

N. F. BURNHAM.
Water-Wheels.

No. 149,027.

Patented March 31, 1874.

Fig. 1.

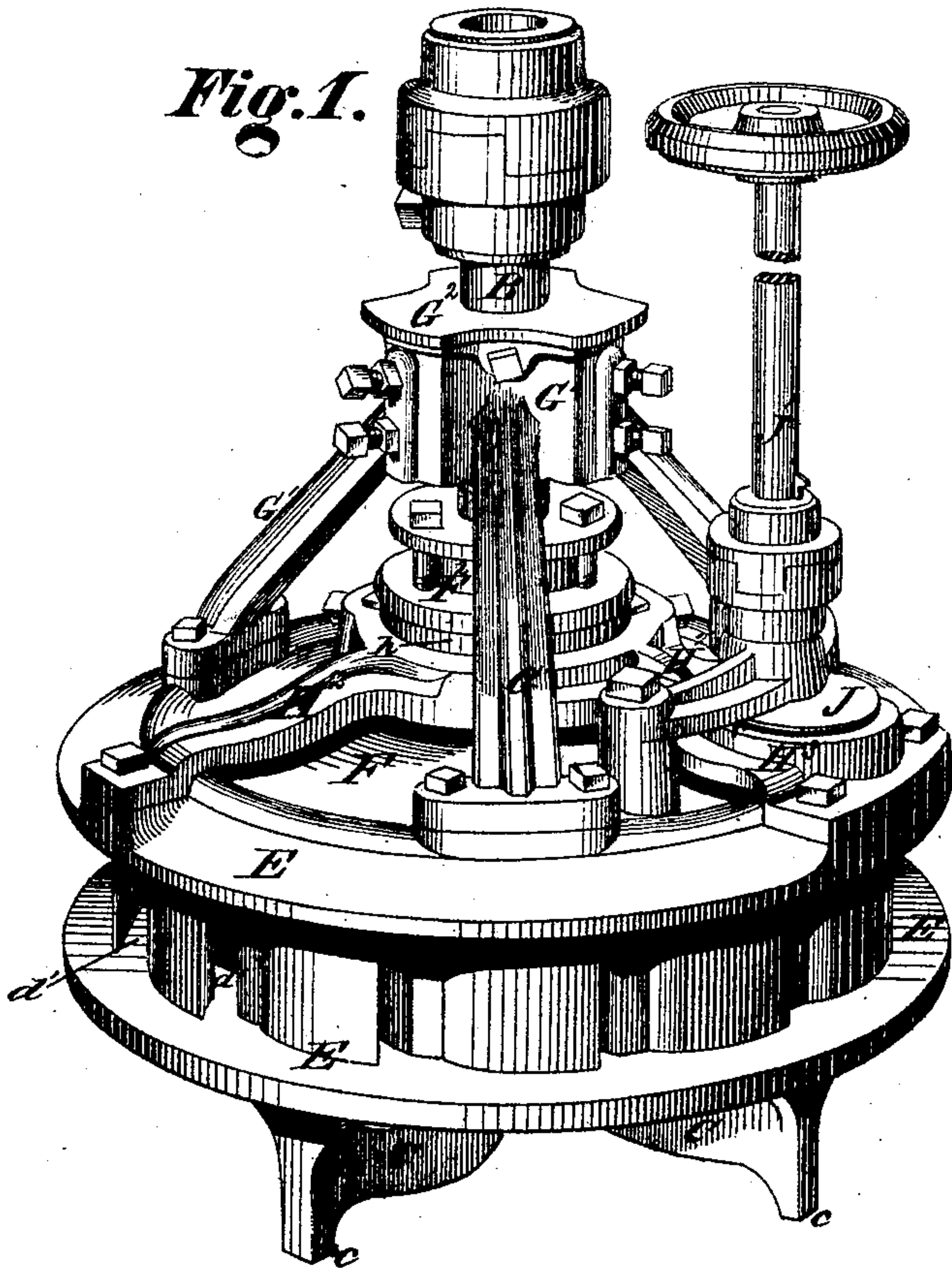
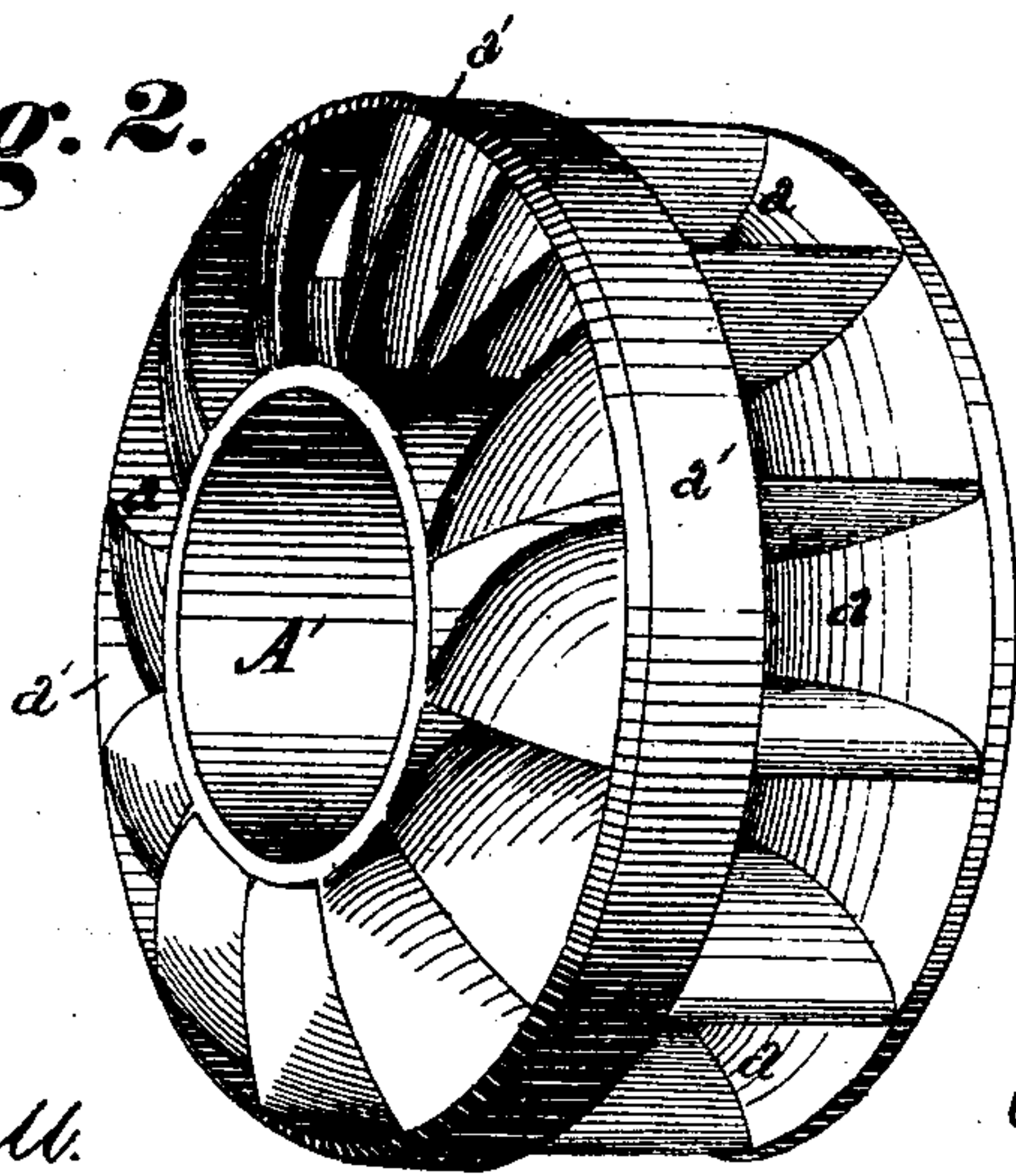


