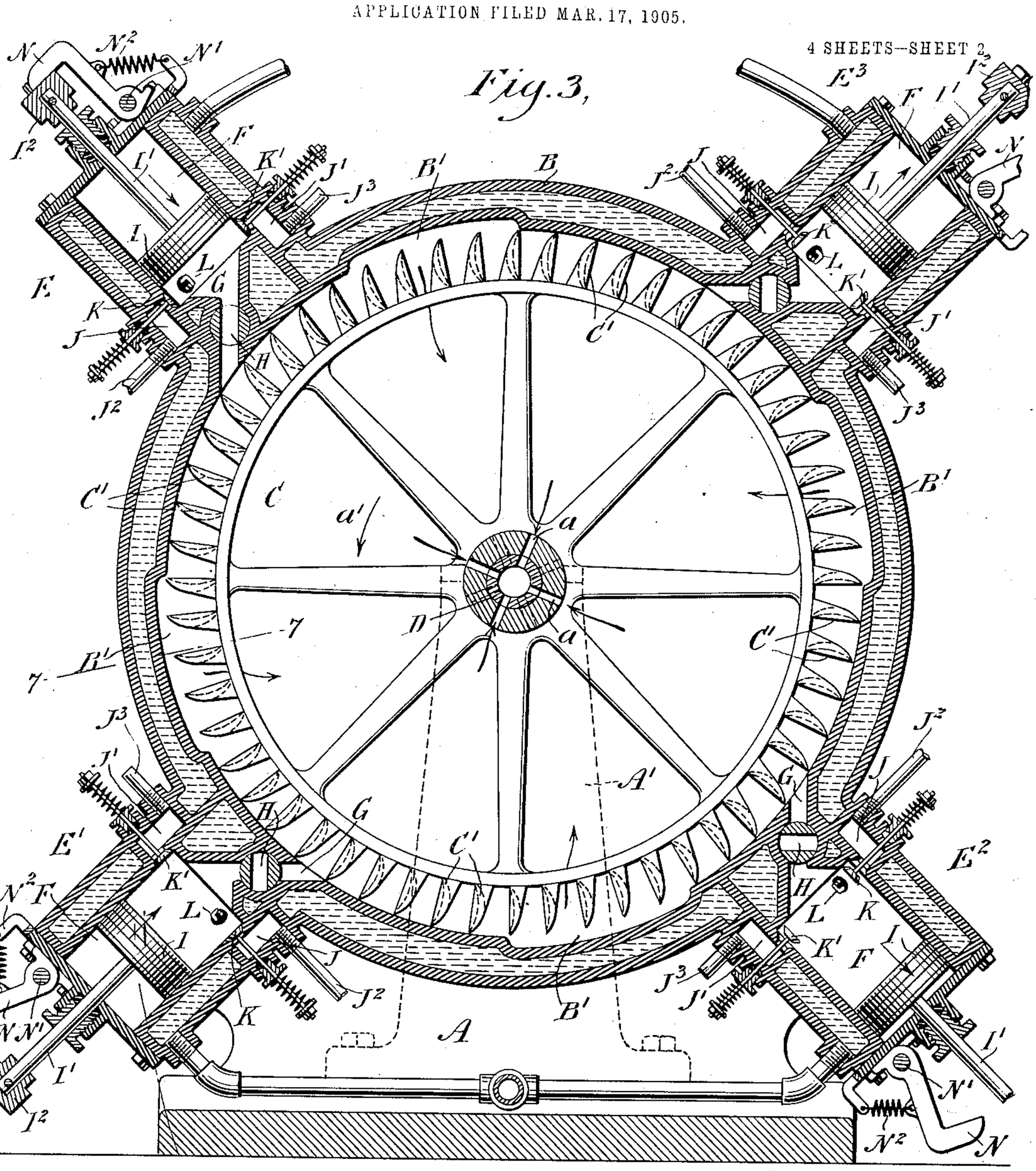
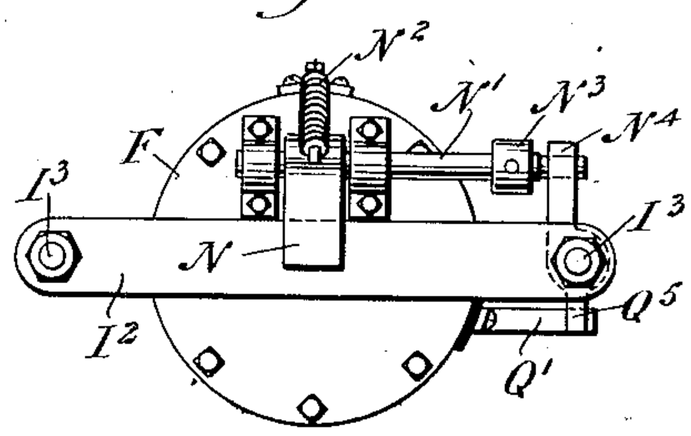


