(No Model.) 3 Sheets—Sheet 1.

J. W. OSBORNE.

VALVE FOR PNEUMATIC CANNON.

No. 427,895. Patented May 13, 1890.

Fig. 3.

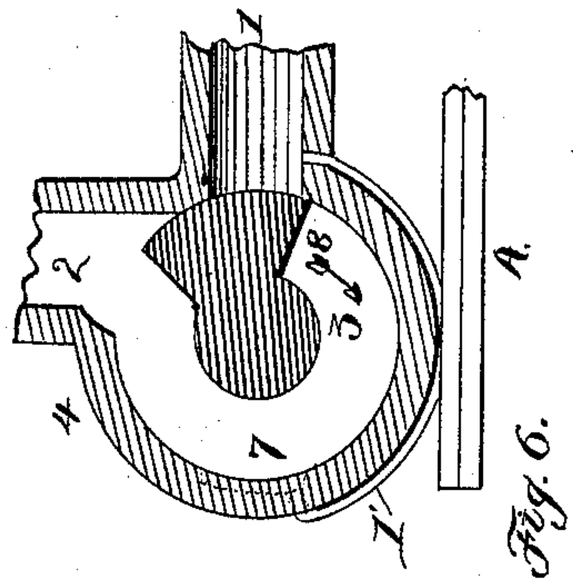


Fig. 6.

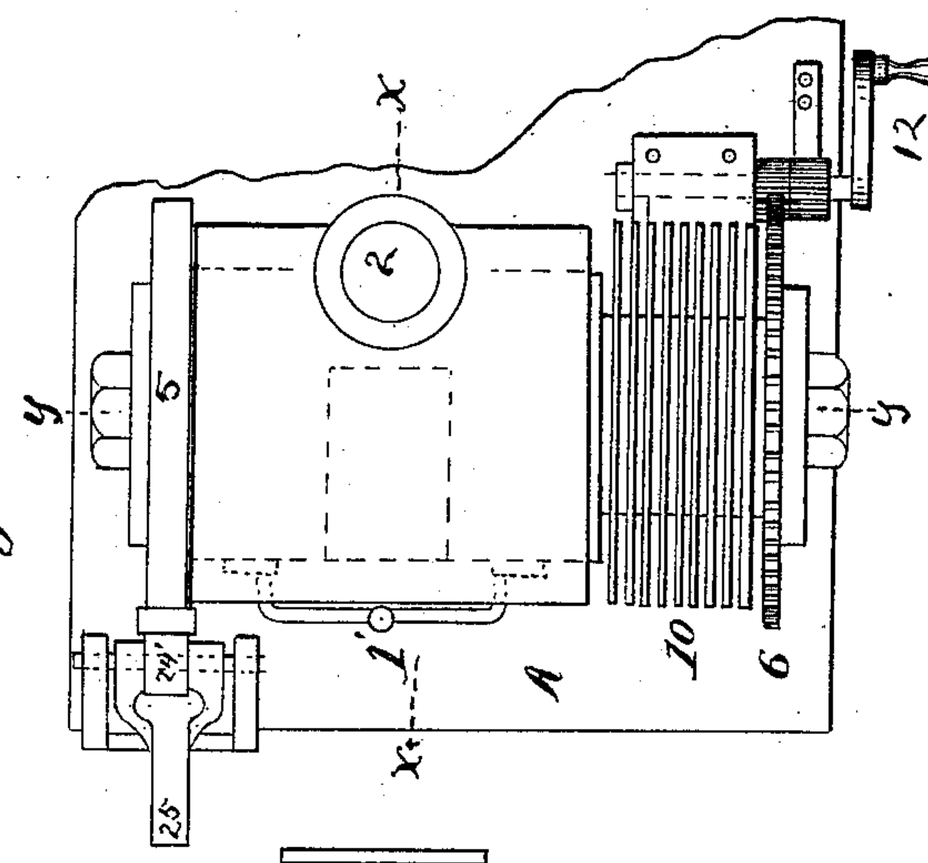


Fig. 2.

