

No. 612,720.

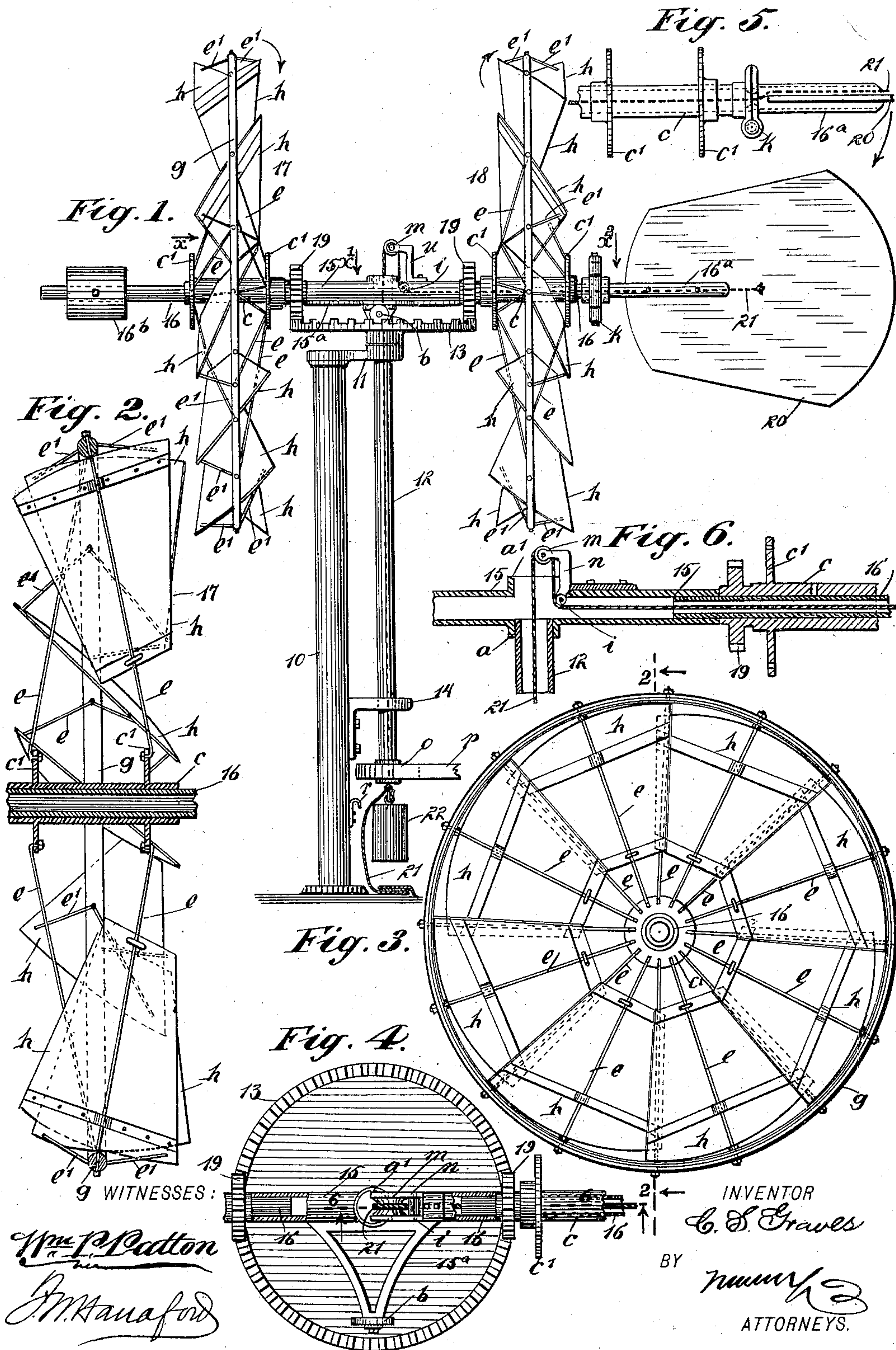
Patented Oct. 18, 1898.

C. S. GRAVES.
WIND WHEEL APPARATUS.

(Application filed Nov. 1, 1897.)

(No Model.)

2 Sheets—Sheet I.



No. 612,720.