Fig. 2.



Witnesses.

J. Snowden Bell.
Jno. Everding

Inventor.

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Fig. 3.

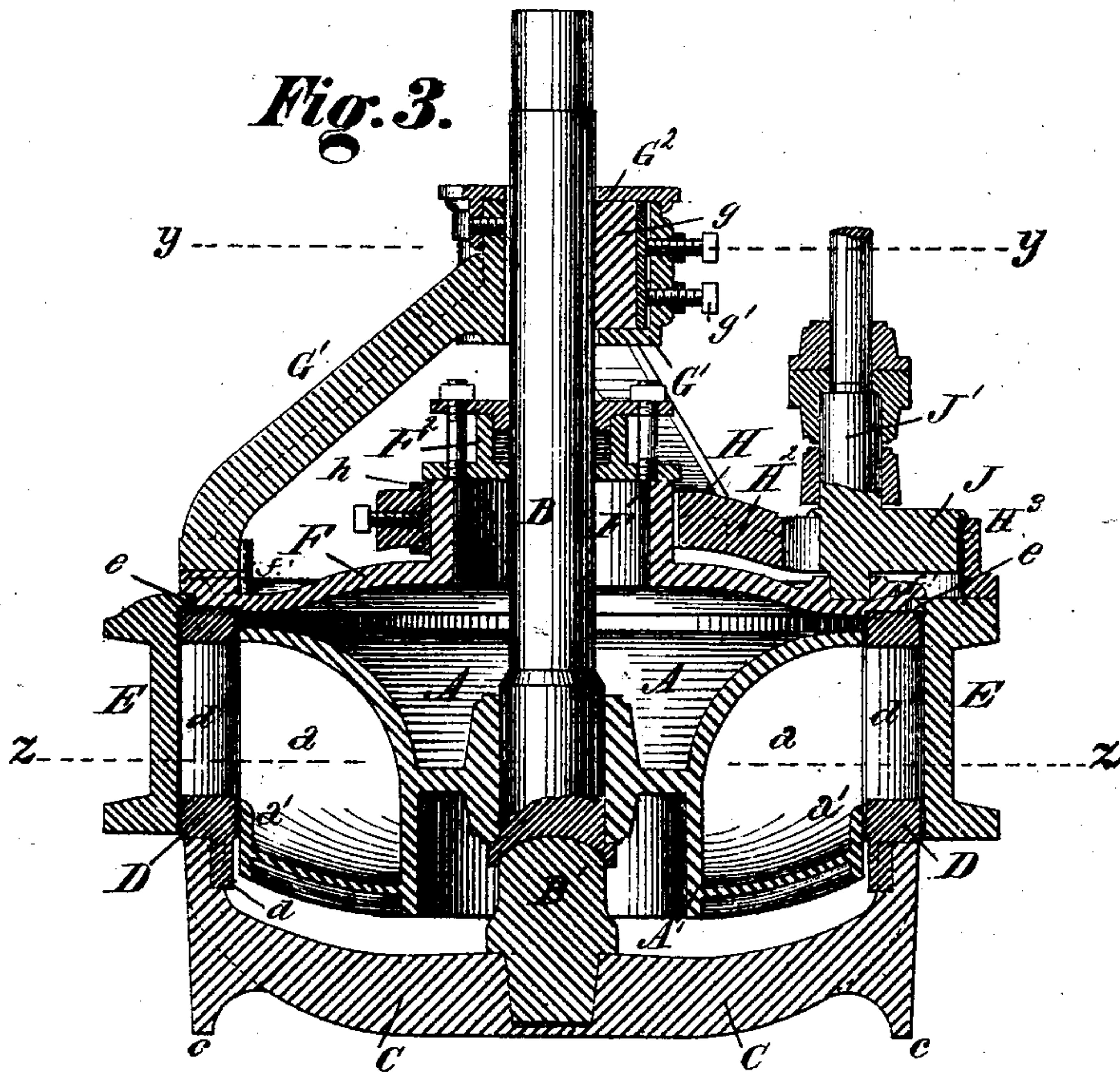


Fig. 4.

