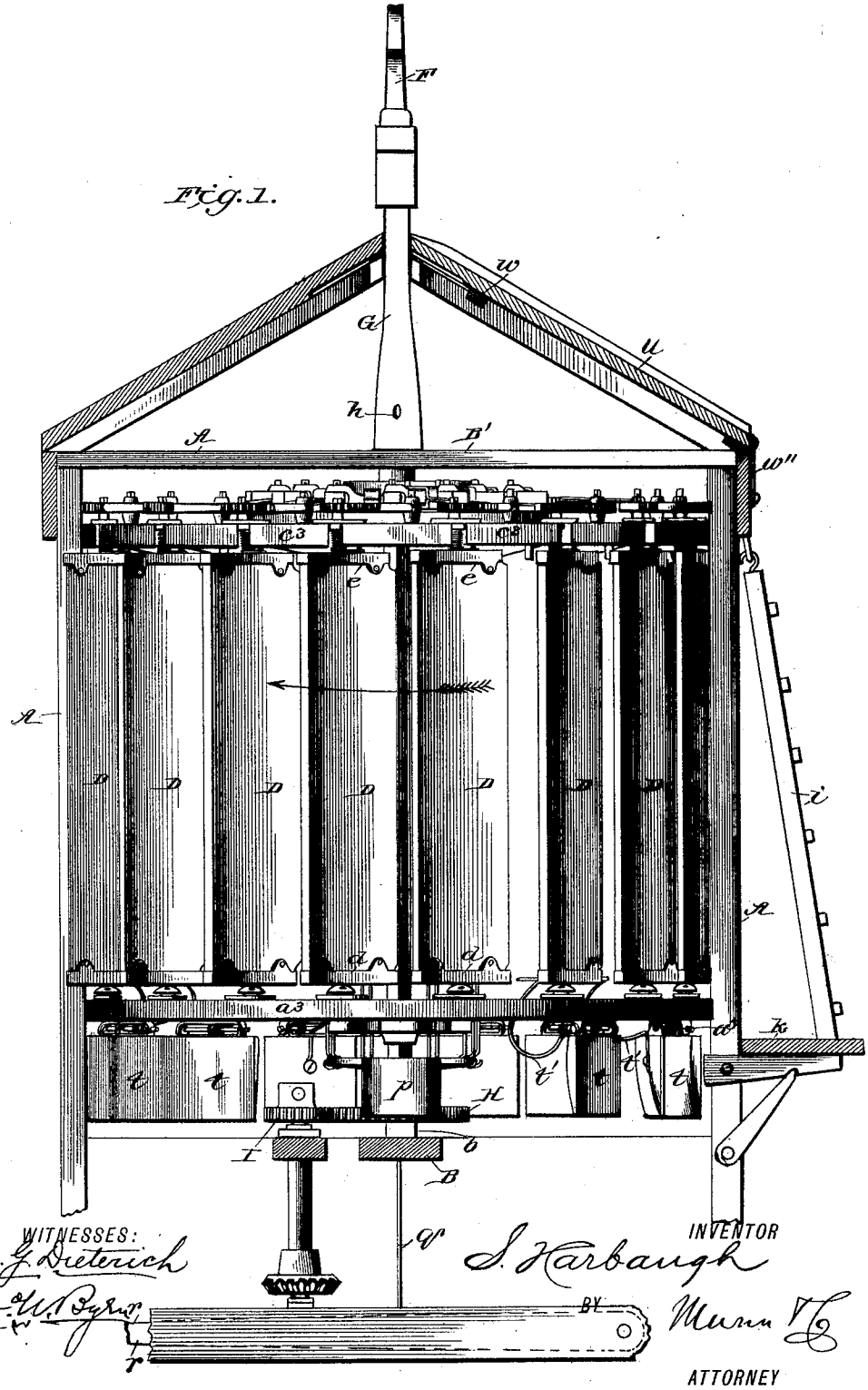
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# S. HARBAUGH.

## WINDMILL.

No. 410,361. Patented Sept. 3, 1889.

Fig. 1.




