No. 756,216. PATENTED APR. 5, 1904.

A. M. CRUNICAN.

AIR MOTOR OR WINDMILL.

APPLICATION FILED NOV. 3, 1902.

NO MODEL. 7 SHEETS—SHEET 1.

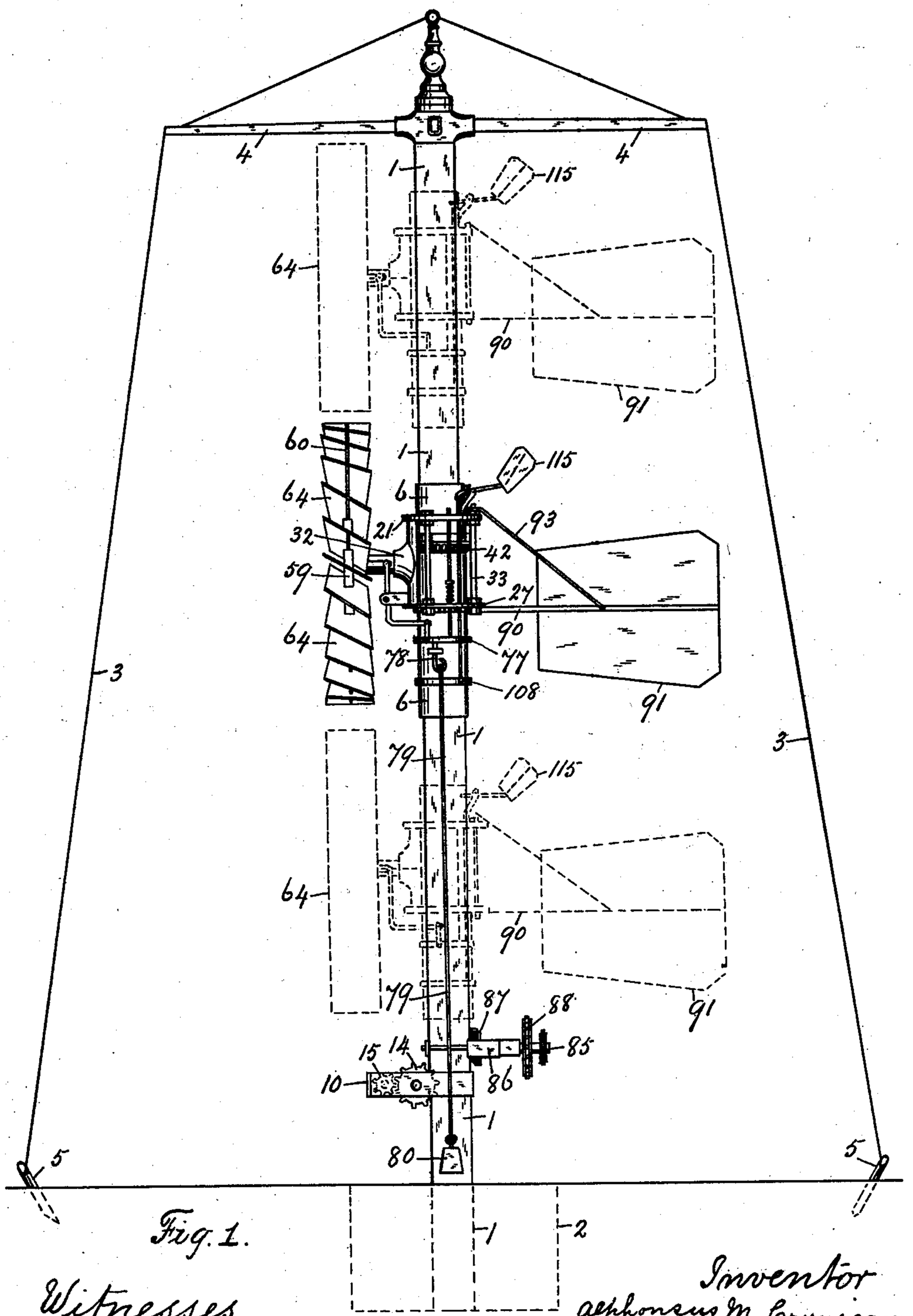

Fig. 1.

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NO MODEL. 7 SHEETS—SHEET 2.

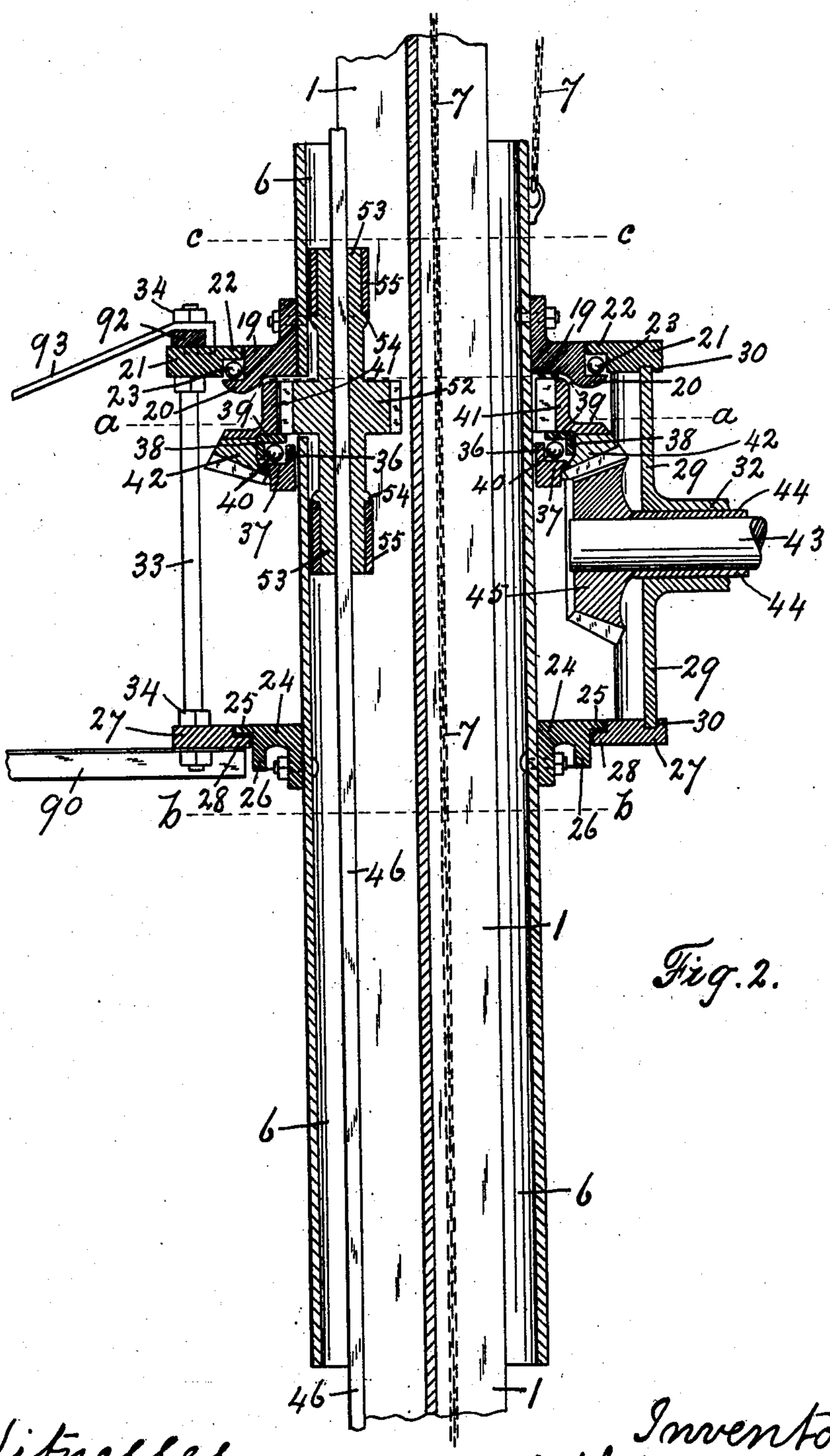

Fig. 2.

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NO MODEL. 7 SHEETS—SHEET 3.

