

(No Model.)

A. WOODWARD.
TURBINE.

No. 280,001.

Patented June 26, 1883.

Fig. 1.

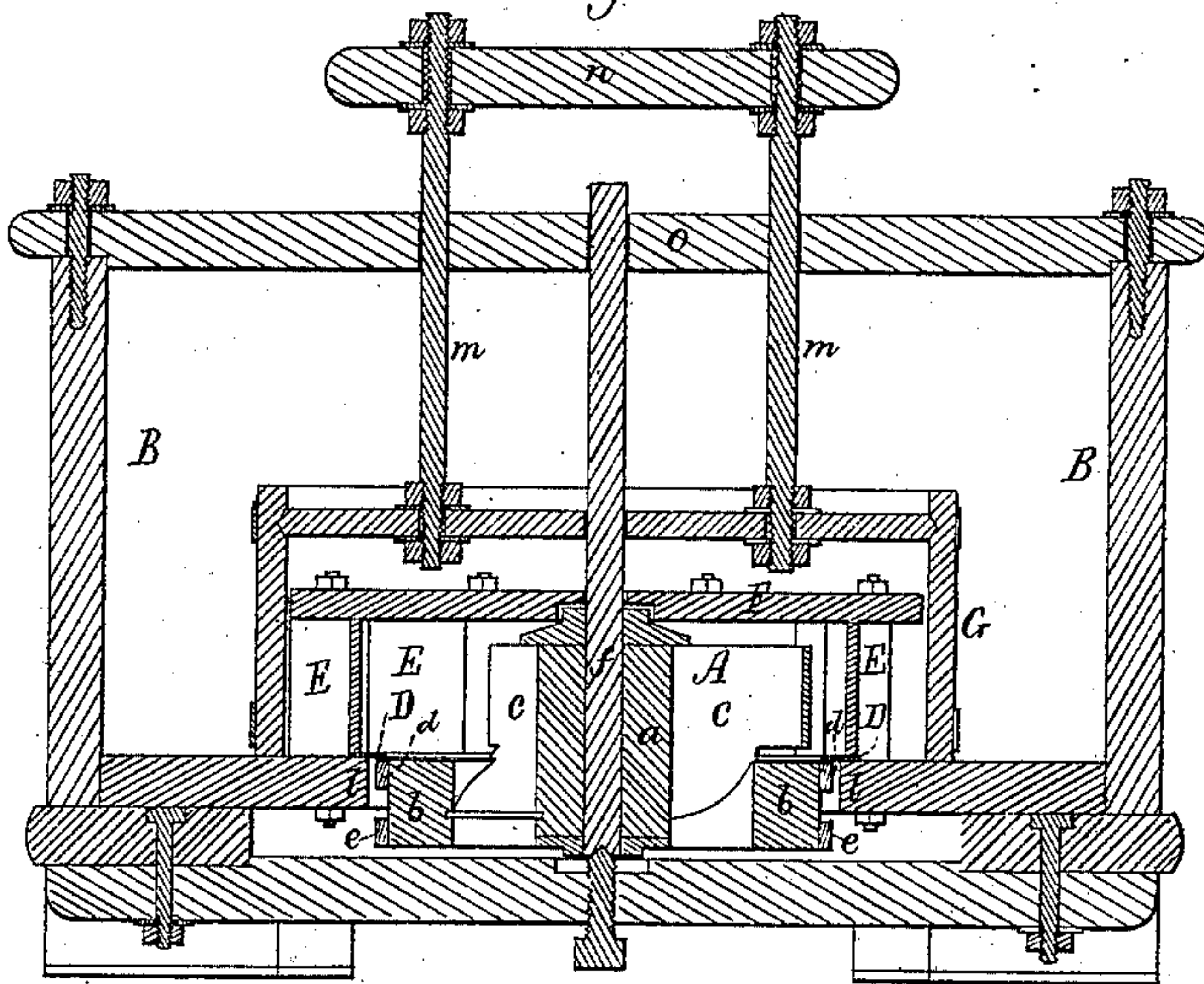


Fig. 2.

