(No Model.) 2 Sheets—Sheet 1.

H. L. FERRIS.

WINDMILL REGULATOR.

No. 422,582. Patented Mar. 4, 1890.

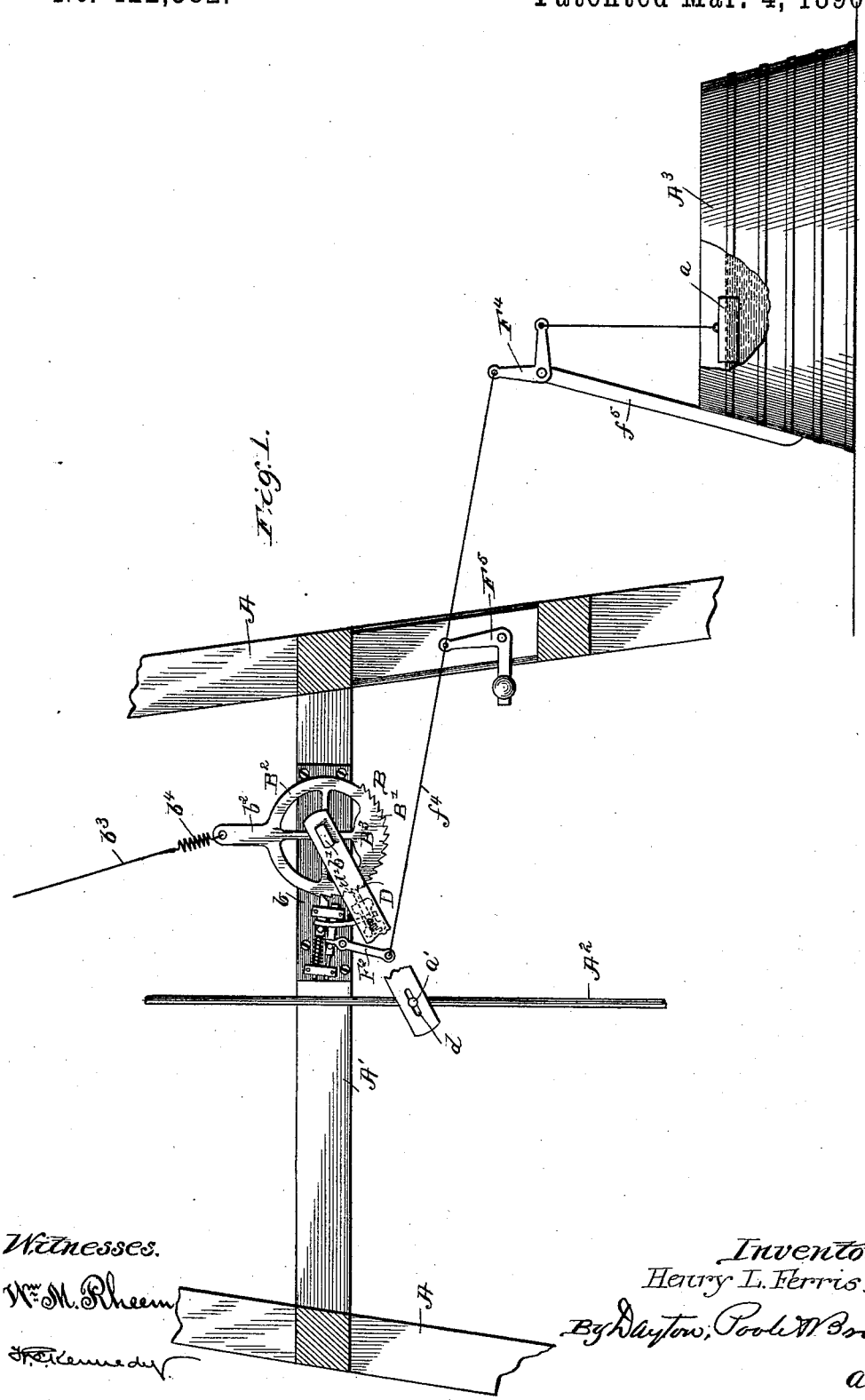

Fig. 1.