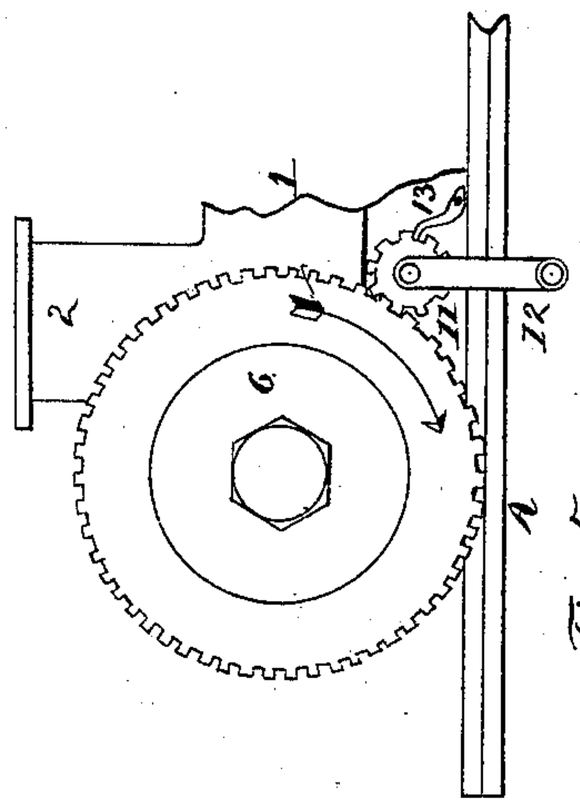


Fig. 5.

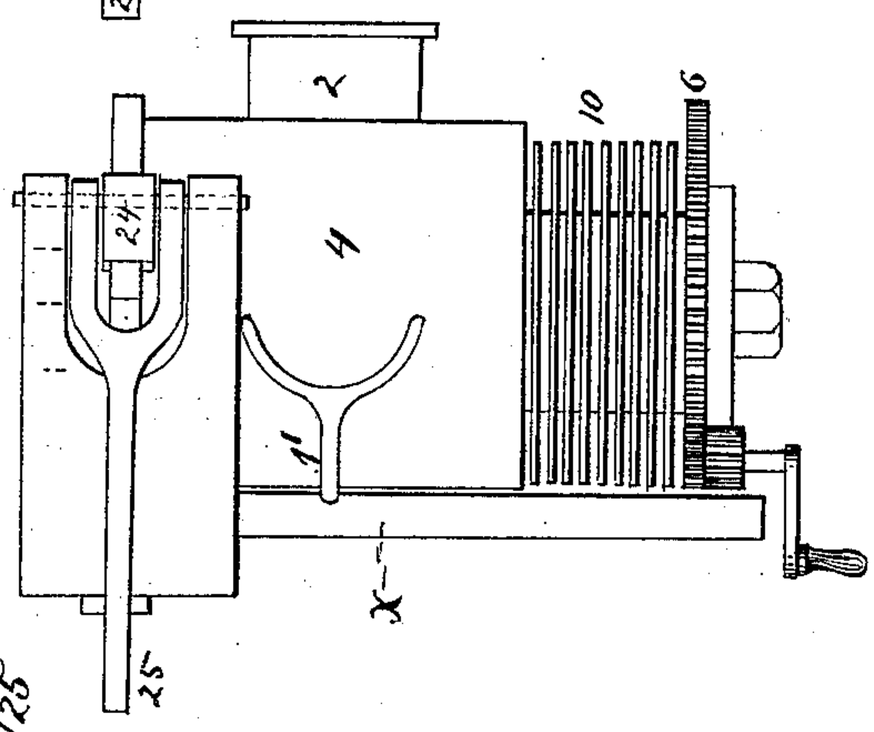


Fig. 1.

