(No Model.) 2 Sheets—Sheet 1.

J. COATES.

WINDMILL.

No. 605,079. Patented June 7, 1898.

Fig. 1.

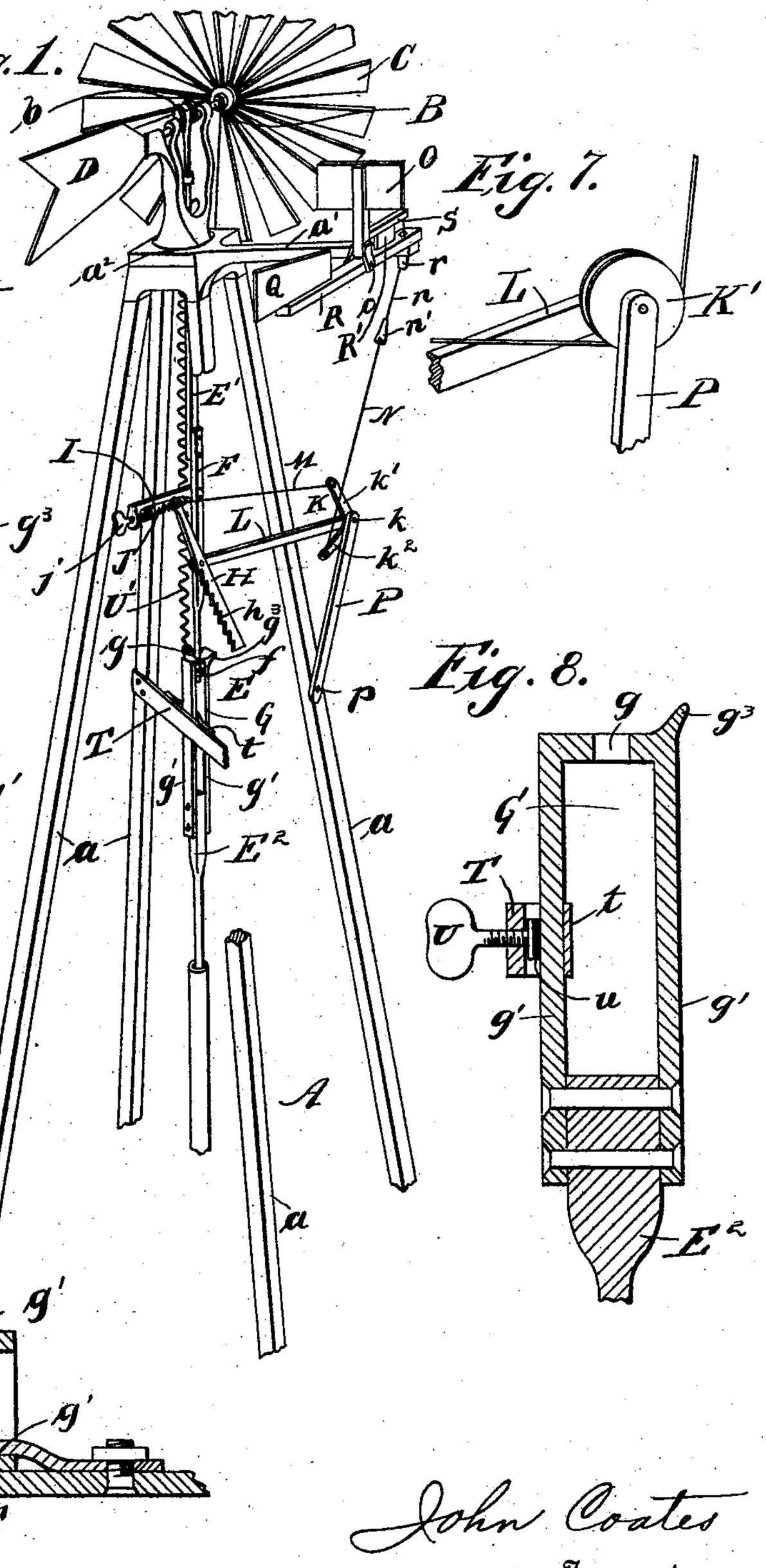

Fig. 4.