Fig. 4,



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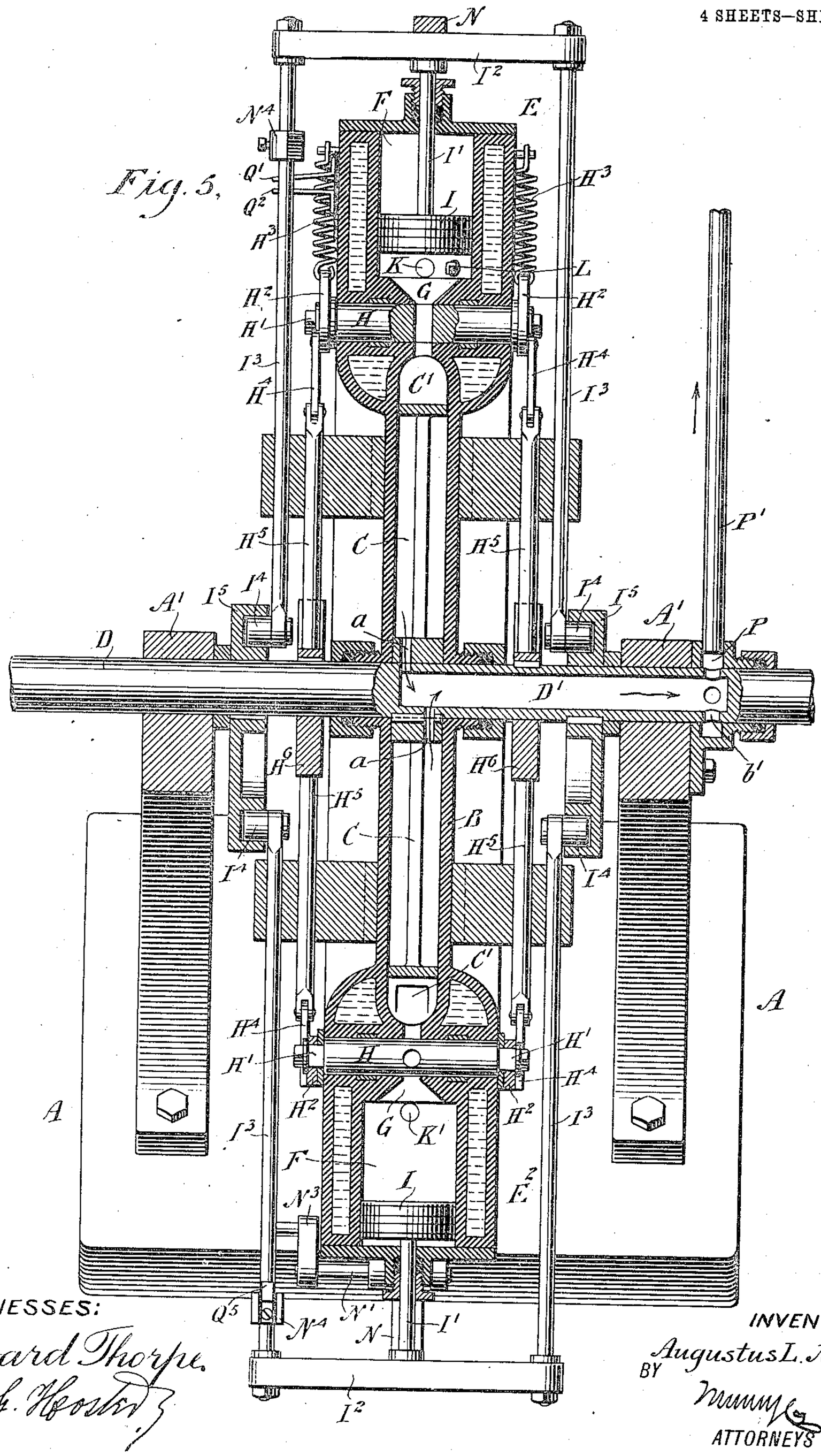
4 SHEETS—SHEET 3.

Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6,

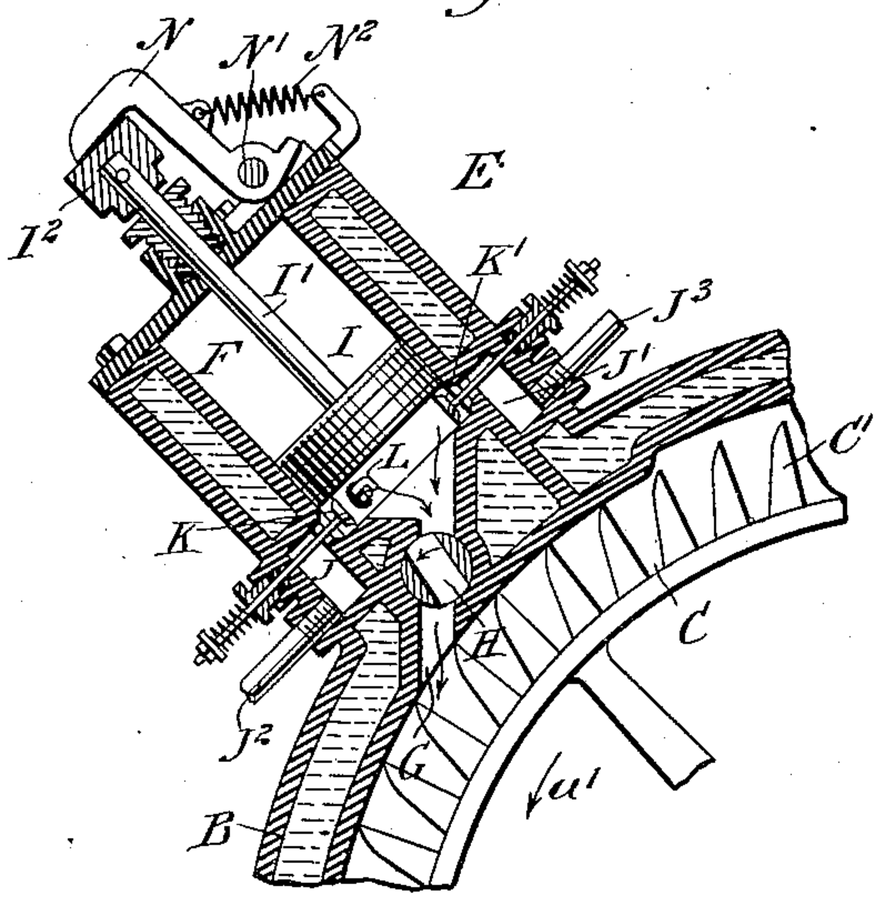