Witnesses.
Wm. M. Rheem
J. F. Kennedy

Inventor.
Henry L. Ferris.
By Dayton, Poole & Brown
Atty's.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

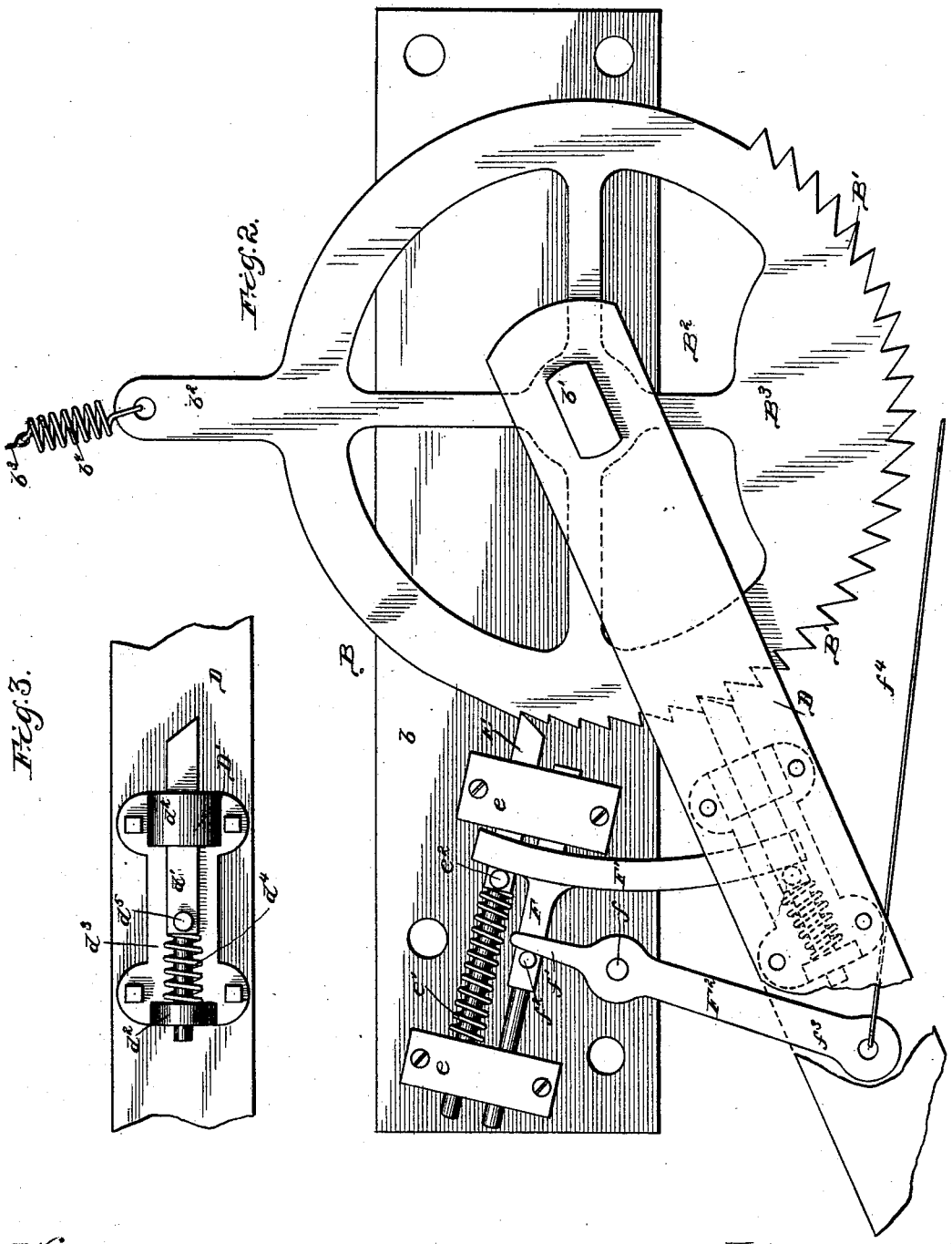

Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY L. FERRIS, OF HARVARD, ILLINOIS, ASSIGNOR TO HUNT, HELM & FERRIS, OF SAME PLACE.

WINDMILL-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 422,582, dated March 4, 1890.

Application filed November 29, 1889. Serial No. 331,941. (No model.)

To all whom it may concern:

Be it known that I, HENRY L. FERRIS, of Harvard, in the county of McHenry and State of Illinois, have invented certain new and useful Improvements in Windmill-Regulators; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a novel construction in devices for regulating the operation of windmills, whereby the operating or wind wheel can be automatically thrown out of the wind when the water has reached a predetermined level in the tank, thereby stopping the pumping operation, and also for automatically throwing the wind-wheel back into the wind when the level of the water is lowered, thus permitting the pumping operation to be resumed.