WITNESSES:
Fred. J. Dieterich
Edw. H. Bynum

INVENTOR
S. Harbaugh
BY
Munn & Co
ATTORNEY

N. PETERS. Photo-Lithographer. Washington. D. C

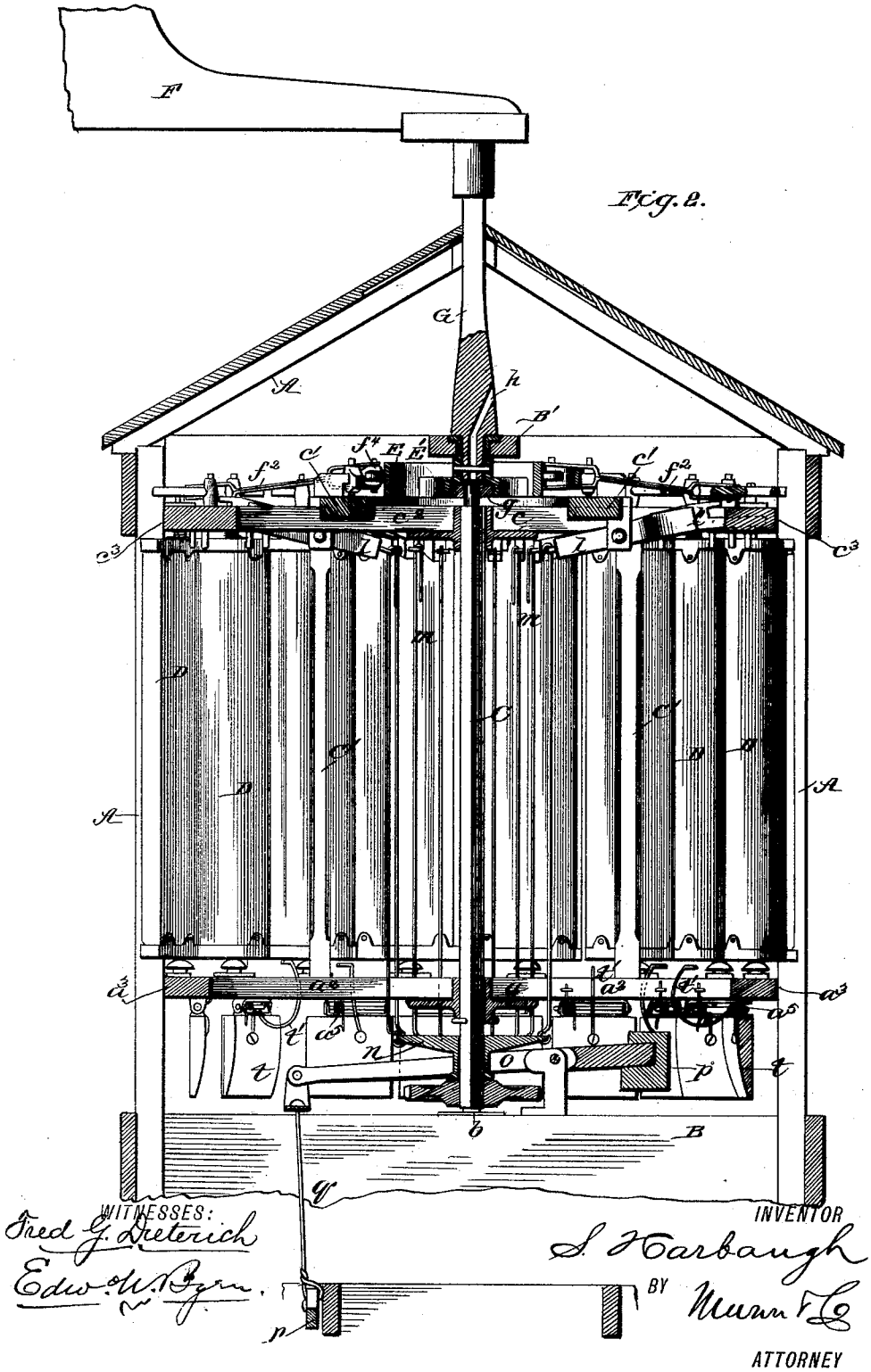
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# S. HARBAUGH.

## WINDMILL.

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Fig. 2.




WITNESSES:
Fred G. Dieterich
Edw. W. Byrn.