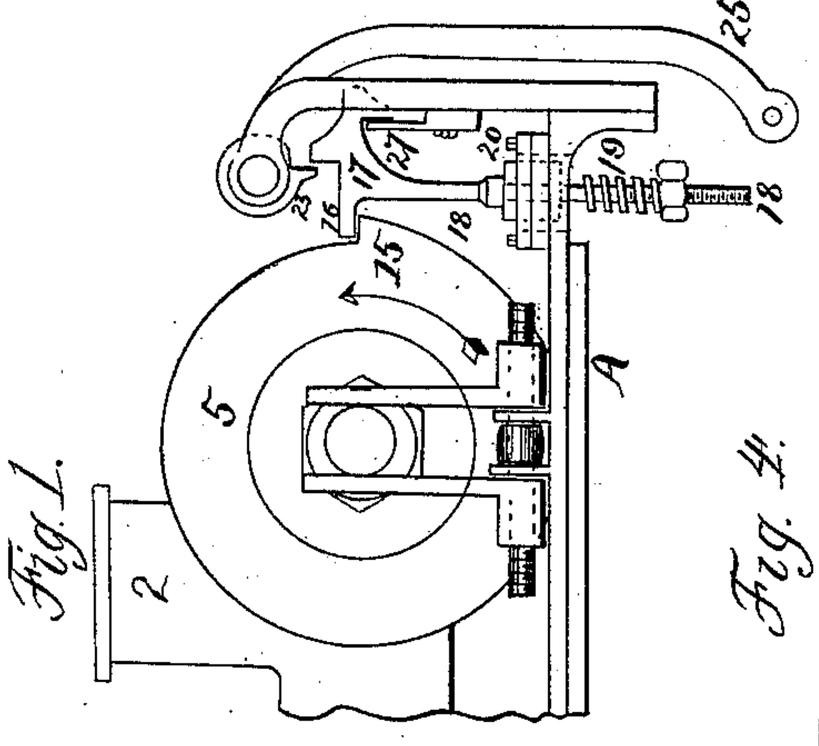
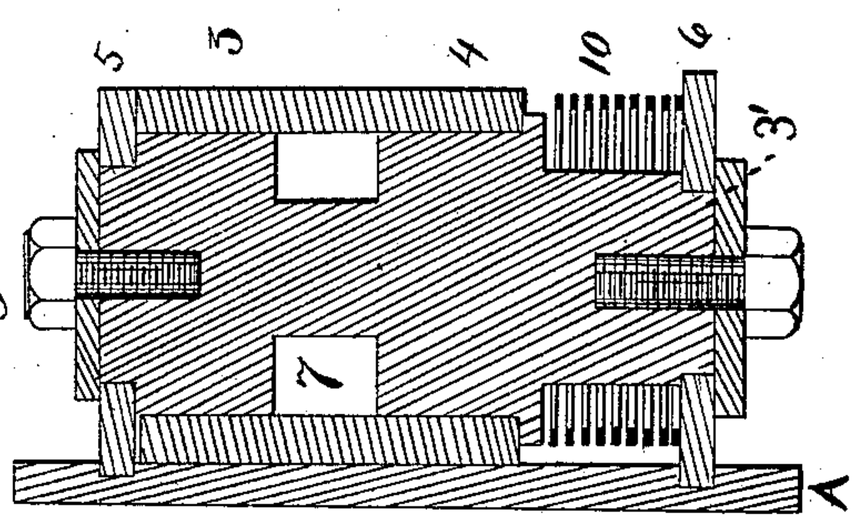


Fig. 4.



Witnesses.
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Philip Hawley.

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(No Model.) 3 Sheets—Sheet 2.

J. W. OSBORNE.

VALVE FOR PNEUMATIC CANNON.

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Fig. 8.

