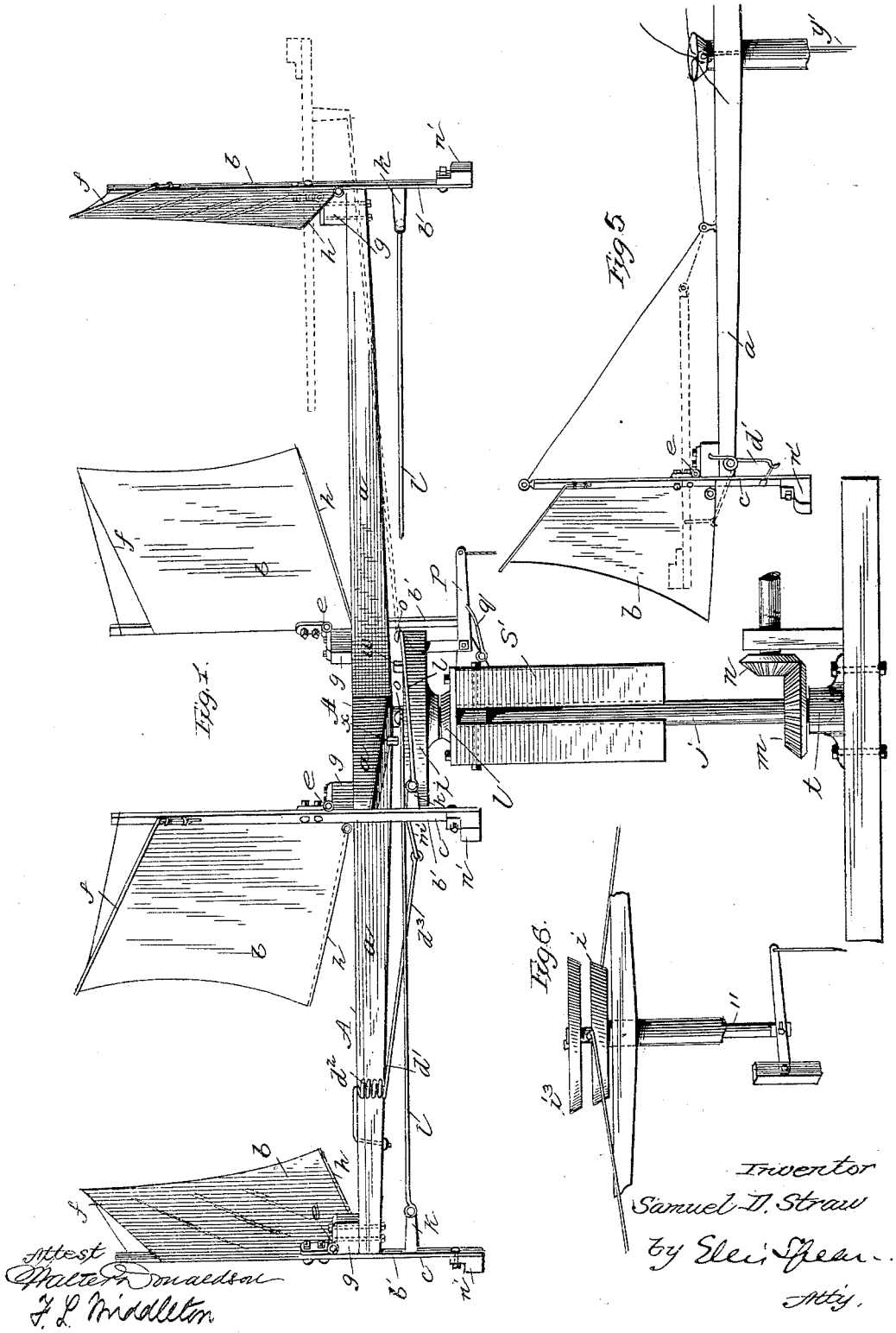
(No Model.) 3 Sheets—Sheet 1.

S. D. STRAW.

WINDMILL

No. 419,024. Patented Jan. 7, 1890.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