INVENTOR
S. Harbaugh
BY Munn & Co
ATTORNEY

N. PETERS. Photo-Lithographer, Washington, D. C.

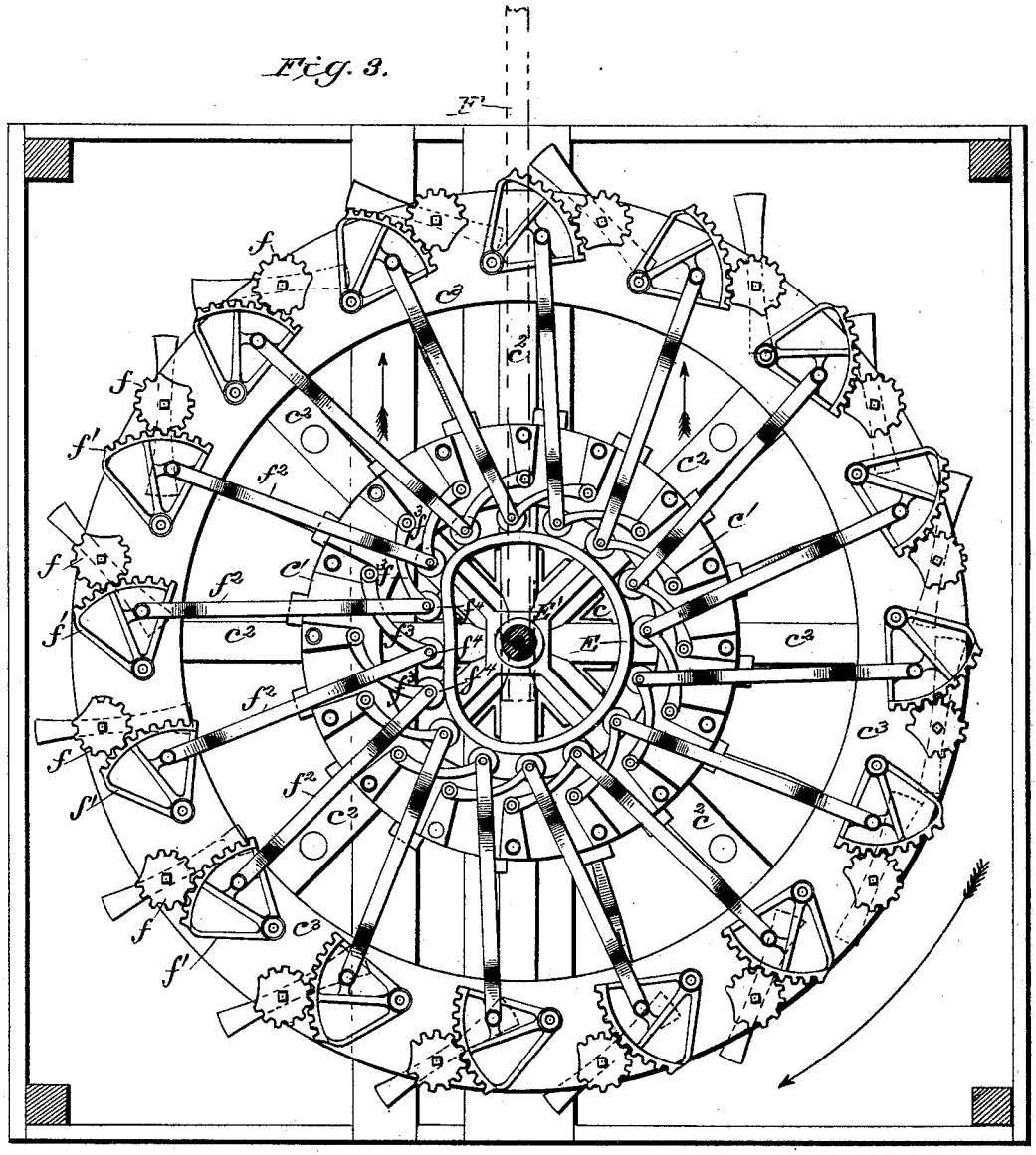
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# S. HARBAUGH.

## WINDMILL.

No. 410,361. Patented Sept. 3, 1889.