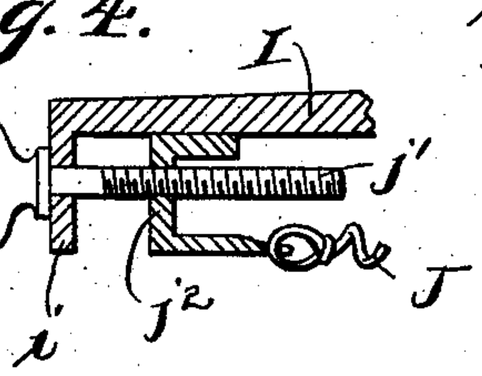

Fig. 5.

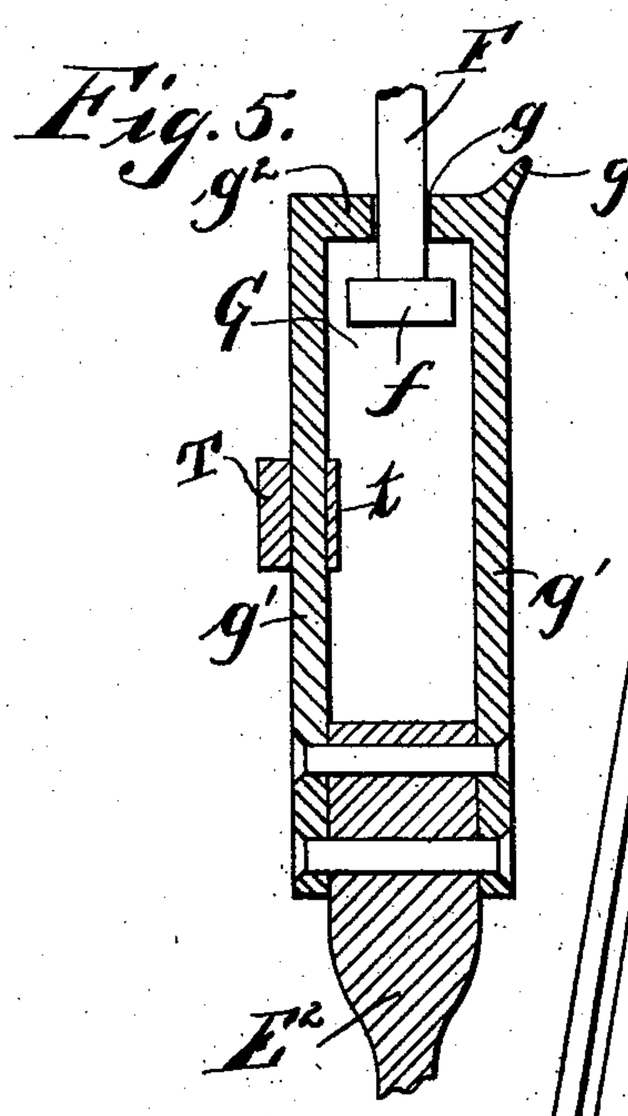

Fig. 6.

