No. 705,700. Patented July 29, 1902.

L. H. OSTERUD.

APPARATUS FOR EQUALIZING, CONTROLLING, AND STORING POWER.

(Application filed June 20, 1901.)

(No Model.) 3 Sheets—Sheet 1.

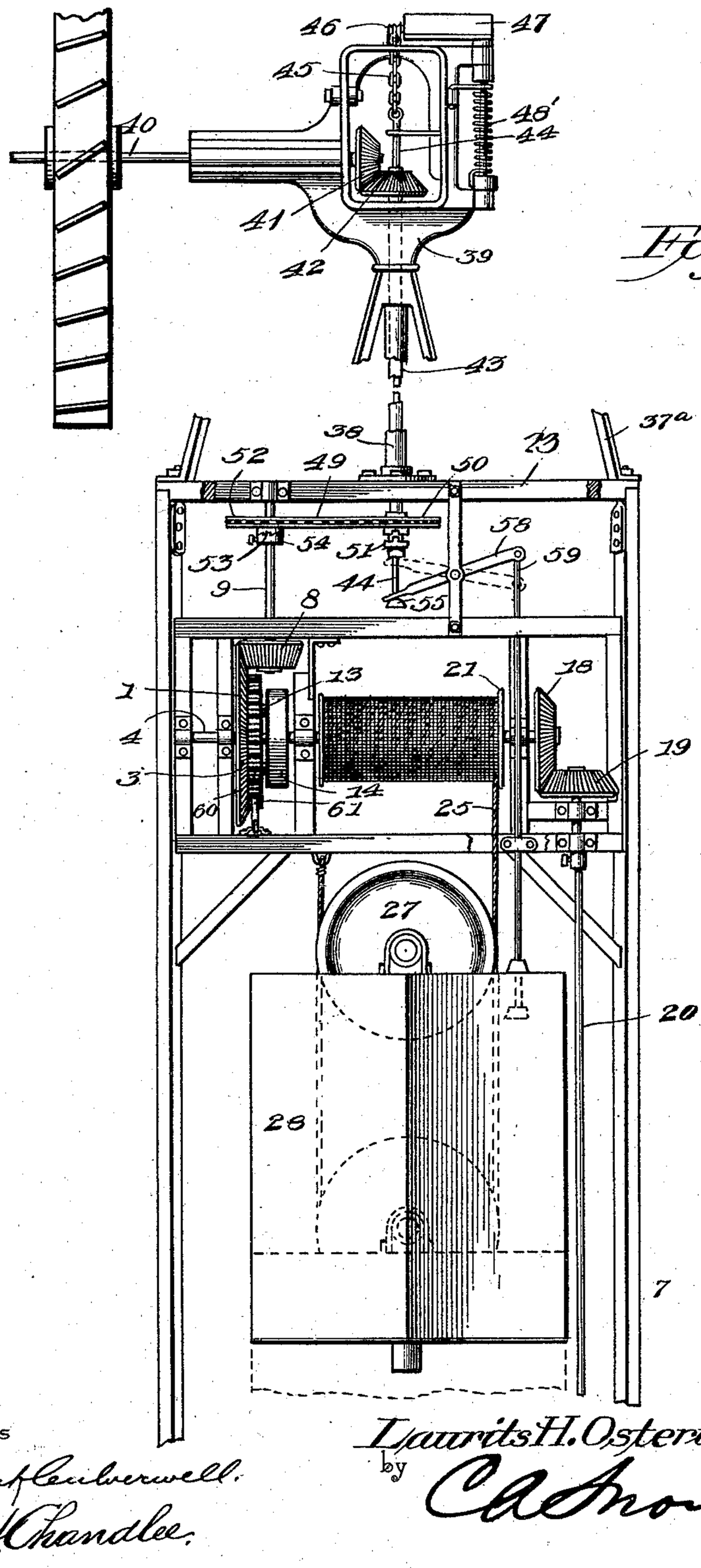

Fig. 1.