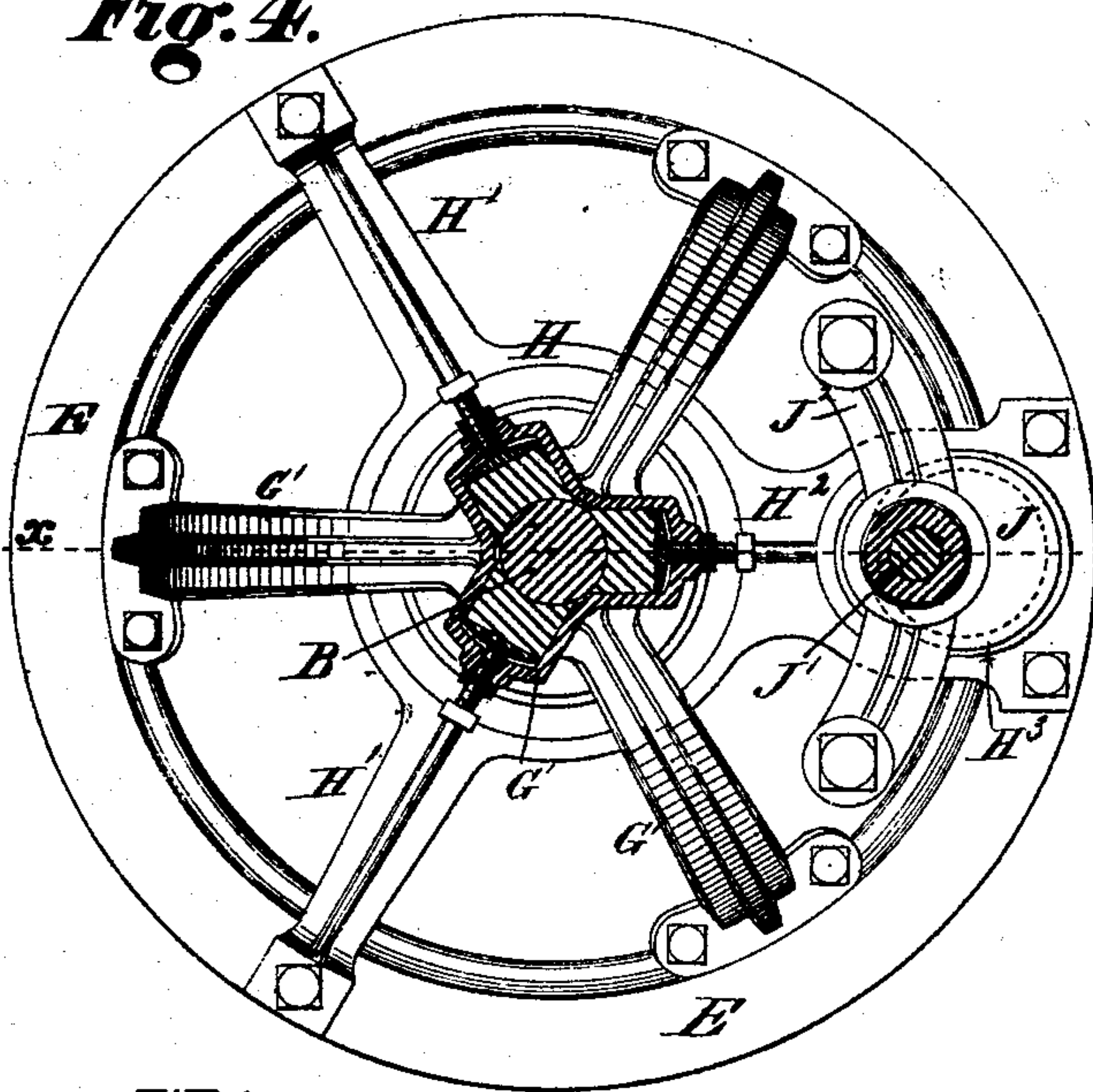