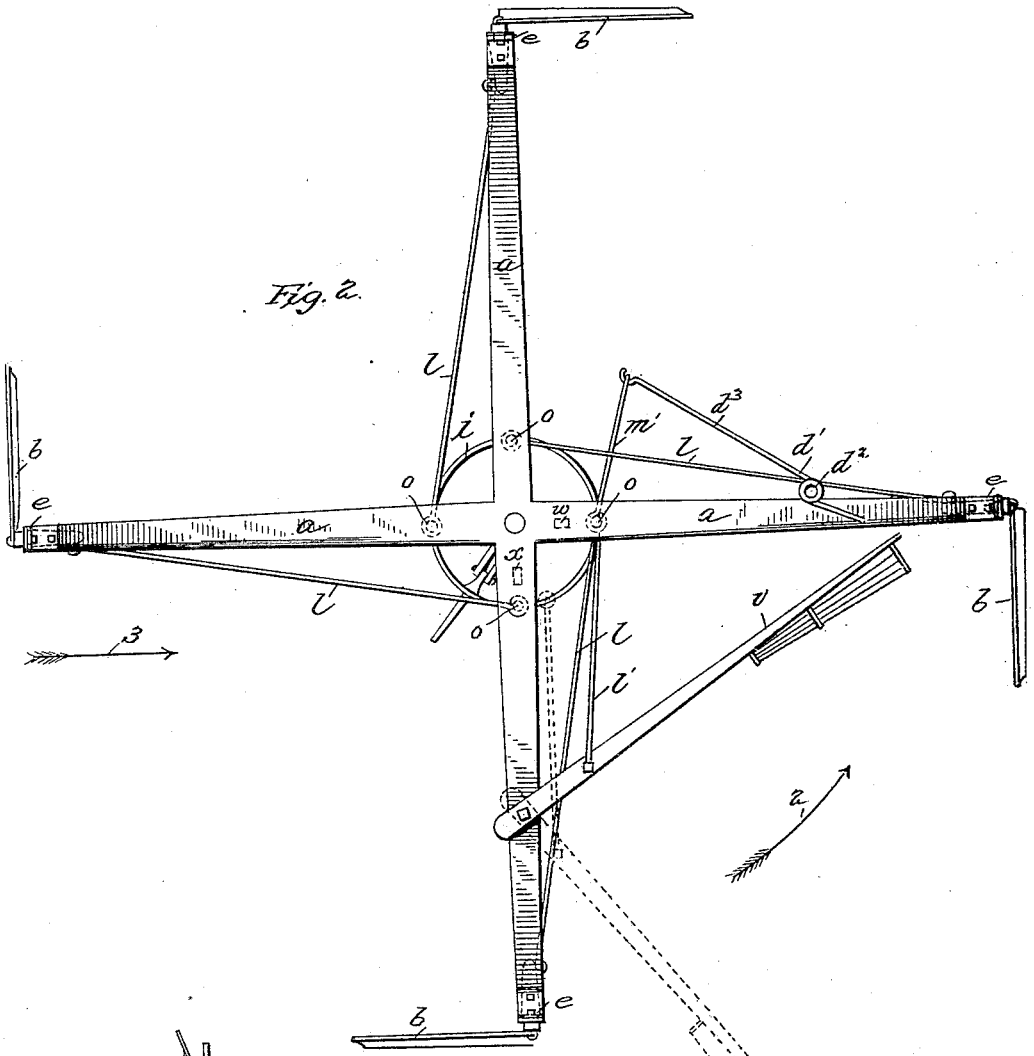
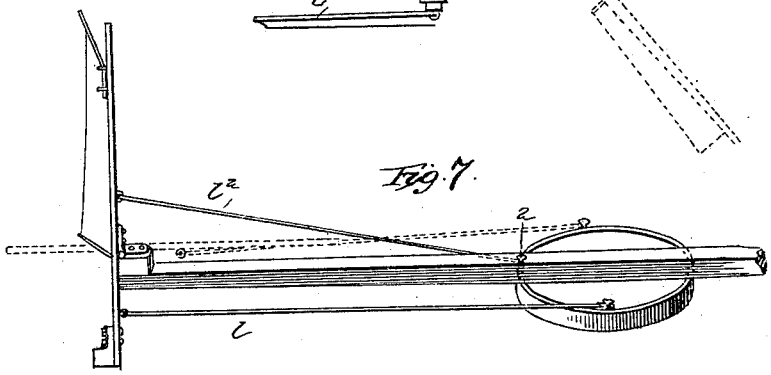


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

S. D. STRAW.

WINDMILL.