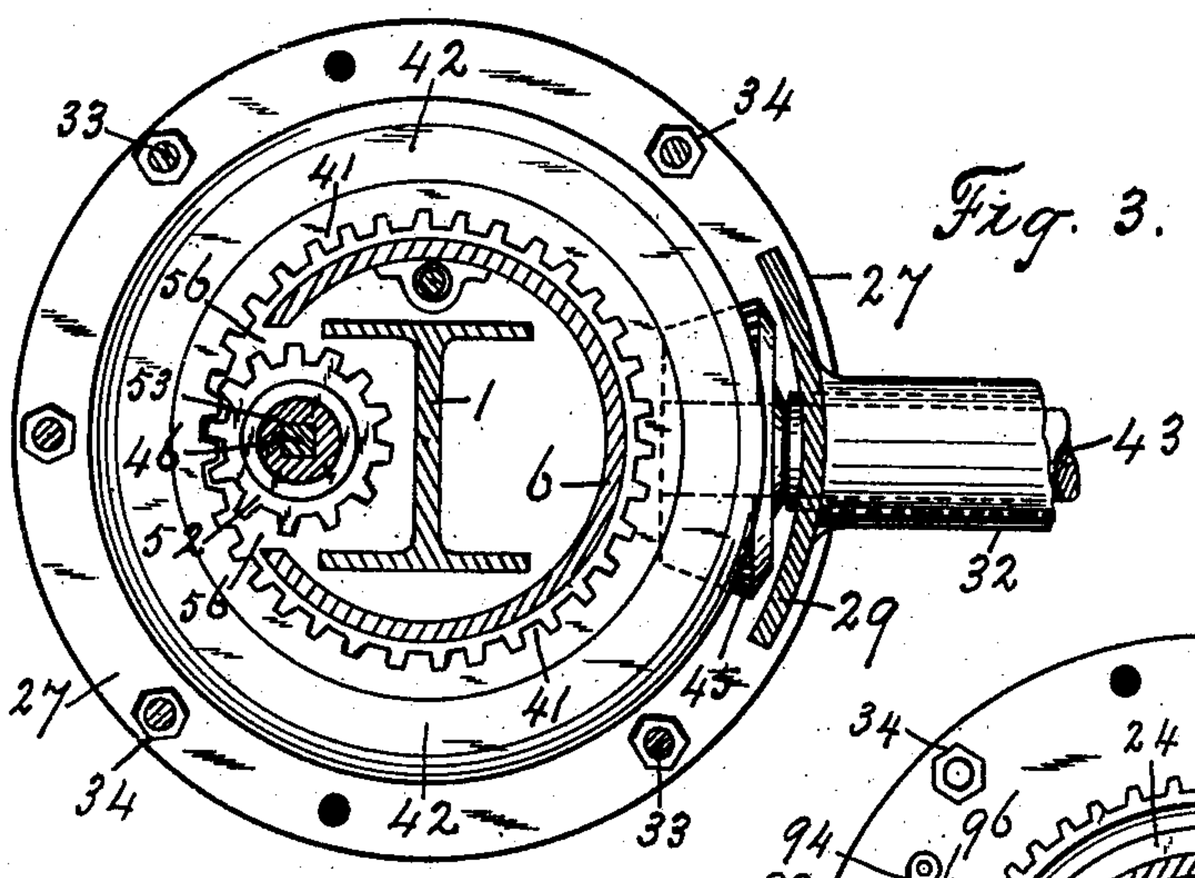

Fig. 3.

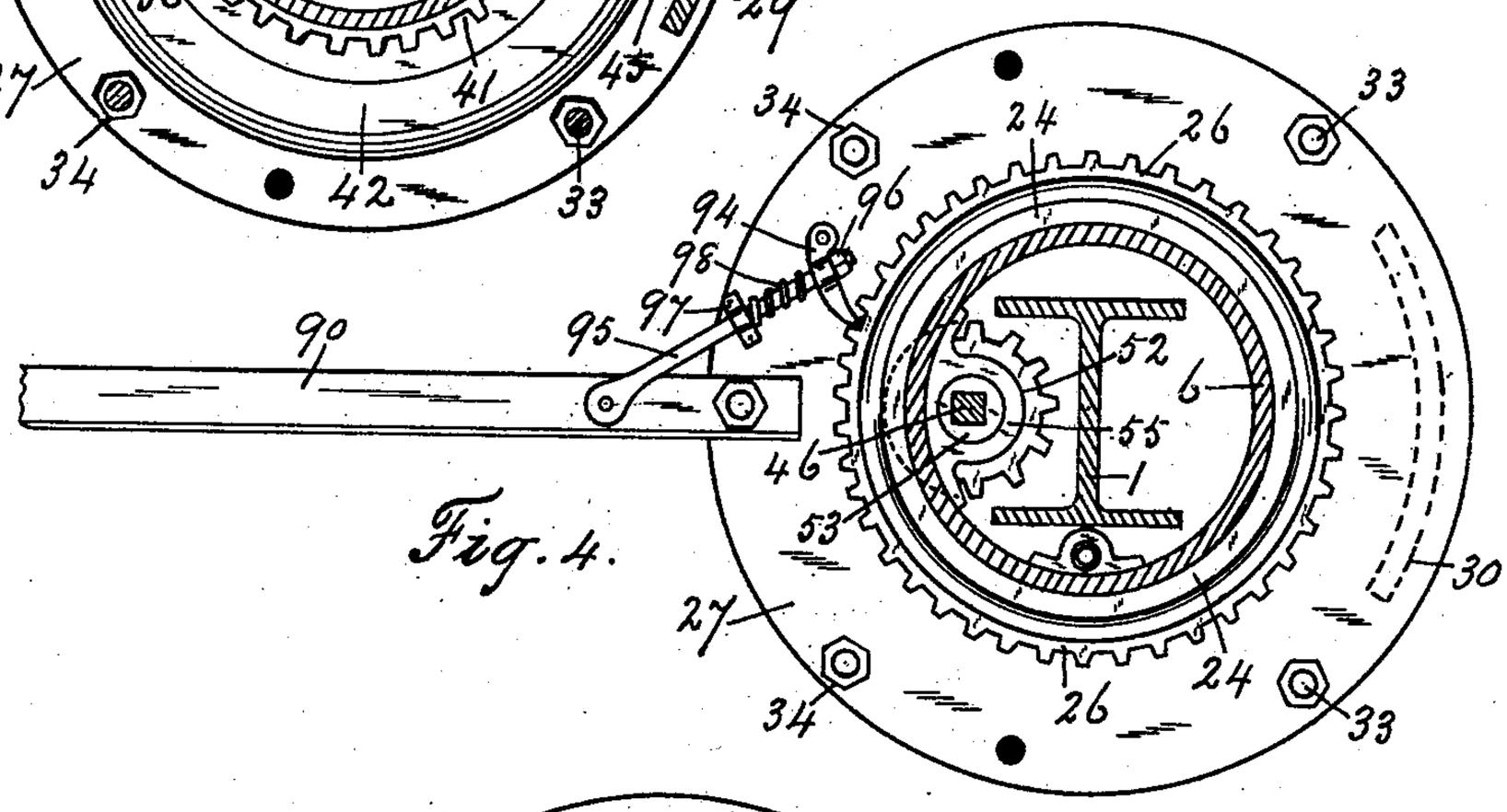

Fig. 4.