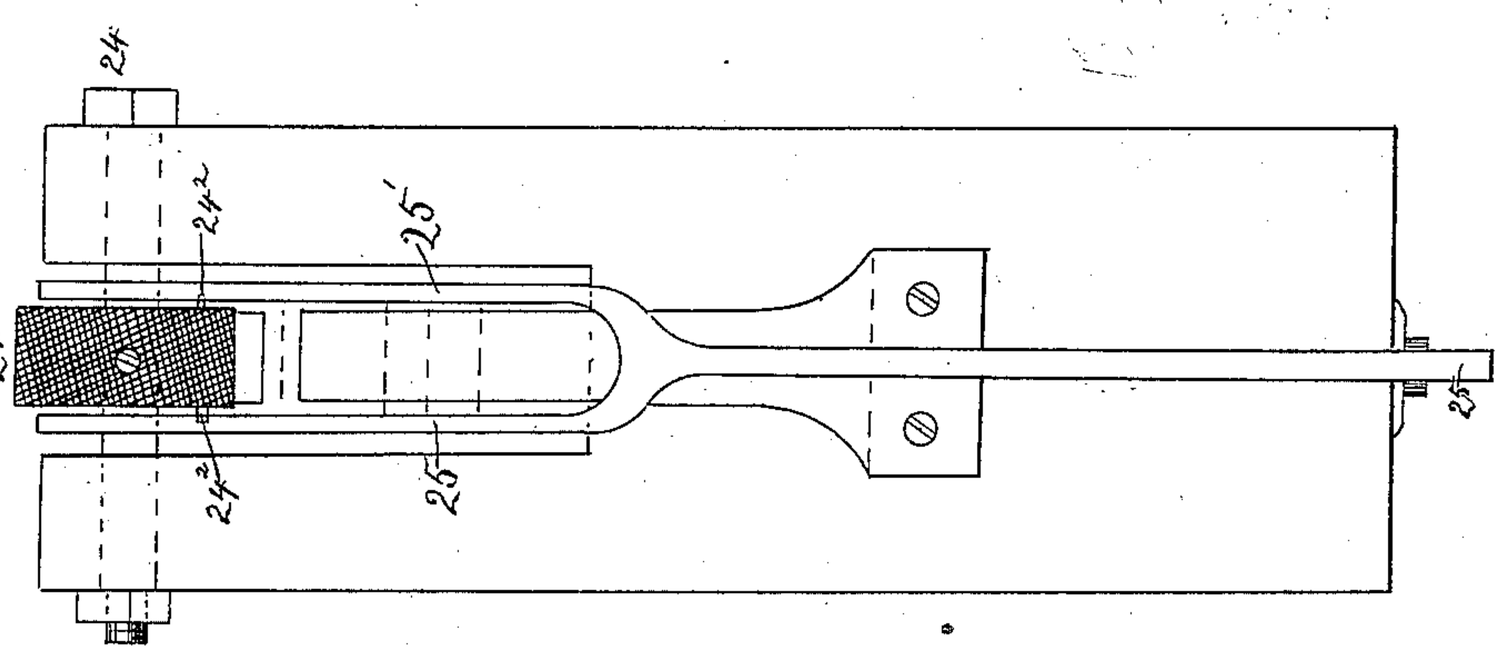
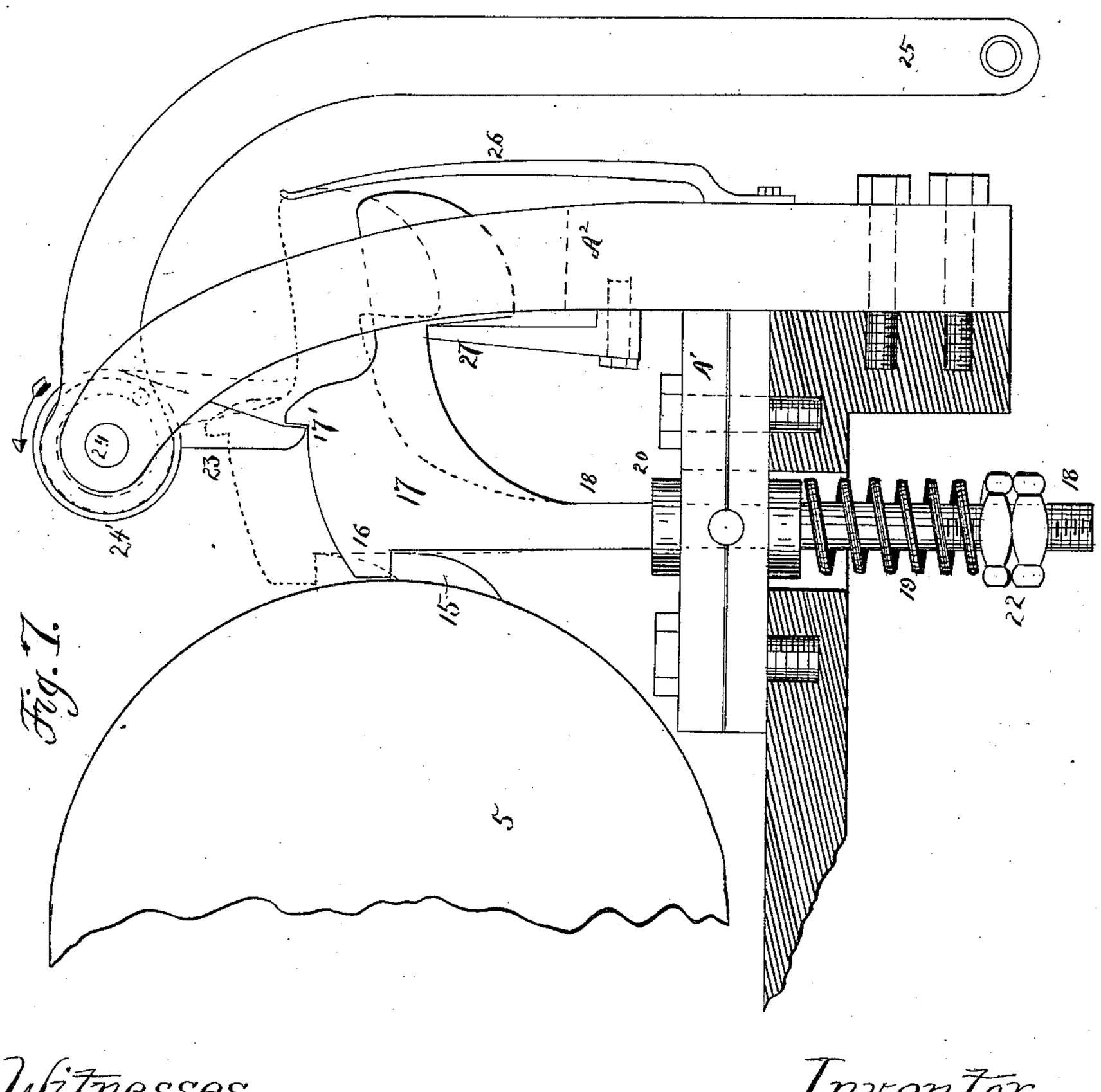


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

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VALVE FOR PNEUMATIC CANNON.

