(No Model.)

3 Sheets—Sheet 1.

W. C. BRAMWELL.

WIND MOTOR.

No. 556,914. Patented Mar. 24, 1896.

Fig:1.

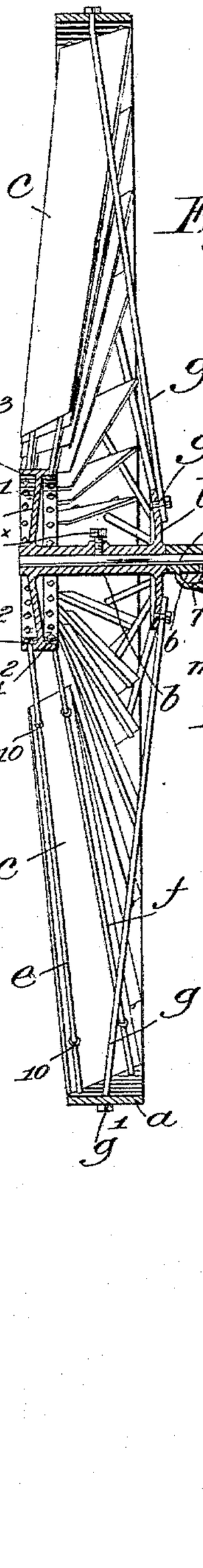


Fig:2.

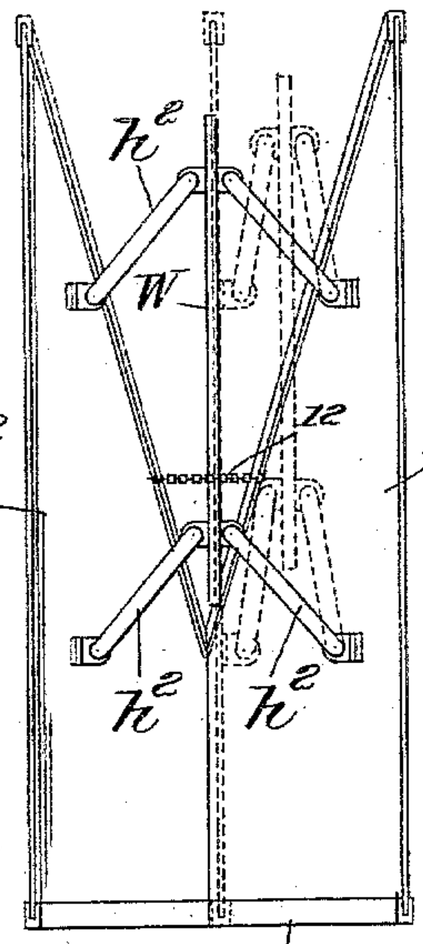


Fig:11.

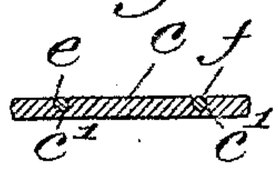


Fig:12.

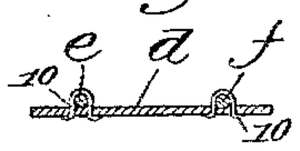


Fig:13.

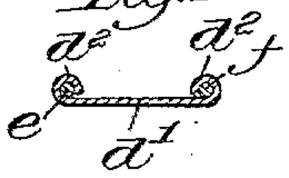
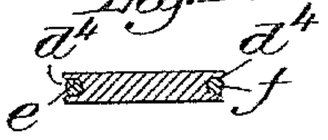


Fig:14.



Witnesses.
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(No Model.)

3 Sheets—Sheet 2.

W. C. BRAMWELL.

WIND MOTOR.

No. 556,914. Patented Mar. 24, 1896.

Fig: 3.