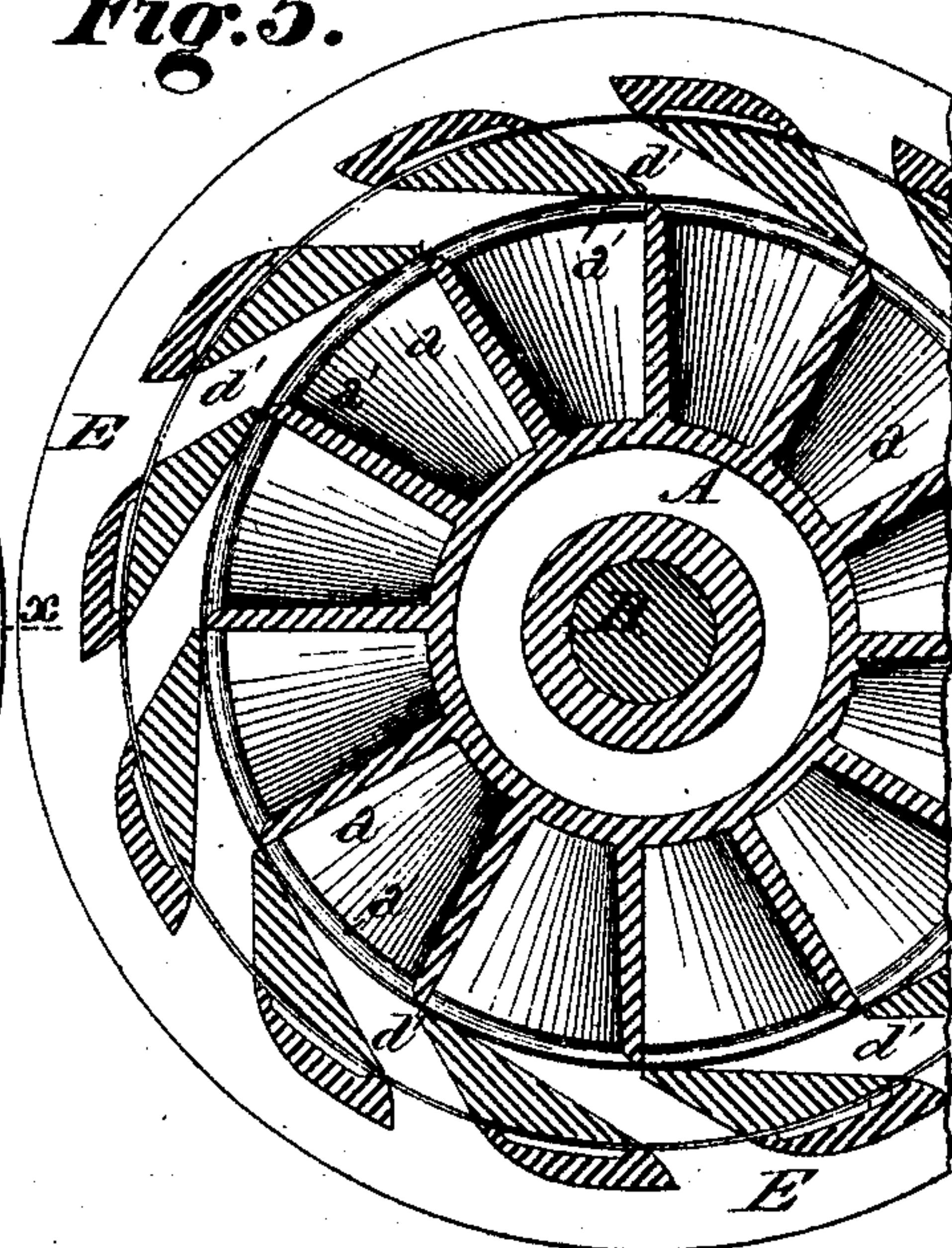