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Fig. 11.

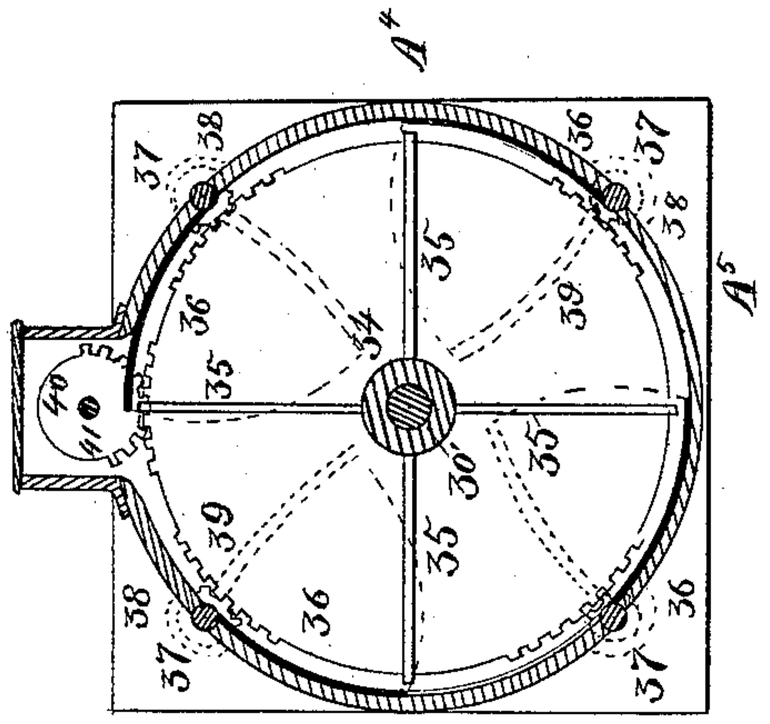


Fig. 10.

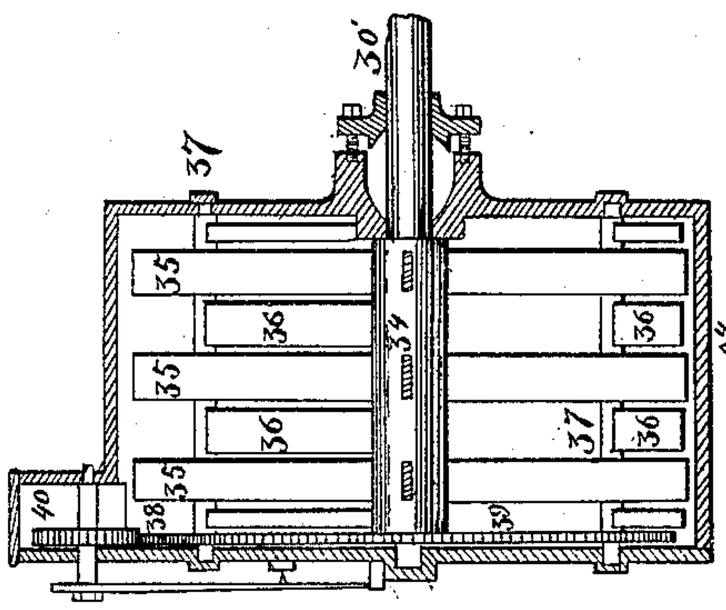


Fig. 12.