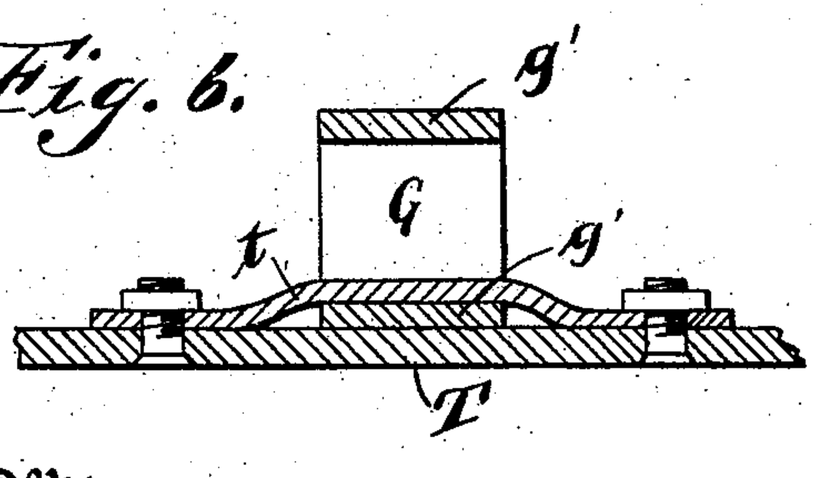

Fig. 7.

Fig. 8.

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Inventor

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By his Attorneys L. R. Littell & Co.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