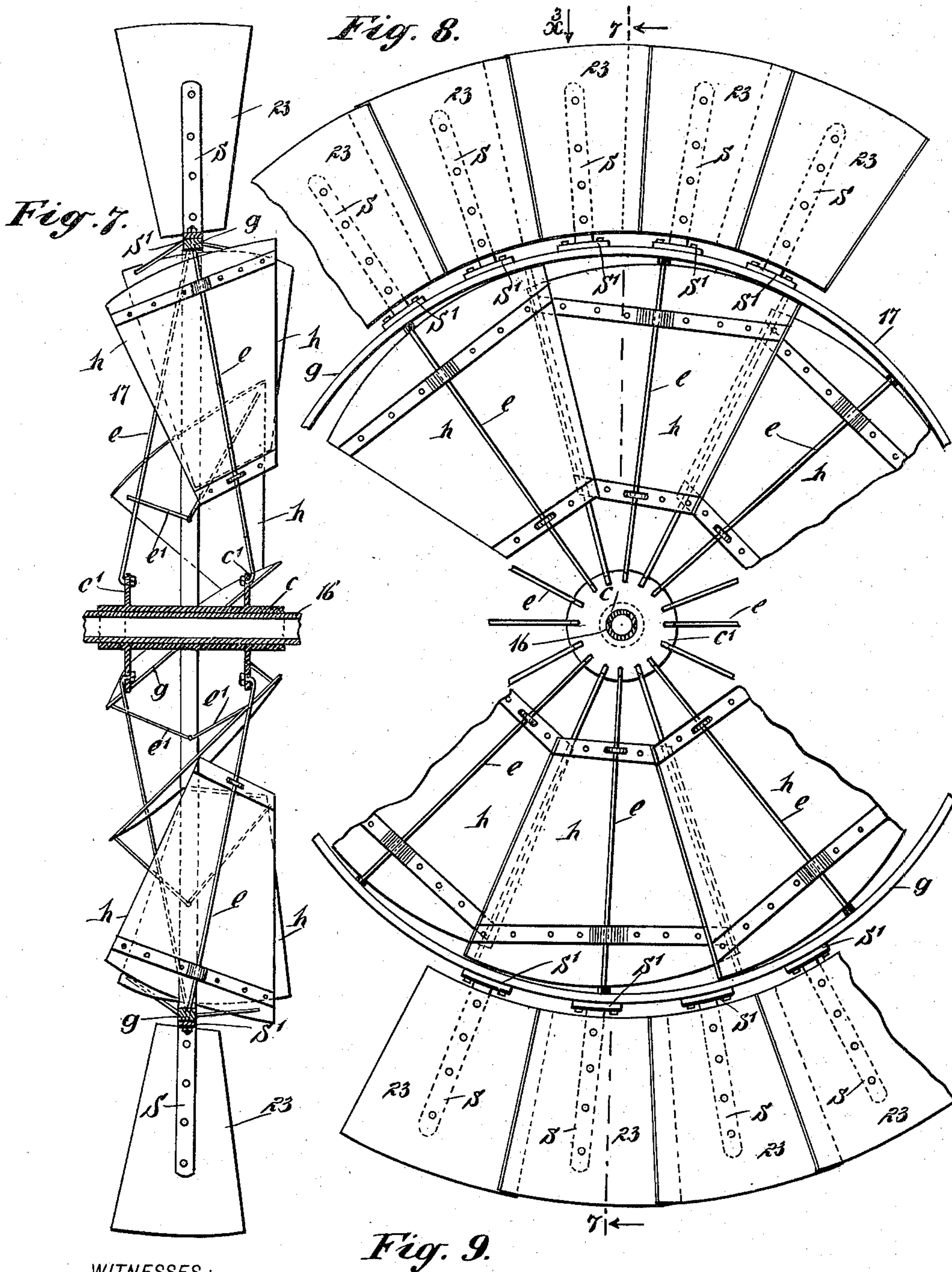
Patented Oct. 18, 1898.

C. S. GRAVES.
WIND WHEEL APPARATUS.

(Application filed Nov. 1, 1897.)