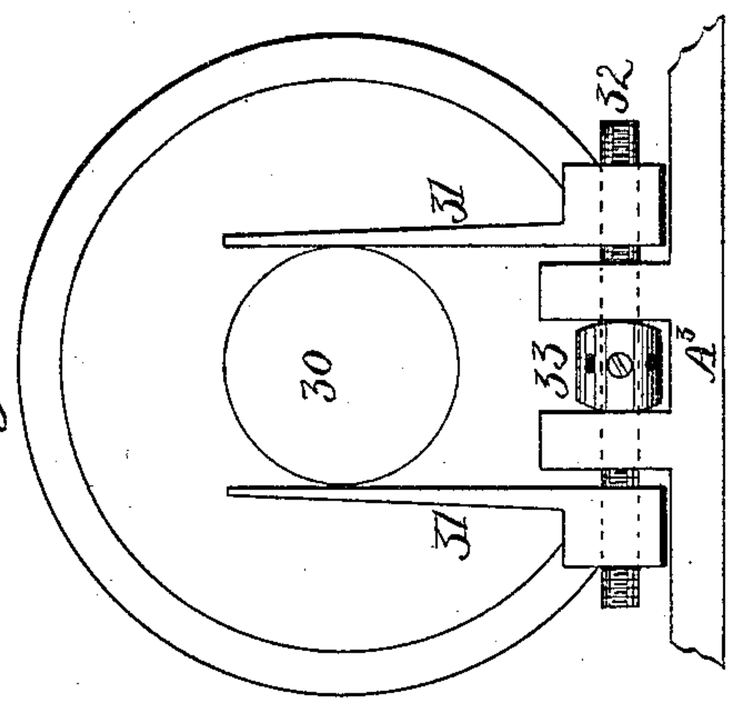
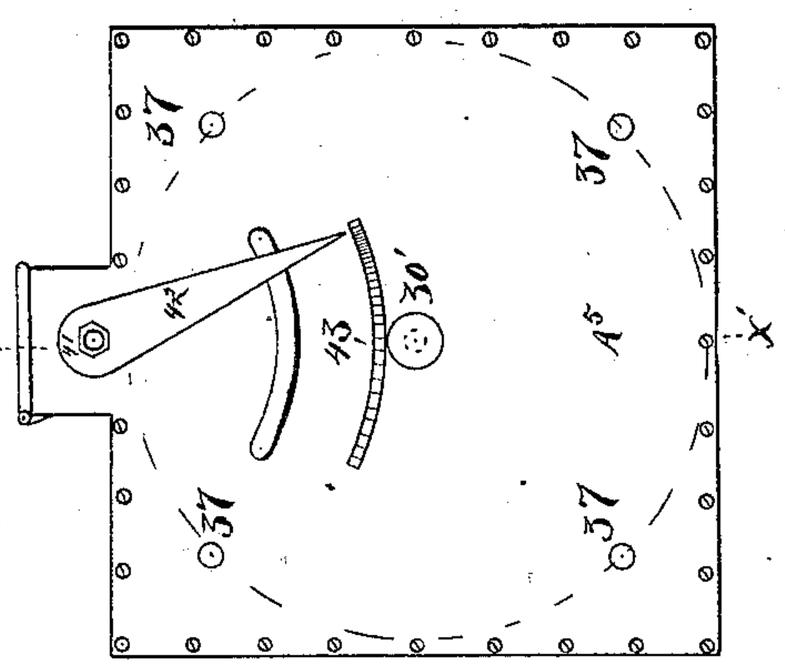


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN W. OSBORNE, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE PNEUMATIC DYNAMITE GUN COMPANY, OF NEW YORK.

VALVE FOR PNEUMATIC CANNON.

SPECIFICATION forming part of Letters Patent No. 427,895, dated May 13, 1890.

Application filed March 8, 1884. Serial No. 123,499. (No model.)

To all whom it may concern:

Be it known that I, JOHN WALTER OSBORNE, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Valves for Pneumatic Cannon, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to power-driven valves or other valves specially designed for use with pneumatic cannon, and to the driving, holding, controlling, and releasing mechanism thereof.

In discharging a pneumatic cannon it is desirable that the supply of compressed air or gas shall be admitted from the supply-pipe to the gun-tube at full head the instant the discharge is to take place; that a full head of air or gas be admitted to the gun-tube as long as the projectile is in the bore and until the projectile leaves the muzzle, and that the valve shall close as quickly as possible after the projectile has left the muzzle, so that the supply of compressed gas remaining in the flask may not be wasted.

While a valve of my construction is adapted for use with a steam-gun, the conditions are so different that the character of the valve must be quite different from those usual in steam-engines.

My invention consists in the combination, with a pneumatic cannon, of a power-driven valve which opens and closes the passage from the gas-flask to the gun-tube; also, in mechanism for driving the same; also, in mechanism for releasing the valve, so that the power-mechanism may drive it, and mechanism for stopping the movement; also, in mechanism for retarding the movement of the valve; also, in the method of operating, all as hereinafter pointed out and claimed.

In the drawings, Figure 1 is an end elevation of valve, showing catch and trigger. Fig. 2 is an elevation of the other end, showing winding mechanism. Fig. 3 is a vertical cross-section on line $x\,x$, Figs. 5 and 6. Fig. 4 is a vertical longitudinal section on line $y\,y$, Fig. 6. Fig. 5 is a rear elevation of the valve and driving mechanism. Fig. 6 is a plan of valve and driving mechanism. Fig. 7 is a side elevation of the trigger and stop enlarged. Fig. 8 is a rear elevation of the same. Fig. 9 is an elevation of one form of retarding device. Fig. 10 is a section of same on line x' x', Fig. 9. Fig. 11 is a reverse view of Fig. 9, with one of the face-plates removed. Fig. 12 is a modified form of retarding device.

