(No Model.) 3 Sheets—Sheet 1.

A. & C. A. CHURCH.

HYDRAULIC WINDMILL REGULATOR.

No. 458,518. Patented Aug. 25, 1891.

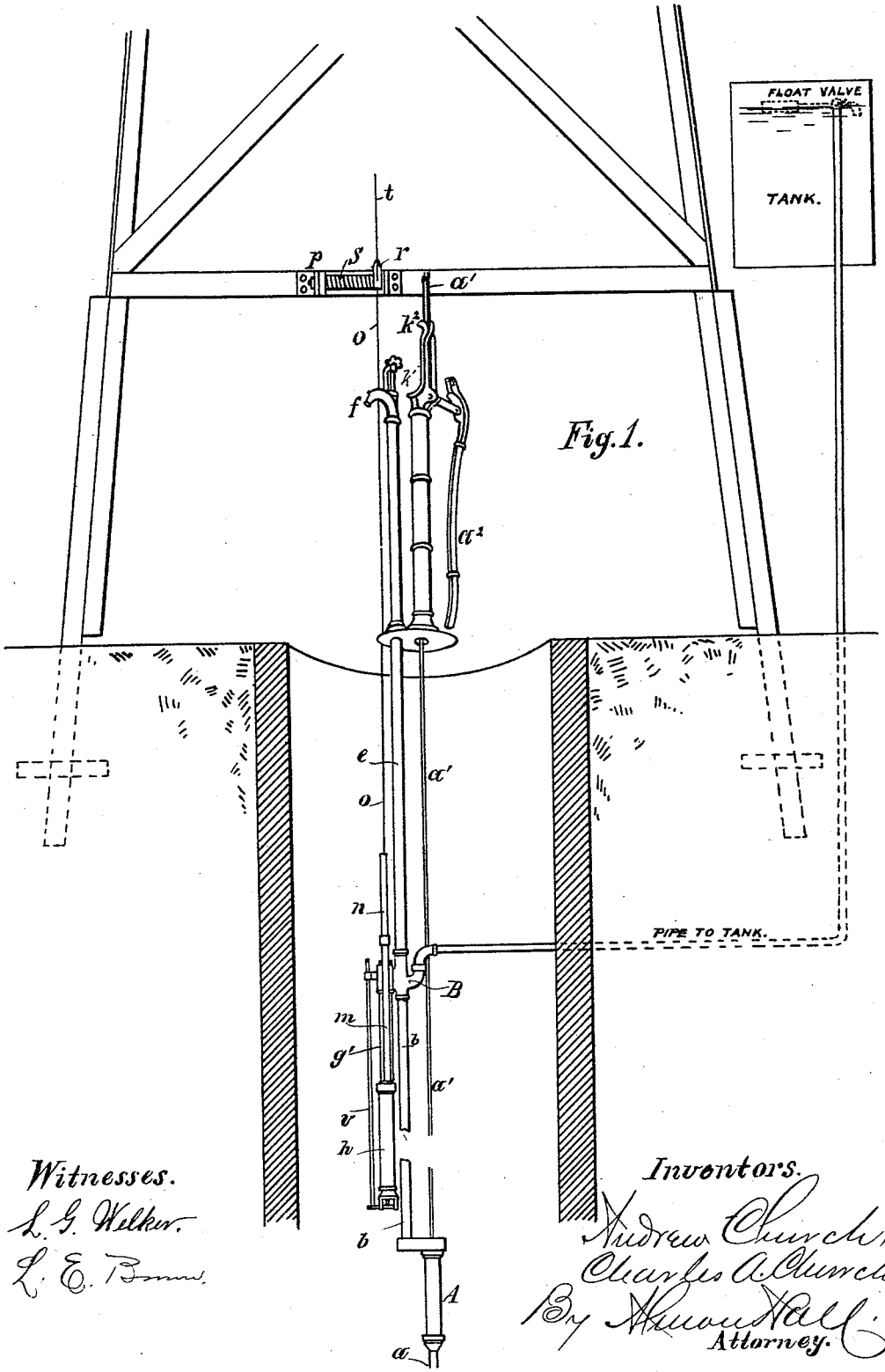

Fig. 1.

