(No Model.) 4 Sheets—Sheet 1.

G. M. BEARD.

WINDMILL.

No. 362,870. Patented May 10, 1887.

Fig. 1.

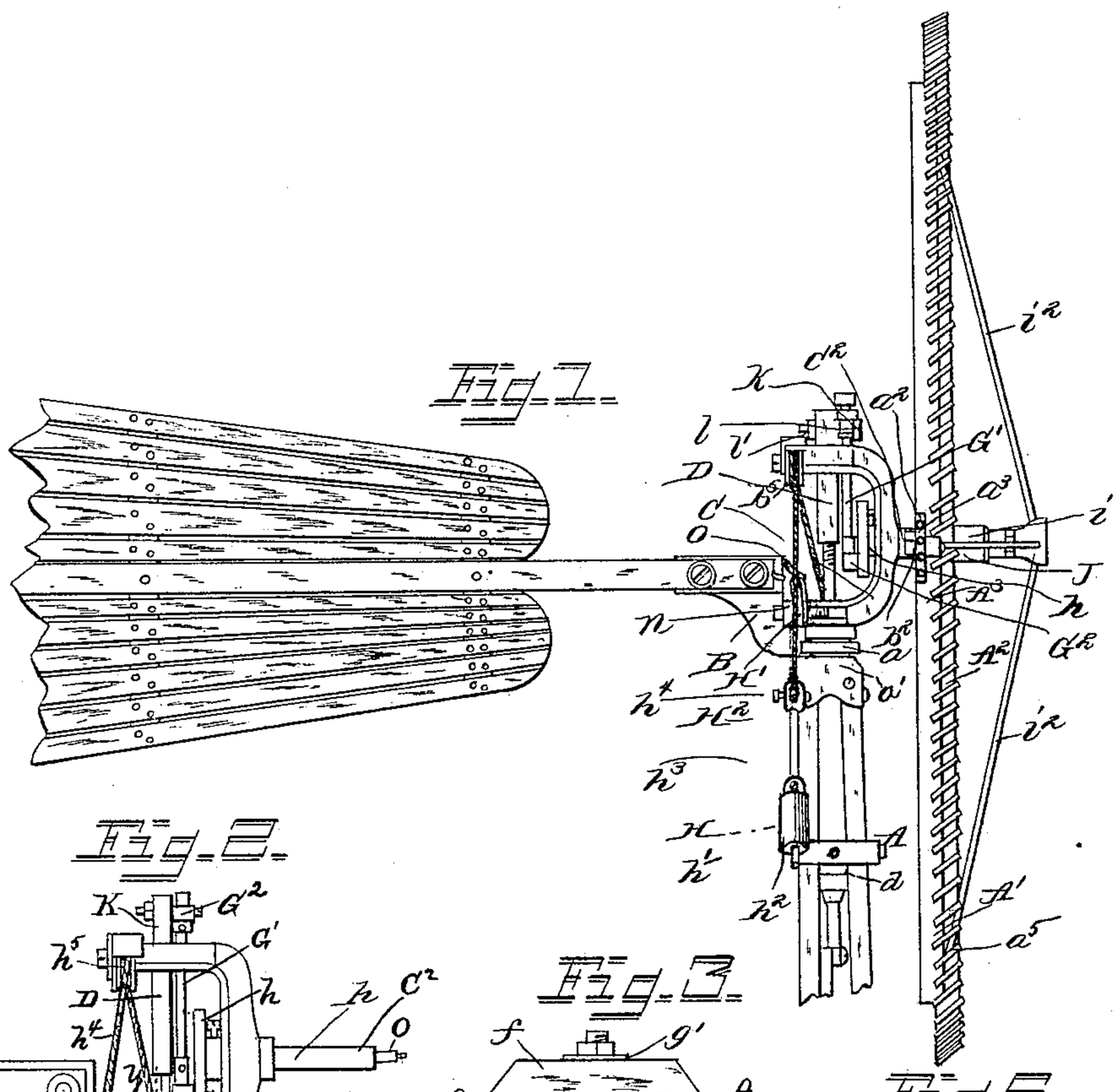


Fig. 2.

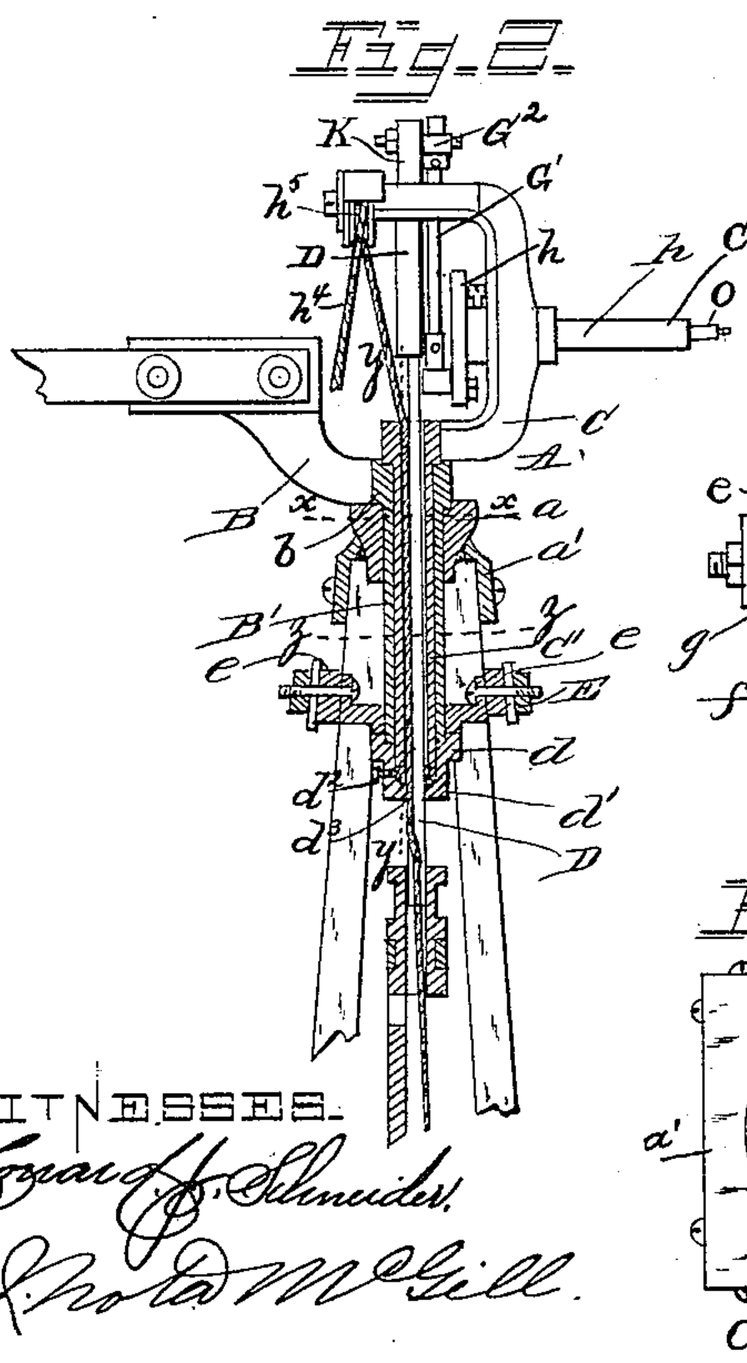


Fig. 3.