The numeral 1 indicates the supply-pipe from the flask, and 2 represents the outlet-pipe which leads into the gun-tube. These pipes may lead in any direction or angle away from the valve; but preferably the inlet 1 and outlet 2 are near together at the valve-body, for a purpose hereinafter explained.

The rotary plug 3 extends through the casing 4 from end to end, and should be drawn firmly against the head of the casing to prevent endwise play. The valve is balanced by a pressure of gas through pipe 1′, leading from front to rear of the valve and opening into small chambers equal in area to the supply-pipe, as usual in balanced valves. A groove 7 extends partly round the plug. The sectional area of this groove will determine the capacity of the valve. It should therefore equal the section of the supply-pipe. The sector 8 stops a part of this groove and is the stopper of the valve.

I have shown the plug 3 as relatively long to secure large bearing-surface. When properly balanced, the plug may be quite short, and is preferably hollow, so as to be as light as possible. For convenience of construction the groove 7 may be turned quite round the plug and the piece 8 afterward put in. The convex face of piece 8 comes in front of the supply-pipe 1 when the valve is closed. When the plug 3 is turned so as to carry piece 8 away from the opening, the passage from 1 to 2 is opened and remains open, so that air can pass either in one direction or the other through some part of groove 7 until piece 8 again stops the pipe 1. The entrance to pipe 2 is enlarged, so that piece 8 may pass without closing it. One end of plug 3 extends outside the casing, as at 3′, and forms a seat for a strong coiled spring or motive power 10, one end of which spring is connected to the plug and the other to the gear-wheel 6, so that when the spring is wound up its tendency

will be to revolve the plug. The gear-wheel 6 engages a small pinion 11, which may be turned by crank or handle 12, and when the spring is wound up by means of this handle it may be locked by the engagement of the pawl 13 with said pinion or a ratchet-wheel alongside thereof. At the other end of plug 3 (or it may be the same end with gear-wheel 6) I place a disk 5, which has a projecting tooth 15. This tooth, when in engagement with the sear 16, will prevent the rotation of the plug; but when the tooth is released from said sear the plug may be rotated by the force of spring 10.

The sear 16 projects from a head 17, and this head has a rod 18 extending down through barrel 20 and surrounded by a spring 19 below said barrel. The barrel 20 may rock on trunnions 21 in suitable supports, as A′ on the frame A. The rod 18 thus moves up a little way through the barrel 20 when the tension of spring 19 is overcome. The tension of spring 19 may be regulated by nuts 22. The sear-head 17 may be swung back to disengage catch 16 from tooth 15 by throwing back the end 25 of the trigger, which rocks the trigger on its pivot 24 and presses against the shoulder 17′ of sear-head 17. When the point 23 of the trigger has swung past the corner 17′ of the sear, the spring 26 throws the sear forward into position to catch tooth 15 as it again comes round. A stop 27, which has preferably a very little resilience, prevents the sear from swinging forward, so as to bear with undue friction on disk 5.

The trigger and sear-spring are shown as supported on standard A^2; but the arrangement may be quite different without departing from the spirit of my invention.

The head 24′ of the trigger will rotate in one direction about its pivot 24, but not in the other direction, being held against such rotation by the stops or pins 24^2, projecting from the sides of said head. These pins are beveled on one side, and the spring-arms 25′ of trigger-bar 25 have notches to receive said pins, which notches may be also beveled in reverse direction. When the arm 25 of trigger is swung back, the spring-arms 25′ will be behind the pins 24^2, and will thus cause the head 24′ to turn on its pivot and press the arm 23 against the catch 17′ of the sear. After the trigger has swung into the position shown in dotted lines its arm 23 will slip past the sear, and the sear will fly back under the influence of its spring 26. To prepare the trigger for the next operation of the valve, the head 24′ will be rotated in the direction of the arrow until the pins 24^2 are again caught by the notches in spring-arms 25′.

From the foregoing description it will be seen that the spring may be wound up so as to drive the plug, and the power of the spring regulated by winding it to a greater or less extent. The plug will be held from rotation by the sear until released therefrom. When released, the plug will make a complete revolution until again arrested by the sear. When the tooth 15 strikes the sear, the latter will yield slightly by compression of spring 19, so that the shock of stoppage be not too great. This yielding will permit the piece 8 of the valve-plug to pass slightly beyond its normal stopping-place, whence the extension of spring 19 will restore it. To permit this overrun, and also to allow the valve-plug to acquire some momentum before it begins to open pipe 1, the piece 8 is made to extend back somewhat farther at its following than at its leading edge.