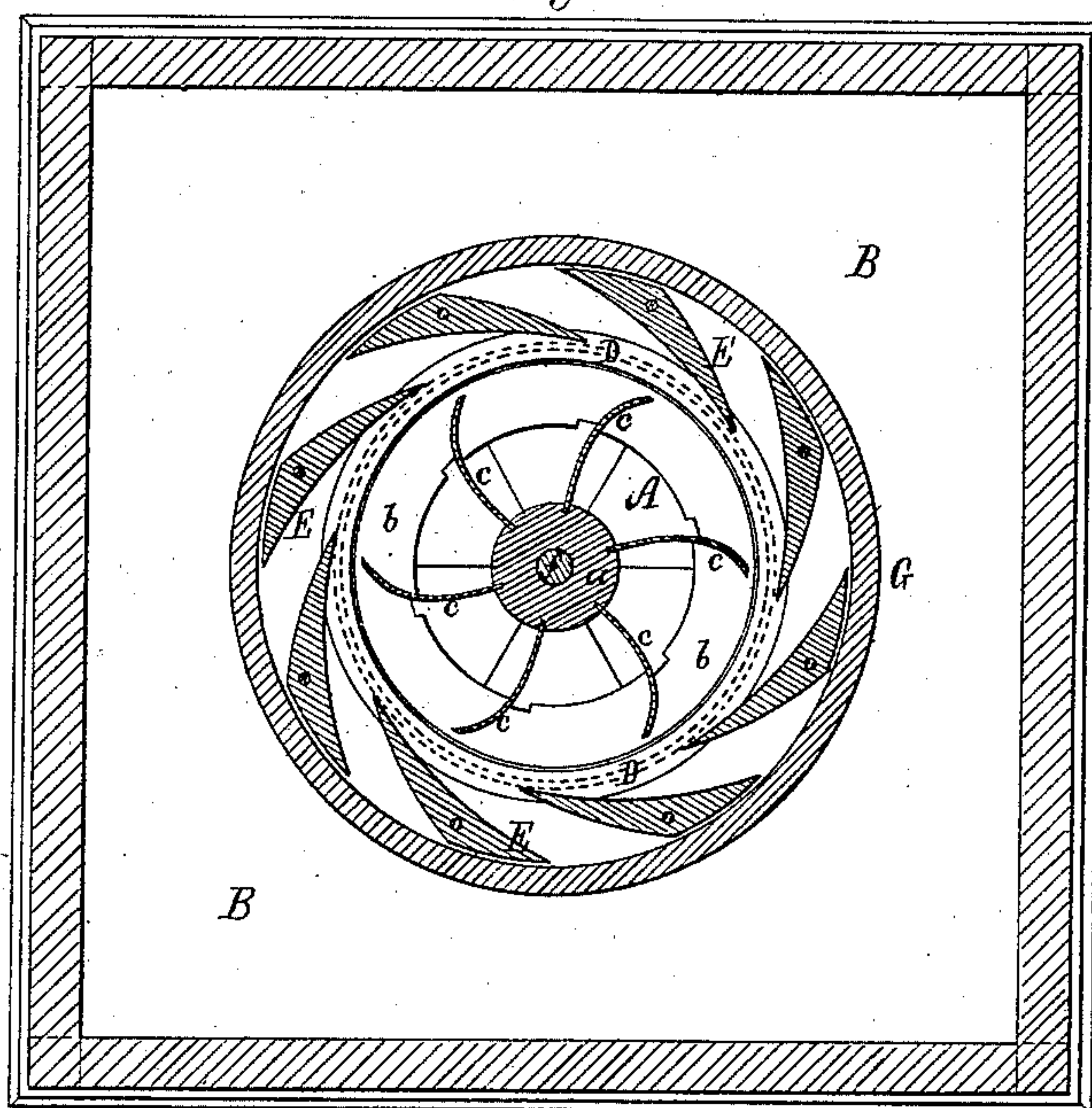


Fig. 3.