Witnesses.
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Attorney.

(No Model.) 3 Sheets—Sheet 2.

A. & C. A. CHURCH.

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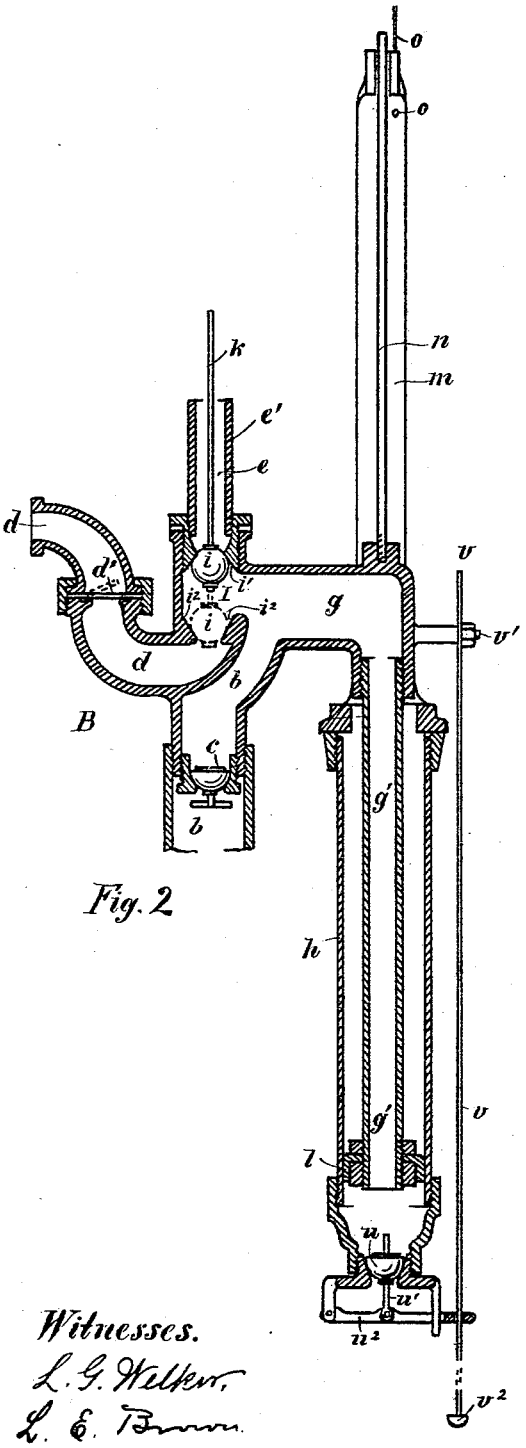

Fig. 2.

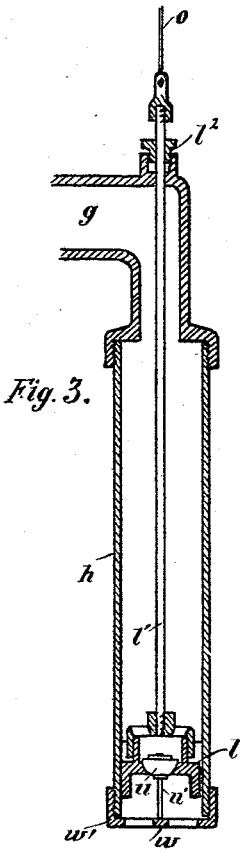

Fig. 3.

Witnesses.
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(No Model.) 3 Sheets—Sheet 3.

A. & C. A. CHURCH.

HYDRAULIC WINDMILL REGULATOR.