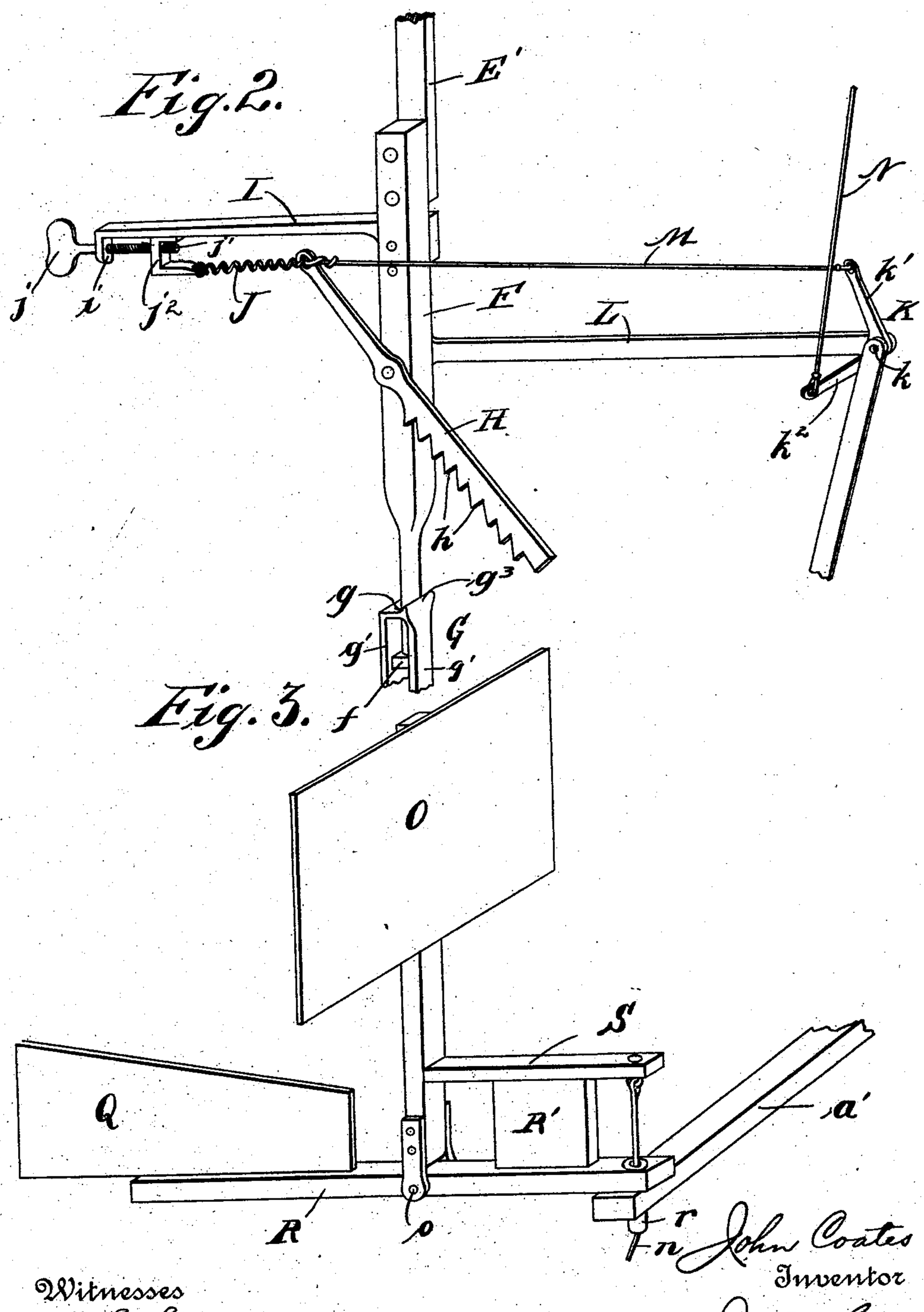

Fig. 3.

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Ralston Hemming.

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Inventor
By his Attorney J. R. Littell

UNITED STATES PATENT OFFICE.

JOHN COATES, OF OLIVE, CALIFORNIA.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 605,079, dated June 7, 1898.

Application filed June 26, 1897. Serial No. 642,381. (No model.)

To all whom it may concern:

Be it known that I, JOHN COATES, a citizen of the United States, residing at Olive, in the county of Orange and State of California, have invented certain new and useful Improvements in Windmills; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to windmills, and has special relation to mechanism for automatically regulating the stroke of the pitman with relation to variation in the strength of the wind.

The object of my invention is to provide a simple and effective regulating mechanism of this character which will automatically operate to control the stroke of the pitman or pump rod and insure a uniform operation of the same during variations in the strength or power of the wind, thus insuring economy in operation and uniform effectiveness or service of the windmill under varying conditions. In carrying out this purpose I provide a mechanism which operates to shorten or lengthen the stroke of the pitman or pump rod without altering the play of the main operating-crank carried by the wheel-shaft, substantially as hereinafter fully set forth.

In the practical operation of windmills the strength or power of the wind materially varies. With a light wind and corresponding short stroke of the mechanism a comparatively small quantity of water will be pumped, while with a long or medium stroke no practical pumping of the water will be effected. Thus, according to the variations in the wind, most windmills generally in use effectively operate only when the force or power of the wind is strong. The design of the improved construction and arrangement embodied in my invention is to so adjust the stroke of the mechanism automatically with respect to variation in the force or strength of the wind that a windmill provided with my improved adjusting mechanism will continuously operate with the maximum of effectiveness and efficiency.

In the drawings, Figure 1 is perspective view of a windmill mechanism embodying my improvements. Fig. 2 is a detail perspective view of the pitman-joint and connecting mechanism. Fig. 3 is a detail perspective view of the vane mechanism controlling the jointed-pitman-adjusting mechanism. Fig. 4 is a detail sectional view of the mechanism for adjusting the ratchet-bar spring. Fig. 5 is a detail vertical sectional view of the sliding joint. Fig. 6 is a detail vertical sectional view of the top end of the lower section of the pitman. Fig. 7 is a detail perspective view illustrating a modification embodying a pulley in lieu of a bell-crank lever between the vane mechanism and the jointed-pitman-adjusting mechanism. Fig. 8 is a sectional view illustrating a modification in the mechanism for governing the gravity action of the lower section of the pitman.

Corresponding parts in all the figures are denoted by the same letters of reference.

Referring to the drawings, A designates the main frame of the windmill, embodying the uprights or posts *a*. B designates the main shaft, carrying the wheel C. D designates the main vane, and *b* designates the crank of the shaft, to which is connected the pitman or pump rod E. All of the foregoing parts except the pitman may be of any usual or preferred construction.