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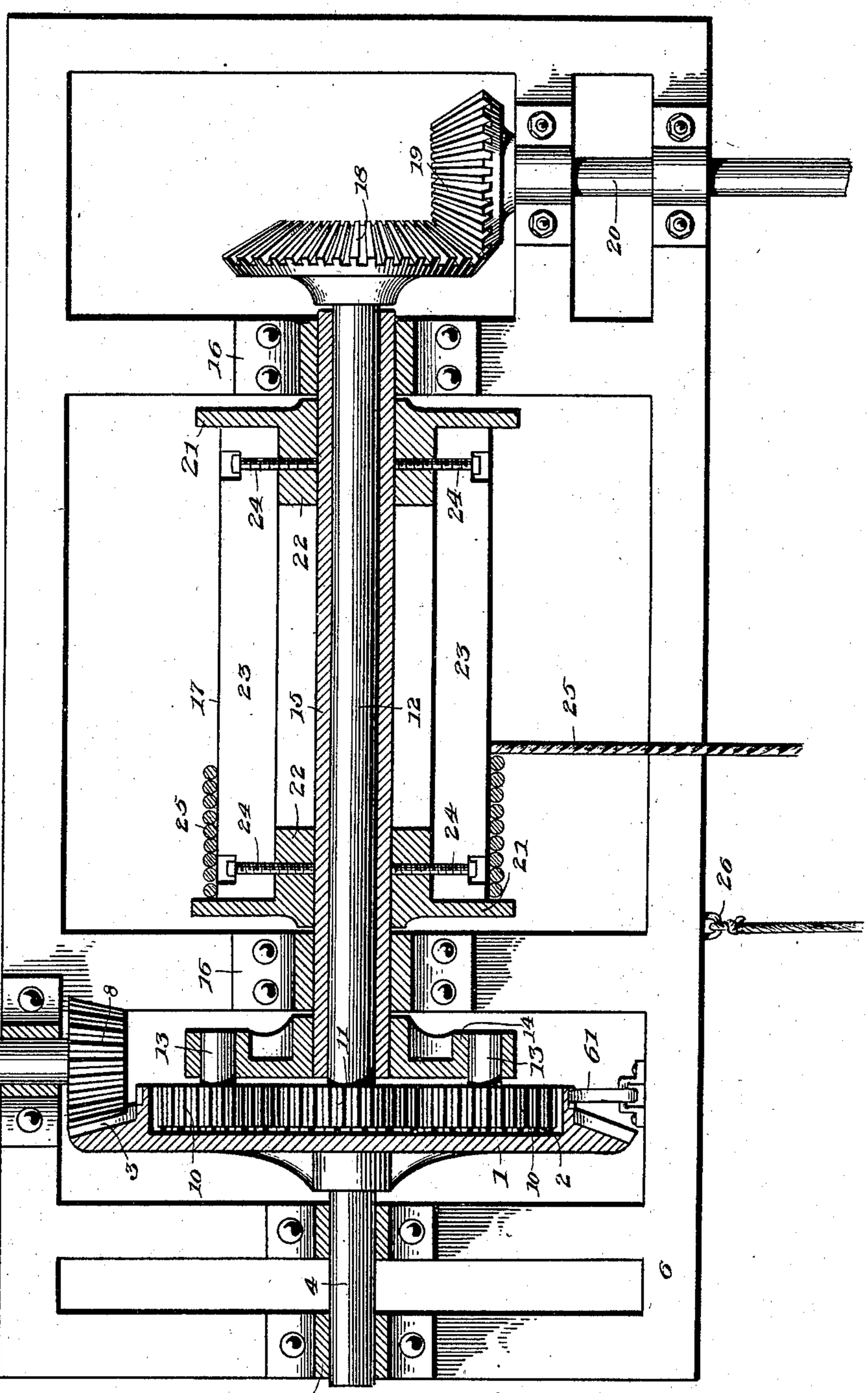
(No Model.) 3 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 6.

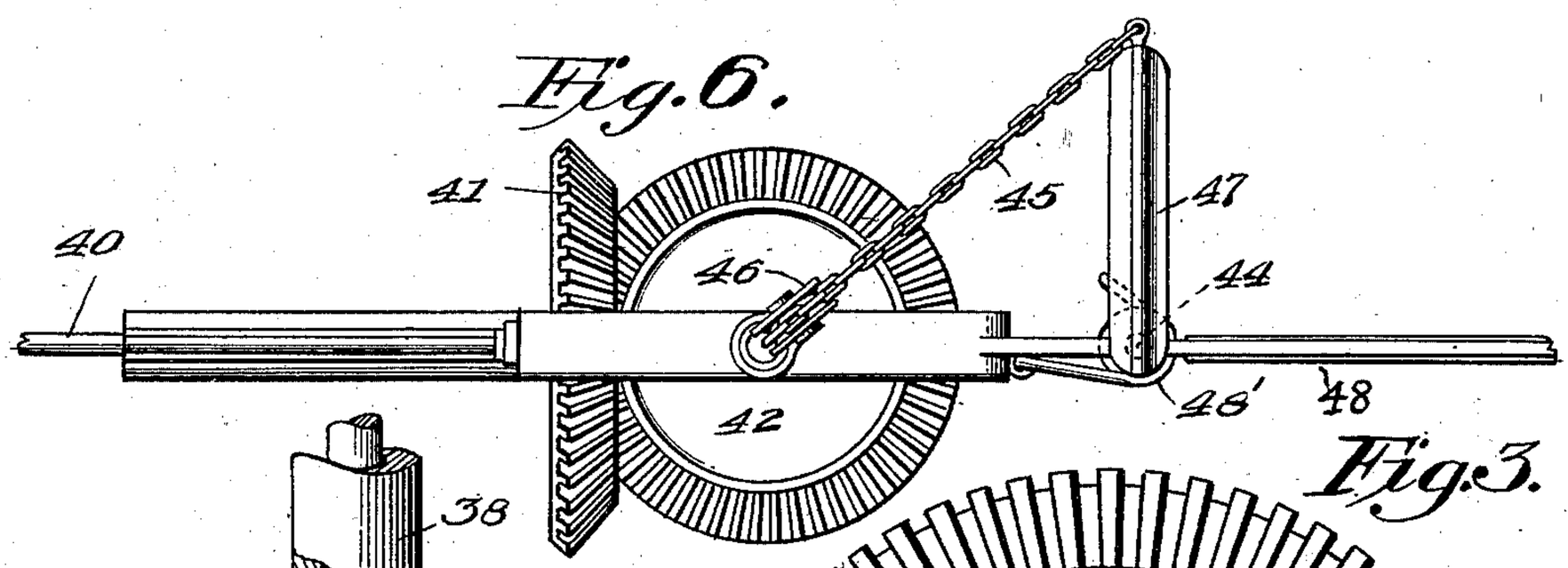


Fig. 7.