Fig. 7,

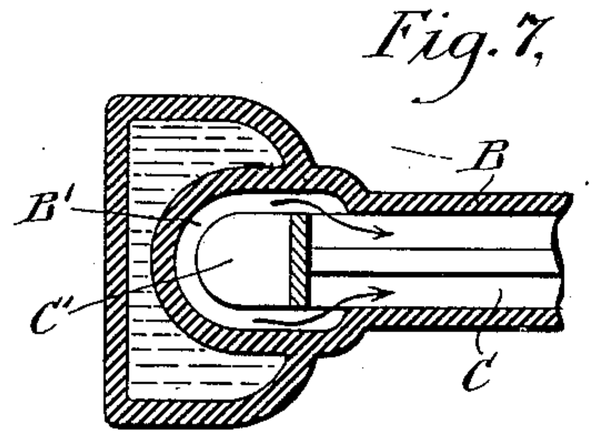
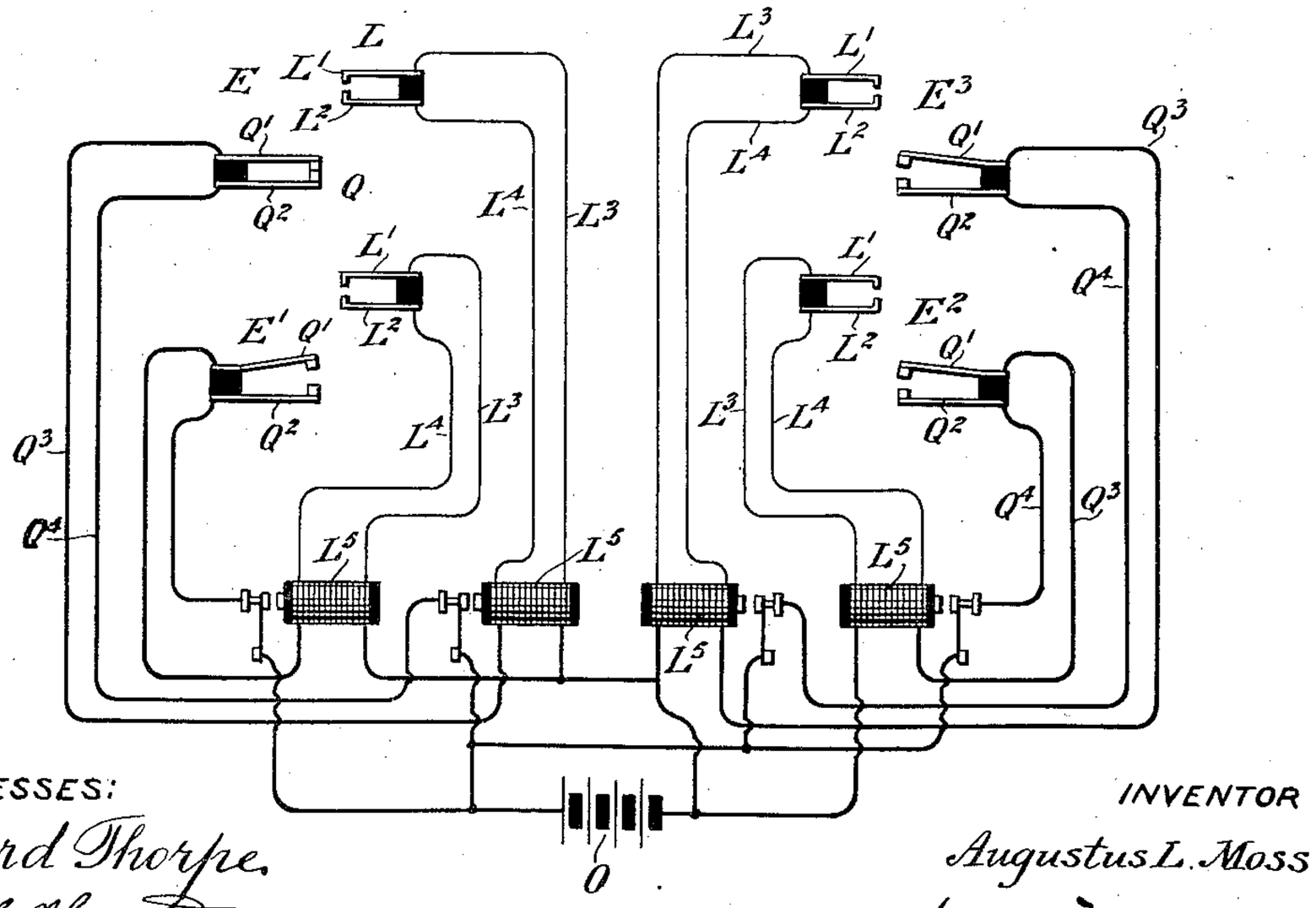


Fig. 8.