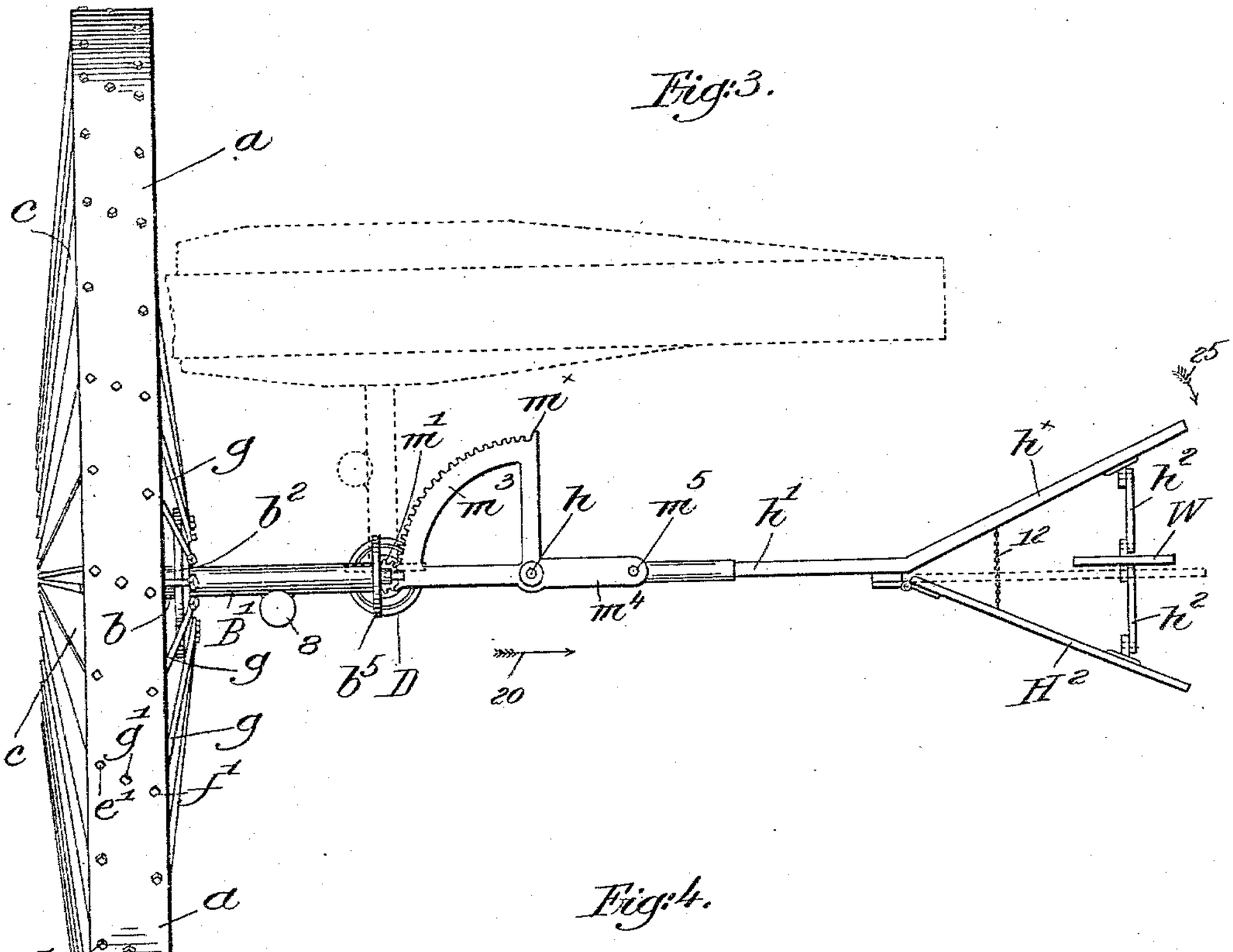

Fig: 4.