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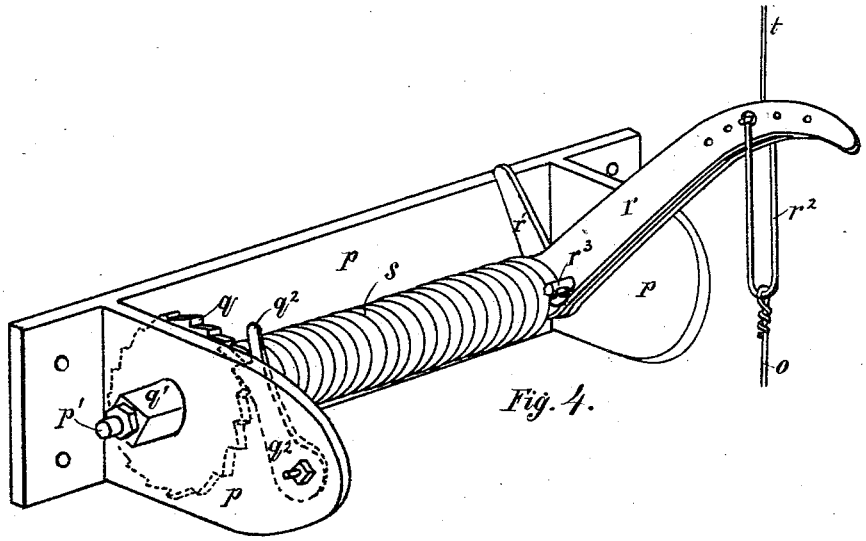

Fig. 4.

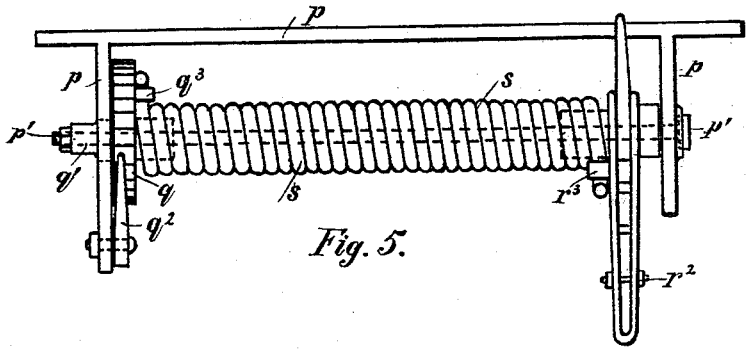

Fig. 5.

Witnesses.
L. G. Welker.
L. E. Brown

Inventors.
Andrew Church,
Charles A. Church,
By Thurman Hall,
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UNITED STATES PATENT OFFICE.

ANDREW CHURCH AND CHARLES A. CHURCH, OF MORENCI, MICHIGAN.

HYDRAULIC WINDMILL-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 458,518, dated August 25, 1891.

Application filed September 25, 1890. Serial No. 366,045. (No model.)

To all whom it may concern:

Be it known that we, ANDREW CHURCH and CHARLES A. CHURCH, citizens of the United States, residing at Morenci, Lenawee county, Michigan, have invented certain new and useful Improvements in Hydraulic Windmill-Regulators, of which the following is a specification.

Our invention relates to that class of automatic hydraulic regulators for pumping-windmills which controls the wind-wheel, allowing it to operate and pump water until the tank is filled, when a float-valve in the tank closes the inlet to the tank, forcing the water back into a hydraulic cylinder, the movement of which operates a rod, which pulls the wheel out of the wind, holding it in that position until the float-valve is opened by lowering the water in the tank, thus relieving the pressure in the hydraulic cylinder, allowing the wheel to again fall into the wind and to resume work until the tank is again filled, when the operation is repeated.

The objects of our invention are to avoid the necessity for constant watching of tanks and throwing the wind-wheel into and out of "gear" by hand when the tanks are full, in order to escape being flooded, and to avoid unnecessary wear and tear of machinery and waste of water, and more particularly to provide a cheap, simple, durable, and effective hydraulic regulator adapted for the purpose above indicated and which may be applied to the discharge-pipe of any windmill-pump at any point; to provide for such regulator a four-way distributing-valve, the body of which may be cast in one piece, which valve shall admit water from the pump either to the pipe discharging at the well or to the pipe leading to a distant tank and simultaneously to the cylinder of the hydraulic regulator regardless of which discharge-valve is open; to provide an arrangement of check-valves which shall prevent return of water from tank to the pump and undue back-pressure from hydraulic cylinder or tank upon the working pump-valves; to provide means for relieving too great pressure on the hydraulic regulator-cylinder when by sudden shifting of the wind the pump is cause to operate while all the outlet-valves are closed, and to provide a cheap, simple, and easily-adjustable device for pulling the hydraulic cylinder back to its retracted position when the float-valve in the tank is opened and the pressure in the regulator-cylinder is relieved, permitting the wind-wheel to again fall into the wind. We attain these objects by means of the device and arrangements of parts shown and illustrated in the accompanying drawings, made part hereof, in which—