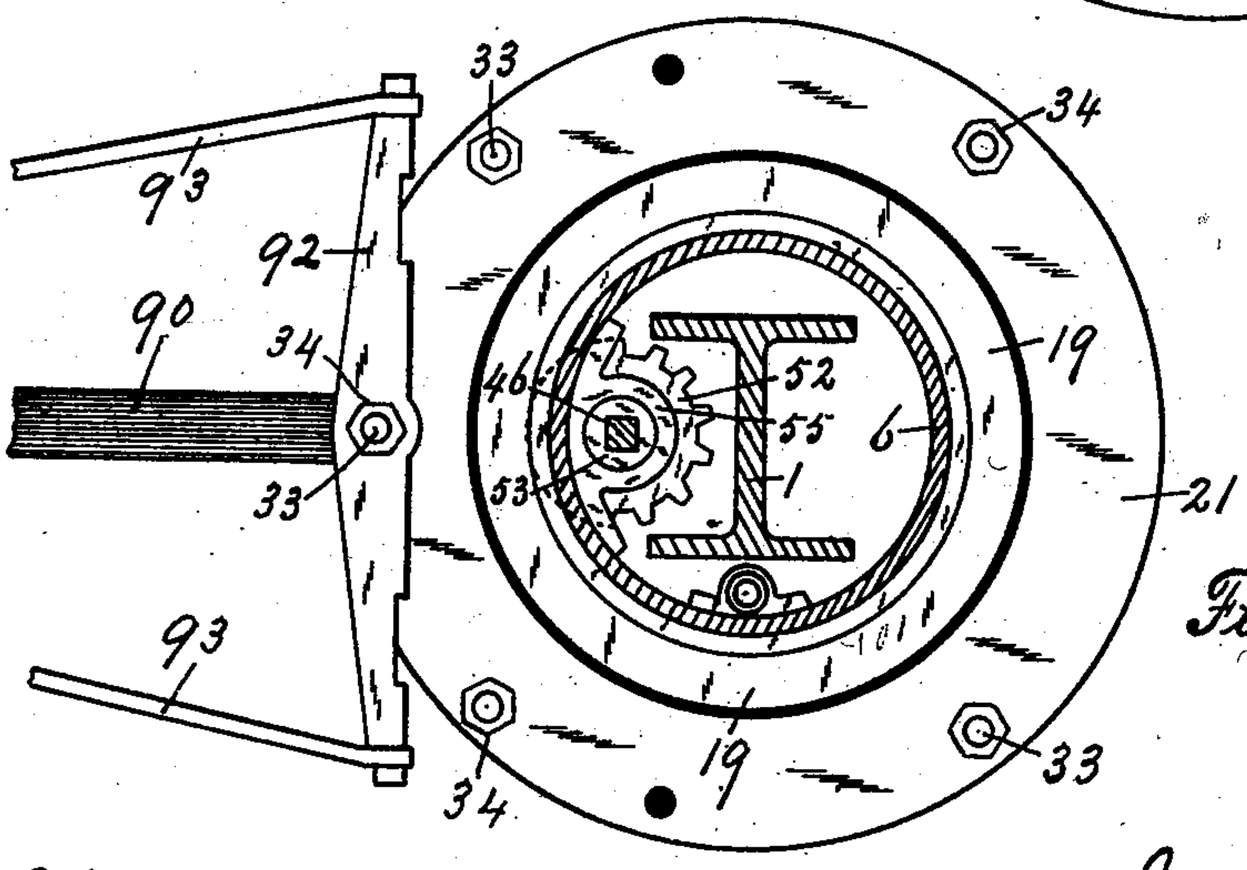

Fig. 5.

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NO MODEL. 7 SHEETS—SHEET 4.

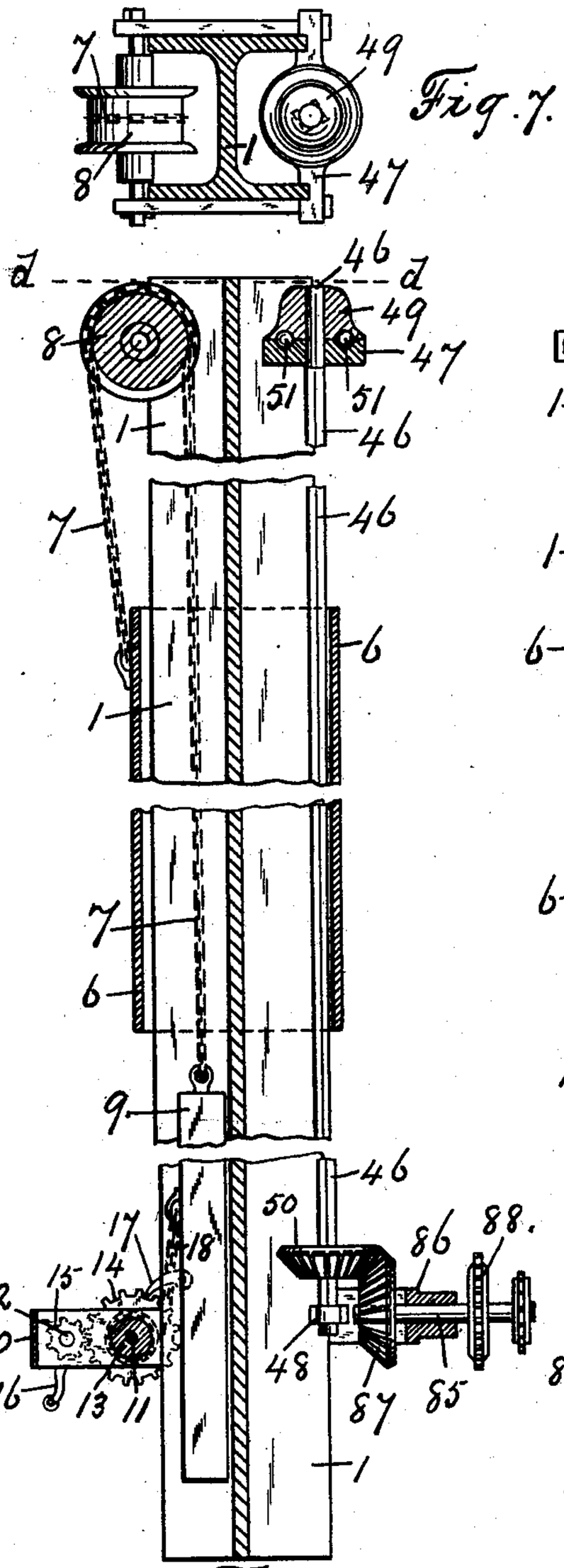

Fig. 6.

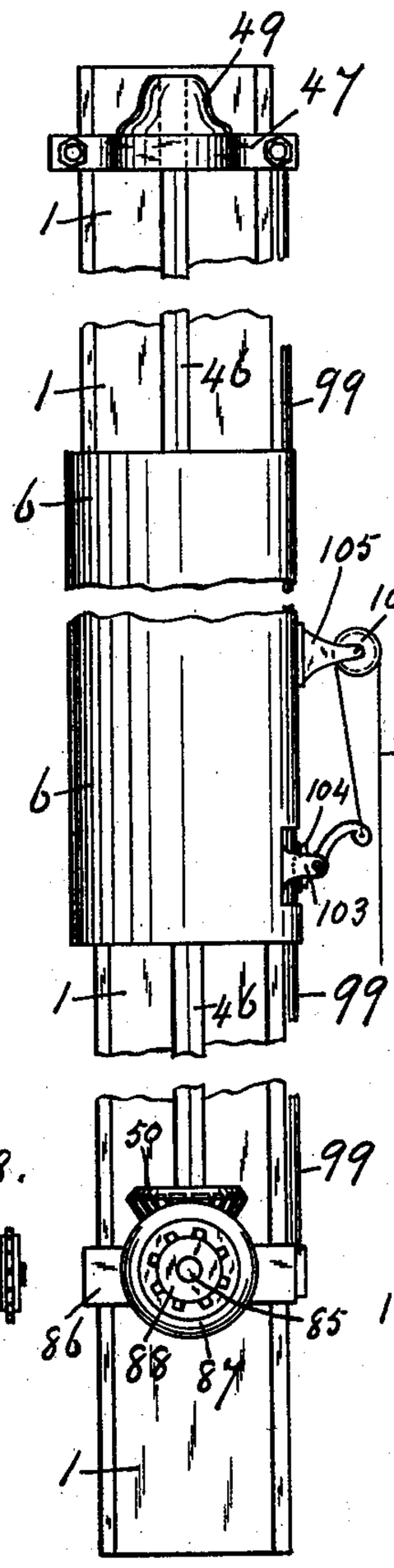

Fig. 8.

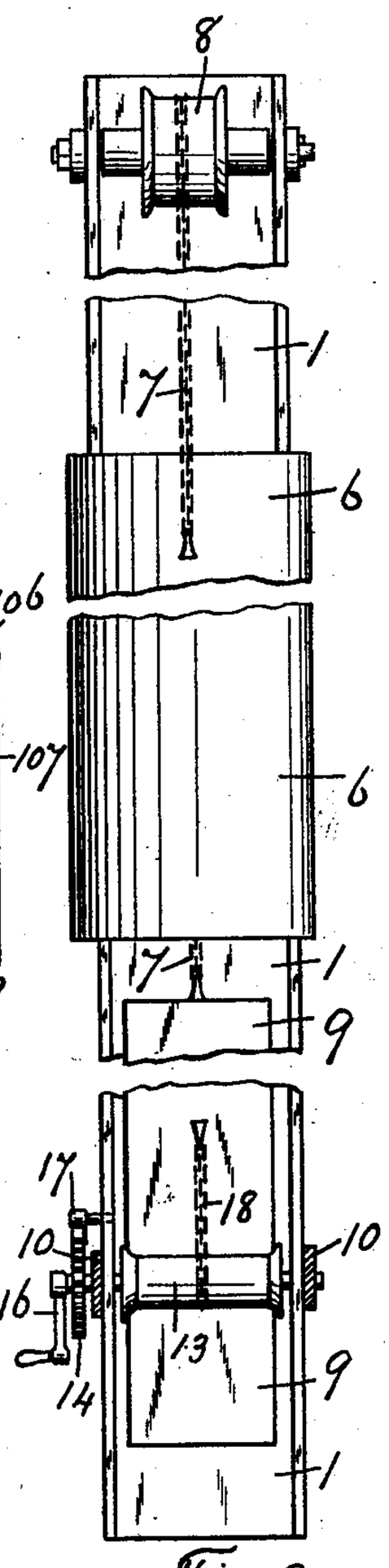

Fig. 9.

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NO MODEL. 7 SHEETS—SHEET 5.