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AUGUSTUS L. MOSS, OF SANDUSKY, OHIO.

EXPLOSION-TURBINE.

No. 820,238. Specification of Letters Patent. Patented May 8, 1906.

Application filed March 17, 1905. Serial No. 250,523.

To all whom it may concern:

Be it known that I, AUGUSTUS LEICESTER Moss, a citizen of the United States, and a resident of Sandusky, in the county of Erie and State of Ohio, have invented a new and Improved Explosion-Turbine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved explosion-turbine in which impact impulses are given in quick succession to the turbine-wheel at different points of its periphery to insure a uniform and powerful running of the turbine.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the improvement. Fig. 2 is a sectional side elevation of the mechanism for actuating the controlling-valves in the nozzles of the explosion-chambers. Fig. 3 is a sectional side elevation of the improvement. Fig. 4 is a plan view of one of the explosion devices. Fig. 5 is an enlarged cross-section of the improvement on the line 5 5 of Fig. 1. Fig. 6 is a sectional side elevation of part of the improvement, showing one of the explosion devices in an exhausting position. Fig. 7 is a cross-section of the improvement on the line 7 7 of Fig. 3, illustrating one of the exhausts; and Fig. 8 is a diagrammatic view of the igniting devices.

On a suitably-constructed frame A is mounted a turbine-cylinder B, in which is arranged to rotate a turbine-wheel C, having peripheral buckets C′ and secured on a shaft D, journaled in suitable bearings held on standards A′, forming part of the main frame A. Around the turbine-cylinder B are grouped a plurality of spaced explosion-cylinders E, E′, E², and E³ for giving impact impulses in quick succession to the turbine-wheel C at different points of its periphery to insure a uniform and powerful running of the turbine.

Each of the explosion-cylinders E, E′, E², and E³ consists, essentially, of an explosion-chamber F, secured to or forming part of the turbine-cylinder B and being preferably in the form of a cylinder, the axis of which is disposed radially to the axis of the turbine-wheel C. From the inner end of the explosion-chamber F extends a nozzle G for discharging the exploded charge against the buckets C′ of the turbine-wheel C to rotate the latter in the direction of the arrow *a*′, and in the nozzle G is arranged a valve H for opening and closing the nozzle G at the proper time and as hereinafter more fully described.

In the explosion-chamber F is mounted to reciprocate a piston I, controlled from the turbine-wheel C and serving to draw in the explosive charge and to compress the same previous to igniting the charge, as hereinafter more fully explained.

Adjacent to the inner end of the explosion-chamber F are arranged a gas-chamber J and an air-chamber J′, of which the chamber J is connected by a pipe J² with a suitable gas-supply, while the other chamber J′ is provided with an air-inlet pipe J³. The chambers J and J′ are connected with the inner end of the explosion-chamber F by spring-pressed valves K and K′, respectively, adapted to open inwardly on the piston I moving outwardly during the suction-stroke and during the time the piston I is at the end of its inward stroke and after the explosion has taken place (see Fig. 6) to allow air and gas to rush into the inner end of the explosion-chamber to clean the latter of the products of combustion, sufficient suction being produced in the inner end of the cylinder by the action of the rotating turbine-wheel C.

In the inner end of the explosion-chamber F is arranged an electric igniting device L for igniting the compressed charge at the proper time, and at the same time the valve H moves suddenly into an open position.

In order to reciprocate the piston I in the cylinder F, the following device is provided: On the outer end of the piston-rod I′ of the piston I is secured a cross-head I², from which extend rods I³, mounted to slide in suitable bearings and provided at their inner ends with friction-rollers I⁴, engaging the eccentric cam-grooves of cams I⁵, secured to the main shaft D on opposite sides of the cylinder B, as plainly illustrated in Fig. 5. When the turbine-wheel C is rotating, then the cams I⁵ rotate with the shaft D, and consequently impart a sliding motion to the rods I³ and to cause the cross-heads I² and piston-rods I′ to impart a reciprocating motion to the pistons I in the explosion-chambers F of the several cylinders E, E′, E², and E³. As the pistons I