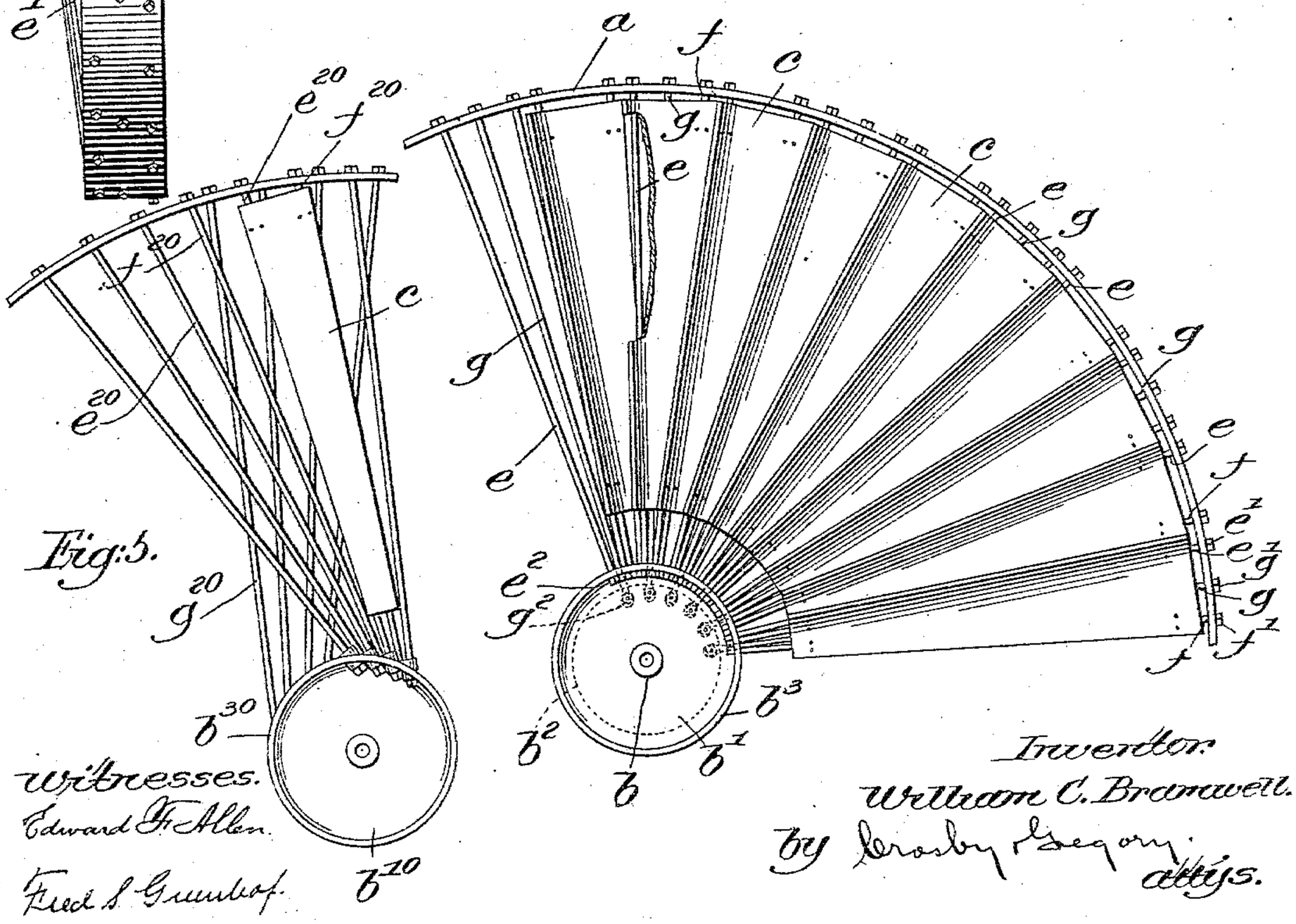

Fig: 5.

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(No Model.) 3 Sheets—Sheet 3

W. C. BRAMWELL.

WIND MOTOR.

No. 556,914 Patented Mar. 24, 1896.

Fig: 6.