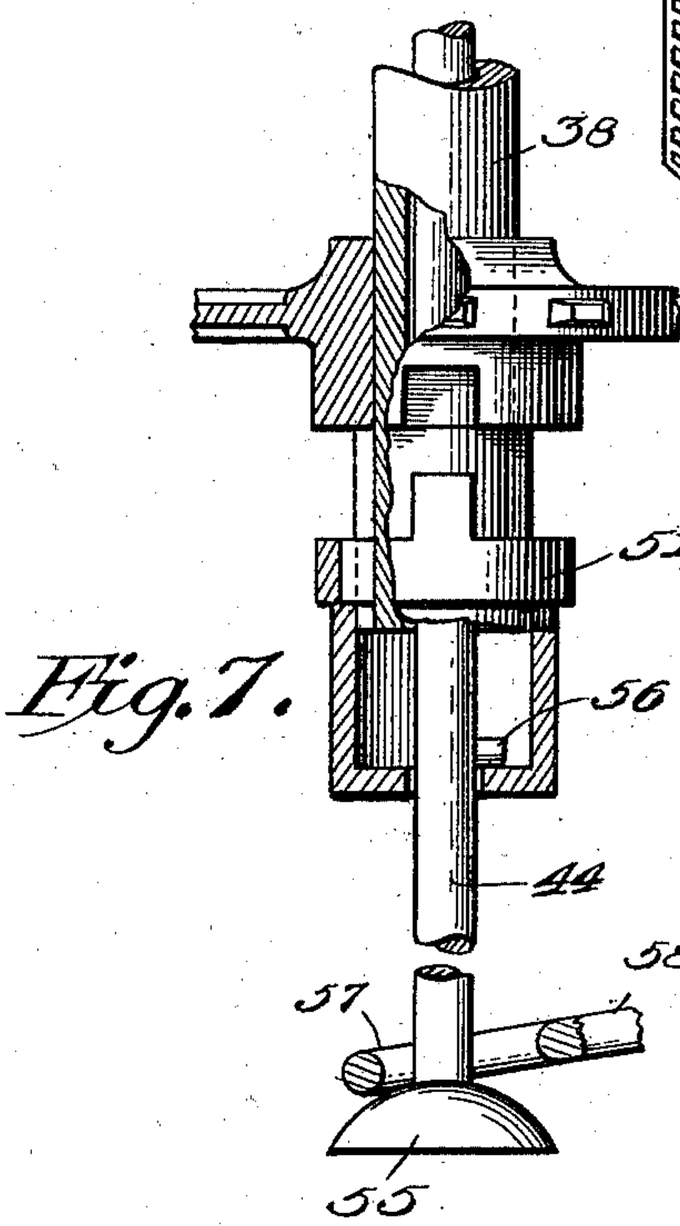


Fig. 3.