*Fig. 3.*




WITNESSES:
Fred G. Dieterich
Edw. M. Ryan.

INVENTOR
S. Harbaugh
BY Munn & Co
ATTORNEYS

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 4.

# S. HARBAUGH.

## WINDMILL.

No. 410,361. Patented Sept. 3, 1889.

Fig. 4.

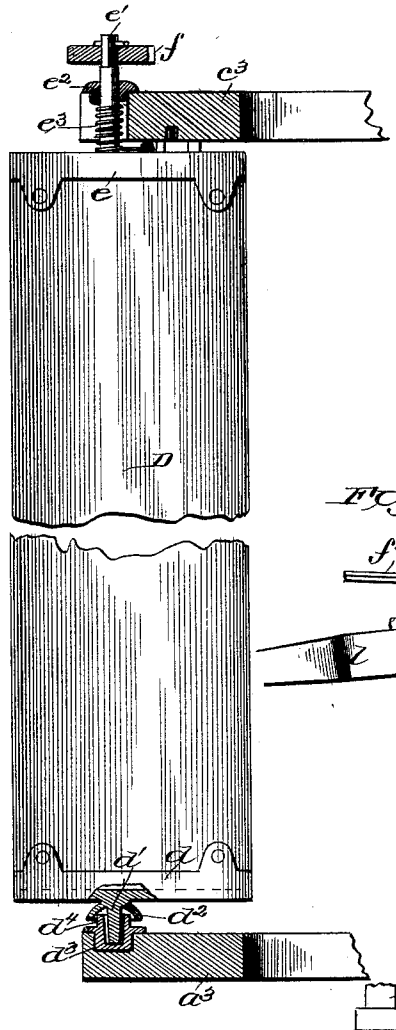



Fig. 5.

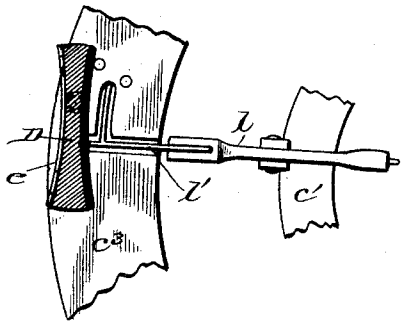



Fig. 6.

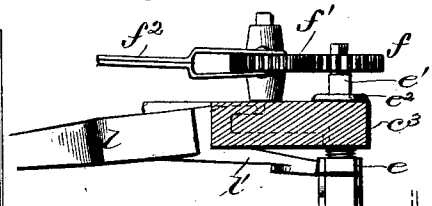



Fig. 8

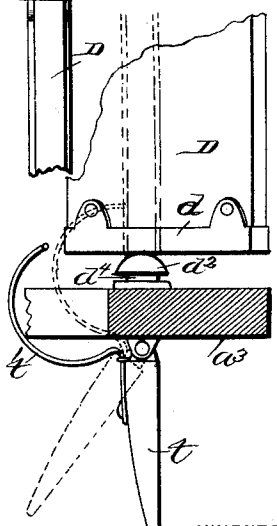
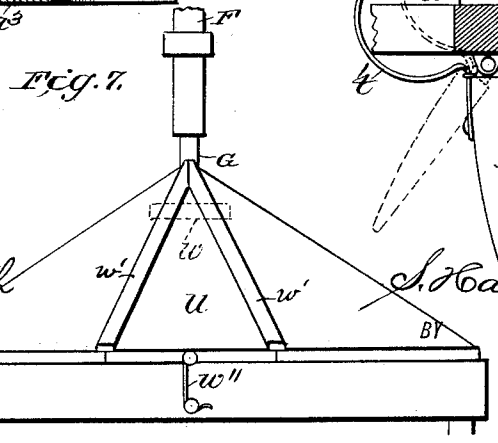






Fig. 7.




WITNESSES:

Fred G. Dieterich

Edw. W. Byrn

INVENTOR

S. Harbaugh

BY

Munn & Co

ATTORNEY

N. PETERS. Photo-Lithographer, Washington, D. C.

# UNITED STATES PATENT OFFICE.

SOLOMON HARBAUGH, OF GENEVA, NEBRASKA.

