3 Sheets--Sheet 1.

S. WALTON.
Turbine-Wheels.

No. 152,958. Patented July 14, 1874.

FIG 1

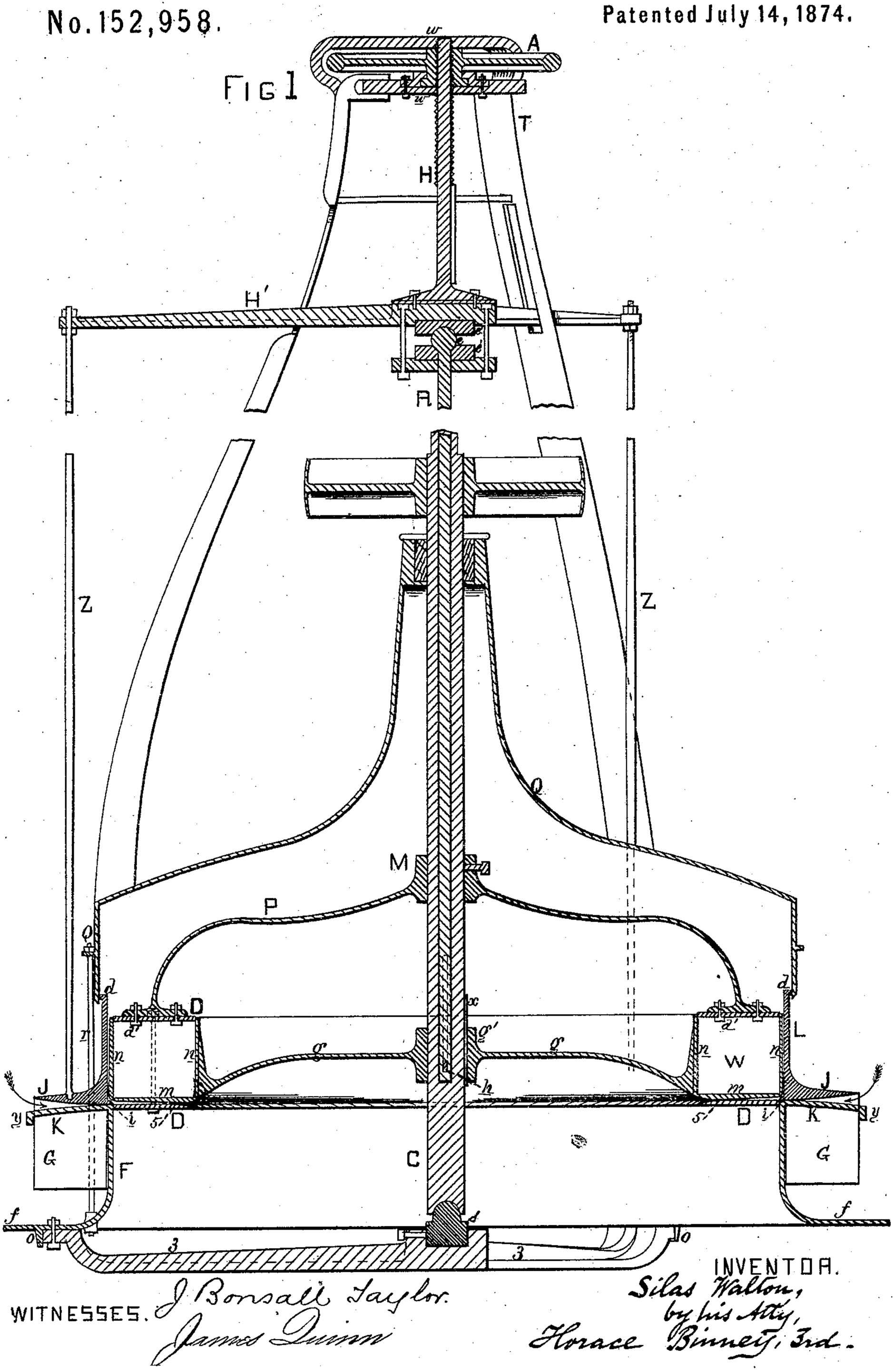