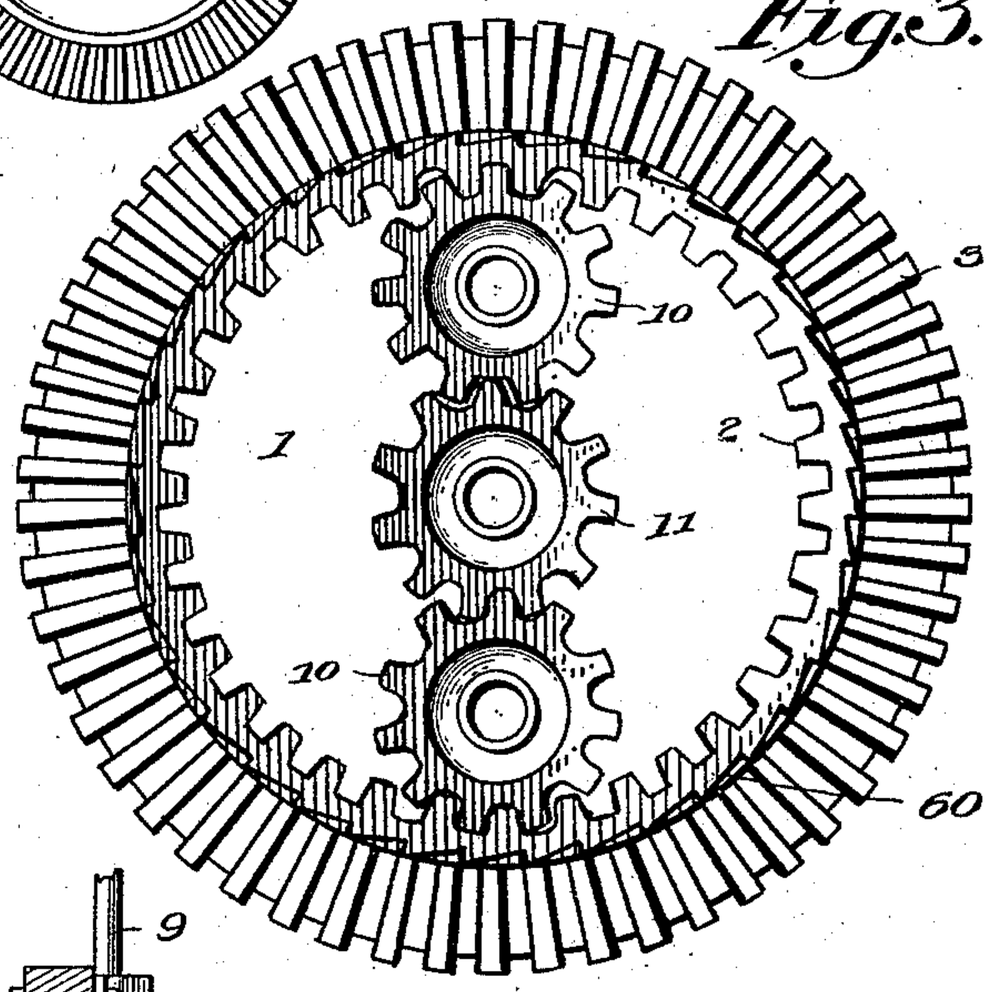


Fig. 8.

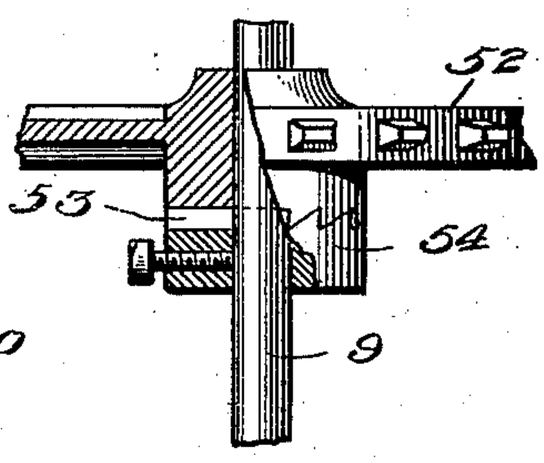


Fig. 5.

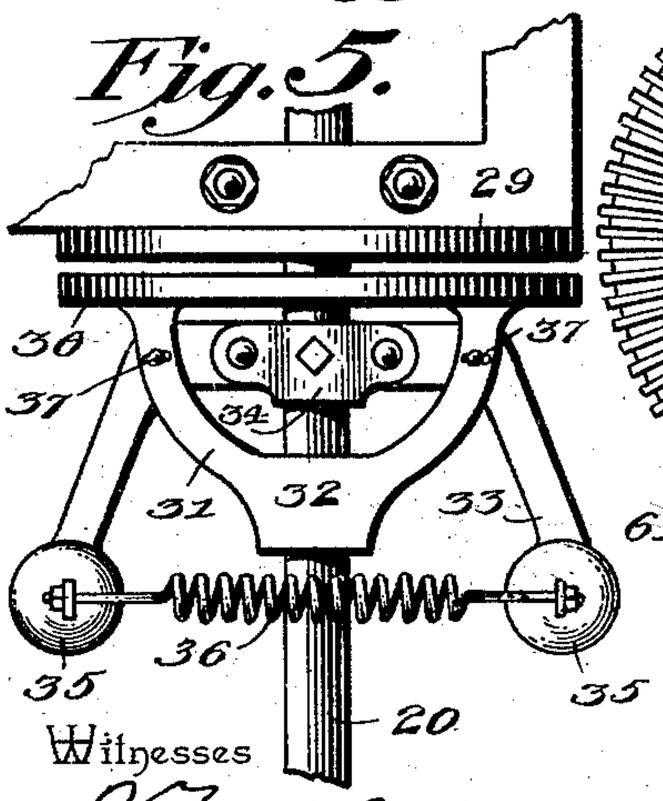
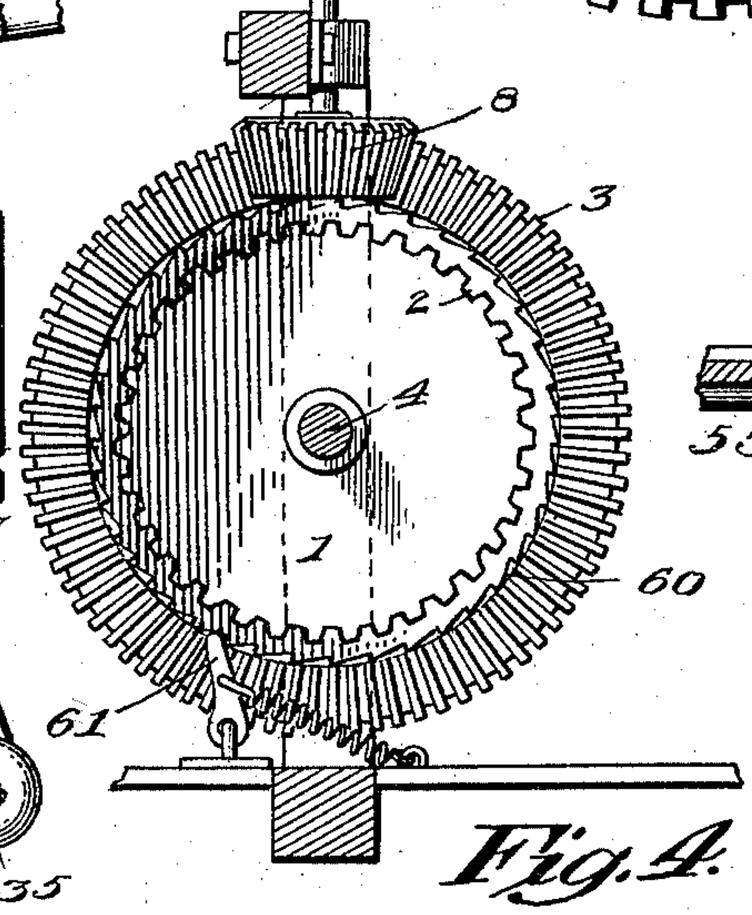