In my invention the pitman or pump rod E is divided into two separate sections—an upper and lower one—E′ and E², respectively, and is preferably constructed of wood. These sections are connected by a sliding or vertically-movable joint, which comprises a connecting-rod F, which may be either cylindrical or rectangular in cross-section and is preferably formed of metal. The top of this connecting-rod is secured to the lower end of the upper section E′ of the pitman, while its lower portion works through a corresponding eye or opening *g* in the top of a loop or bracket G, projecting from the top of the lower section E² of the pitman and comprising, preferably, side plates *g′ g′*, secured to said section E², and the perforated top plate *g*², as shown. At the lower end of the connecting-rod F is provided a nut or head *f* within the bracket G, which operates to draw up or elevate the lower section E² of the pitman on the upstroke of the pitman in the operation of pumping. The connecting-rod is adapted to work freely with a sliding movement in

the bracket which connects it to the lower section of the pitman.

II designates a ratchet-bar which is pivotally mounted upon the connecting-rod F, which forms the lower end of the upper section of the pitman. The bar II has a toothed or serrated edge *h*, adapted to engage a lip or edge g^3 on the top plate of the bracket G, as shown.

Upon the upper portion of the connecting-rod F is secured a laterally-projecting arm I, from the outer end of which extends a spiral spring J. The inner end of this spring is connected to the upper end of the pivotally-mounted ratchet-bar II and governs the operation of the same. This spring may be adjusted by means of a thumb-screw *j* or other suitable mechanism connected with its outer end. The thumb-screw-adjusting mechanism herein shown embodies the screw *j*, working through an angle-arm *i* on the outer end of the arm I and carrying upon its projecting threaded end *j'* a plate j^2, to which the outer end of the spring J is connected, whereby by the turning of the screw the spring may be tightened or loosened, as desired.

K designates a bell-crank lever pivotally mounted, as at *k*, upon an arm L, which extends inwardly to and is pivotally connected with the pitman-rod F. To the upper arm *k'* of the bell-crank lever is connected a wire or connecting-rod M, extending to the upper end of the ratchet-bar II. The rod M and spring J extend at opposite sides of the bar II, as shown. From the lower arm k^2 of the lever K extends a wire or connecting-rod N upwardly to an upright or vertical vane O, hereinafter described, the operation of the vane mechanism being such that the wire N is drawn upwardly or slackens, according to the strength or power of the wind.

In lieu of the bell-crank lever K, I may employ a pulley K', journaled upon the arm L, as shown in Fig. 7 of the drawings, in which modified construction the connecting wires or cables M and N will simply be continuous and be wound around the pulley, so that the latter guides the operation of the continuous connecting wire or cable between the vertical vane and ratchet-bar.

The arm L is carried upon an arm P, pivotally mounted at its lower end, as at *p*, upon one of the posts or uprights *a* of the frame or tower A of the windmill, the pivotal joint between the arms L and P being formed by the pivot *k* of the bell-crank lever K, as shown. The arms L and P, pivotally mounted, as at *k* and *p*, serve to obviate any lateral motion of the pitman arising from the tightening or slackening of the connecting wire or rod M between the bell-crank lever and ratchet-bar as the pitman operates in its up-and-down stroke.

In practice when the wind is light the thumb-screw or spring-adjusting device *j* is tightened, so that the spiral spring J draws the upper end of the ratchet-bar II over and permits the first or second tooth or ratchet *h* to engage with the lip or edge g^3 when the motion of the pitman is downward. Thus the lower section of the pitman is forced downwardly a distance corresponding to the point of engagement of the ratchet-bar, and on the upward movement of the pitman the nut or head *f* of the sliding connecting-bar F will engage with the top g^2 of the bracket G and elevate or lift the lower section of the pitman and the pump-plunger a similar corresponding distance. When the wind becomes stronger, the vane mechanism connected with the wire or rod N will operate to draw the latter upwardly and through the medium of the bell-crank lever and connecting wire or rod M draw the top end of the ratchet-bar over against the tension of the controlling-spring J, so that the ratchet-teeth at the lower end of the ratchet-bar will be engaged with the lip or edge g^3 and operate to carry the lower section of the pitman and the pump-plunger down a relatively great distance, according to the increased force or power of the wind.