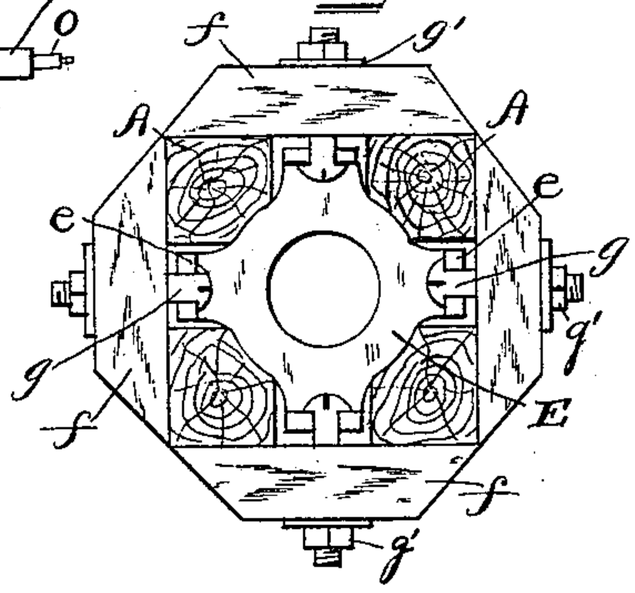
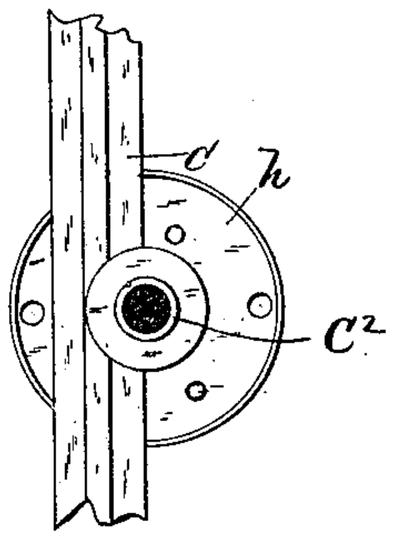


Fig. 4.

Fig. 5.



Witnesses.
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(No Model.) 4 Sheets—Sheet 2.

G. M. BEARD.

WINDMILL.

No. 362,870. Patented May 10, 1887.

Fig 6.

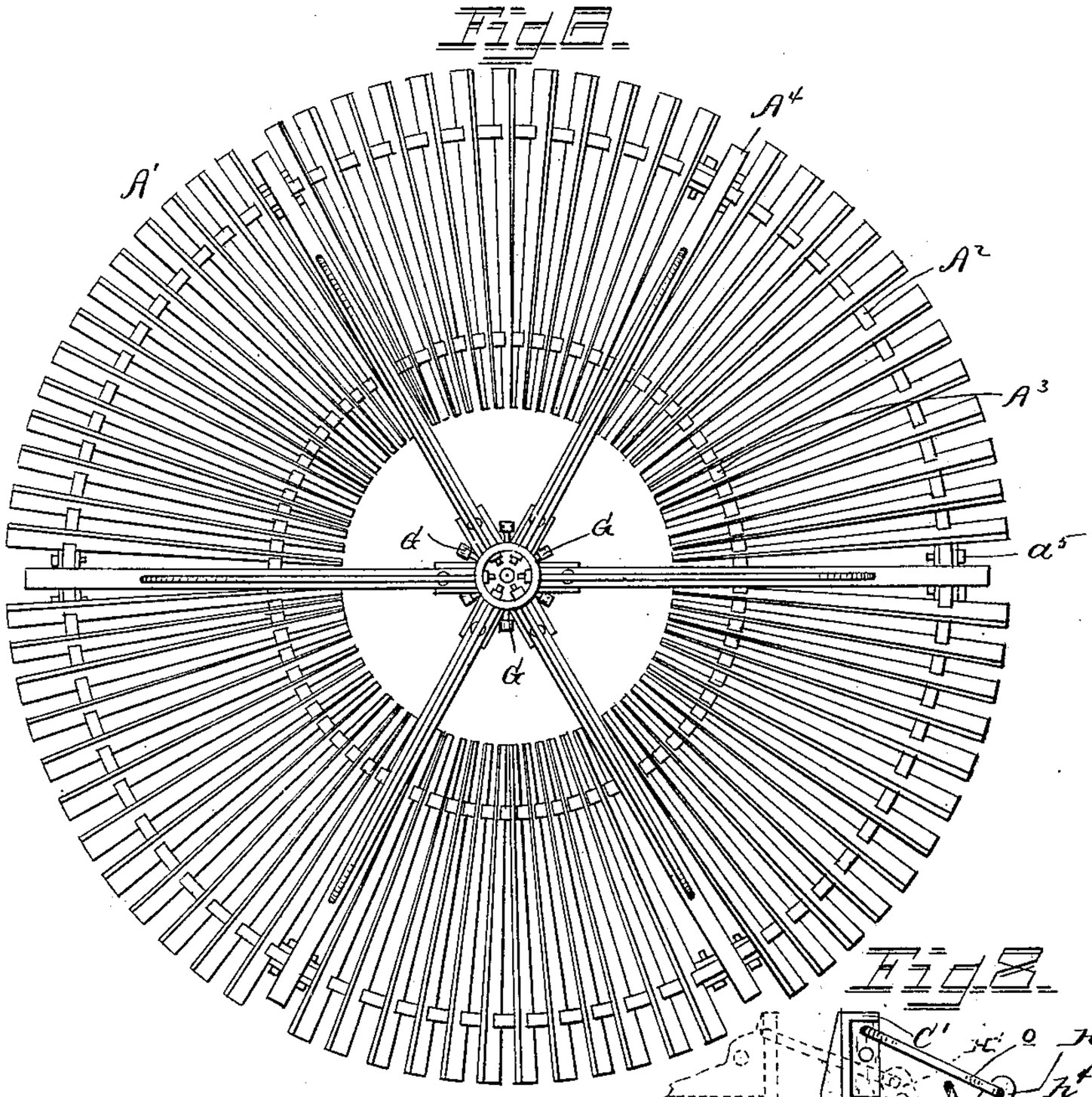


Fig 7.