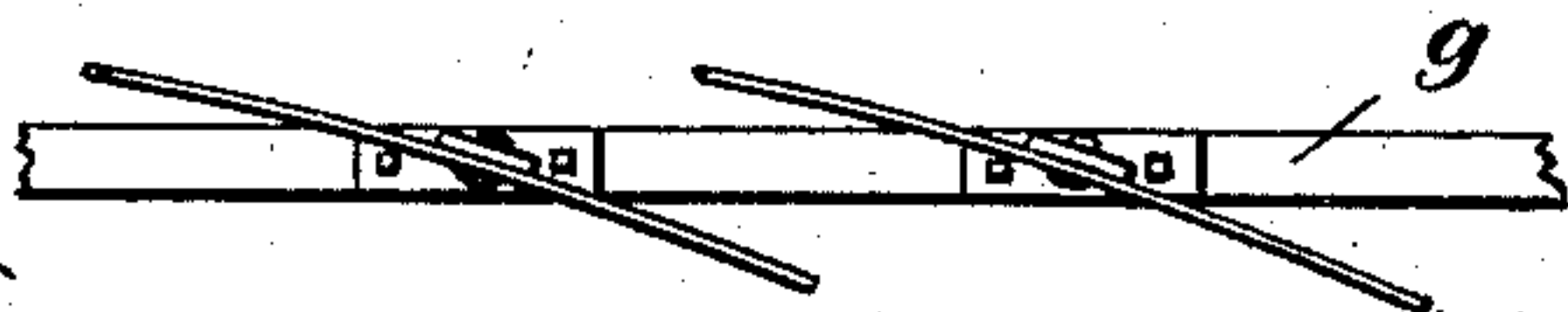
(No Model.)

2 Sheets—Sheet 2.



WITNESSES:

Wm. P. Patton
J. M. Sanford



INVENTOR

C. S. Graves.

BY

Mumford
ATTORNEYS.

UNITED STATES PATENT OFFICE.

CASSIUS S. GRAVES, OF BAD AXE, MICHIGAN.

WIND-WHEEL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 612,720, dated October 18, 1898.

Application filed November 1, 1897. Serial No. 657,077. (No model.)

To all whom it may concern:

Be it known that I, CASSIUS S. GRAVES, of Bad Axe, in the county of Huron and State of Michigan, have invented a new and Improved Wind-Wheel Apparatus, of which the following is a full, clear, and exact description.

This invention relates to wind-driven wheels and attachments used for generation of power and motion, and particularly to a class of such motors wherein a vertical wheel and means to automatically hold the blades of the wheel facing a wind-current is employed.

The object of my invention is to provide a wind-actuated apparatus of the indicated type which embodies novel features of construction that adapt said mechanism for production at a low cost for easy control and render it very effective in operation.

The invention consists in the novel construction and combination of parts, as is hereinafter described, and defined in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the improved wind-motor. Fig. 2 is an enlarged transverse sectional view substantially on the line 2 2 in Fig. 3. Fig. 3 is a detached front elevation of the wind-wheel, seen in the direction of arrow x in Fig. 1. Fig. 4 is a detached plan view of novel details of construction, seen in direction of arrow x' in Fig. 1. Fig. 5 is a detached plan view of other novel features, seen in direction of arrow x'' in Fig. 1. Fig. 6 is an enlarged sectional side view of parts, taken substantially on the line 6 6 in Fig. 4. Fig. 7 is an enlarged transverse sectional view of a wind-wheel, showing other features of the improvement, taken essentially on the line 7 7 in Fig. 8. Fig. 8 is a fragmentary front view of said wind-wheel, and Fig. 9 is a fragmentary plan view of details seen in the direction of arrow x^3 in Fig. 8.

In the drawings, 10 indicates an upright mast used for the support of the working parts of the apparatus. At the upper end of the mast 10 a bracket-arm 11 projects laterally therefrom and is secured in place by any suitable means. The outer end of the arm 11

is vertically perforated for the loose reception of the tubular driven shaft 12. On the end of the shaft 12 that projects above the arm 11 a crown-gear 13 of considerable diameter is affixed, the true faces of the hubs on the gear and arm having contact. The lower portion of the shaft 12 is supported free to revolve by the bracket-arm 14, which extends outwardly from the mast 10, as shown in Fig. 1.