Fig. 5.



Witnesses.

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UNITED STATES PATENT OFFICE.

NATHAN F. BURNHAM, OF YORK, PENNSYLVANIA.

IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. **149,027**, dated March 31, 1874; application filed February 13, 1874.

To all whom it may concern:

Be it known that I, NATHAN F. BURNHAM, of the borough and county of York, in the State of Pennsylvania, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification:

My invention relates to turbine water-wheels, of the class known as flume-wheels, in which the wheel proper rotates within a submerged circular casing provided with a series of chutes or water-ways, which are opened and closed, as required, by means of an external register-gate surrounding the casing, and having a series of openings corresponding with the mouths of the chutes. Sundry Letters Patent of the United States heretofore have been granted to me under the respective dates of February 22, 1859, March 3, 1868, and May 9, 1871, for various improvements in water-wheels, in which the above-mentioned and other features were embodied. The main object of my present invention is to improve and simplify the construction of such wheels and to add to their effectiveness in operation; but some of my improvements may be used without the others, and in wheels differing in construction from that herein shown and described.

The first part of my invention relates to the wheel itself, and its object is to increase the effectiveness thereof; to which end the improvement consists, first, in a novel method of constructing the wheel proper, so that the bottom flange of its upwardly-flaring concavo-convex hub shall extend below the bottom of its periphery, and its buckets shall have a downward slope, either straight or curved at bottom from their periphery to the lower edge of the hub.

The next part of my invention relates to the manner of supporting and packing the wheel-shaft. Its objects are to secure accurate adjustment, firm support, and steady working of the moving parts of the wheel, and at the same time to prevent sand or grit from being forced by the pressure of the water between the wheel-shaft and the cover of the wheel, to which ends my improvement consists, second, in combining, in a flume water-wheel, a casing in which a wheel is inclosed, an elevated bearing or box supporting the shaft, and a

stuffing-box (through which the wheel-shaft passes), interposed between the casing and bearing-box.

The next part of my invention relates to the gate. Its objects are to diminish the power required to move the gate, to simplify the mechanism which opens and closes it, and to dispense with the cog-gearing heretofore employed to attain this result, thus avoiding the liability of breakage and clogging incident to gates actuated by such gearing. To these ends the improvement consists, third, in a novel method of actuating the register gate or gates of a water-wheel by means of a cam and eccentric yoke.

The next part of my invention relates to the casing and register-gate. Its object is to prevent sand or grit from working in between them; to which end the improvement consists, fourth, in constructing the register-gate of a flume water-wheel with an annular flange, which overlaps and rests upon the casing, in combination with a flange on the cover overlapping the flange of the register-gate, and a shoulder abutting against the inner edge of the casing.

In the accompanying drawings, Figure 1 is a view in perspective of a water-wheel and its appurtenances, in which all my present improvements are embodied. Fig. 2 shows a similar view of the wheel proper detached; Fig. 3, a vertical central section of the entire machine on the line *xx* of Fig. 4. Fig. 4 represents a plan view thereof, and also a horizontal section on the line *yy* of Fig. 3, and Fig. 5 a horizontal section on the line *zz* of Fig. 3.

The upper portion of the wheel proper is constructed similarly to the corresponding part of the one shown and described in my patent of February 22, 1859—that is to say, it has a hub, *A*, cylindrical for about one-third of its height, but curving outward at top to the periphery of the wheel proper. A series of radial buckets, *a*, the lower portions of which are suitably curved, as provided in said Letters Patent, is cast with or secured to the hub, their outer lower edges being connected by a ring or band, *a'*. The bottom of the buckets may be either straight or curved. The lower inner flange *A'* of the hub is ex-

tended downward below the ring a' to a depth of, say, one-half of the length of the cylindrical portion of the hub, as heretofore constructed by me, and as shown in my patent of May 9, 1871, and the lower edges of the buckets extend downward in a straight or curved line from the ring a' to the bottom of the flange A' . (See Fig. 2.)

This construction I have found, in practice, to facilitate the proper action of the water upon the buckets and its discharge therefrom, as well as to increase the power of the wheel. The wheel is secured upon a shaft, B , which rotates upon a step, B' , fixed in a bridge-tree or cross, C , properly fastened to the tubular extension d of the annular casing D , or to the casing itself. In very large wheels the tubular extension may be dispensed with and the bridge-tree attached directly to the casing.

The tube d , the inner diameter of which is slightly greater than the diameter of the wheel, terminates at a point not lower than the lower edge of the ring a' , instead of extending to the bottom of the bridge-tree, (see my patent of May 9, 1871,) the shortening of the tube being designed to facilitate the discharge of the water from the buckets.