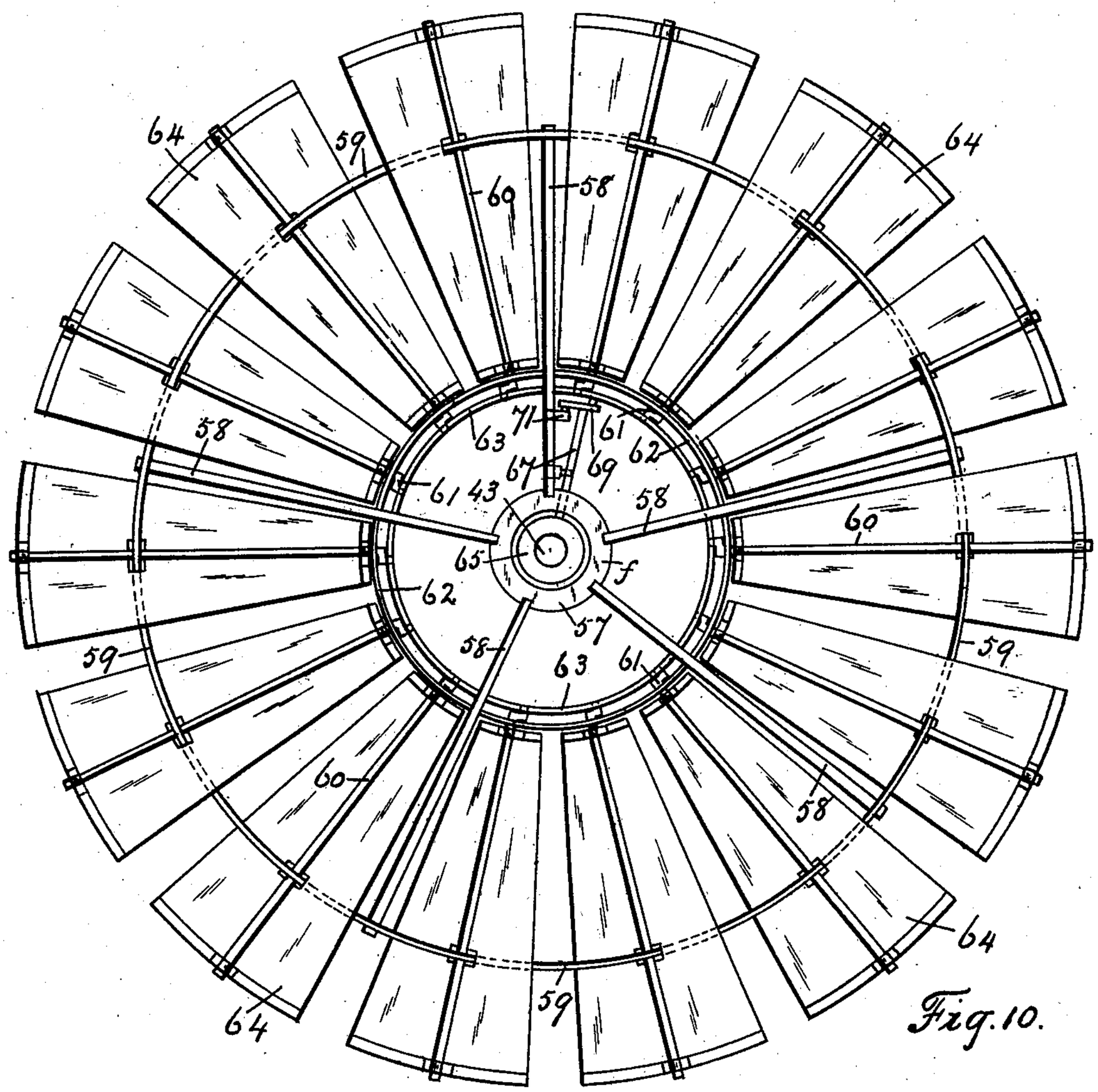

Fig. 10.

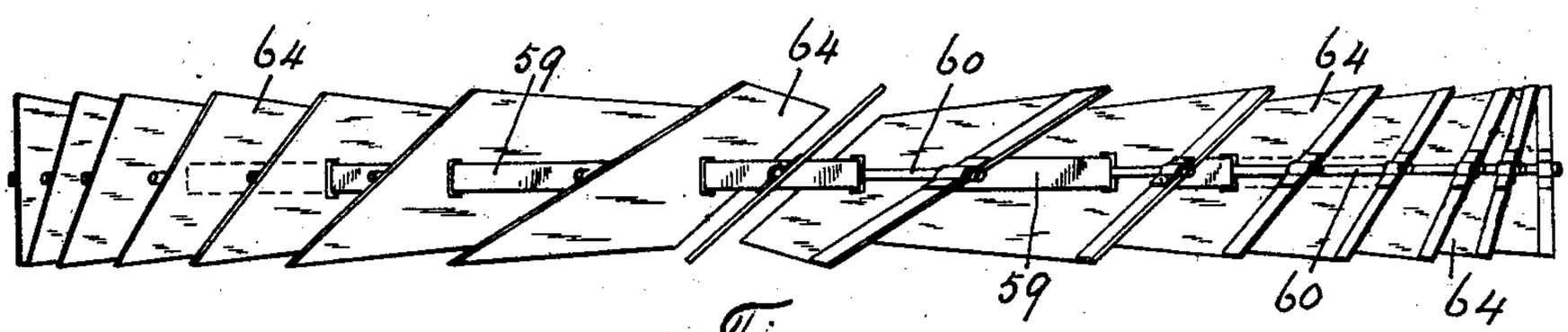

Fig. 11.

Witnesses
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APPLICATION FILED NOV. 3, 1902.

NO MODEL. 7 SHEETS—SHEET 6.

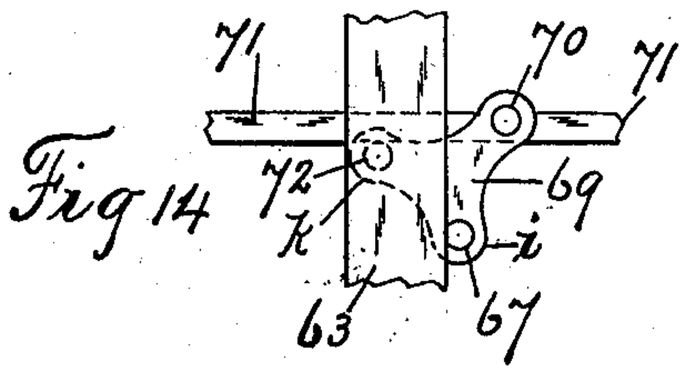

Fig 14

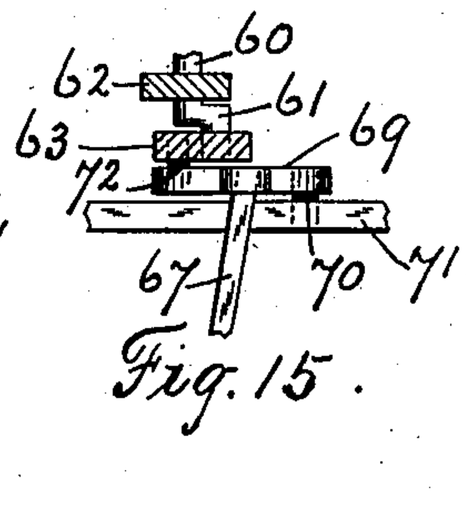

Fig. 15.