## WINDMILL.

SPECIFICATION forming part of Letters Patent No. 410,361, dated September 3, 1889.

Application filed June 15, 1888. Serial No. 277,261. (No model.)

*To all whom it may concern:*

Be it known that I, SOLOMON HARBAUGH, of Geneva, in the county of Fillmore and State of Nebraska, have invented a new and useful Improvement in Windmills, of which the following is a specification.

My invention relates to that class of windmills in which the wheel is constructed in the form of a vertical cylinder having vertical vanes and revolving about a vertical axis; and it consists in the peculiar construction and arrangement of parts designed to secure a greater power and sensitiveness for the wheel and a better regulation of the same, as will be hereinafter fully described with reference to the drawings, in which—

Figure 1 is a vertical front elevation of the wheel, partly in section, looking at the wheel in the same direction that the wind blows upon it. Fig. 2 is a central vertical section, the view being taken at right angles to that shown in Fig. 1. Fig. 3 is a plan view with the roof of the tower and guide-tail removed, the straight arrows showing the direction in which the wind blows. Fig. 4 is a sectional detail showing one of the wheel-vanes. Figs. 5 and 6 are sectional details, in plan and side view, of the locking devices for holding the vanes closed. Fig. 7 is a side view of the roof of the tower, and Fig. 8 is a detail of the regulator.

A represents the tower-frame, in which, near the bottom, is fixed a stout horizontal cross-timber B, Fig. 1, which carries the lower step-bearing *b* for the axis of the wheel, while a corresponding cross-timber B′ at the top forms an upper bearing for said axis.

C is the central vertical axial shaft, which is attached to both the upper and lower heads of the wheel, and between which heads are pivoted the series of vertical vanes D. The central shaft C is made square, and is rigidly attached at its lower end to a metal plate *a*, Fig. 2, having radial seats, in which are seated the radial arms $a^2$, which at their outer ends are connected to a circular rim $a^3$, which together form the lower head of the wheel.

C′ are vertical braces, which extend parallel to the axis from one head to the other to brace and strengthen the wheel. At the upper end of the wheel the axial shaft is attached to a metal frame *c*, having radial grooves like that at the lower head of the wheel, in which grooves are secured radial arms $c^2$, and to which are fastened an inner ring *c′* and an outer rim $c^3$, which together form the upper head of the wheel.

Between the top rim $c^3$ and the bottom rim $a^3$ of the wheel are pivoted the vertical vanes D, which extend all the way around the wheel. These vanes are made with slightly-concave faces and about an inch wide at the front edges, increasing to about three inches at their rear edges. They are pivoted a little closer to their front or narrow edges than they are to their wider edges, so that the wide edge always stands to the rear without trembling or wavering. For the lower pivot of these vanes I construct a metal end seat *d*, Fig. 4, into which the end of the vane fits and is secured. Upon the lower side of this seat is formed a step or spindle *d′*, surrounded by an overhanging bell-shaped flange $d^2$. The spindle *d′* rests in a metal socket $d^3$, seated in the lower rim $a^3$ of the wheel, and this metal socket has an upwardly-extending flange $d^4$, which is embraced by and covered by the bell-shaped flange $d^2$. The socket $d^3$ forms a step-bearing and oil-cup for the lower end of the vane-spindle, and the flange $d^4$ and overhanging bell $d^2$ make a water-proof and dust-proof joint that keeps the bearing from catching water or dirt, thus avoiding rusting or wearing out. At the upper end the vane is provided with another metal end seat *e*, which is formed with a spindle *e′*, that passes through a bearing-plate $e^2$ on the upper rim $c^3$. Around this spindle is wound a spiral spring $e^3$, one end of which is caught in a hole in the bearing-plate $e^3$, and the other end of which is connected to the vane, so that the tension of the spring tends to throw the vane into a radial line with its wide end to the center of the wheel.