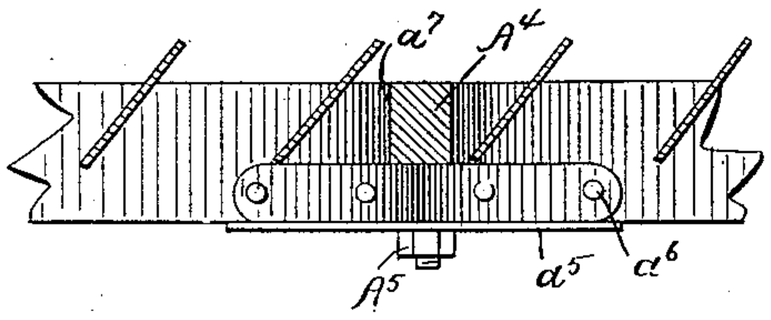
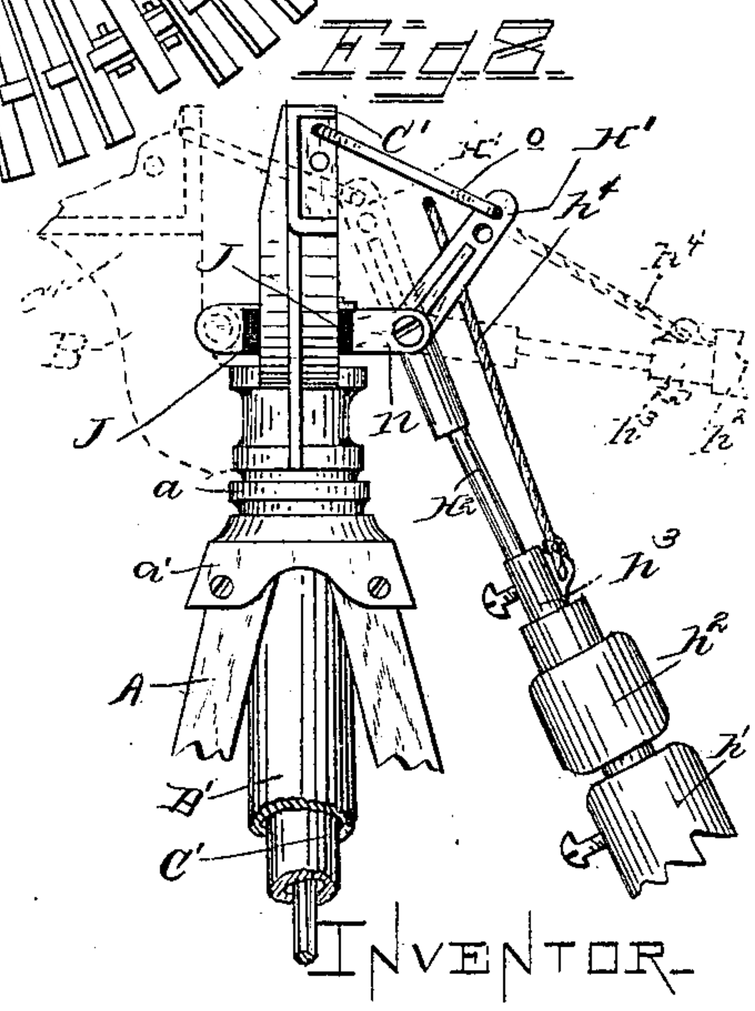


Fig 8.



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(No Model.)

4 Sheets—Sheet 3.

G. M. BEARD.

WINDMILL.

No. 362,870. Patented May 10, 1887.

Fig. 9.

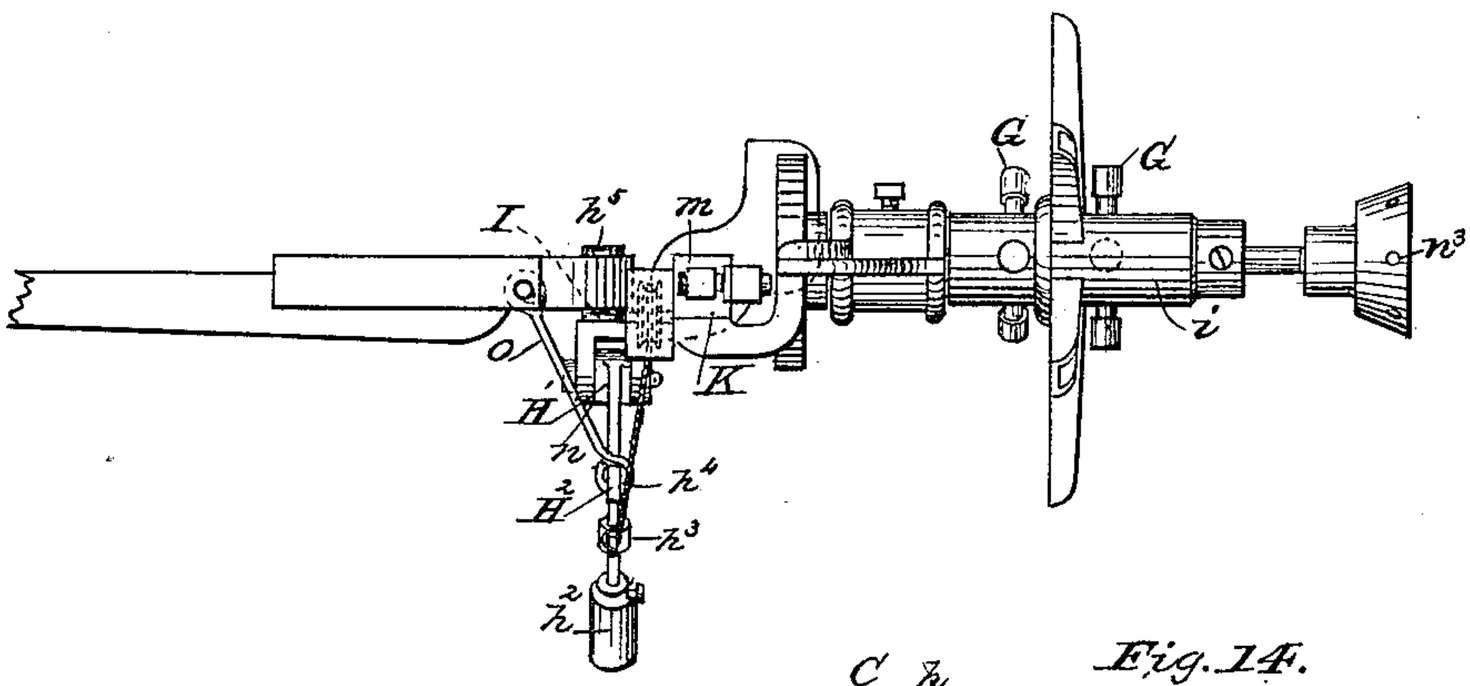


Fig. 14.