The invention consists in the features of construction and combinations of parts hereinafter fully described, and pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a fragmentary view in side elevation, showing a portion of the structure for supporting the windmill and the tank provided with devices constructed in accordance with my invention. Fig. 2 is a detail view in side elevation, showing the main parts of the regulating mechanism detached from the structure. Fig. 3 is a fragmentary detail view, in side elevation, of the lever and pallet connecting the pump-rod with the regulating mechanism, said view being taken from the opposite side to that shown in Figs. 1 and 2.

In said drawings, A A indicate the upright beams of the structure or windmill-tower, and A′ indicates a cross-beam.

A^2 is a pump-rod connected in a familiar manner with the wind-wheel and with the pumping apparatus.

A^3 is a water-tank of familiar construction and located adjacent to the windmill. A weighted float *a* is located within the said tank and is connected with the regulating mechanism, as hereinafter fully described.

B indicates, as a whole, the regulating mechanism, mounted upon a plate *b*, secured to the cross-beam A′. The said regulating mechanism consists, essentially, of a segment of a ratchet-wheel B′, pivoted concentrically upon a pivot-pin or bolt *b*′, fastened to the plate *b*. Said ratchet-wheel segment B′ is connected with the wind-wheel for throwing the latter out of the wind when the former is turned about its pivot in one direction, and said segment is provided with devices connected with the reciprocating pump-rod A for turning said segment. A convenient manner of making said segment B′ is to provide a wheel B^2 with only a segment of its periphery toothed or having ratchet-teeth, as shown at B′ B′. The said wheel B^2 is provided at the untoothed portion of its periphery with a radially-extending arm b^2, which is connected with the wind-wheel by means of a cable or strand b^3, connected with said arm b^2. The said cable or strand b^3 is connected with the wind-wheel in a familiar manner, so that when the cable is pulled downwardly the wheel will be thrown out of the wind.

As a separate and distinct improvement in the means for throwing the wind-wheel out of the wind, a spring b^4 is interposed between the arm b^2 and the wind-wheel, conveniently connecting the said arm and the lower end of the cable. The said spring b^4 is made strong enough to normally withstand without flexion the strain incident in pulling the wheel out of the wind, but is adapted to yield whenever the cable is subjected to a sudden or abnormal strain, which is often occasioned by gusts of wind while the wheel is being pulled out of it, and which would in the absence of said spring tend to injure or disable the regulating mechanism of the windmill.

Upon reference to Fig. 2 of the drawings it will be seen that the teeth B′ are made of different size—that is to say, their height varies—but the distance between their points is the same. The inner end of the teeth are arranged concentric with the wheel B^2, while their outer ends are arranged in an eccentric manner, and their height increases from the point where the wheel is first engaged by the actuating devices for turning it to bring the

wind-wheel out of the wind. The said wheel B^2 is provided with an enlargement or weighted portion B^3, located on the side of the wheel opposite to the arm b^2. The said wheel B′ being mounted loosely upon the bolt or pivot-pin b', it is obvious that when the said wheel is not engaged the weighted portion B^3 falls and throws the arm b^2 upwardly, as shown in Fig. 2, which is its normal position. The devices for turning the said ratchet-segment B′ comprise an operating-lever D and a pallet D′, connected therewith. The said lever D is pivoted at one end to the bolt b' and at its other end is loosely pivoted to the pump-rod A^2 by means of a pin a' on said rod located within a slot d in said lever.

It follows from the above construction that as the pump-rod works up and down the lever D vibrates upon the pivot b' as an axis. The pallet D′, Fig. 3, is secured to the rear face of the lever D, and comprises a sliding pin or bar d', located in bearing-lugs d^2 d^2 on opposite ends of a plate d^3. The rear end of said bar d' is made cylindric, while its front end is preferably square in cross-section. Said cylindric portion slides in a cylindric bearing in the rear lug d^2. A coiled spring d^4, acting by expansion, encircles the cylindric portion of the pin d' and bears at its ends against the rear lug d^2 and the shoulder formed between the cylindric and square portions of the pin. The said spring serves to press the pin d' into engagement with the ratchet-segment.

d^5 indicates a lateral projection or lug hereinafter referred to.