of the several cylinders E, E′, E², and E³ are actuated from the same cams, it is evident that the pistons I are actuated in the proper succession to cause successive compression of the charges in the several explosion-chambers previous to their ignition. During the time the ignition takes place in cylinders E, E′, E², or E³ the corresponding piston I is automatically locked against movement, and for this purpose the following arrangement is made: The cross-head I² for each piston I is adapted to be engaged by a locking-catch N, secured on a shaft N′, journaled in suitable bearings on the outer end of the explosion-chamber F, and the said catch N is normally held out of the path of the cross-head I² by a spring N². On the shaft N′ is secured a crank-arm N³, adapted to be engaged by a cam N⁴, fixed on one of the rods I³, so that when the piston I moves inward and about reaches the end of its inward stroke then the cam N⁴ acts on the crank-arm N³ to impart a swinging motion to the shaft N′ and to the catch N to engage the latter with a cross-head I² to hold the latter, and consequently the piston I, against return movement. When the piston I is on the return or outward stroke, the cam N⁴ moves out of engagement with the crank-arm N³, thus releasing the shaft N′ and the catch N, which latter is immediately pulled back into an inactive position by its spring N². The latch N holds the piston I temporarily against outward movement, so that the force of the explosion is taken up by the latch and not by the cam I⁵ and shaft D.

The valve H in the nozzle G of each explosion-cylinder E, E′, E², and E³ is preferably in the form of a cylindrical rocking valve, and in order to open and close the said valve in unison with the movement of the corresponding piston I the following device is provided: On the outer end of the stem H′ of the valve H is secured an arm H², pulled on at one end by a spring H³ and pivotally connected at its other end by a link H⁴ with a rod H⁵, mounted to slide radially in suitable bearings and abutting with its inner end on the peripheral face of a cam H⁶, secured on the main shaft D. The cam H⁶ is provided with an abrupt portion H⁷, so that when the turbine is running and the shaft D and cam H⁶ turn in the direction of the arrow *a′* then the abrupt portion H⁷ comes successively opposite the inner ends of the rods H⁵ to allow the latter to slide suddenly inwardly, owing to the action of the springs H³, to turn the valve H from a normally closed into an open position. This action takes place at the time the piston I is in its locked position near the innermost end of the cylinder immediately before the explosion of the charge has taken place in the explosion-chamber F. Thus when the explosion takes place the valve H is open and the exploded charge passes through the nozzle G against the buckets C′ of the turbine-wheel C to rotate the latter in the direction of the arrow *a′*. The valve H remains open after the explosion has taken place and during the time the piston I changes from near the end of its downstroke to the beginning of its upstroke, so that the buckets C′, passing the terminal of the nozzle F, cause a suction in the inner end of the explosion-chamber F for the valves K and K′ to open. When this takes place, the inrushing gas and air completely clears the inner end of the chamber F of the products of combustion, which rush through the open valve H and nozzle G into the turbine-cylinder B. As soon as the inner end of the explosion-chamber is cleared of the products of combustion the valve H immediately closes and remains closed until the next explosion is to take place. The products of combustion which pass by way of the nozzle G into the cylinder B finally reach exhaust-chambers B′, formed in the cylinder between adjacent explosion devices, the beginning of a chamber B′ being a distance from the terminal of the preceding nozzle G, as will be readily understood by reference to Fig. 3.

The products of combustion can pass from the chambers B′ to ports *a* in the hub of the turbine-wheel C and the shaft D into the hollow portion D′ of the shaft, (see Fig. 5,) and this hollow portion is provided near its outer end with ports *b′*, opening into a chamber P, surrounding the shaft D, and having an exhaust-pipe P′ for carrying off the products of combustion to a suitable place. The chambers B′ extend around the rim of the wheel C to allow the gases to reach the ports *a*.