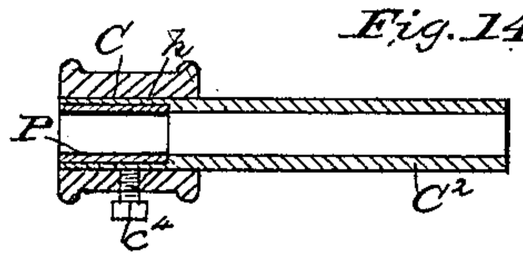


Fig. 10.

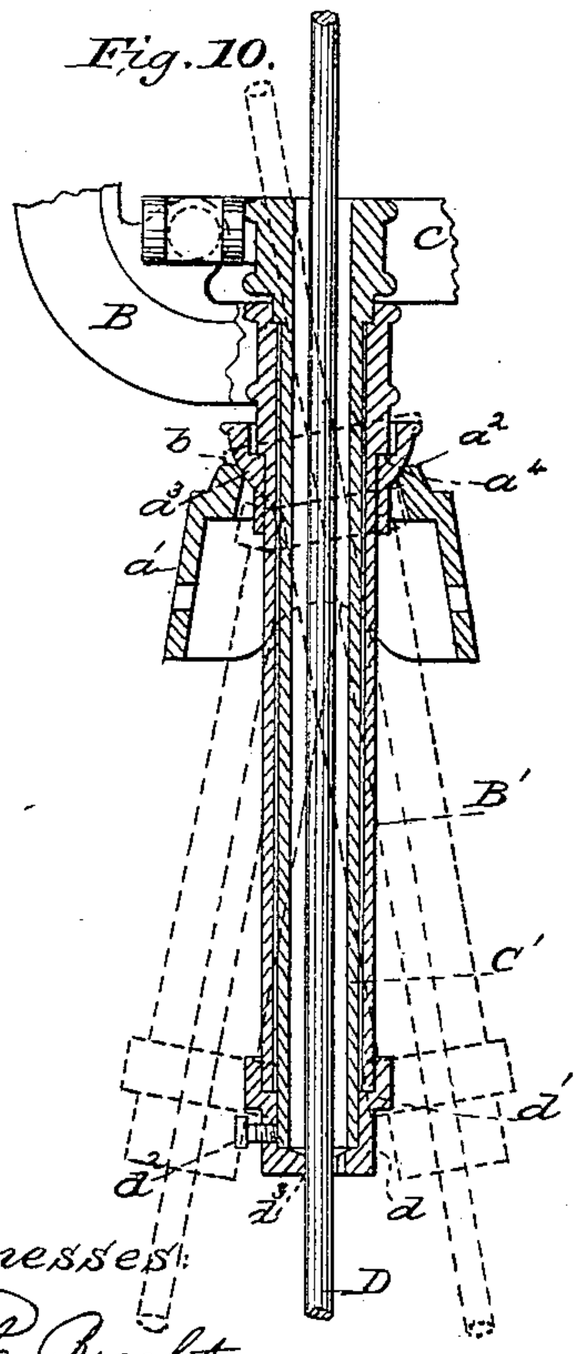


Fig. 11.

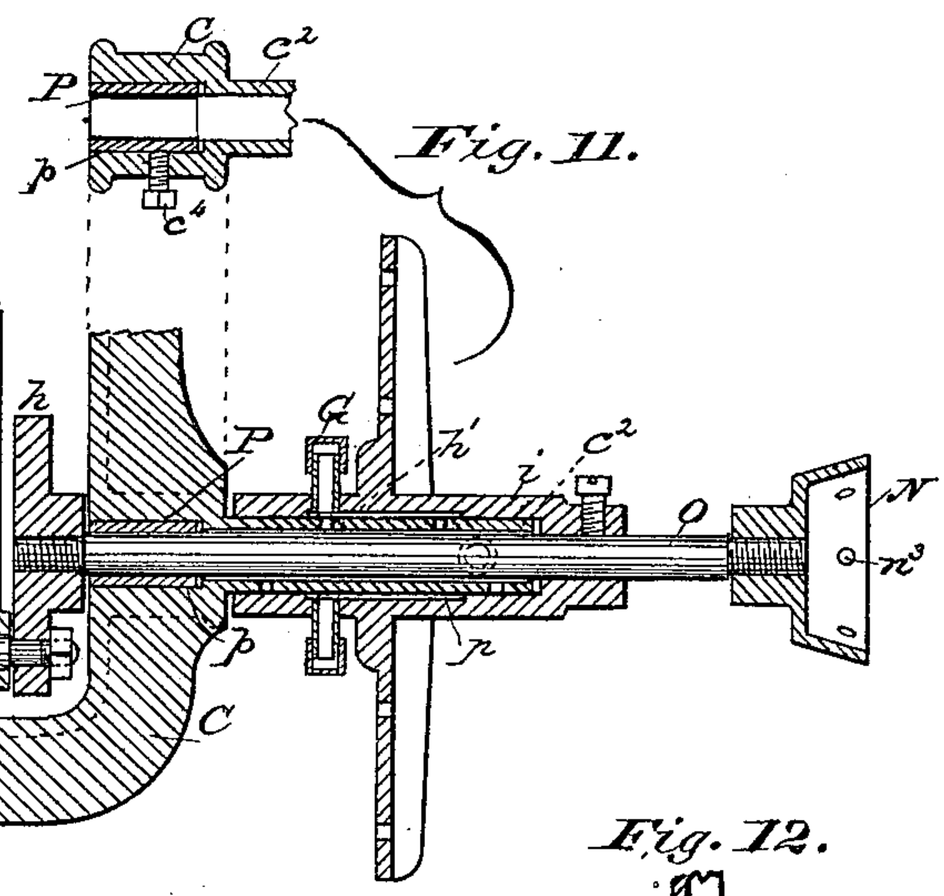


Fig. 12.

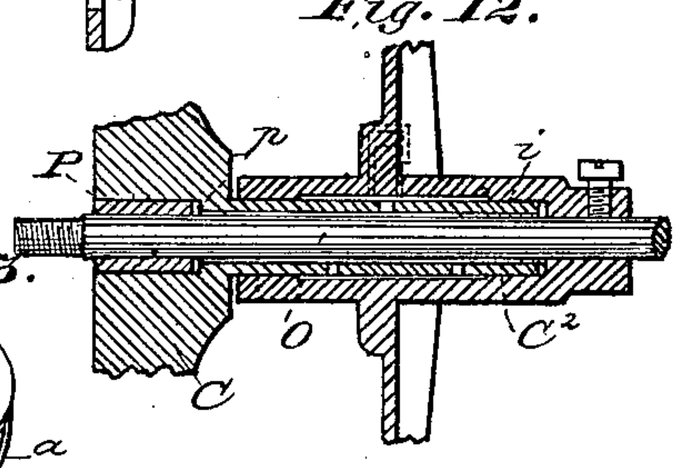
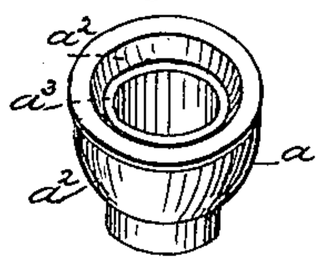


Fig. 13.