E indicates a spring-actuated detent adapted for engagement with the ratchet-segment to prevent a backward movement of the same when it is being turned by the lever and pallet. The said detent E is preferably square in its front end portion and cylindric in its rear end portion, and said detent has a sliding bearing in two blocks e e, secured to the plate b. A coiled spring e', acting by expansion, encircles the cylindric portion of the detent E and bears at its ends against the rear lug e and the shoulder formed between the cylindric and square portions of the detent. The spring e' thus serves to press the detent into engagement with the ratchet-segment to prevent the same from turning backward. The said detent E is provided on its front side with a lateral projection or lug e^2, hereinafter referred to.

It follows from the above construction that the lever D will be vibrated whenever the pump-rod works up and down, and consequently the pallet D′ will turn the ratchet-segment in one direction and the detent E will prevent the same from turning backward. It is obviously necessary to provide some means for holding the pallet and detent from engagement with the ratchet-segment; otherwise the wind-wheel would be pulled out of the wind as soon as it commenced to turn or reciprocate the pump-rod, and thus prevent any water from being pumped. The devices for accomplishing this purpose are constructed as follows:

F indicates a longitudinally-sliding rod or pin mounted in bearings formed in the blocks e e and provided near its forward end with a cross-bar F′. Said cross-bar extends above and below the pin F, but extends a greater distance below the same, and is located in front of and in contact with the lugs d^5 and e^2 on said pallet and detent. The said cross-bar F′ is also curved, as shown, so that when the pallet vibrates with the lever D the said lug d^5 thereon will always be in engagement with the rear edge of said cross-bar. It is obvious that when the cross-bar is retracted it will draw the pallet and pawl from engagement with the ratchet-segment.

F^2 indicates a lever pivoted at f to the plate b and having its short arm f' in engagement with a lug or pin f^2 on the sliding pin F. The long arm f^3 of said lever extends below the beam A′, to which the plate b is secured, and is connected by a rope or strand f^4 with the float a. The said rope is so connected with the float a that when the latter is unsupported it will exert a strain upon the rope sufficient to swing the lever F^2 on its pivot and draw the pallet and detent from engagement with the ratchet-segment. In the drawings the float is shown as connected with the horizontal arm of a bell-crank lever F^4, pivoted upon a standard f^5, while the lever F^2 is connected with the vertical arm of said bell-crank lever F^4.

F^5 is a bell-crank lever pivoted upon one of the upright beams A and having its vertical arm connected with the rope f^4 and its horizontal arm weighted. The said bell-crank lever F^5 is adapted to exert a pressure upon the rope f^4 to draw the same back when the float is unsupported.

The operation of my invention is as follows: In the drawings the parts are shown in the positions they will assume when the water in the tank has reached a level sufficiently high to support the float a, so that the pallet and detent will engage the ratchet-segment. It is obvious that when the float is unsupported it will, through the intermediacy of the rope f^4, lever F^2, pin F, and cross-bar F′, disengage the pallet and detent from the ratchet-segment. The pump-rod thereupon merely vibrates the lever D upon its pivot b'. It is obvious that when the float is unsupported the tank is not filled with water and the wind-wheel will continue to revolve, reciprocate the pump-rod, and pump water into the tank. As soon, however, as the water reaches the float the rope f^4 is slackened, and the springs d^4 of the pallet and e' of the detent, assisted by the bell-crank lever F^5, take up this slack. The said springs also press the pallet and detent toward the ratchet-segment. The said pallet and detent do not come in contact with the ratchet-segment as soon as the float a commences to rise, owing

to the fact that the teeth of said segment nearest the pallet and detent are of a reduced height. The said pallet and detent are so located relatively to the ratchet-segment that when the latter stands with its weighted portion down the short teeth of the ratchet-segment are adjacent to said pallet and detent. The teeth thus located are made of such size that the pallet, as it is allowed to gradually move toward the ratchet-segment by the rising of the float, will not engage only a portion thereof, but will engage the entire tooth in the first instance, as shown in Fig. 2 in dotted lines. In said figure the lever D is shown at the lower limit of its stroke, and it is evident that as the lever rises it will turn the wheel B^2 to the right, the length of the stroke of the lever D being sufficient to turn the wheel B^2 the length of one tooth at each stroke. It is obvious that the detent E will also engage the teeth to prevent the wheel from turning backward. As the lever D continues to vibrate the wheel is turned until the pallet engages the last one of the teeth. During the turning of the wheel the arm b^2 thereon descends and draws the rope b^3 down with it, thus pulling the wind-wheel out of the wind. The wind-wheel then ceases to revolve and the pump rod and lever D cease to work.