Each ignition device L is provided with spaced electrodes L′ and L², connected by wires L³ and L⁴ with an induction-coil L⁵, connected with a suitable source of electrical energy O, such as a battery, as indicated in Fig. 8. The circuit-breaker Q for each induction-coil L⁵ consists of flexible contact-plates Q′ and Q², of which the contact-plate Q′ is connected by a wire Q³ with the induction-coil L⁵, and the other contact-plate Q² is connected by a wire Q⁴ with an armature-lever for the induction-coil L⁵. Normally the contact-plates Q′ and Q² are in an open position, and one of the contact-plates—as shown, the contact-plate Q′—is adapted to be engaged by an arm Q⁵, attached to one of the rods I³, preferably at the cam N⁴, so that when the piston I moves into an innermost position the arm Q⁵ presses the contact-plate Q′ and moves the same in contact with the other plate Q² to close the circuit, thus causing the induction-coil L⁵ to send a current through the wires L³ and L⁴ and the electrodes L′ and L², with a spark passing from one electrode L′ to the other electrode L². Thus it will be seen that when the piston I is moved into an innermost position and compresses the previously drawn-in charge the

explosive charge is ignited by the spark referred to, and the force of the explosive charge is exerted against the buckets C′, as previously explained, to rotate the turbine-wheel C in the direction of the arrow *a′*

I do not limit myself to the particular arrangement of igniting devices above described, as the same may be varied without deviating from the spirit of my invention.

The operation is as follows: When the machine is running and the several parts are in the position illustrated in Fig. 3, then an explosion has taken place in the explosion-cylinder E to turn the turbine-wheel C in the direction of the arrow *a′*, while in the explosion-cylinder E′ the piston I is moving inward to compress the previously drawn-in charge while in the explosion-cylinder E² the piston I is at the end of its suction-stroke—that is, has drawn into the explosion-chamber F the desired mixture of gas and air. In the explosion-cylinder E³ the piston I is at the beginning of the suction-stroke, and in all three cylinders E′, E², and E³ the valve H is in a closed position. As the turbine-wheel C rotates the valve H in the explosion-cylinder I gradually gradually closes, and about the time this takes place an explosion takes place in the explosion-cylinder E′, so as to give another impulse to the turbine-wheel C, it being understood that when this explosion takes place in the explosion-cylinder E′ its valve H opens suddenly to direct the charge against the buckets C′, as above explained. During the final compression of the charge and the ignition and explosion of the charge in the explosion-cylinder E′ compression takes place in the cylinder E², and at the end of the compression period the mixture is ignited in the cylinder E², so that another impulse is given to the turbine-wheel C. In a like manner a final impulse is given to the wheel C shortly after by the exploded charge in the explosion-cylinder E³, and then the next impulse is given to the wheel by the explosion from the explosion-cylinder E to complete the cycle. Thus it will be seen that during each revolution of the turbine-wheel C four successive impulses are given to the buckets C′ in quick succession to insure a uniform and powerful running of the turbine.

The explosion-chambers F of the several explosion-cylinders E, E′, E², and E³ are preferably water-jacketed, as indicated in the drawings, and the cylinder B is likewise preferably water-jacketed to keep the turbine at the proper temperature.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An explosion-turbine comprising a cylinder, a turbine-wheel mounted to turn in said cylinder and provided with peripheral buckets, an explosion-chamber having a discharge-nozzle for discharging a motive agent against the buckets in the direction of rotation of the turbine-wheel, a piston in said explosion-chamber, operating means for the piston controlled from the said turbine-wheel for drawing in an explosive charge and for compressing the same previous to ignition, and means operated by the piston-operating means for locking the piston during the explosion period.

2. An explosion-turbine comprising a cylinder, a turbine-wheel mounted to turn in said cylinder and provided with peripheral buckets, an explosion-chamber having a discharge-nozzle for discharging a motive agent against the buckets in the direction of rotation of the turbine-wheel, a piston in the explosion-chamber controlled from said turbine-wheel for drawing in an explosive charge and for compressing the same previous to ignition, a valve in said nozzle for opening and closing the latter, and means operated by the piston-operating means for locking the piston during the explosion period.

3. An explosion-turbine comprising a cylinder, a turbine-wheel mounted to turn in said cylinder and provided with peripheral buckets, an explosion-chamber having a discharge-nozzle for discharging a motive agent against the buckets in the direction of rotation of the turbine-wheel, a piston in the explosion-chamber controlled from said turbine-wheel for drawing in an explosive charge and for compressing the same previous to ignition, means operated by the piston-operating means for locking the piston during the explosion period, and a valve operating in conjunction with said piston and opening quickly at the end of the compression period of said piston.