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G. P. Kramer.

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(No Model.)

4 Sheets—Sheet 4.

G. M. BEARD.

WINDMILL.

No. 362,870. Patented May 10, 1887.

Fig. 15.

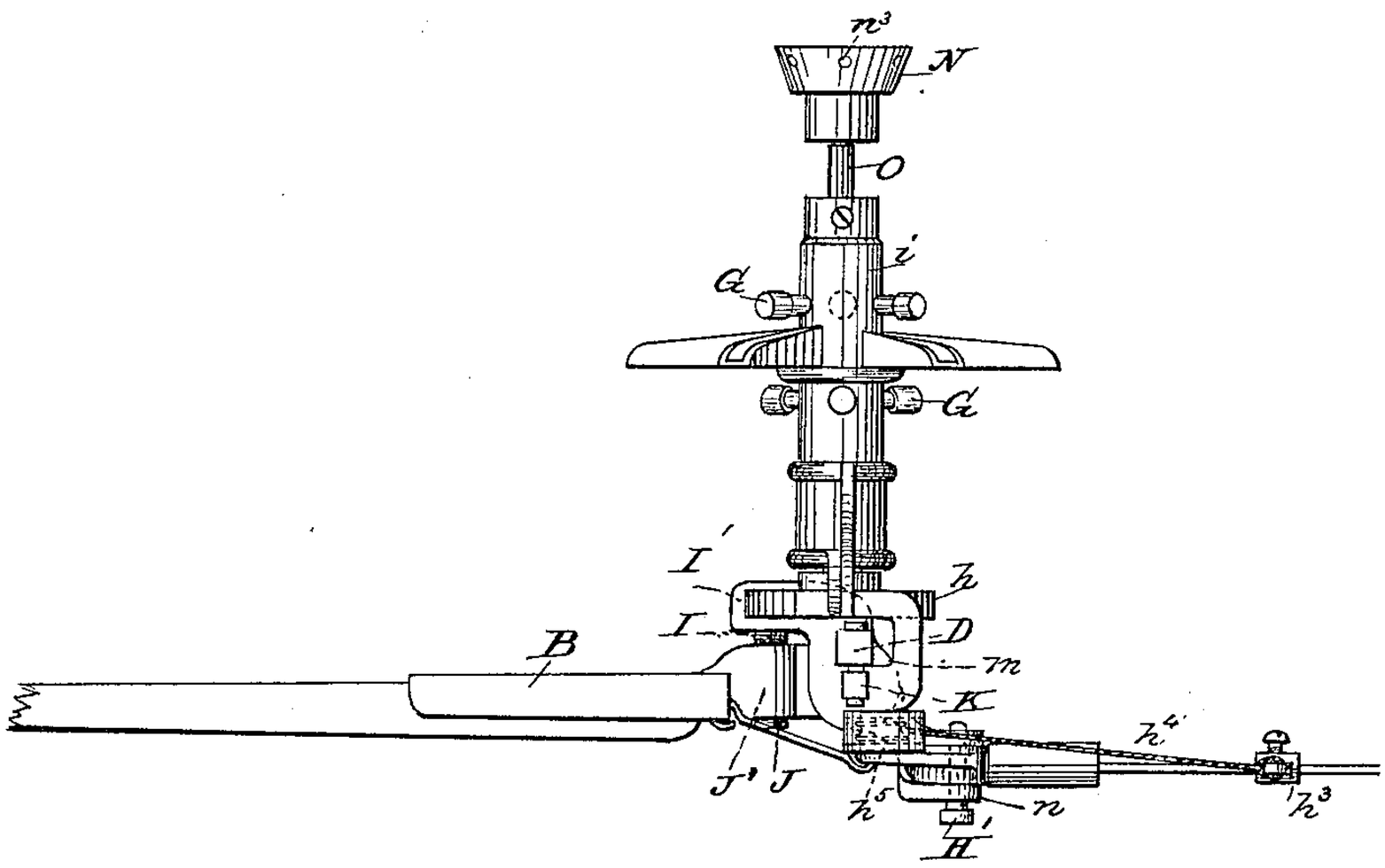
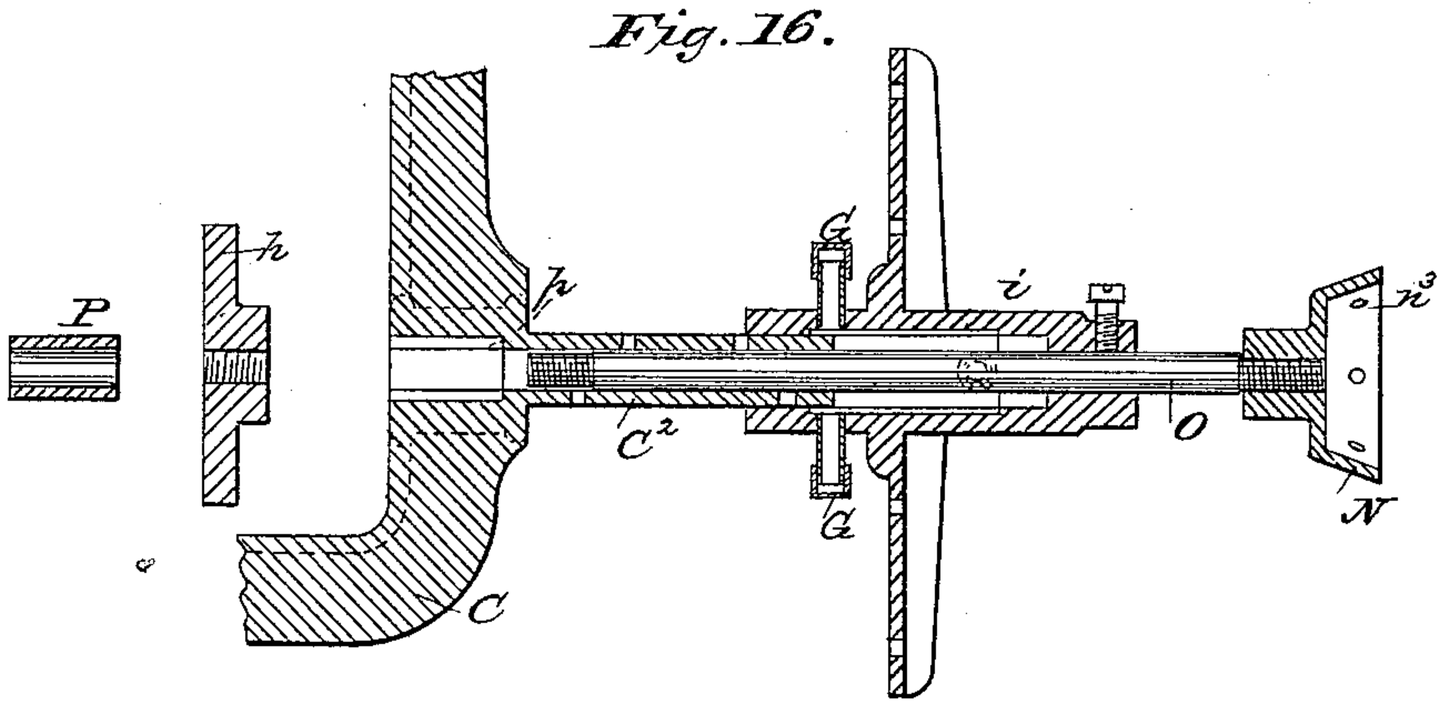