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

LAURITS HANSEN OSTERUD, OF SPRINGVALLEY, MINNESOTA.

APPARATUS FOR EQUALIZING, CONTROLLING, AND STORING POWER.

SPECIFICATION forming part of Letters Patent No. 705,700, dated July 29, 1902.

Application filed June 20, 1901. Serial No. 65,379. (No model.)

To all whom it may concern:

Be it known that I, LAURITS HANSEN OSTERUD, a citizen of the United States, residing at Springvalley, in the county of Fillmore and State of Minnesota, have invented a new and useful Apparatus for Equalizing, Controlling, and Storing Power, of which the following is a specification.

The invention relates to an apparatus for equalizing, storing, and controlling power.

The object of the present invention is to regulate the speed of irregular motive power, such as is furnished by a windmill, and to provide a simple, inexpensive, and efficient device of this character adapted to regulate the power and secure a uniform application of power to a pump or other device to be operated and to store up to a certain extent the excess of power without interfering with the operation of the windmill and the pump or other device operated thereby.

A further object of the invention is to enable such stored power to be utilized when no power is obtainable from the said motive power and to provide means for locking the mechanism against retrograde movement should the wind entirely cease.

The invention consists in the construction and novel combination and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended.

In the drawings, Figure 1 is an elevation of a device constructed in accordance with this invention and shown applied to a windmill. Fig. 2 is an enlarged longitudinal sectional view of the device. Fig. 3 is a transverse sectional view illustrating the arrangement of the gearing for connecting the main vertical gear-wheel with the inner and outer shafts of the device. Fig. 4 is a similar view illustrating the arrangement of the pawl and ratchet for locking the main vertical gear-wheel against retrograde movement. Fig. 5 is a detail view of the governor for regulating the speed of the power-shaft. Fig. 6 is a plan view of the windmill, illustrating the arrangement of the mechanism for swinging the vane to move the wind-wheel out of the wind. Fig. 7 is a detail view illustrating the construction of the clutch of the vertical shaft of the windmill. Fig. 8 is a detail view of the clutch for permitting the mechanism of the windmill to rotate backward without affecting the device.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

1 designates a vertical gear-wheel provided with internal and external spur-teeth 2 and 3 and mounted on a stub-shaft 4, which is journaled in suitable bearings 5 of a frame or support 6, that is mounted on and forms a part of a windmill-tower 7. The external teeth, which are bevel-teeth, mesh with a bevel-pinion 8 of a vertical shaft 9, which is connected with and receives motion from a windmill, as hereinafter explained, and which when the windmill is in operation drives the vertical gear-wheel 1. The internal spur-teeth 2, which are arranged at the inner face of an annular flange of the gear-wheel 1, as clearly illustrated in Figs. 2 and 3 of the accompanying drawings, mesh with intermediate planetary gears or pinions 10, which mesh with a central gear or pinion 11 of an inner horizontal shaft 12, and which are mounted on pivots or stub-shafts 13 of arms 14 of an outer tubular shaft 15. The outer tubular shaft 15, which is journaled in suitable bearings 16 of the support 6, carries a drum 17 and receives the inner shaft 12, which is connected by bevel-gears 18 and 19 with a power-shaft 20. The power-shaft is designed to be connected with the pump or other suitable device or machine to be operated, and any suitable mechanism may be employed for communicating motion from the said shaft 20 to the pump or other device to be operated. The arms 14, which extend from one end of the outer tubular shaft 15, are suitably secured to the same, and the intermediate gears 10, which rotate freely on the pivots or stub-shafts 13, will when the vertical gear-wheel is rotated either communicate motion to the central gear or pinion and drive the inner shaft 12 or they will swing or revolve around the central gear or pinion 11, and thereby rotate the outer shaft and the drum which is secured to the same.