Figure 1 is an elevation of our device, showing hydraulic regulator holding wind-wheel out of gear; Fig. 2, a vertical central longitudinal section of our four-way-valve casing and hydraulic cylinder, hereinafter referred to, showing cylinder when not in operation; Fig. 3, a modification of said cylinder, hereinafter referred to, with parts in position to hold windmill out of gear; Fig. 4, a perspective view of our adjustable spring and arm, hereinafter referred to, designed to pull the hydraulic cylinder from its projected to its retracted position, thus permitting the windmill to fall into the wind; and Fig. 5, a plan view of the same.

In the drawings the wind-wheel is not indicated; but it should be understood that the wheel is of the well-known type which is pulled out of gear by means of a wire leading to the tower, by shifting the edge of the wheel toward the wind and parallel with the vane, the wheel falling into gear by the force of the wind or its own weight when the pull on the governing-wire is released.

A is a common pump, having suction-pipe *a* and being operated by pump-rod *a'*, leading to the windmill and actuated by the wheel. This rod may also be operated by hand in the usual way by means of lever a^2. From the pump leads discharge-pipe *b*, which is provided with a four-way-valve casing B, placed, preferably, just below the frost-line, though it may be attached to the discharge-pipe at any point. This four-way-valve casing receives water from the pump through check-valve *c*, and is designed to distribute water through way *d* to a tank or series of tanks provided with a float-valve of any well-known form controlling the outlet to way *d*, or through way *e* to the discharge *f* at the well, commonly called the "goose-neck," or through way

g, leading to the hydraulic cylinder h. The inlets to ways d and e are opened and closed by means of valve i in valve-chamber I, preferably a ball-valve of india-rubber, having upper seat i' and lower seat i^2. This valve is operated by means of rod k, leading up on the inside of pipe e' through stuffing-box k' and terminating in handle k^2. (See Fig. 1.) When rod k is lifted, valve i is pressed against its upper seat and way b d is open, through check-valve d', from pump to tank. When rod k is lowered and valve i is pressed against its lower seat, way b e is open from pump to goose-neck and the outlet to the tank is closed. Way g leads through fixed pipe g' to the interior of hydraulic cylinder h, which is open at top and closed at bottom. Upon the lower end of pipe g' is a plunger l, fitting closely the interior of cylinder h. When ways b e and b d are closed, water being forced through way g and pipe g' into the space between the plunger l and the closed end of cylinder h, the cylinder, with its appendages, is caused to travel downward upon the plunger l. Cylinder h is provided with a bail or forked coupling m, (see Figs. 1 and 2,) fixed to the head of the cylinder. A vertical rod n, the lower end of which is fixed into a socket in the upper side of the casting B in line with the axis of cylinder h, passes through an opening in bail m at the point where the two branches of the same meet and forms a guide for the cylinder, keeping it in vertical alignment during its stroke. Attached to and leading upward from bail m is wire o, which at its upper end is attached to a device designed to cause the return of the cylinder h to its original position when the water-pressure within the same is relieved, which device I will proceed to describe.