On the portion of the tubular driven shaft 12 which extends above the crown-gear 13 a hollow cross-head 15 is loosely mounted, which head, as clearly shown in Figs. 1, 4, and 6, consists of a cylindrical box having at its longitudinal center two opposite branches a a' , the lower branch a receiving the end of the driven shaft and upon which the cross-head is supported to rotate. At one side of the cross-head 15 an arm 15^a projects above the top face of the crown-gear 13, and on the outer end of said arm a roller b is pivoted, thereby disposing a portion of the weight of the shaft 12 upon the crown-gear 13.

In the ends of the cross-head 15 the ends of two hollow journal-shafts 16 are introduced and secured, and upon the body portions of the journal-shafts the elongated hollow hubs c of the wind-wheels 17 18 are loosely mounted. Integral with or secured upon the hubs c are pinions 19, so supported that their teeth will loosely engage with the teeth of the crown-gear 13.

Preferably the wind-wheels 17 18, which occupy parallel vertical planes, as shown in Fig. 1, have the same diameter, and each wheel is provided with a like number of blades, which on the front wheel 17 are held spaced apart and diagonally inclined in one direction with regard to the axis of the hub c and on the rear wheel 18 are inclined in an opposite direction with regard to said axis.

The preferred means for affixing the blades on the hubs c is shown clearly in Figs. 1, 2, 3, and 7 and consists of the following details of construction.

On each hub c two suitably-spaced circumferential flanges c' are formed or affixed, and from each of these flanges a series of spaced main brace-bars e of equal length project radially. A frame-ring g is provided for each wind-wheel 17 18, the rings being preferably of equal diameter, and said rings may

be cylindric or rectangular in cross-section, as respectively indicated in Figs. 2 and 7.

The main brace-bars *e* for each wind-wheel are secured in or upon the frame-ring *g* therefor, preferably by nuts secured upon the outer ends of the brace-bars, and thus stably connect the frame-ring with the hub-flanges *c'*.

On each of the brace-bars *e*, which have their lower ends secured to the innermost flange *c'* of each hub *c*, a fan-blade *h* is attached, preferably near the transverse center of said blades, and other brace-rods *e'* extend from the outer corners of the fan-blades to a respective frame-ring *g*, to which the outer ends of said rods are attached, whereby the blades *h* are held inclined at like angles.

It will be seen that by the described construction and arrangement of parts the wheels 17 18 are adapted for rotation in opposite directions by a wind-current blowing in the direction of the arrow *x* in Fig. 1, the trend of said wheels being indicated by the curved arrows in Fig. 1.

On the rear end of the rearwardly-extending journal-shaft 16 a hollow bar 16^a is hinged, as shown at *k* in Figs. 1 and 5, said bar being slotted for the reception of the vane 20, secured thereto by bolts or other means.

A flexible connection 21 is attached by one end to the vane 20 near its center, and thence is drawn through the hollow bar 16^a, journal-shaft 16, and cross-head 15 to have engagement with a transversely-journaled roller *i* in said cross-head adjacent to the upright driving-shaft. The flexible connection 21 trends upwardly from the roller *i* and around another roller *m*, pivoted upon a bracket-arm *n*, that is affixed to the upper side of the cross-head 15. From the roller *m* the flexible connection is extended downwardly through the cross-head 15 and driven shaft 12 to have a hooked engagement with a weight-block 22.

It will be seen that the hinge *k* has its leaves perforated for the free reciprocation of the wire rope or other flexible connection 21 therethrough and that from the disposition of the hinge-joint the vane 20 may swing laterally in the direction of the curved arrow in Fig. 5, in which figure a portion of said blade is shown.

The forwardly-projecting journal-shaft 16, whereon the wind-wheel 17 is rotatable, extends at the front of said wind-wheel sufficiently for the reception of an adjustable gravity-block 16^b, designed to counterbalance the weight of the vane 20, and thus facilitate the free action of the wind-power machine.

In operation if the weight-block 22 is hung upon the flexible connection 21 the gravity of said weight will serve to pull the vane 20 into alinement with the journal-shafts 16 and the intermediate cross-head 15, which will adapt said vane to move the wind-wheels 17 18 so as to face them to a wind-current. When the wind rotates the wheels 17 18 in direction of the curved arrows in Fig. 1, the pinions

19 are similarly rotated, and these in turn actuate the crown-wheel 13 and driven shaft 12, thus affording rotary motion and power, which may be transmitted through the pulley *o* on the shaft 12 and belt *p* on said pulley to any desired point by an extension of the belt.