The drum 17, which may be constructed in any suitable manner, is preferably composed of heads 21, provided with octagonal hubs 22 and connected by bars 23, which are secured

by screws or other suitable fastening devices 24 to the hubs, and the said screws, which have their heads arranged in suitable recesses of the bars, extend through the hubs and engage the outer tubular shaft and rigidly secure the drum to the same. Secured to the drum is one end of a flexible connection 25, which has its other end 26 attached to the support 6, and this flexible connection, which is adapted to be wound upon and unwound from the drum, is looped to receive a pulley 27 of a weight 28. The loop of the flexible connection depends from the support, and the pulley which is supported by the loop is mounted on a suitable shaft or spindle which is journaled in suitable bearings of the weight, at the top thereof. The top of the weight is provided with a suitable recess or cavity to receive the lower portion of the pulley, as indicated in dotted lines in Fig. 1 of the drawings; but the weight and the pulley may be constructed in any other suitable manner, as will be readily understood, and more than one pulley may be employed to form a number of loops to enable very heavy weights to be raised for storing a large amount of power.

When the main vertical gear-wheel 1 of the device is rotated, the weight will tend to resist any forward movement of the intermediate gears 10 around the central gear 11, and while such movement is resisted by the weight the rotation of the intermediate gears will rotate the central gear or pinion 11, which is fixed to the shaft 12 and which will thereby operate the pump or other device to be operated by the windmill. Should the power of the windmill increase, the excess of power will operate to rotate the intermediate gears around the central gear 11, and thereby rotate the drum and wind up the weight. As the load, which is represented by the pump or other device to be operated, and the weight remain constant, the upward and downward movement of the weight incident to the rotation of the drum will equalize any variation in the motive power and will secure a uniform application of power to the pump or other device to be operated.

The pump, machine, or other device which represents the load may or may not be constant or uniform, and to compensate for any variation in the same the vertical shaft 20 is preferably connected with a governor, which is clearly illustrated in Fig. 5 of the accompanying drawings. The governor consists of a stationary friction disk or plate 29, secured to a suitable support and arranged to be engaged by a movable friction disk or plate 30, slidingly mounted on the shaft 20 and provided with a pair of arms 31, converging downward and connected with a sleeve 32, which is arranged on the shaft. The arms are pivotally connected with a pair of weighted levers 33, which are approximately L-shaped, as shown. The inner or upper ends of the levers are fulcrumed on a collar 34, and the lower ends of the levers are provided with suitable weights 35 and are connected by a transverse spring 36. The levers are pivotally connected between their ends with the arms 31 by transverse-pins 37 or other suitable fastening devices, which are arranged in slots of the said arms 31, as clearly shown in Fig. 5. The spring, which is provided at its ends with extensions, operates to hold the lower weighted ends of the levers against outward movement to maintain the disk or plate 30 out of engagement with the disk or plate 29; but when the speed of the shaft increases the weighted arms will be thrown outward and will carry the disk or plate 30 into engagement with the disk or plate 29. This will operate as a brake to resist the rotation of the shaft 20, and the latter will be prevented from rotating in excess of or at a rate of speed higher than a predetermined speed. The weighted ends of the levers are provided with perforated ears to receive the extensions of the spring, and the said extensions are threaded for the reception of nuts, as shown.

The tower or framework 7, which is preferably constructed of wood, has mounted upon it an upper or stub tower 37ª, which supports the upper end of a rotary tube 38, and the latter is stepped in a suitable bearing of the framework or tower 7 and is secured to a rotary frame or bracket 39. The rotary frame or bracket is provided with a suitable bearing for the reception of a horizontal wind-wheel shaft 40, which carries the wind-wheel (not shown) and which is connected by bevel-gears 41 and 42 with a vertical shaft 43, located within and extending downward below the vertical tube 38. The vertical shaft 43 is tubular and receives a vertically-movable rod 44, which is connected at its upper end with a chain 45, and the latter extends over a suitable pulley 46 and is connected with an arm 47 of a vane 48. The vane 48 is normally held in a position at right angles to the plane of the wind-wheel to cause the latter to face the wind by a spring 48′, which is connected with the vane and with the rotary frame or bracket, being preferably mounted on the pivot or pintle of the vane, as indicated in Fig. 1 of the accompanying drawings.

The lower end of the vertical tubular shaft is connected by sprocket-gearing 49 with the vertical shaft 9 to communicate motion to the latter. The sprocket-wheel 50 of the said sprocket-gearing is loosely mounted on the lower end of the vertical tubular shaft 43, and it is provided with a suitable clutch-face and is adapted to be engaged by a sliding clutch-section 51, keyed or otherwise slidingly connected with the lower end of the tubular shaft and adapted to be engaged with and disengaged from the sprocket-wheel 50, as hereinafter explained. The other sprocket-wheel 52 of the sprocket-gearing is loosely mounted on the vertical shaft 9, and it is provided at the lower side of its hub with a clutch-face 53, provided with beveled teeth which engage corresponding teeth of a clutch-

section 54. The clutch-section 54 is rigidly secured to the vertical shaft 9, and the two clutch portions or sections produce a forward rotation of the vertical shaft 9 when the windmill is in operation and at the same time permit the sprocket-wheel 52 to rotate backward without straining the mechanism should the wind-wheel rotate backward.