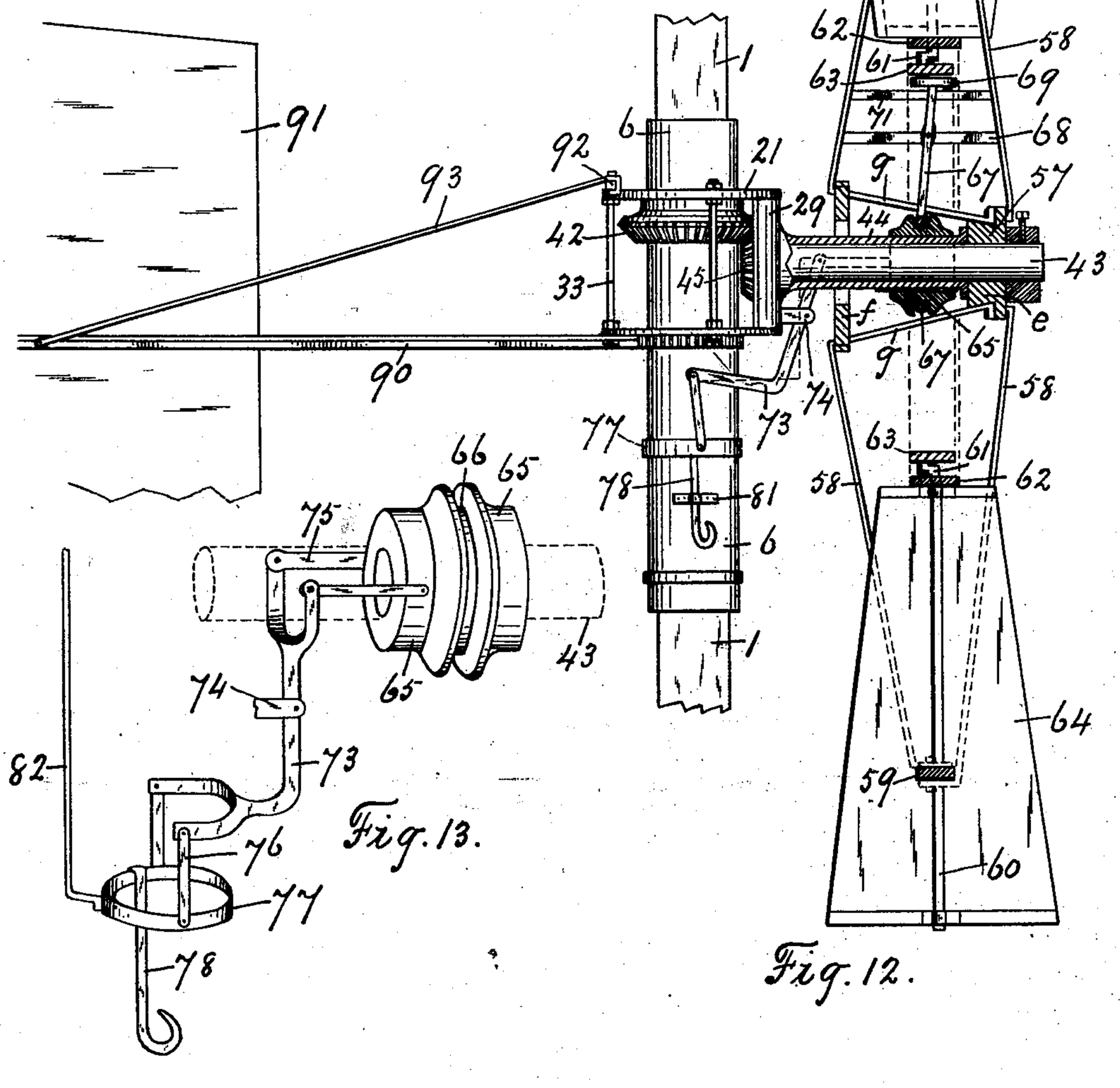

Fig. 13.

Fig. 12.

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NO MODEL. 7 SHEETS—SHEET 7.

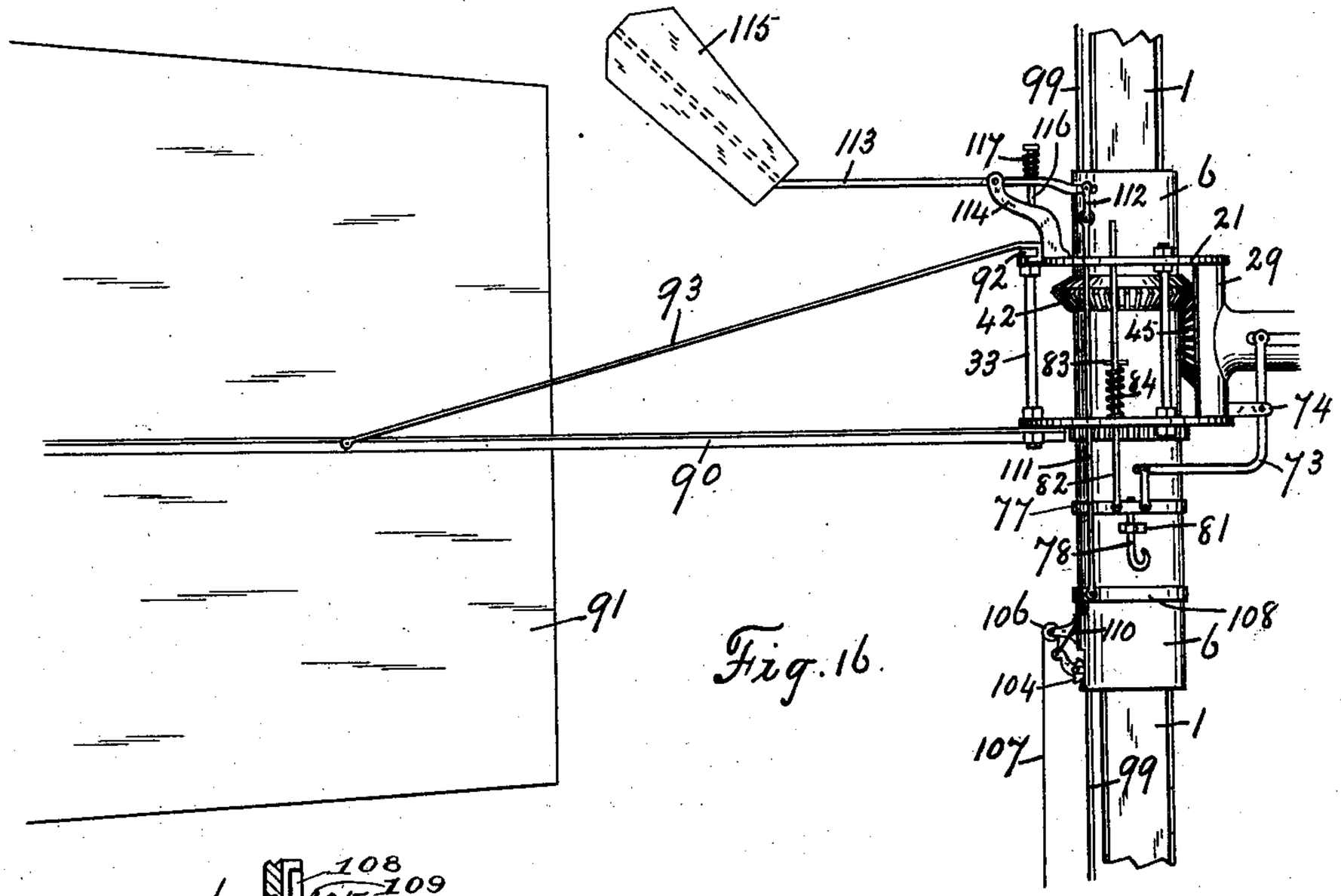

Fig. 16.

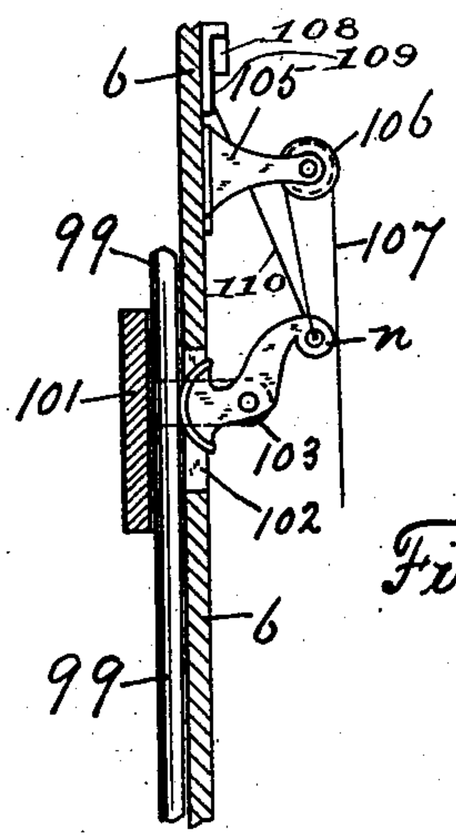

Fig. 17.

Witnesses
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No. 756,216. Patented April 5, 1904.

UNITED STATES PATENT OFFICE.

ALPHONSUS M. CRUNICAN, OF LONDON TOWNSHIP, COUNTY OF MIDDLESEX, CANADA.

AIR-MOTOR OR WINDMILL.

SPECIFICATION forming part of Letters Patent No. 756,216, dated April 5, 1904.

Application filed November 3, 1902. Serial No. 130,008. (No model.)

To all whom it may concern:

Be it known that I, ALPHONSUS M. CRUNICAN, a subject of the King of Great Britain, and a resident of London township, in the county of Middlesex, in the Province of Ontario, Canada, have invented a new and useful Air-Motor or Windmill, of which the following is a specification.