In Figs. 4 and 5, p p is a stout iron bracket, securely bolted to one of the cross-beams of the tower, as indicated in Fig. 1. Passing through the two projecting arms of this bracket is a rod p', which serves at one end as a shaft for ratchet-wheel q, which has cast integral with it a square-headed hub q', and is engaged by pawl q^2, the other end of rod p' serving as a shaft for vertically-oscillating arm r, having stop r' and loop r^2, to which is attached wire o. To this arm r is also attached wire t, leading up to the wind-wheel, by which the same is pulled out of gear. Around rod p' is coiled spring s, which at one end engages lug r^3 on arm r and at its other end engages lug q^3 on the inner side of ratchet-wheel q. By means of a wrench applied to the square head q' of ratchet q the ratchet may be revolved, the lug q^3 carrying with it the adjacent end of coiled spring s, the opposite end of the spring being held fast by lug r^3 on arm r, the pawl q^2 holding the ratchet in any desired position, and spring s is thus adjusted to and retained at any desired tension.

The operation of the device thus far described is as follows: When the tank is full and float-valve closes outlet d, way b e also being closed by valve i, pump A now forces water through way b g and pipe g' into hydraulic cylinder h, which is driven downward, carrying with it its bail or forked coupling m and wire o, which pulls down spring-arm r s, the spring having been previously adjusted to a tension, to overcome which requires a slightly greater water-pressure in the four-way-valve casing B than is necessary to force water from the well to the tank. Arm r, yielding to the downward pull of wire o, pulls the wind-wheel out of gear by means of wire t. If way b d is closed and the pump is discharging through way b e, the windmill may be thrown out of gear in the same way by closing a faucet at f, the back-pressure operating the hydraulic cylinder in the manner just described. It will be seen that the windmill may thus at any time be stopped readily and with little or no exertion by closing the faucet at f and throwing valve i down to its lower seat i^2. The hydraulic cylinder remains in its projected position, holding the wind-wheel out of gear by its pull on wires o and t until the water-pressure within the cylinder is relieved by the opening of the float-valve in the tank or the faucet at f, as the case may be, when coiled spring s, through arm r and wire o, lifts the cylinder to its retracted position, forcing the water contained in the cylinder out without waste through pipe g' and the outlet which happens to be open, releasing the pull of wire t on the wind-wheel, which now falls into the wind and resumes work. It will be seen that our regulator is applicable to a pump supplying a series of pipes leading to any number of elevated tanks, and that as long as any one or more of the discharge-pipes are open the regulator does not operate; but when all of the discharge-pipes are closed the regulator operates and the wind-wheel is thrown out of gear. It frequently happens that while the wind-wheel stands, held by the hydraulic cylinder h, with the edge of the wheel toward the wind a sudden change of direction of the wind will cause the wheel to revolve and the pump to operate. It is clear that with all outlet-valves closed this must produce an undue pressure in the pump, four-way-valve casing, and cylinder, and that leakage or breakage must occur. To obviate this difficulty we provide cylinder h at bottom with a safety-valve u, (see Figs. 2 and 3,) opening inwardly into the chamber between the plunger l and the closed or lower end of the cylinder. The vertical stem u' of valve u is pivoted to horizontal lever u^2, which at one end is fulcrumed to a lug cast on the bottom plate of the cylinder and at the other end embraces loosely a wire v, attached securely at its upper end to a projection v' on casting B and provided at its lower end with a stop v^2. Should the pump be operated by shifting winds after the cylinder has pulled

the wheel out of gear, the cylinder by the increased pressure of the added water, is caused to move a little farther downward, lever u comes in contact with stop v^2 on wire v, lifting and opening valve u, which permits the escape of water as long as the pump continues to operate. As soon as the pump ceases to operate, spring s lifts the cylinder slightly, closing valve u. By means of a set-screw at v' wire v is adjustable vertically, and by this means when the cylinder travels beyond its predetermined limit the safety-valve u is invariably opened, obviating the difficulty just alluded to.

For the reciprocating hydraulic cylinder having a fixed piston may be substituted its equivalent—a fixed cylinder having a movable piston, as shown in Fig. 3. The piston is provided with a rod l', disposed axially of the cylinder and extending out through a stuffing-box l^2 in the top of casting B. To the upper end of this rod is attached wire o, which by the throw of the piston controls the wind-wheel in the manner already described. In this modification of our device the plunger is provided with a safety-valve provided with a downwardly-projecting stem, which, when the plunger is carried down too far by undue pressure in the cylinder, comes in contact with stop w, causing the safety-valve to lift with the same effect as already described. Stop w is a bar cast with and extending across open cap w', which is screwed onto the open mouth of the cylinder. By raising and lowering this screw-cap by means of its screw the height of stop w is adjusted and the point at which the safety-valve shall operate is established.