The rapidity of movement of the plug can be regulated to some extent by the tension of spring 10. In the proportions shown the valve will be quickly opened, and fully open while the plug is making about seven-tenths of a revolution, and will then be quickly closed. It is evident that the proportions may be changed.

For the purpose of balancing the valve, I may put in two pieces similar to 8 and operate the valve with a half-revolution; but this does not give so long an interval between the opening and closing with same rate of motion.

As it is desirable to regulate with nicety the time the valve shall remain open, and as the varying tension of a spring is not sufficiently accurate and reliable for the purpose, I make the spring strong enough to open and close the valve in the shortest time required. To lengthen this period, I retard the movement of rotation in any manner. Devices for such retardation I will now describe as suitable retarders to control the movement of a valve in a pneumatic or similar cannon.

At either end of the valve-plug I extend a shaft 30. This shaft is engaged in Figs. 1 and 12 by strong springs 31, one at each side of the shaft. These springs are held in firm frictional contact with the shaft 30 by a right and left screw 32, which passes through standards on base-frame A^3, and may be turned by a lever applied to head 33. A very strong frictional pressure may be maintained on the shaft 30 in this manner, and the rotary movement of the plug may be thus regulated.

It will be understood that the retarding device may be connected to a counter-shaft geared with wheel 6, or in any other way brought in train with the valve-plug, as well as directly to the shaft of the plug.

Instead of the frictional retarding device last described, I may use the retarder shown in Figs. 9, 10, and 11, or I may apply both retarders, one at each end of the valve-plug. This retarder consists of a cylindrical casing A^4, which may have a square face-plate A^5. The shaft 30′ passes through the casing and is keyed to a sleeve 34 within the casing. The sleeve 34 has projecting radial arms 35—as many as may be necessary—at a little distance apart.

Close to the cylindrical casing A^4, I arrange a number of shafts 37 at equal distances from the sleeve 34, and each of these shafts 37 has a number of arms 36, which by the oscillation of the shafts 37 may be thrown back against the casing, as shown in heavy lines, Fig. 11, or may be turned down so as to project between the arms 35. Each shaft 37 is provided with a small pinion 38, which pinions intermesh with a large gear-wheel 39, common to all the pinions 38 and centered on shaft 30′.

A driving-pinion 40, centered on a short shaft 41, serves to turn the gear-wheel 39. This pinion 40 may be turned by moving the pointer 42. A graduated arc 43 on the dial-plate A^5 indicates the amount of movement and therefore the projection of the arms 36 from their closed position against the side of the casing.

The casing A^4 is filled with oil or other fluid. When the arms 36 are turned back against the casing, the arms 35 may be revolved without much resistance from the fluid; but when arms 36 are projected the flow of the fluid will meet with very great resistance and the revolution of the shaft 30 will be correspondingly retarded.

It will be understood that to get best results the shaft 30′ will be driven at a high speed. This speed can be attained by a very simple geared connection either to shaft 30 or gear-wheel 6.

I claim—

1. The combination, with the supply-pipe of a pneumatic or similar cannon, of a power-driven valve, a driver therefor, and a yielding stop, against which said valve bears, substantially as described.

2. The combination, with the supply-pipe of a pneumatic or similar cannon, of a power-driven valve and a retarder bearing on a moving portion of said valve.

3. The combination, with the valve of a pneumatic cannon, of a power-driving mechanism therefor, a stop, and trigger mechanism operating thereon, by which said stop may be thrown out of engagement.

4. The combination, with the operating-valve of a pneumatic cannon, of a driving-spring, a winding gear and pinion, whereby the spring may be brought under tension, and a retaining-dog operating to retain said pinion, substantially as described.

5. The combination, with the valve of a pneumatic cannon and a power-driver for driving the same, of a retarder, substantially as described, whereby the resistance of a body of fluid to the movement of a piece in said fluid may be made to retard the movement of the valve, as set forth.

6. The combination, with the supply-pipe of a pneumatic or similar cannon, of a power-driven valve and a retarder operating on the valve against the power of the driver to regulate the speed of movement of the valve.

7. The combination, with the supply-pipe of a pneumatic cannon, of a valve controlling the passage to the gun, a continuously-acting motor operating on said valve, a retarder acting on the valve against the power of the motor to diminish the speed of movement of the valve, and a stop by which the movement of the valve is arrested, substantially as described.

8. The combination, with the supply-pipe of a pneumatic cannon, of a rotary valve and a power-motor connected to and actuating the same.

9. The combination, with the supply-pipe of a pneumatic cannon, of a balanced valve controlling the passage in said pipe, a power-motor for said valve, and a retarder operating on the valve to control the rate of movement thereof.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. OSBORNE.

Witnesses:
PHILIP MAURO,
PHILIP HAWLEY.