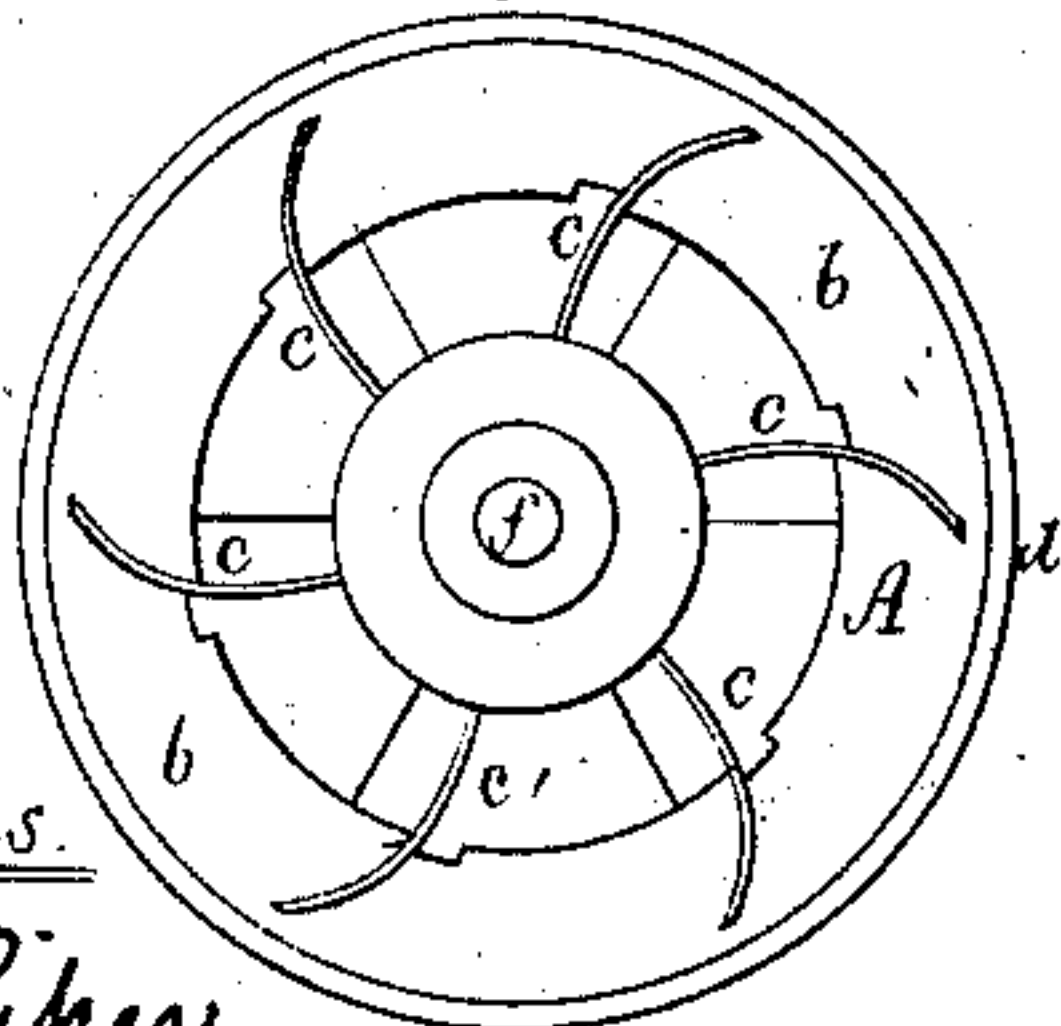


Fig. 4.

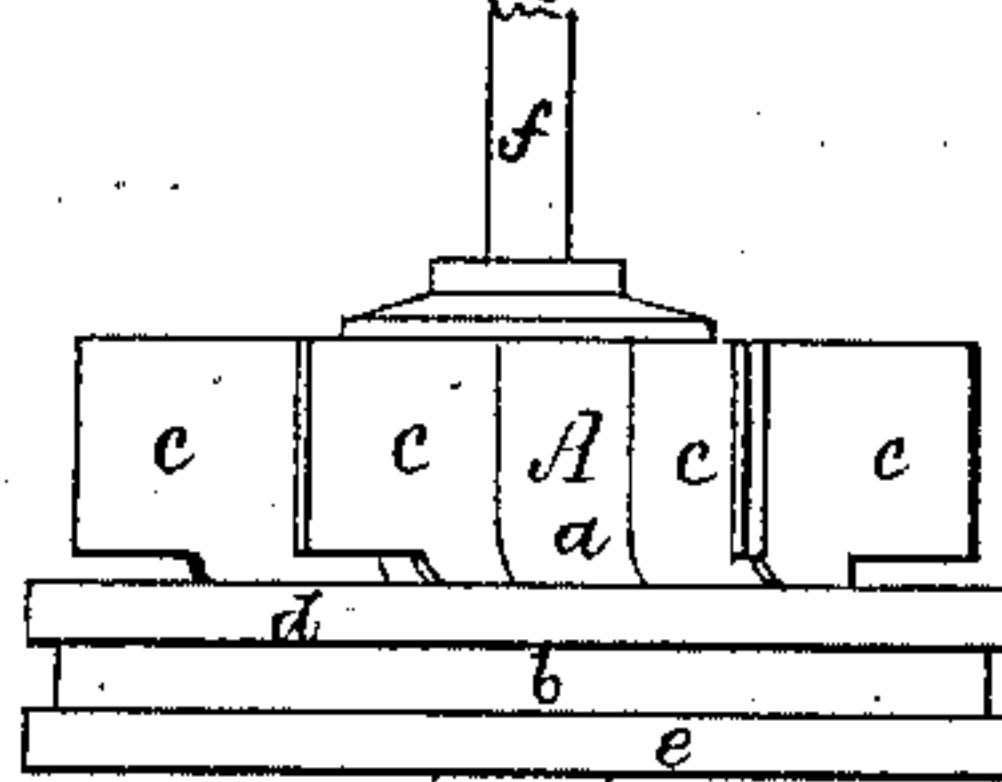
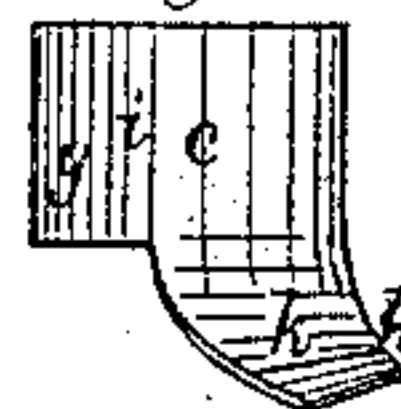


Fig. 5.