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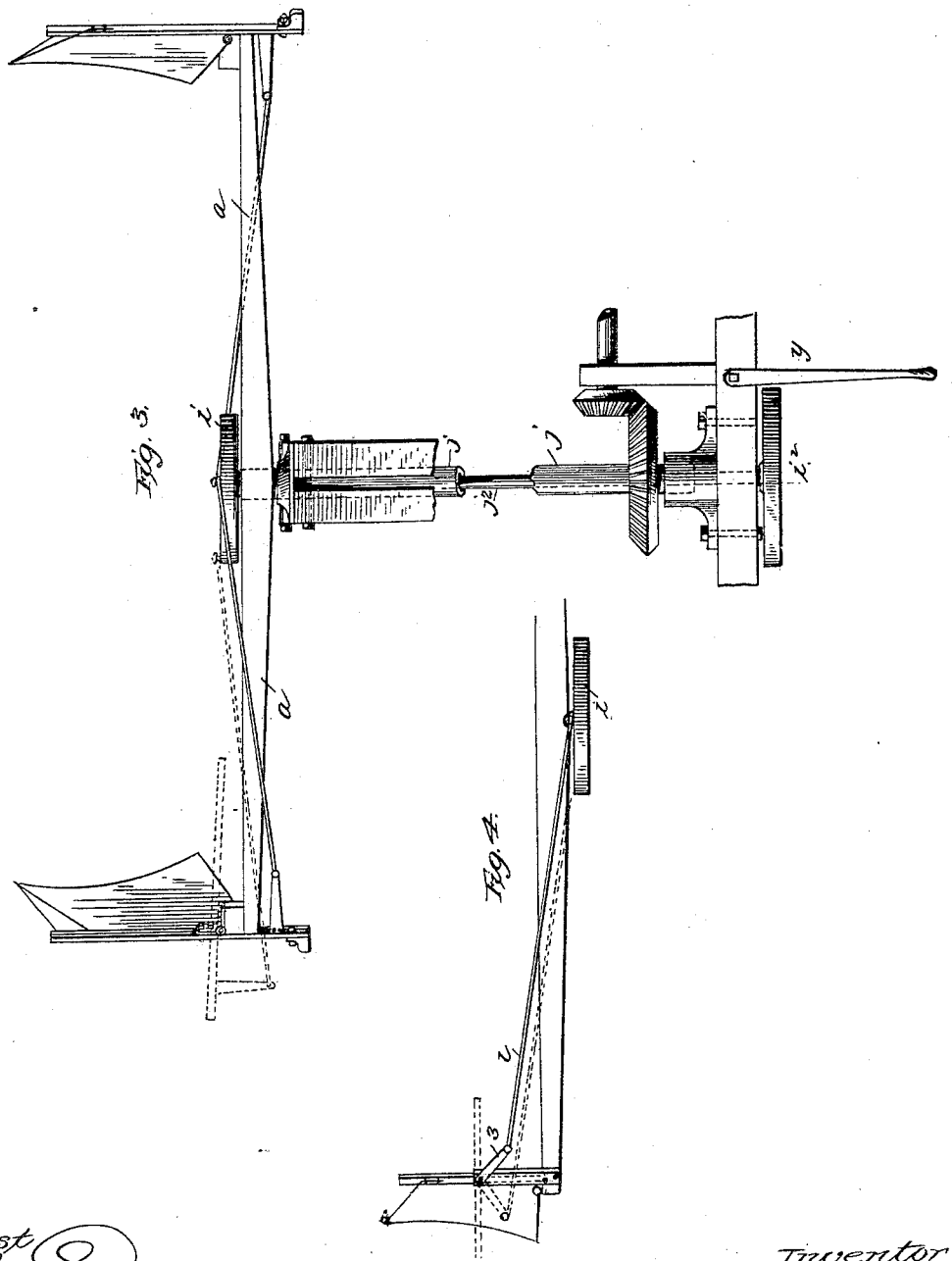

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UNITED STATES PATENT OFFICE.

SAMUEL D. STRAW, OF ELKHART, INDIANA.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 419,024, dated January 7, 1890.

Application filed May 21, 1888. Serial No. 274,567. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STRAW, of Elkhart, in the county of Elkhart and State of Indiana, have invented a new and useful Improvement in Windmills; and I do hereby declare that the following is a full, clear, and exact description of the same.

The object herein sought is the provision of a mill of great power, having the capacity for perfect automatic regulation, and being adapted also to be controlled easily and certainly by hand.

In the accompanying drawings, Figure 1 is a side elevation of a portion of the supporting-derrick and the driving-shaft, with the horizontal radial arms carrying the sails, only four of which are shown. Fig. 2 is a plan view of the radial arms and sails, illustrating the application of a fan for the purpose of governing the sails. Fig. 3 is a modified arrangement of the connections and brake devices for operating the sails simultaneously. Fig. 4 is a modification showing the different manner of pivotally supporting the sails. Fig. 5 shows modified means for operating the sails manually from the center of the wheel. Fig. 6 represents a modified form of brake-wheel. Fig. 7 is a modified form of connection between the sails and the loose collar.