This invention relates to a device by which motion is imparted to mechanism for pumping water, churning, grinding grain, and for many other purposes by the action of the wind on a series of laterally-pivoted radiating fan-blades; and it consists of the improved construction and novel combination of parts, as will be hereinafter described, reference being had to the accompanying drawings, wherein—

Figure 1 is a front view of an air-motor or windmill embodying my invention. Fig. 2 is an enlarged detail central vertical sectional view of the gearing and of the vertically-adjustable sleeve on which it is mounted. In this view a central vertical sectional view of a portion of the main mast on which said sleeve is vertically adjustable is also shown. Fig. 3 is a transverse sectional view on the line *a a* of Fig. 2. Fig. 4 is a transverse sectional view, on the line *b b* of Fig. 2, looking upward at the sleeve. Fig. 5 is a transverse sectional view, on the line *c c* of Fig. 2, looking downward on the sleeve. Fig. 6 is an enlarged detail central vertical sectional view of the main mast and of the sleeve vertically adjustable thereon, both partly cut away, and a side view of the weight which counterbalances the weight of said adjustable sleeve and the gearing mounted thereon, the means by which they are vertically adjusted, and the vertical shaft which communicates motion to a horizontal shaft near the ground. In this view the gearing mounted on the vertically-adjustable sleeve is not shown. Fig. 7 is a transverse sectional view on the line *d d* of Fig. 6. Figs. 8 and 9 are views of the opposite sides of Fig. 6. Fig. 10 is an enlarged detail side view of the wind-wheel. Fig. 11 is a plan view of same. Fig. 12 is a central transverse sectional view of the wind-wheel, the sliding collar which operates the mechanism to throw the wind-wheel in or out of operation, and the sleeve on which said collar is adjustably supported and a side view of the shaft on which said wind-wheel is fixed and of the support of said shaft and its connections with the gearing on the vertically-adjustable sleeve. Fig. 13 is an enlarged detail perspective view of the sliding collar shown in Fig. 12, together with its operating mechanism. Fig. 14 is an enlarged detail plan view of the bell-crank lever and its attachments which are operated by the sliding collar shown in Fig. 12 to throw the wind-wheel in or out of operation. Fig. 15 is a side view of same. In this view the rings which suport the inner ends of the pivot-arms, to which the fan-blades are secured, are shown in section. Fig. 16 is a detail view of a small vane and attachments which automatically release a brake to permit the vertically-adjustable sleeve, wind-wheel and attachments, to automatically lower themselves when acted upon by wind traveling at a rate of speed in excess of that necessary to operate the wind-wheel. Fig. 17 is an enlarged detail side view of the brake and brake-rod and a sectional view of a portion of the vertically-adjustable sleeve.

In the accompanying drawings the numeral 1 designates a mast formed of a beam of H-shaped steel; but it may be formed of any other suitable shape or material desired. The lower end of said mast 1 is inserted and secured in a bed of concrete 2, and its upper end is braced by the stay or brace wires 3, extending from the outer ends of the cross-arms 4 to the anchors 5 in the ground. Said mast 1 is thus rigidly supported and held in an upright position, both above and below the operative parts, thereby making it very solid, and said cross-arms 4 are rigidly secured to and extend from said mast 1 out beyond said operative parts in order that the operation of the latter may not be interfered with by said stay or brace wires 3. 6 designates a sleeve which encircles and at the same time is adapted to be freely adjusted vertically on said mast 1. 7 is a chain secured at one end to

said sleeve 6, which chain extends over a grooved pulley 8, supported in bearings near the upper end of the mast 1. Said chain 7 then extends downward and is secured to the counterbalance-weight 9, and said counterbalance-weight is located out of the way between the flanges of the mast 1 and is adapted to balance the sleeve 6 and the gearing mounted thereon. As a result the raising or lowering of said sleeve 6 and attachments is facilitated.

10 designates a bracket rigidly secured to the mast 1 near the ground; 11 and 12, shafts supported in said bracket 10; 13, a drum, and 14 a toothed wheel fixed on said shaft 11; 15, a toothed pinion, and 16 a crank fixed on the shaft 12; 17, a dog pivotally mounted on the mast 1 and adapted to engage with the toothed wheel 14, and 18 a chain secured at one end to the weight 9 and at the other end to the drum 13.

By turning the crank 16 the toothed pinion 15 and toothed wheel 14 are operated to wind the chain 18 around the drum 13. This will draw the weight 9 downward and raise the sleeve 6 and gearing mounted thereon upward on the mast 1, and said sleeve is held from being accidentally lowered from the position to which it has been elevated by the dog 17 engaging with the toothed wheel 14.

19 designates a collar bolted or otherwise rigidly secured to the sleeve 6 and provided with an external rim-flange 20.

21 designates an annular ring which encircles the collar 19, and said ring 21 is provided with an internal overhanging rim-flange 22, which is adapted to extend over on the external flange 20 of the collar 19, and between said flanges 20 and 22 and the adjacent faces of the collar 19 and annular ring 21 antifriction bearing-balls 23 are interposed, all as shown in Fig. 2.

24 designates a collar bolted or otherwise rigidly secured to the sleeve 6, but at a lower or different elevation than the collar 19, and said collar 24 is provided with an external overhanging rim-flange 25 and with a downwardly-projecting annular toothed flange 26.

27 designates an annular ring provided with the internal rim-flange 28, which is adapted to engage with the rim-flange 25 of the collar 24, all as shown in Fig. 2.

29 designates a standard the ends of which are inserted in recesses 30 in the annular rings 21 and 27, and said standard is provided with the tubular arm 32. 33 designates bolts provided with the nuts 34, which rigidly secure said annular rings together and at the same time hold them spaced apart.

36 designates an intermediate collar rigidly secured to the sleeve 6 and provided with an external rim-flange 37.

38 designates an annular ring provided with the internal rim-flange 39, which is adapted to overlap the flange 37 of the collar 36, and between said flanges 37 and 39 and the adjacent faces of the collar 36 and annular ring 38 the antifriction bearing-balls 40 are interposed, all as shown in Fig. 2.

41 designates an internal gear-wheel which encircles the sleeve 6, and the inner portion of the under side of said internal gear-wheel 41 is supported on the annular flanged ring 38, and to the outer portion of the under side of said internal gear-wheel 41 the beveled gear-wheel 42 is rigidly secured.

43 designates a shaft; 44, a sleeve encircling a portion of said shaft, the inner end of which is adapted to fit into and turn freely in the tubular arm 32 of the standard 29, and 45 a beveled gear-pinion fixed on the end of said shaft 43 and adapted to engage with the beveled gear-wheel 42 on the under side of the internal gear-wheel 41.

46 designates a vertical shaft the central body portion of which is formed square and the ends round, and 47 and 48 are upper and lower bearings, respectively, secured to the mast 1, in which bearings the upper and lower round ends of said shaft 46 are supported and revolve perfectly free. 49 designates a collar rigidly secured to the upper end of said shaft 46 above the bearing 47, and in annular grooves or recesses formed partly in the adjacent faces of said collar 49 and bearing 47 the antifriction bearing-balls 51 are placed. This collar 49 prevents the shaft 46 from falling down through the bearings 47 and 48, and the antifriction bearing-balls 51 facilitate the rotation of said collar 49.

52 designates a gear-pinion which is secured to or formed integral with the spindle 53, which spindle is provided with shoulders 54 near each end, and in this spindle 53 a square axial socket is formed, to which the square shaft 46 is fitted and through which it extends, so that while said spindle is adapted to operate and rotate with said shaft 46 it is at the same time adjustable longitudinally on the latter.

55 designates bearings rigidly secured to the inside of the casing 6, in which bearings 55 the ends of the spindle 53 rotate perfectly free, and an opening 56 is formed in said casing 6 at one side, opposite said gear-pinion 52; and the shaft 46 is so arranged on said mast 1 that a portion of said gear-pinion 52 will project through said opening 56 in said sleeve 6 and engage with the internal gear-wheel 41; and said shoulders 54 on the opposite ends of said spindle 53 abut against the adjacent faces of the bearings 55 to hold the spindle 53 in place and the gear-pinion 52 centrally in the opening 56 in the sleeve 6 and in mesh with the internal gear-wheel 41.

57 designates a hub formed of the collar *e*, keyed on the shaft 43, and the collar *f*, encircling the sleeve 44, and connected together by the portions *g* of the braces 58.

58 designates braces rigidly secured at one end to the hub 57 and at the other end to the ring 59.

60 designates rods, each formed with a crank 61 at their inner ends, and said rods 60 are pivotally supported about midway between their ends in the ring 59 and near their inner ends in the ring 62, and the crank 61 on the inner ends of said rods engage with the ring 63, and said rods 60 radiate from the hub 57, and to each rod a fan-blade 64 is rigidly secured, and said fan-blades have a greater area at one side of said rods 60 than at the other for the purpose which will be hereinafter set forth.

65 designates a collar in which the groove 66 is formed, and said collar is supported by and is adapted to be adjusted perfectly free lengthwise on the sleeve 44.

67 designates a lever pivoted on the cross-bar 68, the latter being rigidly secured at its ends to the braces 58, and the inner end of said lever 67 encircles the adjustable collar 65 and rests in the groove 66 therein.