The vertically-movable rod 44 is provided at its lower end with a head or enlargement 55, and it has a lug 56, which is arranged, as clearly illustrated in Fig. 7, to engage the sliding clutch-section 51 to uncouple the sprocket-gearing from the vertical tubular shaft when the wind-wheel is turned out of the wind. The lower portion of the rod 44 passes through a loop 57 of a lever 58, fulcrumed between its ends on a suitable support, as clearly shown in Fig. 1 of the accompanying drawings. The loop is arranged at the inner end of the lever 58, and the outer end of the latter is connected with a vertically-movable lifting-rod 59, mounted in suitable guides and arranged in the path of the weight and adapted when the latter nears the limit of its upward movement to be engaged by the same. The weight is adapted to force the vertically-movable lifting-rod upward to swing the inner end of the lever 58 downward into engagement with the enlargement or head at the lower end of the rod 44 and gradually draw the wind-wheel out of the wind to stop the windmill. Just as the wind-wheel is drawn completely out of the wind the lug 56 is carried into contact with the sliding clutch-section 51, and the latter is disengaged from the sprocket-wheel 50 to permit the vertical tubular shaft to turn freely without actuating the sprocket-gearing. When the weight descends sufficiently, the vertically-movable lifting-rod drops, and the spring of the windmill swings the wind-wheel into the wind, and the inner end of the lever 58 reëngages the clutch-section 51 with the clutch-section or face of the sprocket-wheel 50.

The main vertical gear is provided on the exterior of the flange, which has the internal spur-teeth, with exterior ratchet-teeth 60, arranged to be engaged by a pawl 61, which is preferably spring-actuated and which is adapted to prevent the windmill from being reversed by the action of the weight should the wind cease to blow and the weight be elevated. The pawl under such conditions will prevent any retrograde rotation, as the main gear-wheel and the power stored by raising the weight will be expended in driving the pump, machine, or other device.

The pump or other machine which constitutes the load may be readily stopped and started at any time, and the device works automatically to turn the wind-wheel in and out of the wind to stop and start the windmill, and the latter is not operated by hand. The windmill when the pump or other machine is stopped operates to raise the weight to the limit of its upward movement, and thereby store a large amount of power, which may be utilized when there is no wind. As soon as the pump or other machine is stopped by a brake or any other suitable means the windmill will continue its operation until the weight arrives at the limit of its upward movement and actuates the vertically-movable lifting-rod 59. This, as before explained, will operate to stop the windmill. The pump or other machine may be started at any time, and as soon as the weight begins to descend the windmill will be again started. Should there be no wind, the power stored by raising the weight may be relied on for operating the pump or other machine. In effect the pump or other machine is altogether driven or actuated by the weight, which produces a constant uniform application of power and which is adapted to rise and fall to compensate for any irregularity either in the windmill or other motive power or in the pump or other machine operated. Thus the irregular power of the windmill is utilized to raise the weight, and the constant and uniform power of the weight insures a uniform application of power irrespective of the power or speed of the windmill.

It will be seen that the vertically-movable weight, which is adapted to store power, is connected with the motive power and with the machine to be operated by gearing which will permit the weight to operate independently of the motive power for actuating the machine when the motive power is withdrawn and while the same is in operation, whereby the said weight is adapted to form the sole means for driving or operating the machine and also for converting irregular motive power into a uniform and constant power. It will also be clear that the weight is not only adapted to compensate for any variations in the speed or power of a windmill or other motive power, but that it is also capable of yielding to any variations or irregularities of a pump or other machine operated by it.

What I claim is—

1. In a device of the class described, the combination of the inner and outer concentric shafts, a main gear, a central gear or pinion mounted on the inner shaft, and an intermediate gear or pinion connected with the outer shaft and meshing with the said gears and adapted to communicate motion from the main gear to the central gear and capable also of revolving around the latter in either direction, substantially as and for the purpose described.

2. In a device of the class described, the combination of the inner and outer concentric shafts, a main gear, a central gear connected with the inner shaft, and a pair of intermediate gears arranged at opposite sides of and connected with the outer shaft and meshing with the said gears and adapted to communicate motion from the main gear to the central gear and capable of revolving backward and

forward around the latter, substantially as described.

3. In a device of the class described, the combination of an inner shaft designed to be connected with the device to be operated, an outer shaft, a main gear designed to be connected with the power, a central gear connected with the inner shaft, an intermediate gear meshing with the central gear and with the main gear and connected with the outer shaft, and capable of revolving around the central gear in either direction and means connected with the outer shaft for resisting the movement of the intermediate gear around the central gear for controlling the application of the power and for storing any excess of power, substantially as and for the purpose described.