The derrick (a portion of which is seen at S′) is of ordinary construction, and has a bearing 1 at its upper end for the main driving-shaft *j*, the lower end of which is stepped, as at *t*, in any suitable support. The power may be transmitted from this shaft by means of the beveled gears *m n*. To the upper end of the shaft *j* is supported the horizontal wind-wheel A, composed of radial arms *a*, preferably four in number. The sails *b* are carried by these arms and are movably supported, so that they are permitted movement into and out of the wind when operated. The masts *b′* for the sails are supported directly over the end of the arms *a*, and the booms *h* and gaffs *f* extend therefrom approximately at right angles to the arms *a*, and thus the sails are positioned entirely upon one side of said arms. Fig. 2 shows this arrangement of the sails, and the arrow 2 represents the direction of movement of the wheel, while arrow 3 indicates the course of the wind. The masts extend vertically from the arms when in normal position, and thus present the sail to the full action of the wind. The sails are movably supported, as before stated, in order to allow them to be moved into and out of the wind, and in Fig. 1 is shown the preferred manner of supporting the sails for this purpose. The masts are connected to a block *g* on the end of the arm *a* by a hinge *e*, so that the sail can be tilted or inclined inwardly toward the center of the wheel to any desired extent until the mast assumes a horizontal position, when the entire sheet will also be horizontal and thus out of the wind. To retain the sail in vertical position, a tension-spring *d′* may be applied to each mast and arm *a*, as in Fig. 7, the spring being of sufficient strength to maintain the vertical position of the sail against a predetermined wind-pressure.

In order to automatically regulate the speed of the mill, governor-weights *n′* may be employed, fixed to the downwardly-extending portion *c* of the masts. These are designed to be acted upon by centrifugal force when the speed of the mill exceeds a certain rate under excessive wind-pressure, and thus move outwardly against the tension of the spring *d′*, causing the upper end of the mast to incline inwardly, and thus partially or wholly move the sail to horizontal position out of the wind, as shown by dotted lines, Figs. 1 and 7.

In the operation of the mill the best results are secured by causing the simultaneous and automatic action of the sails, and for this purpose I employ connections from each sail to a loose collar or wheel common to all. This loose collar or wheel *i*, as in Fig. 1, is preferably located just above the derrick-cap and beneath the wheel. The driving-shaft extends loosely through its hub. This collar can be placed on the shaft above the wheel, if desired, or loosely held to the hub of said wheel either above or below the same. Connecting-rods *l* are joined to the projections K on each of the masts *b′* and extend therefrom tangentially to the collar *i*, being secured thereto at the points *o*. The weights *n′* are employed, as above described, secured to the downward extensions of the masts and acting as centrifugal governors. The spring *d′* in this arrangement consists of the coil d^2,

secured to one of the arms a, with an extension d^3 connected to the collar by the rod m'. When the mill is running at or below the predetermined rate of speed, the sails are upright, and the connections and spring d' remain in normal position, the collar i during this time moving with the wheel A, the force of the spring d' being sufficient to hold the collar steady, and through the connections the sails upright. When, however, by reason of an increase above the desired rate the centrifugal force causes the outward movement of the weights, the sails will be tilted or inclined inwardly, proportionately reducing the wind surface and leverage of the sails and the connections l drawn upon, overcoming the resistance of the spring d' and causing the collar i to move backward, thus effecting the operation of all the sails simultaneously through the connections. A quarter-revolution of the collar i throws the sails into the position out of the wind, as indicated by the dotted lines of Fig. 1, and this movement is limited by the stops x and w on the wheel A and collar coming in contact, Figs. 1 and 2. As the speed decreases the spring d' proportionately pulls all the parts toward normal position. Instead of or in addition to the centrifugal governing-weights n', fans v, Fig. 2, may be used, these being pivoted to two of the opposite arms a, and having connection through rods l' to the loose collar. The spring d' is adjusted as to tension to hold the fans in normal position until a certain velocity is attained, at which time excess of wind-pressure acting against the fan to force it backward, together with the centrifugal force, will pull the collar i around against the force of the spring d', and thus reclining the sails in proportion to the excess of speed attained. As the speed diminishes the wind-pressure on the fans and centrifugal force becomes lessened and the spring exerts its force to retract the parts to normal position. To control the mill by hand, a brake-lever p is pivoted to an ear on the upper end of the derrick, one arm extending upward within the collar to bear upon the inner periphery thereof when operated. A spring q holds the brake-lever normally away from the collar. An operating-cord depends from the horizontal arm of the lever, and by pulling this downwardly the brake-arm of the lever is forced against the collar, thereby retarding the movement of the same, and the wind-wheel, continuing to revolve, makes a quarter-turn and causes the connections l to be rendered effective to tilt the masts with the sails inward and out of the wind to any desired extent.