An important feature of my invention and improvements consists in the divided pitman or pump rod connected by regulating mechanism having an independent sliding movement, the lower section of the pitman having an independent play with respect to the movement of the upper section, while the latter operates to the full extent of the play of the crank upon the main shaft uniformly at each revolution. The independently-operating lower section of the pitman carrying the pump-plunger will, by reason of the sliding regulating mechanism connecting it with the uniformly-moving upper section of the divided pitman, have a downstroke only so far as it is actuated or pushed by the ratchet-bar, and it can operate in its upstroke only so far as it has been thus forced downwardly, whereby the lower section of the divided pitman has an up-and-down stroke different from the uniform stroke of the upper section (which upper section is connected with the crank of the main shaft) and controlled by the regulating mechanism forming the connection between the sections, according to the force or power of the wind.

The vane mechanism for controlling the regulating devices comprises a horizontally-operating vane Q, carried upon an arm R, pivotally mounted, by means of a hollow pivot *r*, upon a horizontal arm *a'*, projecting outwardly from the frame A of the windmill at the top. The upright or vertically-operating vane O is pivotally mounted upon the pivoted arm R, as at *o*, at right angles to the vane Q and carries a laterally-projecting arm S, to which the upwardly-extending wire or rod N is connected. The latter passes downwardly through the hollow pivot *r*, as shown. The horizontal vane Q operates upon its pivot *r* to keep the upright or vertical vane O facing

the wind. When the vane O is operated by the force of the wind and its arm S rises, the wire or rod N is drawn upwardly, thus carrying the bell-crank lever over, so that its upper arm draws upon the connecting wire or rod M against the tension of the spring J, which operation carries or draws the lower portion of the ratchet-bar inwardly and downwardly and effects its operation with relation to the lower section of the pitman.

I prefer to form the top end of the wire or rod N of a leather thong *n*, passing through the hollow pivot *r* and connected to the main portion N by a swivel-joint *n'*, which will permit the turning of said top portion *n* without twisting.

I provide upon the arm R a limiting block or projection R', mounted under or with relation to the arm S of the upright vane, which block will serve as a guide in the initial adjustment of the mechanism, as hereinafter described.

It will be understood that when the adjusting screw or mechanism *j* is tightened to draw up the spring J the latter retains the ratchet-bar from engagement with the lower section of the pitman until the wind blows strongly enough to automatically operate the mechanism, and thus shortens the stroke. If the adjusting screw or mechanism *j* and spring J are tightly set, a strong wind is necessary to lengthen the stroke. If the screw and spring are set in a slack or loose manner, a moderately strong wind will operate to draw the ratchet-bar downwardly and inwardly into engagement with the lower section of the pitman, and thus cause a longer stroke. The tension of the spring J, regulated by its set mechanism *j*, thus governs the length of the stroke in relation to the windmill mechanism and the desired requirements. When the wind is strong enough to force the upright vane backwardly to its full limit of play, the relative arrangement of the mechanism is such that the ratchet-bar will be drawn into position with its lowest tooth in engagement with the lower section of the pitman. The latter then operates with its longest stroke, and will maintain this stroke steadily, without shifting the length of the same, as long as the wind maintains the same degree of strength. As the force of the wind slackens the mechanism will operate to actuate the ratchet-bar, so that its upper teeth are thrown into engagement and the length of stroke thereby correspondingly shortened. When the spring J and set mechanism *j* are very slack or loose, the ratchet-bar is easily operated by a light wind to give or permit a full long stroke and so stop the motion of the wheel unless the well is very shallow.

To obviate downward movement of the lower section of the pitman and pump-plunger by their own gravity or weight, I provide a supporting-spring U', of spiral form, having its top end connected to the frame A (preferably at the top platform a^2) and its lower end connected to the lower section of the plunger, (preferably at the bracket or loop G.) The tension of this spring U' is so adjusted that it will overcome the gravity of the lower section of the pitman, but will permit the operation of the same in a downward stroke by action of the ratchet-bar. This spring U' also serves to economize power by assisting in the upward stroke of the lower section of the pitman, the power exerted in forcing the lower section of the pitman downwardly against the tension of the spring being utilized through the medium of the spring in effecting the return upward stroke.