If the force of the wind is too great and the wheels 17 18 are driven at a higher speed than is desirable, the weight-block 22 may be removed and the flexible connection 21 be slackened so as to allow the vane 20 to swing a proper degree on the hinge-joint *k*, the wire rope 21 being then secured upon a hook *r* or other projection on the mast 10. This adjustment of the vane 20 will permit the force of the wind-current to move the wind-wheels 17 18 so that they do not directly face the wind, and consequently the rapidity of rotary motion had by said wind-wheels is reduced and may be completely arrested by the means indicated.

In Figs. 7, 8, and 9 there is shown an important feature of this improvement, consisting in the provision of a series of attachable fan-blades 23. The blades 23 have each an arm *S*, whereon is a foot *S'*, that may be secured by screw-bolts upon the frame-ring *g*, and the several blades 23 are thus held projected from the frame-ring. A sufficient number of the supplementary fan-blades 23 is provided to fill the ring *g*, whereon they are suitably spaced apart and set diagonally across said ring at a proper angle, which is preferably that of the transverse set of the main fan-blades *h* on each wind-wheel 17 18. The supplementary fan-blades 23 afford convenient means for increasing the power of the wind-motor at times when there is but little wind blowing, and thus enable the performance of an increased amount of work, as occasion may require.

Ball-bearings may be provided for the reduction of friction between the main working parts; but as these bearings may be of any approved or suitable construction they have not been illustrated in the drawings.

It is claimed for the improved wind driving apparatus that it is very simple, inexpensive in construction, and highly efficient in service, the peculiar construction of parts permitting an erection of the motor at any desired point quickly, dispensing with the necessity of building a costly tower for support of the motor mechanism.

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

1. The combination with an upright support and a hollow driven shaft hung from said support and rotatable thereon, of a crown-wheel secured on the upper end of the driven shaft and rotatable on the support, a hollow cross-head revoluble on the upper part of the driven shaft, and provided with a lateral arm having a loose bearing on the upper side of the crown-wheel, a wind-wheel having a pin-

ion meshed with the crown-wheel and rotatable on a shaft projecting from the cross-head, a vane hinged to swing laterally on a shaft projecting from the cross-head, and a flexible connection extending from the vane through the cross-head and hollow driven shaft for control of said vane, substantially as described.

2. The combination with an upright support, a hollow driven shaft hung from and rotatable on said support, a crown-wheel secured on the hollow shaft and revoluble on the support, a hollow cross-head loosely mounted upon the driven shaft above the crown-wheel, and a lateral arm having a roller on the outer end which loosely bears on the flat top of the crown-wheel, of two hollow journal-shafts extending from the ends of the cross-head, a pair of wind-wheels rotatably mounted on the journal-shafts and having their blades pitched in opposite directions, a pinion fast on the hub of each wind-wheel and meshed with the crown-wheel, a vane hinged to swing laterally on the rear end of one journal-shaft, and a flexible connection extended to the cross-head and thence downwardly for control of the vane, substantially as described.

3. The combination with a supported upright driven shaft, and a cross-head loosely mounted thereon, of a crown gear-wheel fixed upon the driven shaft below the cross-head, a lateral arm rigidly projected from the cross-

head at one side thereof, and a roller on the outer end of the arm having loose contact with the upper face of the crown gear-wheel, substantially as described.

4. In a device of the described construction, the wind-wheel, comprising a sleeve-like hub having two spaced circumferential flanges thereon, a frame-ring held concentric with the hub by spaced main brace-rods, that extend between the hub-flanges and frame-ring, inclined fan-blades on brace-rods that extend from the same flange on the hub to the frame-ring, and other brace-rods which connect the frame-ring with upper corners of each fan-blade, substantially as described.

5. In a wind-wheel of the described construction, the combination with the frame-ring, center hub, main brace-rods, inclined fan-blades on certain of said brace-rods, and stiffening-braces extending between the fan-blades and the frame-ring, of a series of spaced radial arms having foot-flanges removably secured upon the frame-ring, and supplementary fan-blades secured on said arms to provide blade extensions for the wind-wheel, substantially as described.

CASSIUS S. GRAVES.

Witnesses:

HARRY H. SIMPSON,
J. T. HADWIN.