4. In a device of the class described, the combination of an inner shaft designed to be connected with the device to be operated, an outer shaft, a main gear, a central gear connected with the inner shaft, an intermediate gear meshing with the said gears and connected with the outer shaft and capable of moving around the central gear in either direction, and a weight also connected with the outer shaft, substantially as and for the purpose described.

5. In a device of the class described, the combination of a main gear designed to be connected with the power, an inner shaft, an outer shaft, a central gear connected with the inner shaft, the intermediate gears meshing with the said gears and connected with and located at opposite sides of the outer shaft and mounted independently of the main gear, whereby it is adapted to move freely around the central gear in either direction, a flexible connection arranged to be wound up by the rotation of the outer shaft, and a weight supported by the flexible connection, substantially as described.

6. In a device of the class described, the combination of an inner shaft, a main gear, a central pinion connected with the inner shaft, an outer shaft, intermediate gears connected with the outer shaft and meshing with the main gear and with the central pinion and capable of moving around the latter in either direction independently of the main gear, a drum carried by the outer shaft, a weight, and a flexible connection supporting the weight and connected with the drum, substantially as described.

7. In a device of the class described, the combination of inner and outer shafts, a main gear-wheel provided with internal and external teeth, a central pinion mounted on the inner shaft, intermediate gears meshing with the central pinion and with the internal teeth of the main gear and connected with the outer shaft, a drum carried by the outer shaft, a flexible connection attached to and adapted to be wound around the drum, a weight supported by the flexible connection, the shaft 9 designed to be connected with the motive power and provided with a pinion meshing with the external teeth of the main gear, and gearing for connecting the inner shaft to the device to be operated, substantially as described.

8. In a device of the class described, the combination of the inner and outer shaft, a central pinion connected with the inner shaft, a main gear having ratchet-teeth, intermediate gears connected with the outer shaft and meshing with the central pinion and with the main gear and capable of revolving around the central pinion in either direction independently, a weight connected with the outer shaft, and a pawl mounted independently of the support of the intermediate gears and adapted to engage the ratchet-teeth of the main gear to lock the same against backward movement, substantially as and for the purpose described.

9. In a device of the class described, the combination of inner and outer shafts, a main gear-wheel provided with internal and external teeth and having a ratchet, a central pinion mounted on the inner shaft, intermediate gears meshing with the central pinion and with the internal teeth of the main gear and connected with the outer shaft, a drum carried by the outer shaft, a flexible connection attached to and adapted to be wound up by the drum, a weight supported by the flexible connection, the shaft 9 designed to be connected with the motive power and having a pinion meshing with the external teeth of the main gear, gearing for connecting the inner shaft with the device to be operated, and a pawl for engaging the ratchet, substantially as described.

10. In a device of the class described, the combination of a main gear having internal and external teeth, a central gear designed to be connected with the device to be operated, an intermediate gear meshing with the central gear and with the internal teeth of the main gear and adapted to communicate motion from the latter to the former and capable of revolving around the central gear, and means for resisting the movement of the intermediate gear around the central gear, substantially as described.

11. In a device of the class described, the combination of a main gear, a central gear designed to be connected with the machine or device to be operated, means for connecting the main gear with the motive power, a pair of intermediate gears located at opposite sides of the central gear and meshing with the same and with the main gear and capable of revolving around the central gear in either direction, and means for resisting the movement of the intermediate gears around the central gear, substantially as and for the purpose described.

12. In a device of the class described, the combination with a windmill provided with means for drawing the wind-wheel out of the wind, a main gear, a central gear, interme-

diate gears meshing with the main gear and with the central gear and adapted to communicate motion to the latter and to revolve around the same, a weight connected with the intermediate gears, a lifting-rod arranged in the path of the weight and connected with the means for drawing the wind-wheel out of the wind, and gearing for connecting the main gear with the windmill, substantially as described.

13. In a device of the class described, the combination with a windmill provided with a hinged vane, and having means for swinging the same, of a main gear, a central gear, intermediate gears meshing with the main gear and with the central gear and arranged to revolve around the latter, a weight connected with the intermediate gears, gearing for connecting the main gear with the windmill, a clutch for coupling such gearing to the windmill, a lever arranged to operate the clutch and to actuate the means for swinging the vane, and a lifting-rod connected with the lever and arranged in the path of the weight, substantially as described.

14. In a device of the class described, the combination with a source of power and a machine or device to be operated, of a vertically-movable weight, and gearing connecting the weight with the source of power and with the machine or device, said gearing being provided with an element capable of moving backward and forward independently of either the source of power or the machine or device, substantially as described.

15. In a device of the class described, the combination with a source of power, and a machine or device to be operated, of a vertically-movable weight, a drum, a flexible connection connecting the weight with the drum, and gearing connecting the drum with the source of power and with the machine or device to be operated, and adapted to permit the weight to operate independently of the former to actuate the latter and equalize the former, and also to store energy, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LAURITS HANSEN OSTERUD.

Witnesses:

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C. W. ACKLEY.