69 designates a bell-crank lever pivoted on the pivot-bolt 70, supported by the cross-bar 71, the latter being rigidly secured at its ends to the braces 58, and to one arm, *i*, of said bell-crank lever the lever 67 is pivotally secured, and the other arm, *k*, of said bell-crank lever is pivotally secured by the pivot 72 to the ring 63.

31 designates a collar rigidly secured to the shaft 43, which collar abuts against the hub 57 to securely hold the latter and the wind-wheel on said shaft 43.

73 designates a lever forked at each end and pivoted on the arm 74, secured to the standard 29.

75 designates links which connect the upper forked ends of the lever 73 with the adjustable collar 65; and 76 designates links which connect the lower forked ends of said lever 73 with the loose band 77, encircling the sleeve 6.

78 designates a hooked bar which engages and is vertically adjustable with said loose band 77; but the latter is rotatable around the sleeve 6 independent of the hooked bar 78. 79 is a rope secured to said hooked bar 78, and 80 a weight which may be readily and easily attached or detached from the lower end of said rope 79 for the purposes which will be hereinafter set forth.

81 designates a clasp which holds the hooked bar 78 against the sleeve 6.

82 is a guiding-rod which is secured at one end to the band 77. This rod then extends upward through holes in the annular rings 21 and 27. 83 is a pin secured transversely in said guiding-rod 82, and encircling said guiding-rod 82 between said pin 83 and the annular ring 27 is a coil-spring 84. (All shown particularly in Fig. 16.)

85 designates a horizontal shaft supported by and rotating perfectly free in the bearing 86, secured to the mast 1, and 87 is a beveled gear-wheel, and 88, a chain-wheel fixed on said shaft 85, and said beveled gear-wheel 87 is so placed on said horizontal shaft 85 that it will mesh with the beveled gear-wheel 50, fixed on the lower end of the vertical shaft 46.

90 designates an arm pivotally secured to the under side of the annular ring 27; 91, a large vane rigidly secured to the outer end of said arm 90; 92, a bar pivotally secured to the upper annular ring 21, and 93 diagonal braces each secured at one end to the vane-arm 90 and at the other end to the outer ends of the bar 92, all as shown in Figs. 4, 5, and 16.

94 designates a dog or pawl pivotally secured to the under side of the annular ring 27 and adapted to engage with the teeth of the annular toothed flange 26.

95 designates a rod pivotally secured at one end to the vane-arm 90, and its other end extends through a hole formed in said dog 94, and a nut 96 on the end of said rod 95 prevents the latter from disengaging from said dog 94.

97 designates a clasp which holds the rod 95 against the under side of the annular ring 27, and 98 a coil-spring encircling said rod 95 and interposed between said dog 94 and said clasp 97.

99 designates a brake-rod secured at its upper and lower ends in the bearings 47 and 86, respectively, and said rod is loosely fitted to and extends through a side bearing 101, secured to the interior face of the sleeve 6 opposite the opening 102, formed in said sleeve, all as shown in Figs. 8 and 17.

103 designates brackets in which the eccentric brake 104 is pivoted, and said brake 104 extends through the opening 102 in the vertically-adjustable sleeve 6 and engages with the brake-rod 99, and the outer end or handle *n* of said brake is the heaviest and overbalances the eccentric end, so that when in its normal position the brake 104 engages with the rod 99.

105 designates a bracket situated above the brake 104, and mounted in said bracket 105 is a grooved pulley 106, and 107 is a cord which is secured at one end to the handle *n* of the eccentric brake 104. It then extends over the grooved pulley 106 to the ground.

108 is a band which extends around and is fitted loosely to the sleeve 6, and 109 is a vertically-adjustable slide which engages with said band 108, and said band 108 moves vertically with said slide 109, but is adjustable around the sleeve 6 independent of said slide 109. 110 is a cord which is connected at one end to said slide 109 and at the other end to the handle *n* of the eccentric brake 104.

111 is a guiding and connecting rod which extends through holes in the upper and lower annular rings 21 and 27, and said rod 111 is connected at its lower end to the band 108, and its upper end is connected by the coupling-link 112 to the pivotal vane-arm 113, pivoted on the bracket 114, and to the outer end of said arm 113 the small vane 115 is secured

at about right angles to the large vane 91, so that when the large vane 91 is feathering the wind the small vane 115 will be against the wind.

116 designates a bolt which extends through the pivotal vane-arm 113, and its lower end is secured to the bracket 114, and 117 is a coil-spring which encircles said bolt 116 between the enlarged head thereof and said pivotal vane-arm 113.

The operation is as follows: By winding the chain 18 around or unwinding it from the drum 13 the vertically-adjustable sleeve 6, together with the gearing mounted thereon and the wind-wheel, may be raised or lowered to work at any place on the mast 1 from the ground to the cross-arms 4; and by means of the counterbalance-weight 9, crank 16, and gear connected therewith said sleeve 6 and attachments may be adjusted near the ground for the purpose of oiling, or to be out of the way of storms, or to be adjusted to catch a current of air at any elevation on the mast 1. As a result the oiling is accomplished with ease and with perfect safety to the operator and is very likely to be attended to more regularly, and when the direction of the wind changes and said wind strikes the vane 91 from the opposite side to that at which the parts 94 to 98 are situated the dog 94 rides on the teeth of the annular toothed flange 26, and again when the direction of the wind changes and said wind strikes the vane 91 on the same side as that on which the parts 94 to 98 are situated the arm 90 swings slightly on the pivot-bolt 33. This acts on the rod 95 to disengage the dog 94 from the teeth of the annular toothed flange 26 and permits the vane 91 to adjust the wheel to the wind, and the instant that the wheel is adjusted to the wind the force of the wind is removed from the side of the vane, the vane-arm moves back to its normal position, and the dog 94 again engages with the teeth of the annular toothed flange 26, and the excessive movement pivotally of said arm 90 on the pivot-bolt 33 is limited by the bar 92 abutting against the nuts 34 on the bolts 33 adjacent to the ends of said bar 92, so that when the wind is blowing in one direction and the vane has adjusted the wheel to the wind the parts 94 to 98 lock the annular ring 27 with the collar 24 on the sleeve 6 to prevent the gear from acting on the sleeve 6 to cause the latter to bind on the mast. At the same time when the direction of the wind changes the parts 94 to 98 permit the vane to adjust the wheel to the changed direction of the wind, and the beveled gear-pinion 45, being secured to the shaft 43, supported by the standard 29, it engages with the beveled gear-wheel 42 at whatever point the large vane 91 and parts connected therewith may be adjusted to by the wind. Again, the beveled gear-wheel 42 and internal gear-wheel 41 being supported by ring 38 and rotating independently of the sleeve 6 and the annular rings 21 and 27 and attachments and said internal gear-wheel 41 engaging with the gear-pinion 52, as the wind-wheel revolves, said beveled gear-pinion 45, beveled gear-wheel 42, internal gear-wheel 41, gear-pinion 52, and shaft 46 are rotated, as well as the beveled gear-wheels 50 and 87, shaft 85, and chain-wheel 88, secured to said shaft 85, from which chain-wheel motion is communicated by a chain belt to the pump, churn, or any machinery requiring to be operated, and the spindles 53, to which the gear-pinion 52 is secured, being vertically adjustable on the shaft 46, the latter is operated at whatever elevation the sleeve 6 and attachments may be adjusted to on said mast 1. By securing the weight 80 to the lower end of the rope 79 the band 77, the guiding-rod 82, and the adjacent arm of the lever 73 will be lowered and the coil-spring 84 compressed. This will draw the upper end of the lever 73, the adjustable collar 65, and lower end of the lever 67 toward the standard 29 and adjust the upper end of the lever 67 outward to operate the bell-crank lever 69, ring 63, and cranks 61 on the ends of the radial rods 60 to bring the side of the fan-blades 64 to the wind to rotate the wind-wheel and start the mill to work, and when said weight is removed, said fan-blades having a greater area on one side of said radial rods, as hereinbefore described, the current of air has the greatest effect on the side having the greatest area. As a result the blades are automatically adjusted by the current of air to feather the latter, and they remain so until it is wished to start the mill to work, which is done at once by securing the weight to the lower end of the rope 79, when the parts connected therewith will be operated as hereinbefore described and the machine started to work.