In the adjustment and operation of the vanes of the wheel I provide a mechanism which secures the following results: first, the closing of the vanes on one side of the wheel and continuously opening them on the other side, so as to get a better effect of leverage and a greater power for the wheel, and, secondly, the closing of the vanes around the entire

wheel, so that the wheel ceases to run when it is no longer needed for action. To accomplish these adjustments the springs $e^3$ afford power for moving the vanes in one direction and a cam mechanism and gearing affords means for moving the vanes in the other direction, which I will now proceed to describe. On the upper end of the spindle $e'$ at the top of the vane is rigidly fixed a pinion $f$, Figs. 3 and 6, into which meshes a segmental gear $f'$, which latter is jointed to a connecting-rod $f^2$, that runs toward the center of the wheel and is jointed to an arm $f^3$, which is pivoted to the inner ring of the wheel-head. At the joint between the connecting-rod $f^2$ and arm $f^3$, which forms an elbow, there is carried a small roller $f^4$, which bears upon the outer surface of a cam-ring E. The function of this cam-ring is to project the connecting-rods and turn the segmental gears and pinion, so as to cause the vanes on one side of the wheel to be closed (the right-hand side in Fig. 3) and those on the other side and the front to be open. This cam-ring is connected to the guiding-tail of the windmill, so as to accomplish this no matter in what direction the wind is blowing.

F is the guiding-tail of the windmill, which is rigidly connected to a short vertical mast G, which turns in bearings in the upper part of the frame-work, and at its lower end is made hollow and extends into and is fastened to a tubular hub E′ of the cam-ring, (see Fig. 2,) so that when the position of the tail changes to suit the wind the cam-ring moves with it accordingly. This cam-ring is formed so that when the rollers at the ends of the connecting-rods are nearest the center the springs of the vanes throw them into radial position, causing them to project beyond the periphery of the heads for a greater leverage, as shown on the left-hand side of Fig. 3. On the opposite side of the cam, the rollers being projected farther away from the center, the vanes are shut up or arranged tangential to the wheel. Between these two points at the front of the wheel the vanes are half-open and at an inclination that helps to rotate the wheel, while at the back side of the wheel the vanes are partly open, but standing at a reverse inclination to that given at the front side of the wheel, which (being on the rear side of the axis) also co-operates to further increase the power, so that with my devices all the vanes on the front, back, and one side of the wheel are practically effective for turning the wheel, while those on the other side are closed. This makes a wheel of great sensitiveness and power and adapted to run with good results in very light winds.

In the bottom of the cam-hub is formed a recess to receive a wooden bushing $g$, Fig. 2, which forms the upper bearing for the wheel-shaft C. This bearing is kept well lubricated with oil, which is fed to the same through an oil-duct $h$ in the tail-mast G, which communicates through its hollow end with the opening in the hub of the cam-ring.

I will now describe the means for throwing the wheel out of the wind, which is accomplished by shutting up the vanes on both the windward and leeward side of the wheel, so that the wheel presents to the wind on both its sides the equal surfaces of a closed cylinder. To the under side of the inner ring of the upper head of the wheel is fulcrumed for each vane a lever $l$, Figs. 2, 5, and 6, whose outer end is provided with a metal extension $l'$, that plays transversely through a slot in the outer rim $c^3$. When this metal extension is up in its slot in the rim, it forms no obstruction to the vane; but when it is down, as in Fig. 6, it forms a stop to the vane and drops behind the same whenever the vane is projected by the cam to its tangential or closed position, as in Figs. 5 and 6. The inner ends of these levers are each connected to pull-rods $m$, Fig. 2, which latter are connected to a disk $n$, which slides up and down on the central shaft of the wheel. This disk has a hub which swivels in a lever $o$, which has a heavy weight $p$ on one side of its fulcrum, and on the other side is attached by a rod $q$ to a hand-lever $r$. When this hand-lever $r$ is held down and secured in its lower position, as in Fig. 2, the weight $p$ is raised and the disk $n$ drops to its lowest position, bringing down the inner ends of levers $l$ and raising the stop-extension $l'$ up out of range of engagement with the vanes, and the wheel is then in action.