Fig. 16.



Witnesses:

F. C. Brecht.

G. P. Kramer.

Inventor:

George M. Beard,

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Attorneys

UNITED STATES PATENT OFFICE.

GEORGE M. BEARD, OF AUBURN, INDIANA, ASSIGNOR OF ONE-HALF TO W. H. RAKESTRAW, OF SAME PLACE.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 362,870, dated May 10, 1887.

Application filed August 27, 1885. Serial No. 175,470. (No model.)

To all whom it may concern:

Be it known that I, GEORGE M. BEARD, a citizen of the United States of America, residing at Auburn, in the county of De Kalb and State of Indiana, have invented certain new and useful Improvements in Windmills, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to windmills of that class which revolve in a vertical plane and are thrown out of the wind according to the amount of work and speed required, and according to the force of the wind, said wheel being adjusted relative to the vane and connected therewith by a weighted lever, the object being to produce a windmill or wind-engine for operating pumping and other machinery, which shall be simple, economical in cost, efficient in use, easy to manage, compact in form, durable and not liable to get out of order, and easily and quickly repaired, owing to the simplicity of construction and the fewness of parts, which may be readily reached.

A further object is to equalize the bearing of the wheel and devise a means for the equal distribution of oil or other lubricant to the bearing on each side of the wheel.

A still further object is to obtain a snug and easy bearing for the tubular shank depending from the wheel-supporting casting in the casting uniting the posts composing the tower, so that said tubular shank may be adjusted to a vertical position without any binding thereof in its bearings.

Another object is to secure a positive connection between the lower ends of the tubular shanks depending from the wheel and vane castings, whereby the one may not be vertically and laterally displaced relative to the other and the one be free to revolve independent of the other.

With these ends in view I have devised the simple and improved construction embodying my invention, which consists in the novel features more particularly hereinafter referred to, claimed, and shown in the annexed drawings, in which—

Figure 1 is a side view of a wind-engine of my construction, adapted to carry out my invention. Fig. 2 is a side view, partly in section and parts broken away. Fig. 3 is a section on the line Z Z of Fig. 2, on an enlarged scale, and having the tubular shanks of the castings removed. Fig. 4 is an enlarged detail sectional view taken on the line X X of Fig. 2. Fig. 5 is a detail view in elevation with the wheel removed and viewing the shaft endwise, showing the eccentric disposition of the said shaft. Fig. 6 is a front view of the wheel detached. Fig. 7 is an enlarged detail view of a section of said wheel. Fig. 8 is also an enlarged detail view, in side elevation, of the governor mechanism in its normal position, also showing the position of the same by dotted lines when thrown out of the wind. Fig. 9 is a plan view of the castings having the wheel-blades removed and part of the vane broken away. Fig. 10 is an enlarged side view, partly in section, of the lower portion of the wheel and vane castings, showing the tower-casting and the means for mounting the tubular shanks of the castings in the tower-casting for securing a snug bearing without any binding when plumbing said shanks. An exaggerated adjustment is shown by dotted lines to make the same more apparent. Fig. 11 is a longitudinal sectional view, on an enlarged scale, of the wheel-hub and connections and a cross-section through the casting, respectively, showing the means for securing the sleeve in place. Fig. 12 is a similar view of a modified form. Fig. 13 is a perspective view of the universal sleeve-bearing for the castings, which support the wheel and vane. Fig. 14 is a sectional view of the wheel-casting, showing the tubular extension made separate and secured thereto, and having the sleeve inserted in its inner end. Fig. 15 is a plan view similar to Fig. 9, but showing the relative portions of the castings when the wheel is thrown out of the wind. Fig. 16 is a view similar to Fig. 11, showing the manner of operation in removing or inserting a sleeve.

The tower or derrick A is of the usual form, and the corner-posts composing the main stay are united at their upper ends by a casting, a', centrally apertured to receive a sleeve, a, which forms the bearing for the vane and wheel castings. The sides of the opening through the casting a' are flared outwardly on the arc of a circle, and that portion a^2 of the

sleeve *a* contacting with the sides of the aperture of the casting is correspondingly formed on the arc of a circle, giving an approximately ball-and-socket joint, so that the sleeve may have a slight movement therein, and yet have a firm bearing on all sides when so adjusted.

The vane-casting B, provided with a tubular shank, B′, extending in a downward direction, fits snugly within the sleeve *a*, and a shoulder, *b*, near the upper end of the tube, fitting in a recess, a^3, in the sleeve, rests upon a shoulder, a^4, thereby supporting and forming a bearing, which prevents the casting dropping through or sagging. The wheel-supporting casting C is likewise provided with a tubular shank, C′, which is fitted within the tubular shank B′, and is slightly longer to project below the lower end of the shank B′ and receive a reducing-collar, *d*, which is secured thereto by a set-screw, d^2. The enlarged portion *d′* receives the lower end of the shank B′, and holds it at a relative distance from the shank C′, thereby reducing the friction between the two shanks by preventing the contacting of their sides as the wear comes upon the collar.

The two castings have each an independent movement, the one in the sleeve-bearing the other within the shank of the one mounted in the latter bearing; or they may revolve together in the sleeve-bearings.