4. An explosion-turbine comprising a cylinder, a turbine-wheel mounted to turn in said cylinder and provided with peripheral buckets, an explosion-chamber having a discharge-nozzle for discharging a motive agent against the buckets in the direction of rotation of the turbine-wheel, a piston in the explosion-chamber controlled from said turbine-wheel for drawing in an explosive charge and for compressing the same previous to ignition, means operated by the piston-operating means for locking the piston during the explosion period, and a valve operating in conjunction with the said piston and opening quickly at the end of the compression period of said piston and remaining open until after the beginning of the return stroke of the piston whereby the turbine-wheel may create a suction in the said working chamber to clear the same of the products of combustion.

5. An explosion-turbine comprising a cylinder, a turbine-wheel having peripheral buckets and arranged to turn in said cylinder, an explosion-chamber having a nozzle for discharging a motive agent against the buckets of the turbine-wheel, a piston reciprocat-

ing in the said explosion-chamber and controlled from said turbine-wheel, means for supplying said explosion-chamber with an explosive charge, an ignition device for igniting the said explosive charges, means operated by the piston-operating means for locking the piston during the explosion period, and a valve in the said device operating in unison therewith.

6. An explosion-turbine, comprising a cylinder, a turbine-wheel having buckets and mounted to turn in said cylinder, an explosion-chamber having a nozzle for discharging a motive agent against the buckets of the turbine-wheel, a piston reciprocating in the said explosion-chamber and controlled from the said turbine-wheel, means for supplying the said explosion-chamber with an explosive charge, a valve in the said nozzle and operating in unison with said piston, an automatic locking device for said piston, and means whereby the piston-operating means may control the operation of said locking device.

7. An explosion-turbine, comprising a cylinder, a turbine-wheel having peripheral buckets mounted to turn in the said cylinder, a plurality of explosion-cylinders spaced apart from each other and grouped around the said cylinder, each explosion-cylinder comprising an explosion-chamber having a nozzle for discharging an explosive charge against said buckets means for supplying an explosive charge to said explosion-chamber, an igniting device in the explosion-chamber, a reciprocating piston in the explosion-chamber for drawing in an explosive charge and for compressing the same immediately previous to the ignition of the charge by said igniting device, means connected with the turbine-wheel for operating the piston, and means operated by the piston-operating means for locking the piston during the explosion period.

8. An explosion-turbine, comprising a cylinder, a turbine-wheel having peripheral buckets mounted to turn in the said cylinder, a plurality of explosion-cylinders spaced apart from each other and grouped around said cylinder, each explosion-cylinder comprising an explosion-chamber and having a nozzle for discharging an explosive charge against the said buckets, means for supplying an explosive charge to said explosion-chamber, an igniting device in the explosion-chamber, a reciprocating piston in the said explosion-chamber for drawing in a charge and compressing the same immediately previous to the ignition of the charge by said igniting device, means connected with the turbine-wheel for operating the piston; means operated by the piston-operating means for locking the piston during the explosion period, and an automatic valve in said discharge-nozzle.

9. An explosion-turbine comprising a cylinder, a turbine-wheel having peripheral buckets and mounted to turn in the cylinder, a plurality of explosion-cylinders spaced apart from each other and grouped around the cylinder, each explosion-cylinder comprising an explosion-chamber having a nozzle for discharging an explosive charge against said buckets, means for supplying the explosive charge to said explosion-chamber, an igniting device in the explosion-chamber, a reciprocating piston in the said explosion-chamber for drawing in a charge and compressing the same immediately previous to the ignition of the charge by said igniting device, means for locking the piston against movement during the explosion period, an automatic valve in said discharge-nozzle, means for operating the said piston, and the said valve in unison from the turbine-wheel, and means whereby the piston-operating means may operate the locking device.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AUGUSTUS L. MOSS.

Witnesses:
H. L. PEEKE,
JOHN H. IMMEL.