When it is desired to start the mill, the brake-lever is again released and the sails assume an upright position by reason of the action of gravitation upon the weights n and the return movement of the collar and connections under the force exerted by the spring d'.

As before intimated, the precise position and arrangement of the independent loose wheel or collar i is not essential, and in Fig. 3 is shown a modified arrangement from that heretofore described. In this the collar is fixed to the upper end of the shaft j^2, which extends entirely through the hollow driving-shaft j and below the step and supporting-beam therefor. The connections from the collar to the sails do not differ in this form from that heretofore described. The hand-brake, however, is provided by the employment of a brake-wheel i^2, secured to the lower end of the shaft j^2, and a lever y, suitably supported. The same effect is secured by this arrangement when the brake is applied, as heretofore mentioned.

Fig. 4 illustrates a different method of pivoting the sail-mast—that is, by extending a bracket upwardly from the end of the arm and pivoting the mast near its center thereto. The journal is provided with a crank-arm 3, which is in connection through rod l with the collar i.

For manually controlling the sails the support for the wheel may be formed hollow, as in Fig. 5, and through this suitable operating-connections may pass to the sails, in the present instance the form shown being the ropes y'.

Fig. 6 illustrates a modification of the brake mechanism, in which a supplemental collar i^3 is fixed to the upper end of a rod $l\,l$, which extends through the hollow shaft. In this form both collars are beveled, and by pulling downwardly the rod $l\,l$ by means of the cord and lever shown the collar i^3 will be thrown into frictional contact with the loose collar i, and thus the movement of the same retarded or stopped. The collar i with its connection does not differ in any respect, excepting in being beveled, as mentioned, from those already referred to. The booms of the sails are provided with coiled springs at their ends near the mast, whereby the sails are allowed to fill with wind better and swing outwardly when taking wind directly, thereby creating a greater leverage. This same construction allows the sail to swing inward when coming against the wind. The same result may be accomplished by forming the boom of spring material, so that it will bend near its outer end when the sail fills with wind.

Fig. 7 illustrates the preferred form of connection used between the loose collar and the sails, in which a second rod l^2 is employed, fastened to the mast above its hinge, and extending thence to the collar, being connected to the latter at point 2 a quarter-turn from the point of connection of the rod l. This arrangement has the advantage of lightness and durability. When the hand-brake is applied in the construction first described, the sails are forced out of the wind by the pushing action exerted through the single rod l, and for this reason the rod l must be heavy enough to sustain the strain upon it

during the action, and thus not only is the weight of the mechanism increased, but the wind-surface also is enlarged and the power of the mill injured. In the second arrangement the sail is moved out of the wind by a pull upon the rod l^2, exerted through the loose collar when the hand-brake is applied. Whatever movement is made by the mast is accomplished by a pull upon either one or the other connections.

I claim as my invention—

1. In combination, the horizontal wind-wheel, the vertical masts pivotally secured thereto to have movement toward and from the center of the wheel, a revoluble collar at the center of the wheel, rods extending from said collar to the pivoted masts, governing weights or vanes, and yielding means for returning the parts to normal position, substantially as described.

2. In combination, the horizontal wind-wheel, the vertical masts pivoted thereto, the sails on said pivoted masts, a revoluble collar at the center of the wheel, rods extending therefrom to the pivoted masts, and governing means, substantially as described.

3. In combination, the horizontal wind-wheel, the movable sails, a hollow shaft for supporting the wind-wheel, a collar arranged to have movement independent of the wind-wheel, operating-rods extending from said collar to control the sails, a second shaft extending through the hollow shaft, and a brake-ring on said second shaft, substantially as described.

4. In combination, the wind-wheel, the sails pivoted thereto, the hollow shaft, the revoluble collar, with connections to the masts, the brake-rod extending through the hollow shaft, and the brake-ring carried thereby and located in close proximity to the revoluble collar to engage therewith, substantially as described.

5. In combination, the hollow supporting-shaft, the wind-wheel supported thereon, the masts with the sails pivoted to said wheel, and the connections extending from the mast radially to the hollow central supporting-shaft, and thence through said shaft for manually operating the sails, substantially as described.

6. In combination, the wind-wheel, the masts pivoted thereto to have movement toward and from the center, the loose collar, and the rods l^2, connecting the masts with the loose collar, said rods being secured to the masts at points above their pivots, substantially as described.

7. In combination, the wind-wheel, the masts pivoted thereto, the loose collar, and the connecting-rods $l\ l^2$, substantially as described.

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

SAMUEL D. STRAW.

Witnesses:
WILLIAM H. HANENSTEIN,
J. N. VANFLEET.