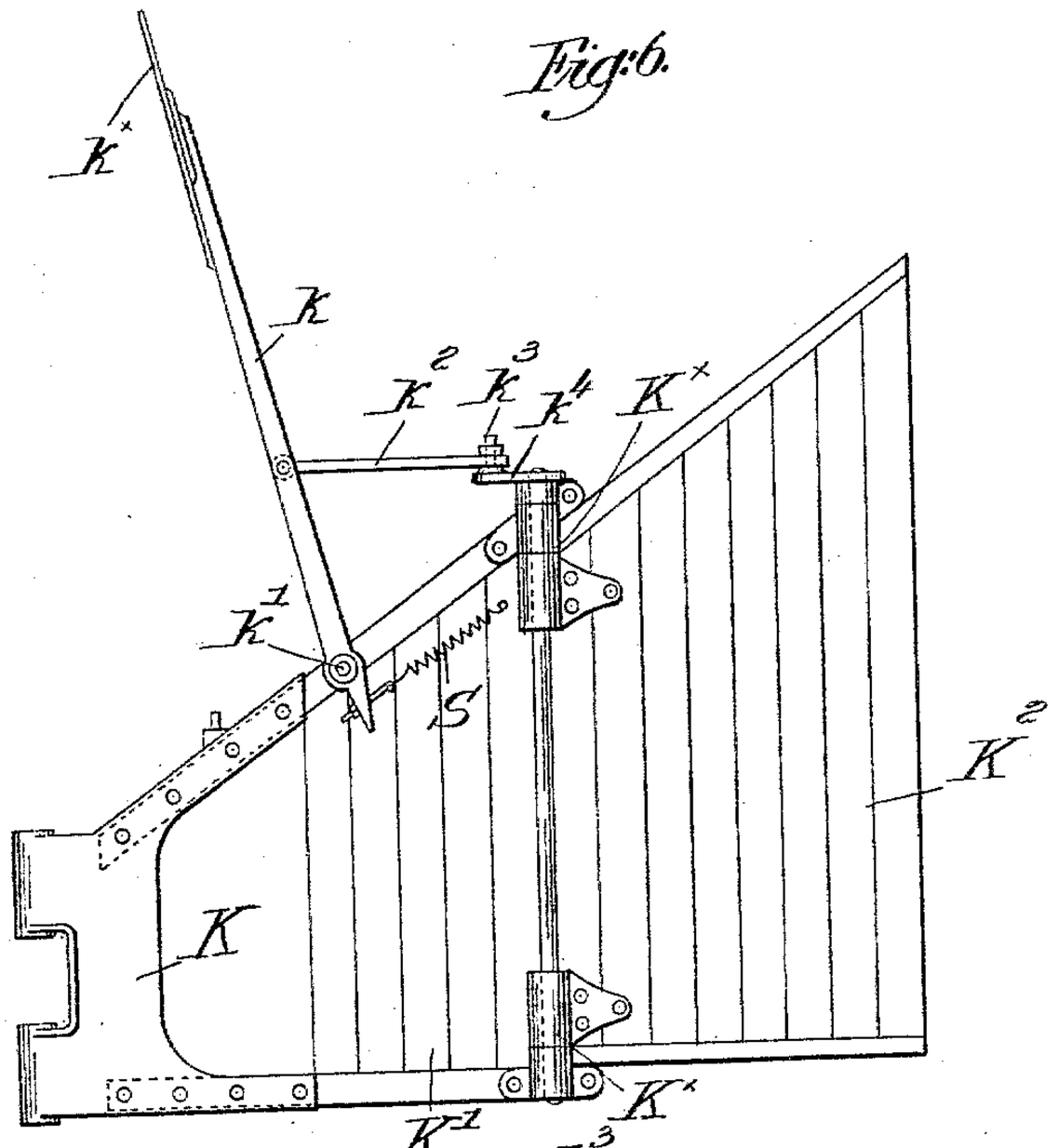


Fig: 7.

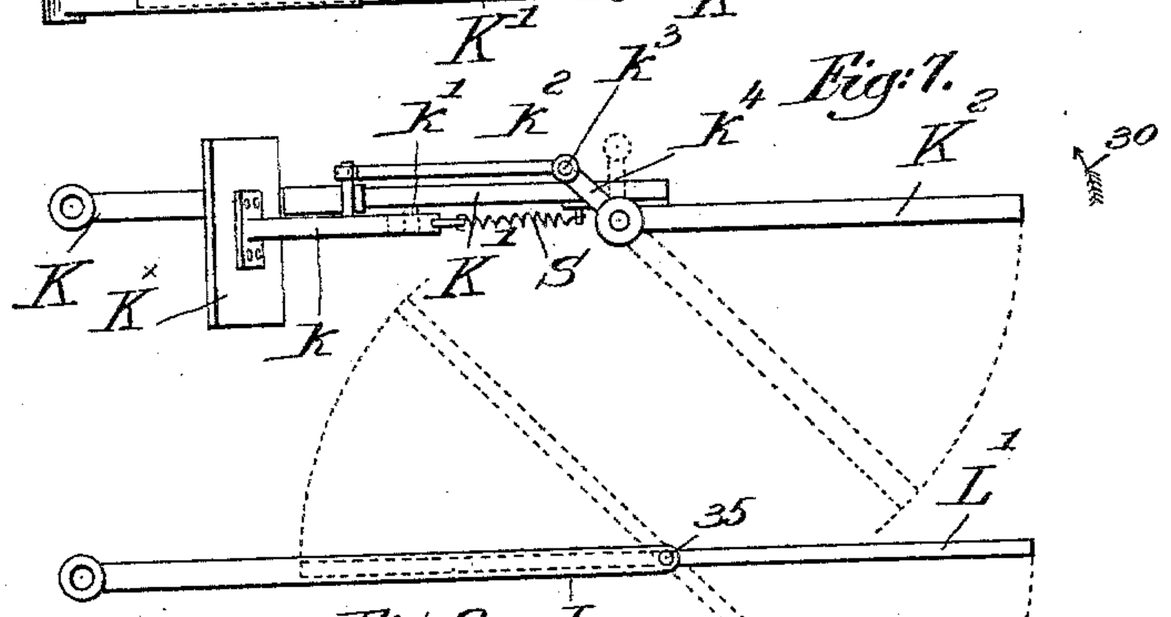


Fig: 8.

Fig: 10.