Some of the advantages of our windmill-regulator are the following: Cheapness, and simplicity. Four-way-valve casing B may be cast in one piece. The lathe-work on valve-seats for valves c and i may be conveniently and cheaply done, as these valves have the same axis. Water is introduced through way b on the outside of valve-chamber I, centrally between the two valve-seats i' i^2, permitting valve-rod k to pass down through pipe e' in a straight line, so that upper and lower connections of the four-way-valve casing may be applied at any point on the straight vertical discharge-pipe of any pump, securing alignment and proper working of parts. (It should be here noted that heretofore the three-way cocks of windmill-pumps and valves communicating with the hydraulic regulator have been made part of the pump-head, making the regulator only applicable to pumps specially constructed for them.) The arrangement of the four-way-distributing-valve casing provides a free water-way communicating with goose-neck, distant tank, and hydraulic regulator regardless of the position of the ball-valve i. The arrangement of check-valves c and d' prevents undue back-pressure on the working valves of the pump either from elevated tank or hydraulic cylinder. Safety against overpressure of water when the pump is operated, while all outlet-valves are closed, is secured by the automatic action of the safety-valve in bottom of plunger or hydraulic cylinder.

Having fully described our invention and its construction, what we claim, and desire to secure by Letters Patent, is—

1. In a hydraulic windmill-regulator, a hydraulic cylinder, in combination with a four-way-valve casing adapted to be applied to the discharge-pipe of a pump having an inlet from the pump, an outlet to the hydraulic cylinder, two service-outlets, a single valve controlling the opening into either of the two service-outlets, said valve having seats with the same axis as the inlet, and a valve-chamber communicating centrally between said valve-seats with the inlet from the pump and the outlet to the hydraulic cylinder, substantially as shown and described, for the purpose specified.

2. In a hydraulic windmill-regulator, a valve mechanism comprising in its construction a valve-casing having an inlet from the pump, an outlet to a hydraulic cylinder, two service-outlets, a single valve controlling the opening into either of the two service-outlets, said valve having two seats with the same axis as the inlet, and the service-outlet leading to the goose-neck, a check-valve in the outlet leading to the elevated tank, and a check-valve in the inlet to the casing, the whole constructed as described, whereby the regulator may be applied to the discharge-pipe of a pump without disturbing its other parts, substantially as shown and described, for the purpose specified.

3. In a hydraulic windmill-regulator, a reciprocating hydraulic cylinder having a safety-valve, in combination with an adjustable stop adapted to open said valve at any desired point in the throw of the cylinder, whereby undue pressure in the cylinder and its connections may be avoided by the opening of said valve, substantially as shown and described, for the purpose specified.

4. In a hydraulic windmill-regulator, the hydraulic reciprocating cylinder, in combination with a spring s, an arm r, controlled by said spring, a ratchet and pawl q q^2, adapted to adjust and maintain the tension of said spring, and the connections intermediate of said cylinder and said arm, substantially as shown and described, for the purpose specified.

5. In a hydraulic windmill-regulator, a bracket p, provided with a shaft p', having a ratchet q q', a pawl q^2, an arm r r', and a coiled spring s, engaging arm r and ratchet q, in combination with the wind-wheel and reciprocating hydraulic cylinder and the rods or wires connecting said wheel and cylinder, substantially as shown and described, for the purpose specified.

6. A hydraulic windmill-regulator comprising in its construction a pump, a four-way-valve casing, a reciprocating cylinder having a safety-valve, and an adjustable stop actuating said valve, rods or wires leading from said cylinder to the wind-wheel, and a spring having adjustable tension and suitably connected with said rods or wires, substantially as shown and described, for the purpose specified.

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CHARLES A. CHURCH.

In presence of—
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H. E. GREEN.