A centrally-apertured casting or spider, E, fitted on the tubular shank B′, just above the stepped collar *d*, having slotted projections or lugs *e*, extending from its outer edges at points opposite the spaces between the stay-posts of the tower, forms part of the plumbing device. Cross pieces or bars *f*, arranged across the spaces between the stay or corner posts opposite the casting or spindle, and secured thereto, have set-screws *g*, projecting therefrom and entering the slots of the lugs *e* of the casting, heads upon their inner ends by which to engage the lugs of the casting, and nuts and washers *g′* on their outer ends by which to adjust the position of the casting relative to the posts or uprights of the tower. Manifestly by loosening the nuts upon any one side of the tower and tightening those upon the opposite side, the position of the casting or spider will be changed relative to the tower, and the lower ends of the shanks may be brought into a perpendicular line with their upper ends, thereby centering or plumbing the mill. By reason of the shanks having a bearing in the sleeve *a*, and its universal connection with the cap or casting *a′*, the upper portion of the sleeve is shifted correspondingly with the adjustment of the spider, so that the shanks of the castings have no binding action within the cap *a′*. By this construction, if the tower should not be set exactly level, or should at any time be wrested from a vertical or plumb position, the mill can be plumbed or brought back into a perpendicular position by the centering device irrespective of the cap and without fear of any binding action of the shanks therein, because of the universal connection of the bearing-sleeve with the cap.

The wheel A′ has its strengthening-rims A^2 A^3 made in sections, the ends of which abut without overlapping, forming true circles, so that the slots may be placed equally close together, or at stated intervals apart, without presenting the usual break on each side of the arm of the wheel, thereby gaining a greater surface for the action of the wind, and producing a compact and neat wheel.

The various rim-sections are joined together by angle-plates, which are conformed to the curvature of and bolted to the rim-sections at their joints, the said plates being applied to the outer sides or convexities and one edge of said sections, thus firmly securing and bracing the same at their joints. A second plate, a^6, may also be applied to the inner or concaved side of said rim-sections, and secured in place by the same bolts fastening the angle-plates to the rim-sections. The arms A^4 of the wheel are let into mortises a^7 in the rim-sections, made half and half in each section, immediately at the joints, and are fastened in said mortises and to the rim-sections and angle-plates by headed bolts A^5, passing through all of said parts and secured by nuts.

Projecting at right angles from the wheel-casting is a tubular sleeve, C^2, of wrought or cast metal. It may be one with the casting, as shown in Figs. 11, 12, and 16, or be separate from and secured thereto, as shown in Fig. 14. The plane of this sleeve is to one side of the plane of the vertical axis of the mill, so that an abnormal force of wind will carry the wheel out of its action and present only its edge, thereby preventing injury to the mill. The wheel-hub *i* extends on each side of the plane of the wheel for a nearly equal distance, and its outer contracted end has secured therein a shaft, O, by a set-screw or other suitable means, which will permit the ready detachment of the shaft from the hub. The shaft projects beyond the contracted end of the hub, and is provided with a cup-shaped casting, N, having radial openings n^3, formed obliquely therethrough, for the reception of the inner ends of brace-rods i^2, extending obliquely from the wheel-arms or spokes. It projects through the hub, and is of a length to extend through the casting C and have a crank, *h*, on its inner end. The wheel-shaft has a bearing within the tubular extension C^2, and the latter projects within the wheel-hub sufficiently far to permit its extending relatively about an equal distance on each side of the plane of the wheel, in order to equally distribute the weight and friction, and thus balance the wheel. The bore of the wheel-supporting casting, through which the shaft O extends, is enlarged at *p* on its inner end, and a bushing or sleeve, P, of a substance softer than the shaft O, such as Babbitt metal, lead, brass, or fibrous material, inserted therein, receives and prevents any too great wear of the shaft, and

is shorter than the depth or length of the enlargement, leaving a space between its inner end and the bottom of the recess, so that when the sleeve becomes worn it may be removed by inserting a hooked instrument in said space back of the sleeve, and then drawing outward, which will effect the desired result. A set-screw, C^4, passing through the casting, holds the sleeve therein. To remove and replace the sleeve in the manner just mentioned, it is first necessary to disengage the crank from the inner end of the shaft, and then slide the wheel outward from the casting on the tubular bearing sleeve C^2 sufficiently far till the end of the shaft passes the inner end of the bushing, when it may be readily removed in the manner above noted and as shown in Fig. 16, provided the set-screw is loosened. During this operation the tubular bearing-sleeve supports the wheel on its outer end, as is indicated in said Fig. 16.

The sleeve is at the opposite side of the plane of the vertical axis of the mill to that upon which the governor is disposed, to enable the wheel to present a greater surface on one side of the vertical axis of the mill than that side upon which the governor is disposed, so that when the force of the wind exceeds or becomes greater than the force exerted by the governor to hold the wheel in the wind the latter will turn and swing partially or wholly out of the wind, according to the increase in the force or pressure of the latter.

Radially arranged upon and passing through the hub, with their inner ends connecting with its bore, are series of lubricant boxes or tubes G, having their outer ends closed by screw-caps. Two series of these boxes or tubes are employed, one series being arranged upon each side of the plane of the wheel, the tubes of one series alternating with the tubes of the other series. Instead of this arrangement, the boxes or tubes may be merged into and form a single series located in the plane of the wheel, as indicated by dotted lines in Fig. 12. In this case the lubricant boxes or tubes will be located between the spoke-sockets of the hub. The lubricant fed by these boxes or tubes is, by the nature of their disposition and location, thoroughly and uniformly distributed during the movement of the wheel over and upon the wheel bearing or sleeve C^2 and the inner surface of the hub, and upon the exterior and interior surfaces of the said sleeves, the lubricant readily finding its way to the interior of the latter. When the wheel is at rest or out of action, and to some extent while in action, the lubricant will drain or find its way back into those boxes pointing downward or having their outer ends below a horizontal plane, passing through their inner ends for retention therein, and in readiness to be again supplied or fed, as above noted, when in the operation of the mill they shall come uppermost or have their outer ends elevated above a horizontal plane relative to their inner ends, thus automatically lubricating and recovering the surplus or excess of lubricant and effecting the reusing of the same, preventing the loss or waste thereof.

A bearing, K, secured to the end of the overhanging arm of the wheel-supporting casting, receives the angular or guiding end of the pump-rod D, the lower portion of which is reduced, and passed through the tubular shank C′, is prevented from contacting with the inner side thereof by extending through an aperture, d^3, in the closed end of the collar d, which forms a guide-bearing. A wrist-pin or sleeve and pin connection, G^2, serves to connect the upper end of the pitman or crank rod G′ with the upper end of the pump-rod, the lower end of the pitman or crank rod being in connection with the crank or disk h, secured upon the inner end of the wheel-shaft. The pitman is adjustably connected with the crank or disk to vary the stroke of the pump-rod, preferably by being secured in one of a series of apertures formed in the disk at unequal distances from the axial line about which it rotates. The upper end of the overhanging arm of the wheel-supporting casting is provided with a recess, m, to give clearance for the pitman and permit action or movement in the operation of transmitting a reciprocatory motion to the pump-rod.