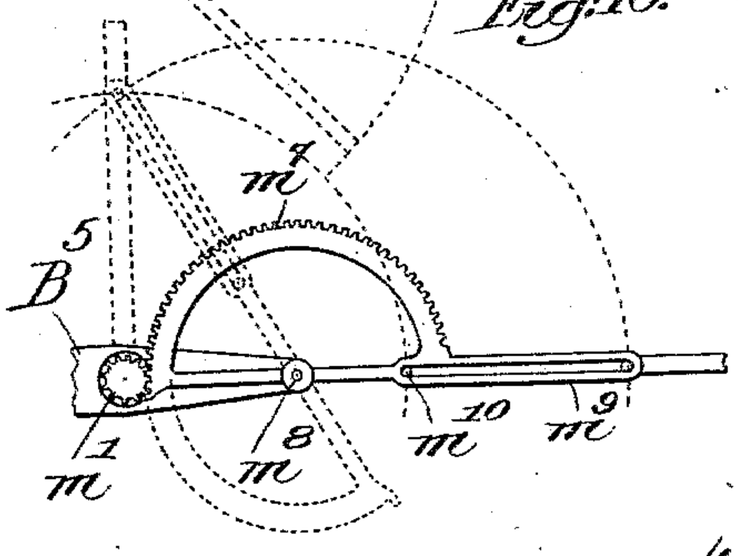
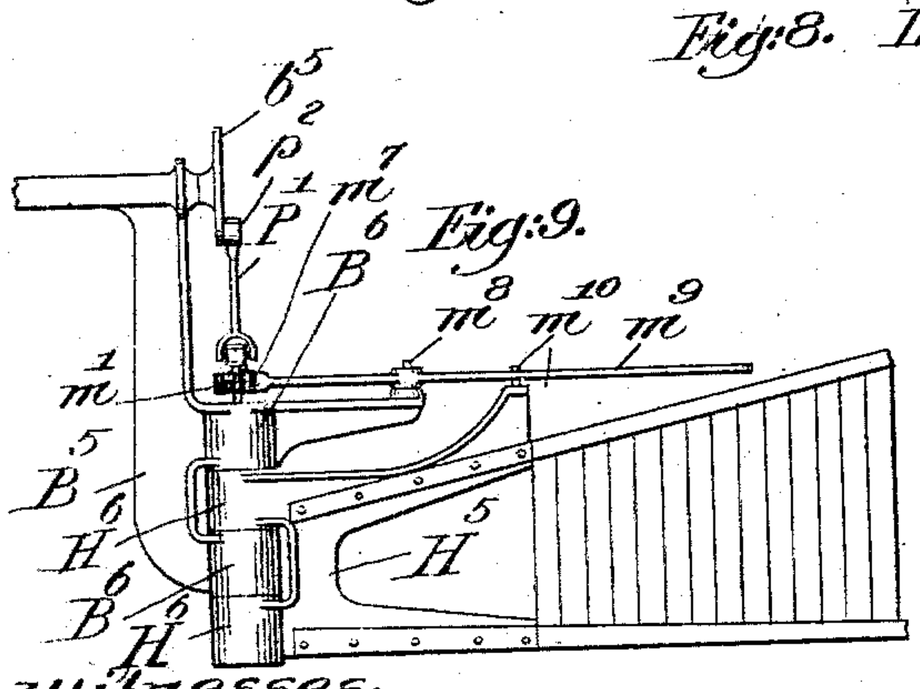


Fig: 9.



Witnesses.
Edward G. Allen.
Fred'k Gunlof.

Inventor:
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UNITED STATES PATENT OFFICE.

WILLIAM C. BRAMWELL, OF HYDE PARK, MASSACHUSETTS.

WIND-MOTOR.

SPECIFICATION forming part of Letters Patent No. 556,914, dated March 24, 1896.

Application filed October 7, 1895. Serial No. 564,902. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. BRAMWELL, of Hyde Park, county of Norfolk, State of Massachusetts, have invented an Improvement in Wind-Motors, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object the production of means for pumping water by the action of the wind upon the blades or sails of a wind-wheel in a simple and efficient manner.

The wind-wheel to be hereinafter described is so light that it will rotate and perform useful work in the lightest breezes, while possessing strength sufficient to withstand the severest hurricane, the construction of the wheel being such that it can be shipped in pieces and quickly put together, and when so put together is entirely self-contained, whereby it can be applied to or removed intact from its shaft. The wheel-rim is made light and thin, depending upon compression for its strength, the spokes connecting the rim and hub being mere wires under high tensional strain and giving great rigidity to the wheel.

I have provided simple mechanism for conveniently starting and stopping the wheel from at or near the ground by means of the pump-rod, and the speed of the wheel in high winds is governed automatically by devices attached to the rudder and acting when a predetermined pressure of the wind on said rudder is exceeded, as will be hereinafter described in the specification and particularly pointed out in the claims.

Figure 1 in elevation and partially in section represents a wind-wheel and rudder embodying one form of my invention, the wheel being shown at right angles to the spectator and with the supporting-standard and pump-rod broken out to save space. Fig. 2 is an end view of the rudder, looking toward the left, Fig. 1. Fig. 3 is a top or plan view of the mechanism shown in Fig. 1 and illustrating one form of mechanism for turning the rudder relative to the plane of the wheel. Fig. 4 is a partial front elevation of the wind-wheel. Fig. 5 is a similar view showing a modified form of wheel. Fig. 6 is a side elevation of a modified form of rudder and governor therefor. Fig. 7 is a top or plan view thereof. Fig. 8 is a plan view of yet another modification of the rudder. Fig. 9 in elevation represents a modified form of attachment for the rudder and the connections between it and the wind-wheel. Fig. 10 is a top or plan view thereof; and Figs. 11, 12, 13, and 14 are cross-sectional views of various forms of wind-blades, showing the mode of attaching them to the spokes of the wheel.