A guide device for the lower section of the pitman may be provided. This guide mechanism embodies a transverse bar T, secured to the posts or uprights *a* of the frame A, as shown. Upon the inner face of the cross-bar T is secured a metallic strap *t*, embracing one of the side plates *g'* of the open loop or bracket G.

If desired, in lieu of the supporting-spring U' a set-screw U may be arranged to work through said cross-bar T and bear against the side plate *g'* at its point of connection with the embracing-strap *t*, this substitute construction being shown in Fig. 8 of the drawings. The inner bearing end of the set-screw U may be provided with a washer *u*, preferably formed of leather. By adjustment of this set-screw mechanism sufficient friction is brought to bear upon the top bracket of the lower section of the pitman to prevent the latter from descending or dropping by gravity and at the same time permit of its operation in a downward stroke by action of the ratchet-bar.

While I have herein illustrated and described the substitute set-screw friction mechanism as one form of device for retaining the lower section of the pitman against gravity action, the preferred construction for effecting this office consists of the spring U', as hereinbefore described.

Under some circumstances, especially in relation to the types of windmills commonly in use, the horizontal vane devices Q R, herein shown, may be dispensed with, and the vertical vane O, with its arm S, may be pivotally mounted upon the main vane D, in which obvious construction and arrangement it will only be necessary to carry the wire or cable N from the arm S downwardly through a tubular or hollow pitman or pump rod and to the bell-crank lever or pulley.

It will be noted that the main factors in carrying out the regulation of the lower section of the divided pitman and pump-plunger reside in the sliding-joint connection between the upper and lower sections of the divided pitman and the operation of the lower section of the pitman in its downward stroke by the ratchet-bar.

The operation and advantages of my invention will be readily understood by those skilled in the art to which it appertains. It

serves by means of the mechanism and in the manner above set forth to effectively regulate the stroke of the plunger with relation to variation in the strength or power of the wind without altering the connecting-crank mechanism between the pitman and main wheel-shaft. In a light wind the regulating mechanism secures a very short stroke of the plunger and effectively pumps, while in a strong wind a full stroke of the plunger is permitted. During the greater part of the time the wind blows lightly, and an ordinary windmill will therefore not pump advantageously unless permanently set with a short or medium stroke, in which case effective operation is lost whenever the wind blows strongly. With my invention the stroke may be set or adjusted for effective operation in a very light wind, and then when the wind increases in force the stroke will be automatically lengthened and again shortened when the force of the wind decreases.

In the initial adjustment of my improved regulating mechanism the operator should stand by the ratchet-bar spring mechanism when the wind blows very lightly and tighten the set-screw *j* and spring J until the arm S of the upright vane O is drawn down (by the intervening connecting mechanism) to the limiting-block R′; or this can be done before the wind begins to blow, and then when the wheel begins to turn the screw *j* may be tightened or loosened to give the pump such a stroke as will equal the power of the wheel. Then as the wind increases in force and the power of the mill correspondingly increases the vane O will be forced backwardly, its arm S will rise and draw up the wire N, the bell-crank lever K will be operated to draw upon the wire M, the ratchet-bar H will be drawn against the tension of the spring J into engagement with the lower section of the pitman, and the latter will be pushed down in a stroke so regulated with relation to the force of the wind that the maximum degree of power and efficiency is at all times secured. As the pitman rises the head *f* of the connecting-rod F will engage the top of the bracket G and draw up the lower section of the pitman to the same extent that it has been pushed down by the ratchet-bar.

If at any time the force of the wind is strong enough to cause the lowermost notch or tooth of the ratchet-bar to engage the lip g^3, the maximum length of stroke will be attained, and this maximum stroke will continue until the force of the wind is reduced. As the power of the wind becomes lessened the spring J will automatically operate to overcome the upright vane O and intervening mechanism and draw all said regulating mechanism in a reverse movement, so that the teeth of the ratchet-bar will be disengaged from the lip g^3 and the stroke of the lower section of the pitman correspondingly shortened as the power of the wheel is decreased.