In devices of this kind as heretofore constructed the objection has been that, owing to the teeth of the ratchet, which were all of the same height, and that the pallet by which they were operated approached the teeth gradually as the float rose, said pallet would merely engage the tip end of the tooth, and it often occurred that the points of the teeth or of the pallet have been broken off in consequence of the great strain imposed upon them. However, when the strain upon the teeth in pulling the wheel out of the wind has not been so great as to break the teeth, it sometimes happened that a gust of wind would strike the wheel suddenly, thus tending to pull it back into the wind, the said wind-wheel being rigidly connected with the regulating mechanism, and in some cases this sudden strain upon the teeth and the pallet thus occurring would break the same. The construction herein described overcomes these objections, for the reason that the pallet always engages the entire tooth, which latter, being shorter, is of greater strength than the same portion of a longer tooth. The spring b^4 also serves to protect the teeth from injury. As before described, the said spring is of such strength that it stands without flexion the ordinary strain incident to pulling the wind-wheel out of the wind. However, when the rope is subjected to a sudden or abnormal strain such as is occasioned by gusts of wind striking the wheel, such strain is not communicated to the ratchet-teeth or the pallet, but is taken up by the spring b^4, which bends and acts as a cushion to relieve the teeth of strain and prevent their breakage.

The parts remain in the position last described so long as the tank is filled with water; but it is obvious that as soon as the level of the water falls the float descends, and then, through the intermediacy of the rope f^4, lever F^2, pin F, and cross-bar F′, the pallet and detent are disengaged from the ratchet-teeth, and thus the wheel B^2 is free to turn on its pivot. The weighted portion B^3 having been turned to the left will immediately drop upon the release of the wheel B^2 to the position shown in Figs. 1 and 2. This movement brings the teeth of reduced size on said wheel into position to be again engaged by the pallet when the latter acts to pull the wind-wheel out of the wind at another operation. The arm b^2 thus being in an upright position, the rope b^3 is slack and the wheel free to swing back into the wind. Whenever said wheel does swing back into the wind the pump-rod will vibrate the operating-lever until enough water has been pumped into the tank to raise the float, whereupon the pallet and detent will be let into engagement with the ratchet-segment and the wheel pulled out of the wind, as before described.

I claim as my invention—

1. A windmill-regulator comprising a pivoted ratchet-segment the teeth of which are of gradually-increasing height beginning from the point where they are first engaged by the devices for turning the same, an operating-lever pivoted concentrically with said ratchet-segment and connected with a reciprocating part of the windmill, a spring-actuated pallet upon said operating-lever adapted to normally engage the said teeth of the ratchet, and devices, substantially as described, connected with said pallet and with the float located in the tank into which the water pumped by the windmill flows and adapted to hold said pallet from engagement with the said teeth when the float is unsupported, substantially as described.

2. A windmill-regulator comprising the regulating mechanism connected with a moving part of the windmill and with the wind-wheel for throwing the latter out of the wind, and a spring interposed between said regulating mechanism and the wind-wheel, substantially as described.

3. A windmill-regulator comprising a pivoted ratchet-segment, an operating-lever connected at one end with a reciprocating part of the windmill and having engagement with said ratchet-segment, whereby when said part is reciprocated said ratchet-segment will be turned upon its pivot, said ratchet-segment being also connected with the devices for pulling the wind-wheel out of the wind, and a spring interposed between said ratchet-wheel and the windmill, substantially as described.

4. A windmill-regulator comprising a pivoted part B^3, connected with a moving part of the windmill, said part B^3 being connected with the device for pulling the wind-wheel

out of the wind and provided at a point opposite such point of connection with a weighted portion B^3, substantially as described.

5. A windmill-regulator comprising a wheel B^2, said wheel being provided with a ratchet-segment, and an operating-lever connected at one end with a reciprocating part of the windmill and having engagement with said ratchet-segment, whereby the latter is turned as the said part is reciprocated, said wheel B^2 being connected with the devices for pulling the wheel out of the wind and provided at a point opposite such point of connection with a weighted portion, as B^3, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

HENRY L. FERRIS.

Witnesses:
N. E. BLAKE,
E. H. SENGER.