When it is desired to throw the wheel out of the wind, the lever $r$ is raised, and weight $p$ in falling causes the disk $n$ to be raised, which, by slackening up the rods $m$, allows the outer ends of the levers $l$ to fall from their superior gravity and causes the stop-extensions $l'$ of the levers to drop into range of engagement with the vanes, as in Fig 6. Then, as the wheel turns as fast as the vanes reach that side of the wheel where they shut up tangentially, these stop-projections $l'$ drop behind the rear and heavier ends of the vanes and act as stops to hold the vanes to this position and keep them from moving inwardly from the tension of their springs. As soon as a complete revolution has been made, all the vanes are thus opposed by the stops and the wheel is inoperative. To make it operative again the lever $r$ is drawn down and secured, which causes the weight $p$ to be raised and the disk $n$ to fall with the inner ends of levers $l$, raising the outer ends $l'$ of the levers and removing the stops from the vanes, which are then free to respond to their spiral springs and cause the connecting-rods and rollers to move inwardly again into range of contact and co-operation with the cam.

To provide for the regulation of the windmill, so as to reduce its speed and power automatically when the wind gets to blowing too hard, I hang for each vane beneath the lower head of the wheel a deflector-blade $t$, which is hinged to the lower rim $a^3$ and is provided with an axial spring $a^5$ and also a curved

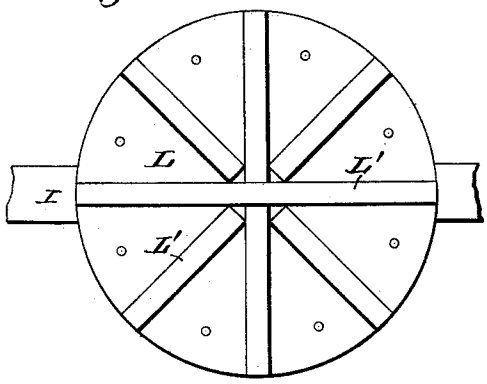
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# L. L. KELLOGG.

## WASHING MACHINE.

No. 410,362. Patented Sept. 3, 1889.

Fig. 5.



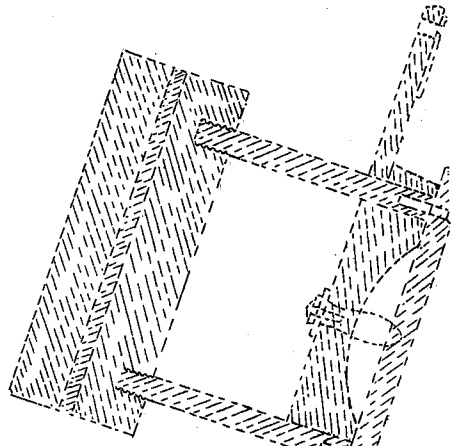
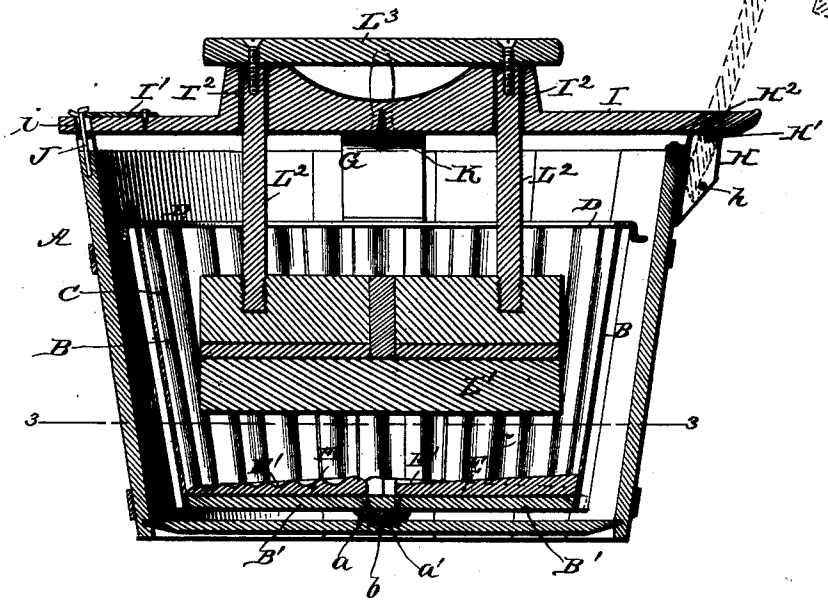



Fig. 1.




WITNESSES:

Fred G. Dieterich

Jas. A. Ryan

INVENTOR

Luke L. Kellogg

BY Munn & Co

ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.