The governor H, comprising the rod H^2, having an elbow pivotal connection, H′, with the wheel-supporting casting and a movable weight, h^2, adjustably secured thereupon by a set-screw or other suitable means, is also provided with a sleeve or collar, h^3, likewise made adjustable thereon, which may be weighted or not, as desired, to serve as a supplementary counterpoise. To the sleeve or collar h^3 is connected a strap or chain, h^4, leading up to and passing over a small pulley, h^5, hung in a suitable support, preferably cast with and at the upper overhanging end of the wheel-supporting casting, said cord thence passing down through the tubular shank C′ of the casting, and in practice connecting with a pressure-regulator; or it may be loose and serve as a means to throw the engine out of the wind by pulling down thereon and securing its end. The adjustability of the weight and weighted sleeve permits of the varying of the leverage of the governor, in order to regulate the wind-pressure working capacity of the engine or mill, while the adjustability of the collar permits the shifting of the end of the cord, so as to increase or decrease the leverage corresponding with the adjustment of the weight, so that the same amount of force applied to the lower end of the cord or chain may at all times effect a change in position of the wheel, so as to throw it out of the wind; or in case the said end of the cord may be applied to a pressure-regulator the leverages of the weight and collar may be so adjusted and proportioned that at any adjustment an equal amount of force may be transmitted from the governor to the cord and from it to any regulator. The

elbow H′ of the governor is pivoted at its angle to and between parallel studs *n* upon an arm or stop, I, cast with the wheel-supporting casting. A link, *o*, connecting with the upper end of the elbow H′, unites it with the vane casting in such manner that when the wheel is in the wind the rod H^2 is in a pendent position, and when the wheel is out of the wind, or partially so, it will be proportionally elevated, occupying a nearly horizontal position when the wheel is wholly out of the wind. When the force or pressure of the wind falls below that exerted by the governor to bring the wheel into the wind, the rod H^2 will gravitate and cause the wheel to come into the wind.

The arm or stop I, together with a similar stop or arm, I′, is cast upon the wheel-supporting casting in the plane of the upper end of the tubular shank C′, at about right angles to each other.

A projection, J′, cast upon the vane-casting in the plane of the stops I I′, is provided with buffer-blocks J on each end, against which the stops I I′ impinge in the swinging of the wheel to limit its movement in either direction relative to the vane and cushion the blow incident to the two castings coming together, thus preventing injury or any jarring, which would otherwise occur if the casting themselves contracted.

It is to be noted that the wheel has its own or an independent bearing, and that both itself and bearing are free from any jarring motion occasioned by the reciprocating movement of the pump-rod, which jarring is taken up by the shaft O and the sleeve P within the wheel-supporting casting. Furthermore, no looseness of the wheel on its bearing-sleeve C^2 can effect or cause any jarring or unsteadiness of the crank on the end of the shaft, which works loosely within the tubular bearing C^2, and has a bearing only within the sleeve P. Openings formed in the sleeve-bearing permit the passage of the lubricant from the exterior of the sleeve to the interior, whence it finds its way along the shaft to the sleeve P. The bore of the wheel-hub is enlarged midway its ends to form an annular chamber for the reception and retention of the lubricant, and also to reduce the contacting surfaces and throw the same on the inner and outer ends of the tubular sleeve-bearing.

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

1. In a wind-engine, the combination, with the wheel-supporting casting having a tubular spindle projecting laterally therefrom, of the wheel mounted on said spindle, which spindle projects about an equal distance on each side of the plane of the wheel, and the wheel-shaft journaled within the spindle, having the outer end keyed to revolve with the wheel, and having the inner end connected with the pump-rod, substantially as and for the purpose described.

2. In a wind-engine, the combination, with the wheel-supporting casting and the tubular spindle projecting laterally therefrom, having a bearing formed at its inner end of less diameter than the bore of said spindle, of the wheel mounted upon the spindle, the wheel-shaft passing through the bore of said spindle keyed to the outer end of the hub of the wheel and journaled at its inner end in said bearing, the crank, the pump-rod, and suitable connections between the crank and pump-rod, substantially as set forth.

3. In a wind-engine, the combination of the wheel-supporting casting having a tubular extension projecting therefrom, and having a bore in line with the extension, the inner end of which is enlarged, forming a recess, a sleeve having a bore of less diameter than the bore of the tubular extension, seated in the recess, leaving a space between the bottom of the recess and the inner end of the sleeve, the wheel-hub mounted on the tubular extension, and a shaft keyed to the hub and projecting through said extension, and having a bearing in the sleeve, substantially as described, whereby the sleeve may be replaced without necessitating the removal of the wheel from its bearing, substantially as set forth.

4. In a wind-engine, the combination of the wheel-supporting casting having a tubular spindle projecting laterally therefrom, the wheel mounted thereon, and having the spindle projecting about an equal distance on each side of the plane of the wheel, the two series of radial lubricating-boxes, one series being located on one side of the plane of the wheel, the other series on the other side of the plane of the wheel, the boxes of one series alternating with the boxes of the other series, the wheel-shaft keyed to the outer end of the wheel-hub, passing through the spindle and lubricated by said boxes, that portion of the shaft on each side of the plane of the wheel being lubricated by its respective set of boxes, substantially as set forth.

5. In a wind-engine, the combination of the tower, the movable bearing located at its upper end, the wheel-supporting casting having a depending shank mounted in the bearing and adjustable to and from a perpendicular line, carrying the bearing with it, without any binding, and the centering device, substantially as and for the purpose described.

6. The combination of the tower, the apertured cap uniting its upper ends, the casting having a shank depending therefrom, and a collar mounted on the shank, forming a bearing therefor and seated in the aperture of the cap, the outer side of the collar being formed on the arc of a circle, whereby a firm bearing is always maintained between it and the cap, and the shank of the casting is free to be adjusted to or from a perpendicular line without any binding thereof in the collar.

7. The combination of the vane and wheel-supporting castings, each provided with tubular shank-extensions, the one mounted within

the other, the inner one being the longer, and a reducing-collar secured to the lower end of the inner tubular shank, and having its enlarged end embracing the lower end of the outer shank and forming a rest therefor, whereby longitudinal and lateral movement of the shanks relative to each other is prevented, and the one free to revolve independently of the other, substantially as described.

8. The combination of the vane and wheel castings having tubular shanks, the one journaled within the other, an arm projecting from the wheel-casting, a weighted lever pivoted thereon, a link connecting the lever with the vane-casting, a weighted collar adjustably secured on the lever, a pulley located above the casting-shanks, nearly in line with their bore, and a cord connected at one end with the adjustable weighted collar and movable to and from the fulcrum of said weighted lever simultaneously with the adjustment of the weighted collar proportionately to the pressure and velocity of the wind, for the purposes set forth, and having the other end passed over said pulley and down through the inner tubular shank, substantially as described.

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

GEORGE M. BEARD.

Witnesses:

HENRY J. SHAFER,

W. H. RAKESTRAW.