When once initially adjusted or set with relation to the size of the windmill, the power of the same, the depth of the well, &c., no further adjustment of the governing spring mechanism *j* J will be necessary and its original fixed relative adjustment will enable the proper and automatic regulation of the stroke under any varying conditions in the wind-power.

By means of my improved divided pitman and connecting regulating mechanism when applied to a windmill an adjustment by which the possible stroke can be materially lengthened can also be secured. Thus an ordinary windmill which works with a set stroke of six inches can be set to a stroke of nine or more inches if my divided pitman and regulating mechanism are employed. It will be, furthermore, noted that the lost motion is so controlled by my sliding coupling mechanism between the sections of the divided pitman that the motion of the wheel-crank with relation to the lower section of the pitman and pump-plunger is lost until the ratchet-bar pushes or forces the lower section of the pitman on its downstroke.

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

1. As an improvement in windmills, a divided pitman or pump rod comprising two sections, a joint mechanism comprising a connecting-rod secured to the top section and having a sliding connection with the lower section and a pivotally-mounted ratchet-bar adapted to engage and actuate the lower section, and mechanism for controlling the operation of the ratchet-bar, substantially as and for the purpose set forth.

2. As an improvement in windmills, a divided pitman or pump rod comprising two sections, a joint mechanism comprising a connecting-rod secured to the top section and having a sliding connection with the lower section and a pivotally-mounted ratchet-bar adapted to engage and actuate the lower section, spring devices governing the ratchet-bar, and mechanism for actuating the ratchet-bar against the tension of said spring devices, substantially as and for the purpose set forth.

3. An improved windmill, comprising a divided pitman or pump rod embodying an upper and lower section, a joint mechanism connecting said sections and embodying a connecting-rod secured to the top section and having a sliding connection with the lower section and a pivotally-mounted ratchet-bar adapted to engage and actuate the lower section, spring devices for throwing the ratchet-bar out of engagement with the lower section, connecting cords or rods extending between the ratchet-bar and a controlling mechanism, and a controlling mechanism for drawing upon said cords or rods to cause the same to actuate the ratchet-bar against the tension of the spring, substantially as and for the purpose set forth.

4. An improved windmill, comprising a di-

vided pitman or pump rod embodying two sections, a joint mechanism permanently connecting said sections but permitting an independent movement of the lower section with relation to the upper section and embodying a device for intermittently bearing upon the lower section, mechanism for retaining said intermittently-bearing device out of engagement with the lower section, devices connected with said intermittently-bearing device and adapted to draw against the action of said retaining mechanism, and means for operating said connection devices, substantially as and for the purpose set forth.

5. As an improvement in windmills, a divided pitman or pump rod comprising upper and lower sections, a joint mechanism permanently connecting said sections and comprising a connecting rod or device having a movable connection with the lower section and permitting an independent movement of the same with relation to the upper section and a device intermittently bearing upon the lower section, and means for governing the operation of said intermittently-operating device, substantially as and for the purpose set forth.

6. An improved windmill, comprising a divided pitman embodying an upper section and a lower section, the upper section being connected to the main operating mechanism of the windmill, devices supporting the lower section independently of the upper section, a sliding joint connecting said sections, devices for intermittently engaging the lower section, and means for operating the devices which engage the lower section in their intermittent movement, substantially as and for the purpose set forth.

7. An improved windmill, comprising a divided pitman embodying an upper section and a lower section, the upper section being connected to the main operating mechanism, devices supporting the lower section independently of the upper section, a sliding joint connecting said sections, a ratchet-bar pivotally carried upon the upper section and adapted to engage the lower section, and mechanism for throwing said ratchet-bar into and out of engagement with the lower section, substantially as and for the purpose set forth.

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

JOHN COATES.

Witnesses:
THOS. WALMSLEY,
W. H. H. CLAYTON.