The bridge-tree is composed of three or more radial arms, C , united to a central hub, and each provided with a leg or standard, c , which legs or standards serve as supports for the wheel and casing when placed in working position. They also afford convenient facilities for handling and transporting the same. Chutes or water-ways d' are formed in a casing, D , and the admission of the water thereto is regulated, as required, by an annular register-gate, E , in which a corresponding series of openings is provided. Recesses are formed to allow of the escape of sand or other abrasive matters which would tend to obstruct the working of the gate, as provided in my aforesaid patent of May 9, 1871. These recesses may be formed either upon the gate or the casing, as deemed most advisable. An annular flange, e , is formed upon the inner and upper surface of the gate E , and serves to support the same upon the casing D . A circular cap-plate or cover, F , which is, by preference, dished outwardly, rests upon the top of the casing D , and is provided with an annular flange, f , upon its periphery, which flange overlaps the flange e of the gate, and prevents the entrance at this point of sand or other foreign matters between the same and the casing. A shoulder, f' , on the cover abuts against the inner edge of the casing, (see Fig. 3,) and serves as an additional safeguard against the entrance of such matters. By this construction, it will be seen that the flange of the gate-ring, in effect, works in an annular groove or recess in the casing, and thus forms a close joint. A ring or flange, F^1 , projects upward from the cover F , and supports a stuffing-box, F^2 , containing suitable packing, through which the shaft B passes. The shaft is also maintained in its normal vertical posi-

tion by three or more packing-pieces, g , inserted in a box, G , which is firmly supported by arms or braces G' , secured by bolts to the cover F or the casing D .

By this method of construction, I am enabled to dispense with the dome I have hitherto employed, (shown in my patent of 1871, hereinbefore mentioned,) to support the shaft-bearing firmly, and to use a stuffing-box, at the same time insuring a stable support for the bearing, which support prevents jarring or lateral motion of the shaft, and correspondingly prevents any contact of the wheel and casing when the former is in rotation.

The gate E is connected, by arms $H^1 H^1 H^2$, to a ring, H , which turns upon the flange F^1 of the cover F , the ring H being provided with gibs or brasses h , adjustable by set-screws to a proper bearing upon the hub, as shown in my patent of 1871, above mentioned. The arm H^2 contains a cam-yoke or strap, H^3 , within which a cam or eccentric, J , oscillates, the latter being formed upon or secured to a shaft, J^1 , stepped in the cover F , and passing through a bearing, J^2 , bolted thereto. This shaft extends upward for a proper distance, and is provided with a pair of couplings, x , uniting it with a shaft, x' , having upon it a hand-wheel, J^3 , by which it is operated.

The oscillation of the eccentric produces a corresponding movement of the cam-yoke H^3 , and also of the gate E , thereby regulating or shutting off entirely the access of water to the chutes d' , as may be required. This mode of operating the gate avoids the use of the gearing hitherto employed for the purpose; and, as the eccentric shaft may be stepped close to the periphery of the cover, or on an extension thereof, if deemed preferable, the leverage thus obtained enables the gate to be moved more readily than when gearing is used. This plan is also cheaper, and less liable to clog, break, or get out of order, than gearing.

In using wheels with an outer inclosing-case, I prefer to mount the eccentric shaft in bearings in said outer case, and to extend the cam-yoke out to suit this change.

I claim as my invention—

1. The hub constructed, substantially as described, with an upward flare, and with its lower portion extended below the periphery of the wheel, in combination with buckets, constructed substantially as described, having their lower edges sloped downwardly from the periphery to the hub, these members operating in combination, substantially as set forth.

2. The combination, in a flume-wheel, of the casing, the wheel inclosed therein, the elevated bearing-box mounted upon the casing, the stuffing-box interposed between the bearing-box and casing, and the water-wheel shaft passing through the stuffing-box and elevated bearing, these members being constructed and operating in combination, substantially as set forth.

3. The combination, with a turbine water-wheel, of a cam or eccentric and a yoke or

strap, substantially as set forth, to operate the gate or gates.

4. The combination of the casing, the gate, the flange on the gate overlapping the casing, the cover, the flange on the cover overlapping the flange on the gate, and the shoulder on the cover abutting against the inner edge of the casing, these members being constructed and operating substantially as set forth, whereby.

a tight joint is formed between the gate and casing.

In testimony whereof I have hereunto subscribed my name.

NATHAN F. BURNHAM.

Witnesses:

DAVID SMALL,
PETER AHL.