When using the eccentric brake 104, the dog 17 may be disengaged from the toothed wheel 14, and when so adjusted the eccentric brake 104 holds the vertically-adjustable sleeve 6 and attachments from accidentally lowering or being lowered. When so adjusted, if a windstorm of great force was to strike the mill it would force the inclined small vane 115 backward and downward and lower the vane end of the pivotal vane-arm 113. This would raise the opposite end of the vane-arm 113, the connecting-rod 111, band 108, slide 109, and draw upward on the rope 110 to raise the outer end or handle *n* of the eccentric brake 104 and disengage it from the brake-rod 99, when the action of the wind on the fan-blades 64 would be to lower the wind-wheel, sleeve 6, and attachments on the mast 1 near to the ground and out of the wind. Thus all running away of the mill or damage or injury therefrom is avoided and completely prevented. As a result a simple, strong, durable, inexpensive, and light and easy-running air-motor or windmill is provided; one in which a single

mast is used instead of a tower; one in which the gearing may be easily lowered to oil, and thus do away with the necessity of the oiler climbing up to the top of the machine and exposing himself to danger from falling; one in which the wind-wheel may be raised or lowered with ease to any elevation to catch a current of air at any elevation on the mast 1; one which is so constructed that the gearing and wind-wheel will be automatically lowered out of danger at the beginning of storms of excessively high wind, and one in which the raising and lowering of the sleeve and gearing and wind-wheel mounted thereon may take place at the same time as the wind-wheel is revolving on its axis to communicate motion to the gearing which rotates the vertical operating-shaft 46, and both of these operations may be taking place while the vane 91 is being adjusted by the wind to move the annular rings 21 and 27 and wind-wheel around the sleeve 6 to maintain the fan-blades against and in proper position to be acted upon by the wind.

Having thus described my invention, I claim—

1. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, gearing mounted on said sleeve and a wind-wheel mounted on said gearing, in combination with a counterbalance-weight, a chain connecting said counterbalance-weight with said vertically-adjustable sleeve, and an antifriction-pulley secured to said mast near its upper end over which said chain extends, and means for raising and lowering and holding said sleeve at the position to which it is adjusted, substantially as and for the purpose set forth.

2. In a device of the class described, a mast, means for rigidly holding said mast in an upright position, a sleeve vertically adjustable on said mast, gearing mounted on said sleeve, and a wind-wheel mounted on said gearing, in combination with a counterbalance-weight, a chain connecting said counterbalance-weight with said vertically-adjustable sleeve, an antifriction-pulley secured to said mast over which said chain extends, and means for raising, lowering and holding said sleeve at the position to which it is adjusted, substantially as and for the purpose set forth.

3. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, gearing mounted on said sleeve, a wind-wheel mounted on said gearing, a counterbalance-weight, a chain connecting said counterbalance-weight with said vertically-adjustable sleeve, and an antifriction-pulley secured to said mast near its upper end over which said chain extends, in combination with shafts 11 and 12, a gear-wheel and drum on the shaft 11 and a gear pinion and crank on the shaft 12, a chain connecting said drum with said counterbalance-weight, a dog pivoted on said mast and engaging with said gear-wheel, and means for supporting said shafts, substantially as and for the purpose set forth.

4. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, gearing operated by the wind mounted on said sleeve, a counterbalance-weight, a chain connecting said counterbalance-weight with said vertically-adjustable sleeve, and an antifriction-pulley secured to said mast near its upper end over which said chain extends, in combination with a brake-rod secured to said mast and extending through said sleeve, a brake pivotally secured to and extending through an opening in said sleeve and engaging with said brake-rod, and means for adjusting said brake, substantially as and for the purpose set forth.

5. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, gearing operated by the wind mounted on said sleeve, a brake-rod secured to said mast and extending through said sleeve, and a brake pivotally mounted on and extending through an opening in the side of said sleeve and engaging with said brake-rod, in combination with a vertically-adjustable slide connected to said brake, a band 108 adjustable around said sleeve, with which band said slide engages, a rod 111 connected at one end to said band, means for guiding and holding said rod in a vertical position, a pivotal vane-arm connected at one end to said rod 111, a bracket for supporting said vane-arm, and a vane secured to the outer end of said vane-arm, substantially as and for the purpose set forth.

6. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, and means for adjusting and holding said sleeve at the position to which it may be adjusted, upper and lower collars 19 and 24 rigidly secured to said sleeve and provided with external rim-flanges, upper and lower annular rings 21 and 27 provided with internal rim-flanges and supported by said collars, and antifriction ball-bearings interposed between said upper sleeve and said upper collar, in combination with a vane-arm secured to said lower annular ring, a vane secured to the outer end of said arm, a standard secured to said annular rings, a shaft journaled in said standard, and a wind-wheel keyed on and rotating with said shaft, substantially as and for the purpose set forth.

7. In a device of the class described, a mast, a sleeve vertically adjustable on said mast, and means for holding said sleeve at the position to which it may be adjusted, upper and lower collars 19 and 24, rigidly secured to said sleeve and provided with external rim-flanges, upper and lower annular rings 21 and 27 provided with internal rim-flanges, and supported by said collars, antifriction ball-bearings interposed between said upper annular ring and said upper collar, and an annular toothed flange 26 on the under side of said lower col-

lar, in combination with a vane-arm 90 pivotally secured to said lower annular ring, a vane secured to the outer end of said vane-arm, a bar 92 pivotally secured to the upper annular ring 21, diagonal braces extending from said pivotal vane-arm 90 to said pivotal bar 92, a dog pivotally secured to said lower annular ring and adapted to engage with the teeth of the annular toothed flange 26 on the lower collar 24, a rod 95 pivotally secured at one end to said pivotal vane-arm 90 and its other end extending through and adapted to be adjusted back and forth in said dog, a nut on said rod for holding it in engagement with said dog, a clasp secured to said lower annular ring for guiding and holding said rod thereon, and a coil-spring 98 interposed between said clasp and said dog, substantially as and for the purpose set forth.

8. In a device of the class described, a mast, a sleeve encircling said mast, and a beveled and internal gear-wheel supported on and revolving around said sleeve, in combination with a gear-pinion provided with a spindle, and one side of which gear-pinion extends through an opening 56 in said sleeve and engages with said internal gear-wheel, a vertical operating-shaft extending through and secured to said spindle and journaled in bearings secured to said mast, and bearings 55 secured to the inside of the sleeve, in which said spindle is supported, substantially as and for the purpose set forth.

9. In a device of the class described, a mast, a sleeve encircling said mast, a flanged collar 36 rigidly secured to said sleeve, an annular flanged ring 38 supported by said collar 36, antifriction bearing-balls 40 interposed between said ring and said collar, and a beveled and internal gear-wheel encircling said sleeve and supported by said ring, in combination with a gear-pinion, provided with a spindle, one side of which gear-pinion extends through an opening 56 in said sleeve, and engages with said internal gear-wheel, a vertical operating-shaft extending through and secured to said spindle, and journaled in bearings secured to said mast, and bearings 55 secured to the inside of said sleeve, in which said spindle is supported, substantially as and for the purpose set forth.

10. In a device of the class described, a mast, a sleeve encircling said mast, upper and lower collars 19 and 24 rigidly secured to said sleeve, upper and lower annular rings 21 and 27 supported by said collars, a standard 29 supported by said annular rings 21 and 27, a shaft 43 journaled in said standard, and a beveled gear-pinion secured to one end and a wind-wheel to the other end of said shaft, in combination with a beveled and internal gear-wheel supported on and revolving around said sleeve, and engaging with said beveled gear-pinion, a gear-pinion provided with a spindle, one side of which gear-pinion extends through an opening 56 in the side of said sleeve and engages with said internal gear-wheel, a vertical operating-shaft extending through and secured to said spindle, and journaled in bearings secured to said mast, and bearings 55 secured to the inside of said sleeve in which said spindle is supported, substantially as and for the purpose set forth.

11. In a device of the class described, a wind-wheel having radial arms 60 provided with cranks 61 on their inner ends, fan-blades 64 secured to said radial arms and having a greater area on one side of said arms than the other, rings 59 and 62 in which said arms are pivotally supported, a hub 57, braces 58 for supporting said ring 59, and connecting it with said hub, and a shaft 43 on which said hub is keyed, in combination with a ring 63 engaging with the cranks 61 on said radial arms, a lever 67 pivotally secured on a cross-bar 68, a bell-crank lever 69 pivotally secured on a cross-bar 71, one arm, *k*, of which is pivotally secured to said ring 63 and the other arm, *i*, to the lever 67, a collar 65 adjustable on a sleeve 44, with which collar the lower end of said lever 67 engages, a loose band 77 on the sleeve 6, a lever 73 fulcrumed on the standard 29, coupling-links for connecting said lever to said adjustable collar 65 and said loose band 77, a vertically-adjustable hooked bar engaging with said loose band, a clasp for guiding said hooked bar as it is vertically adjusted, a rod 82 connected to said loose band 77 and extending through holes in annular rings supported on a sleeve 6, a transverse pin 83 secured in said rod 82, a coil-spring 84 interposed between one of said annular rings and said transverse pin, a rope secured to said hooked bar, and a weight secured to said rope, substantially as and for the purpose set forth.

In testimony whereof I have signed in the presence of the two undersigned witnesses.

ALPHONSUS M. CRUNICAN.

Witnesses:

P. J. EDMUNDS,

A. BYRICK.