Referring to Figs. 1, 3 and 4, the wheel comprises a rim a of comparatively thin metal of suitable breadth, a hub b, and spokes c, the rim having drilled therein a row of holes near each edge, the holes in one row being set forward of the holes in the other row a distance depending upon the angle of the blades. The hub b is preferably made of cast metal, having annular disks b' and b^2 at its front and rear end, respectively, the disk b' having a laterally-extended peripheral flange b^3, in which two rows of holes are drilled corresponding to the holes in the wheel-rim a. A series of rods or wires e under tension pass through the outer rows of holes on the rim a and disk-like flange b^3 and retained in place under tension by suitable nuts e' and e^2, while a second series of similar rods or wires f pass through the inner rows of holes in rim and flange and are retained by nuts f' and f^2, and owing to the staggered arrangement of the holes in the two rows the pairs of tension members determine the angle of the blades. The disk b^2 has a row of holes therein, and a central row is made in the wheel-rim a to receive tension members g, retained in place by nuts g' and bolts g^2, as clearly shown in Figs. 1 and 4, and by means of the nuts on the threaded tension members e, f and g the latter can be stretched very tightly to bring the rim rigid and true with the hub.

As will be seen in Figs. 1 and 3, the hub b is longer than the width of the rim a, and when the spokes e and f are under proper tension relative to the lateral braces g the rim is brought substantially into a plane equidistant from the hub ends.

In principle a wheel thus constructed is a large bicycle-wheel with a flat rim, possessing the same advantages of extreme lightness and

strength, the differences in details of construction adapting it for use as a wind-wheel. As the flange b^3 is narrower than the rim a the inner ends of the tension members e and f converge, and to pairs of said members the wind-blades are attached, said members thus serving a double purpose.

The wires g at the back of the wheel are tension-braces and may be wider apart than the member e and f.

The blades may be made of wood, metal, papier-maché, leatheroid, or other suitable material, and they may be attached to their supporting members in various ways.

In Fig. 11 I have shown in cross-section a non-metallic blade c, provided on one face with grooves c' parallel to its longitudinal edges, which latter converge toward its inner end at an angle corresponding to the angle between the two wires e and f of any pair, and by pressing the blade against the wires to embed them in the grooves and then moving the blade longitudinally toward the wheel center it becomes wedged in place and can be retained by a staple or other device.

In Figs. 1 and 4 and in Fig. 12 the blade d is shown as held to the two tension members by small staples 10, passed through the blade and clinched or bent over its face, and in Fig. 13 a sheet-metal blade d' is shown with its longitudinal edges d^2 bent around the tension members.

Yet another modification of blade is shown at d^3, Fig. 14, wherein the longitudinal edges are grooved at d^4 to receive the tension members, the shape of the blades, whatever the manner of attaching them to the tension members, being shown in Figs. 1 and 4.

The complete wheel is fixed by a suitable set-screw $b^\times$, Fig. 1, upon a spindle or shaft b^4 rotatable in a bearing B′ in a bracket-like casting B, said spindle or shaft having fast on its inner end a crank or disk b^5, to which the pump-rod is connected, as will be described. The casting B has a vertical hub B^2 provided with raceways to receive balls b^6, held in place by flanges 15 and 16 on the upper end of a hollow supporting-standard D, forming an extended and antifriction-bearing for the bracket B and the weight carried thereby, and renders the rudder very sensitive. In the bearing B′ is formed an oil-reservoir 6, and a wick 7 feeds the oil to the shaft b^4, oil being introduced into the reservoir by means of an oil-cup 8.

The pump-rod P passes through the hollow standard D and above the top of the latter has a loose sleeve p held in place by collars 2 2 on the rod and connected pivotally to the forked end p' of a pitman P′ pivoted at its upper end to the crank-disk b^5 at p^2, whereby the pump-rod may be freely rotated while being securely connected to the pitman P′.

A rudder-casting H is hinged to the casting B by a pintle h, and the arms h' of the rudder are bolted to the casting H, said arms being grooved to receive thin boards, forming the rudder H′. The arms h' are bent at $h^\times$ toward their outer ends, (see Fig. 3,) and a wing H^2 is pivoted to them or to the face of the main rudder H′, said wing being normally extended at an opposite and equal angle to the main rudder.

Referring to Fig. 2, a flat or other suitable weight W is suspended by toggle-arms h^2 between the rudder H′ and the wing H^2, said toggle-arms being pivotally connected at their outer ends thereto, the weight W normally tending to separate the wing from the rudder as far as permitted by a chain or other flexible limiting device 12.