Fig. 6.



Witnesses.

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UNITED STATES PATENT OFFICE.

ABIJAH WOODWARD, OF KEENE, NEW HAMPSHIRE.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 280,001, dated June 26, 1883.

Application filed January 2, 1883. (No model.)

To all whom it may concern:

Be it known that I, ABIJAH WOODWARD, of Keene, in the county of Cheshire, of the State of New Hampshire, have invented a new and useful Improvement in Turbines; and I do hereby declare the same to be described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a vertical section of one of my improved turbines, with its penstock and other appliances, to be described. Fig. 2 is a horizontal section taken through the chutes. Fig. 3 is a top view, and Fig. 4 a side elevation, of the wheel, while Fig. 5 is a top view, and Fig. 6 a front elevation, of one of the double-acting buckets of the wheel.

The nature of my invention is defined in the claims hereinafter presented.

My invention relates to the kind of turbines or horizontally-acting water-wheels represented and described in the United States Patent numbered 2,622, dated May 12, 1842, and granted to me. In that wheel the direct-acting and reacting faces of each of the buckets were concave. As a consequence the water, on impinging against the reacting face of the bucket, tended to retard rather than to advance the revolutions of the wheel, for it would, by the reacting face, be deflected in the direction of revolution of the wheel. With my improved turbine double-acting bucket the direct-acting face is convex and the reacting face is concave, whereby, by the latter, when the wheel is revolving, the water is deflected in a direction contrary to that of the wheel's motion, and, as a consequence, acts to propel the wheel forward.

In the drawings, the turbine A is shown as composed of a hub, *a*, a broad and deep rim or felly, *b*, a series of double-acting buckets, *c*, and two encompassing hoops or rings, *d e*, arranged as represented, there projecting upward from and concentrically with the hub a vertical shaft, *f*. Each bucket consists of two curved wings, *g h*, united together and arranged as represented. The direct-acting face *i* of each bucket is convex, while its reacting face *k* is concave. The bucket is arranged in the wheel so that the upper wing shall project

radially from the hub and extend over the felly, the reacting or lower wing being extended down between the hub and the felly and from one to the other of them.

The penstock (shown at B) has a circular aperture, *l*, in its bottom to receive the wheel, and on said bottom a flat annulus, *D*, to come in close contact, or substantially so, with the upper hoop of the felly, the hoops and annulus being of metal.

The felly *b* is made of wood, and necessarily has to be quite thick to receive and support the metallic double-acting buckets, the lower curved portions of which at their edges are let or extend into such felly. To keep the felly in its normal condition, or prevent it from being burst asunder by the centrifugal force generated in the wheel while it may be in rapid revolution, it becomes necessary to encompass the felly with the strong iron hoops *d e*. The hub, also of wood, extends above the felly and has the buckets inserted in it, as well as in the felly, the buckets being extended over the felly, which has to be sufficiently thick to allow of such extension.

Over the flat annulus and about the wheel is a series of curved chutes, *E*, which are covered by a circular cap-plate, *F*, that extends over the wheel, the shaft of which passes up through such cap-plate and an inverted tub or gate, *G*, arranged over the chutes and cap-plate, in manner as represented. This gate is provided with standards *m m* and a cross-head, *n*, the standards being extended upward from the gate through a bar, *o*, going across and fixed to the penstock. By lifting the said cross-head the gate can be raised to allow water, when in the penstock, to flow through the channels between the chutes and against the buckets of the wheel.

The metallic annulus *D* prevents wear of the wooden bottom of the penstock or the joint between it and the wheel. Were it not for this annulus dirt and foreign matters carried between the wheel and penstock by the water would soon cut or wear away the penstock immediately around the wheel, so as to cause much waste and leakage of water.

I claim—

1. The turbine composed of the hub, double-acting buckets, felly, and hoops, arranged substantially as set forth.

2. The penstock provided with the flat
5 annulus, the curved chutes and their cap, and the gate arranged as set forth, in combination with the turbine composed of the hub, double-acting buckets, felly, and hoops, and provided

with the shaft, and having the upper of said hoops arranged in or about in contact with the 10 said annulus, all being substantially as represented.

ABIJAH WOODWARD.

Witnesses:

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