Should the force of the wind increase sufficiently to press the wing inward, thereby overcoming the weight W, the said wing would collapse more or less nearly to the dotted-line position, Fig. 3, thereby destroying the equilibrium of the rudder. The wind coming in the direction of arrow 20, Fig. 3. the rudder will be turned more or less in the direction of arrow 25, Fig. 3, according to the amount of inward movement of the wing H^2, the wind-pressure acting against the outer face of the bent portion of the rudder. When the rudder is thus turned on the standard D the wheel is turned out of the wind a distance proportional to the pressure and velocity of the wind above a predetermined amount, determined by the weight W, so that excessive wheel velocity, shocks, jars, &c., will be prevented, the wing acting in conjunction with the rudder as a speed-governor, and only operating when necessary.

A modified form of rudder and governor is shown in Figs. 6 and 7, wherein the rudder-casting K has rigidly attached thereto the rudder K′, to the outer end of which the wing K^2 is hinged $K^\times$, and normally kept in parallelism with the rudder.

When it is necessary to counteract high velocity and wind-pressure, the wing is turned more or less nearly into dotted-line position, Fig. 7, whereby the rudder will be turned in the direction of arrow 30. A lever k, pivoted at k' to the rudder K′, has a plate $k^\times$ secured to its upper end transversely to the length of the rudder, the lower end of the lever being attached to one end of a spring S, the other end of which is attached to the rudder to normally maintain the lever in the position shown in Fig. 6, though obviously a weight on the end of the lever would subserve the same purpose. A link k^2, pivoted at one end to the lever k, is pivoted at its other end to an upright pin k^3 on a bent arm k^4 rigidly connected to the wing K^2.

When the pressure and velocity of the wind exceed a predetermined amount it acts on the plate $k^\times$ at nearly a right angle thereto, forces the lever back against the spring S, and through the link k^2 opens the wing K^2, so that practically the rudder is bent, and the wind-pressure acting upon said wing will

turn the rudder in direction of arrow 30 to throw the wheel out of the wind.

In the modification shown in Fig. 8 the wing L′ is hinged at or near its center at 35 to the outer end of the rudder L and by the same actuating mechanism (shown in Figs. 6 and 7) is swung into dotted-line position (shown in Fig. 8) by the abnormal wind-pressure.

Obviously weights or springs may be used to balance a corresponding wind-pressue in any of the rudders shown, and other counter-balancing devices might be employed without departing from the spirit of my invention.

I have herein utilized the pump-rod, which may of necessity extend to or near the ground, to start and stop the wind-motor without necessitating a climb to the top of the tower or building.

At the top of the standard D a bearing 40 is fixed and through it is passed the depending hub m of a gear-wheel m', a collar m^2 on the lower end of the hub retaining it in the bearing. The hub has a square or other than round hole through it, through which is extended the pump-rod P having a corresponding cross-section, so that rotation of the rod will turn the hub and gear m', the rod being free to be reciprocated. A segment-gear m^3 in mesh with the gear m' is pivoted on the pintle h of the rudder, Fig. 3, and has an extended arm m^4 provided with a hole or slot to receive a pin m^5 secured to the rudder, so that rotation of the gear m' by means of the pump-rod P will cause the segment-gear m^3 to be turned, thereby swinging the rudder on its pintle relative to the plane of the wind-wheel.

In Fig. 3 the position of the wheel relative to the rudder is shown by dotted lines when the rudder is thus turned to its full extent.

At the lower end of the pump-rod I have shown in Fig. 1 a standard D^2 rotatably supporting a controlling hand-wheel D^3 having a squared hole, through which a squared portion of the pump-rod passes and can be reciprocated, rotation of the wheel turning the rod to turn the gear m' and thereby the rudder to start or stop the wheel.

Other devices may of course be used for effecting the rotative movement of the pump-rod.

A long tooth $m^\times$ at each end of the segment-gear m^3 serves as a stop to prevent disengagement with the gear m'.

Much cumbersome and heavy mechanism is dispensed with, and a convenient and ready means of starting and stopping the wheel is provided.

In Figs. 9 and 10 a slightly-modified construction is shown wherein the wheel-supporting bracket B^5 has hubs B^6 to embrace the top of the standard, and the rudder-casting H^5 is also provided with hubs H^6, which also embrace the standard, the gear m' rotatable by the pump-rod engaging a semicircular gear m^7 journaled at m^8 on an arm of the bracket B^5 and provided with a longitudinally-slotted arm m^9, which engages a pin m^{10} on the rudder, and in Fig. 10 the dotted lines show the position of the rudder and the gear when turned to stop the wheel.

My improved wind-motor is not restricted to pumping purposes, as by countersinking the outer ends of the tension members e and f and the braces g the rim a may be used as a pulley for driving a belt to transmit power to any desired piece of apparatus.

Other means may be employed for attaching the wind-blades to the tension members, and the tension of the said members may be regulated by turnbuckles or other devices, and said tension members may be arranged tangentially to the hub, as shown in Fig. 5.

The members e^{20} and f^{20} shown are connected to the flange b^{30} of the hub-disk b^{10} tangentially, and the braces g^{20} are also tangentially connected to the hub, crossing the other blade-supporting members, as shown in Fig. 5.

Wherever the word "tension" is herein used it implies a powerful longitudinal strain, drawing the hub and rim of the wheel together with great force, sufficient to withstand the pressure of gales and hurricanes against the face of the wind-wheel, whereas with mere tightness the wheel would be dismembered.

Although the wheel herein thus described is less than one-twentieth the weight of any wheel now known to me it cannot be blown to pieces.

In the wheel embodying my invention the wires form the chief structural feature of the wheel, holding the rim and hub together while said wires are under tension, and also serving in addition to support the wind-blades.

The governing devices controlling the rudders herein are not affected by the wind until its force or pressure becomes greater than desired, whereupon they act to prevent undue wheel velocity.

An ordinary "side vane" or rudder as heretofore used acts constantly, and does not permit the wheel to steadily face the wind even when the latter is light, and hence is not a governor in the use of the term as herein employed.

I claim—

1. A wind-wheel comprising a rim, an elongated hub, a double series of tension members fixed at their outer ends to the rim and at their inner ends to one end of the hub, means to apply tensile strain to said tension members, and brace members under tension connecting the rim and the other end of the hub, the double series of tension members supporting wind-blades at an angle to the plane of the wheel, substantially as described.

2. A wind-wheel comprising a rim, an elongated hub having disks at or near its ends, tension spokes or wires connected at their

inner ends to one of said disks and at their outer ends to the rim, to form a double series, means to apply tensile force to said wires or spokes, and wind-blades secured to the latter, each pair supporting a blade at an angle to the plane of the wheel, substantially as described.

3. A rudder for wind-wheels, comprising a main rudder, a wing pivotally connected thereto and adapted to be swung toward or from the main rudder, and a governor to control the angular position of the wing relative to the rudder, said governor being actuated by wind-pressure above a predetermined amount, substantially as described.

4. A rudder for wind-wheels, comprising a main rudder, a wing pivotally connected thereto, means to normally maintain the said wing at a given angle relative to the main rudder, and a governor actuated by the pressure of the wind above a predetermined amount, to vary the angle of the wing to the main rudder, substantially as described.

5. In a wind-motor, a wind-wheel, a main rudder connected thereto, and relatively fixed to move the wheel relatively to the direction of the wind, a pivotally-mounted wing or auxiliary rudder, and a governor controlled by excessive wind-pressure, to swing the wing at an angle to the main rudder, whereby the latter will be deflected to turn the wheel proportionally out of the wind, substantially as described.

6. A rudder for wind-wheels, comprising a main rudder, a wing pivotally connected thereto and adapted to be swung toward or away from it laterally, means to normally hold said wing fixed relatively to the main rudder, a blade pivotally supported on the latter and at right angles thereto, and connections between said blade and wing, whereby when the wind-pressure upon the blade overcomes the resistance of the holding means said blade and wing will be turned, to change the angle between the wing and main rudder, substantially as described.

7. In a wind-motor, the wind-wheel, its rudder, a governor for the rudder, operated by excess of wind-pressure above a predetermined amount, to automatically turn the wheel out of the wind proportionally to the excess of pressure thereof, and means to return the parts to normal position when the wind-pressure falls to or below said predetermined amount, substantially as described.

8. A wind-wheel, a rudder hinged thereto, a reciprocating rod driven by the wheel and rotatable about its longitudinal axis, and connections between the rod and the rudder, whereby rotation of the rod will vary the angle of the rudder relative to the plane of the wind-wheel, substantially as described.

9. A wind-wheel, a rudder hinged thereto, a rod longitudinally reciprocated by rotation of the wheel, and rotatable on its longitudinal axis, a gear adapted to be rotated by said rod, and an intermediate gear connected to the rudder and in mesh with the rotatable gear, whereby the angle of the rudder may be changed by rotation of the reciprocable rod, substantially as described.

10. A hollow supporting-standard, a casting rotatably mounted thereon, a wind-wheel mounted on said casting, and a rudder hinged thereto, combined with a rotatable and reciprocable pump-rod extended through the standard and reciprocated by the wind-wheel, and means intermediate said rod and rudder, to turn the latter upon its support by rotation of the rod, substantially as described.

11. A hollow supporting-standard, a casting mounted to swing laterally thereon, a wind-wheel carried by the casting, and its shaft and crank-pin, a rudder, its casting also mounted on the standard, a rotatable rod extended through the standard and connected to said crank-pin, to be reciprocated thereby, connections between the two castings, including a gear through which the rod reciprocates and which is rotatable therewith, and means to rotate the rod and gear to change the angle between the two castings, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM C. BRAMWELL.

Witnesses:

JOHN C. EDWARDS,

AUGUSTA E. DEAN.