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FIG 2

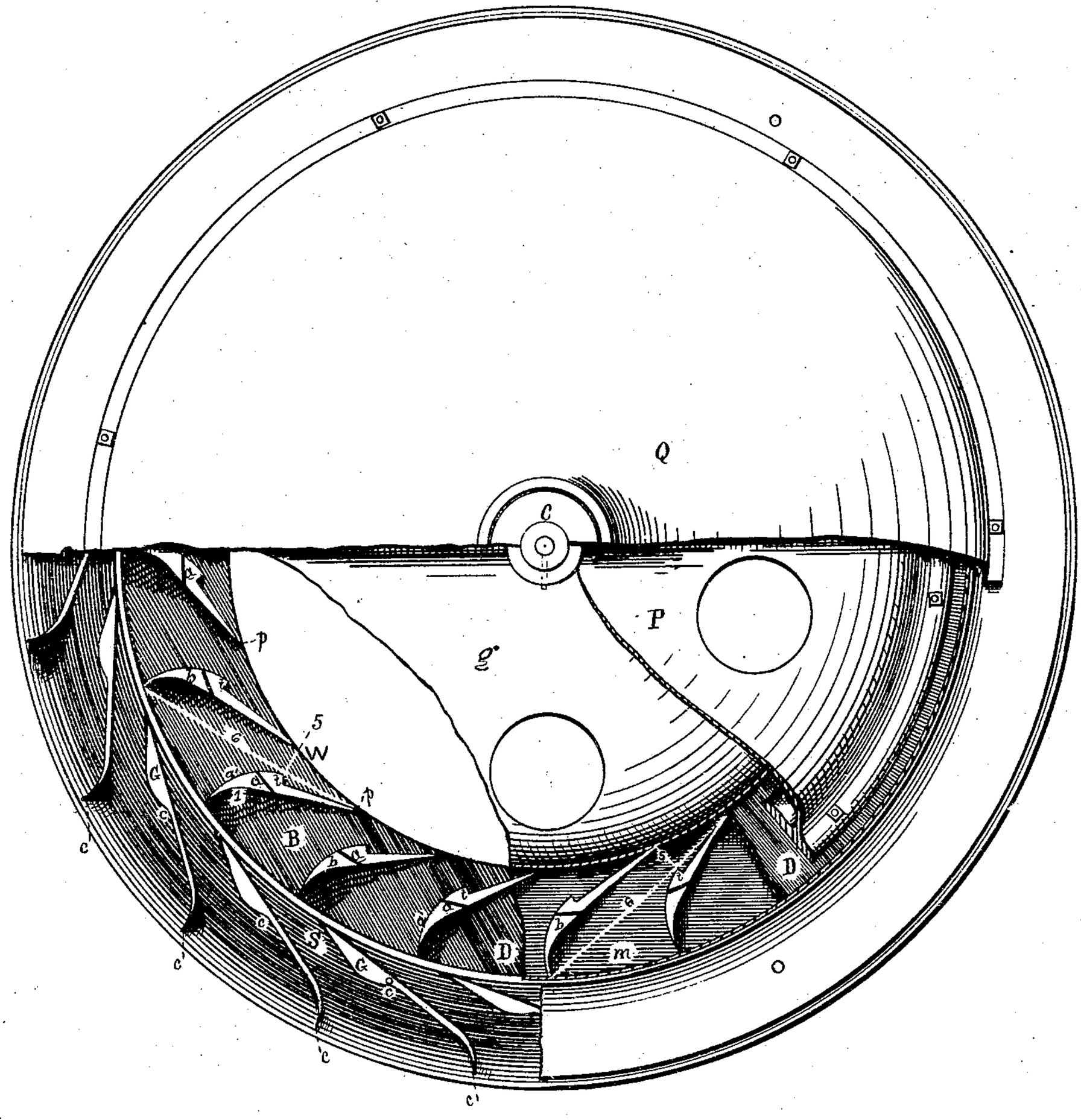

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FIG 4

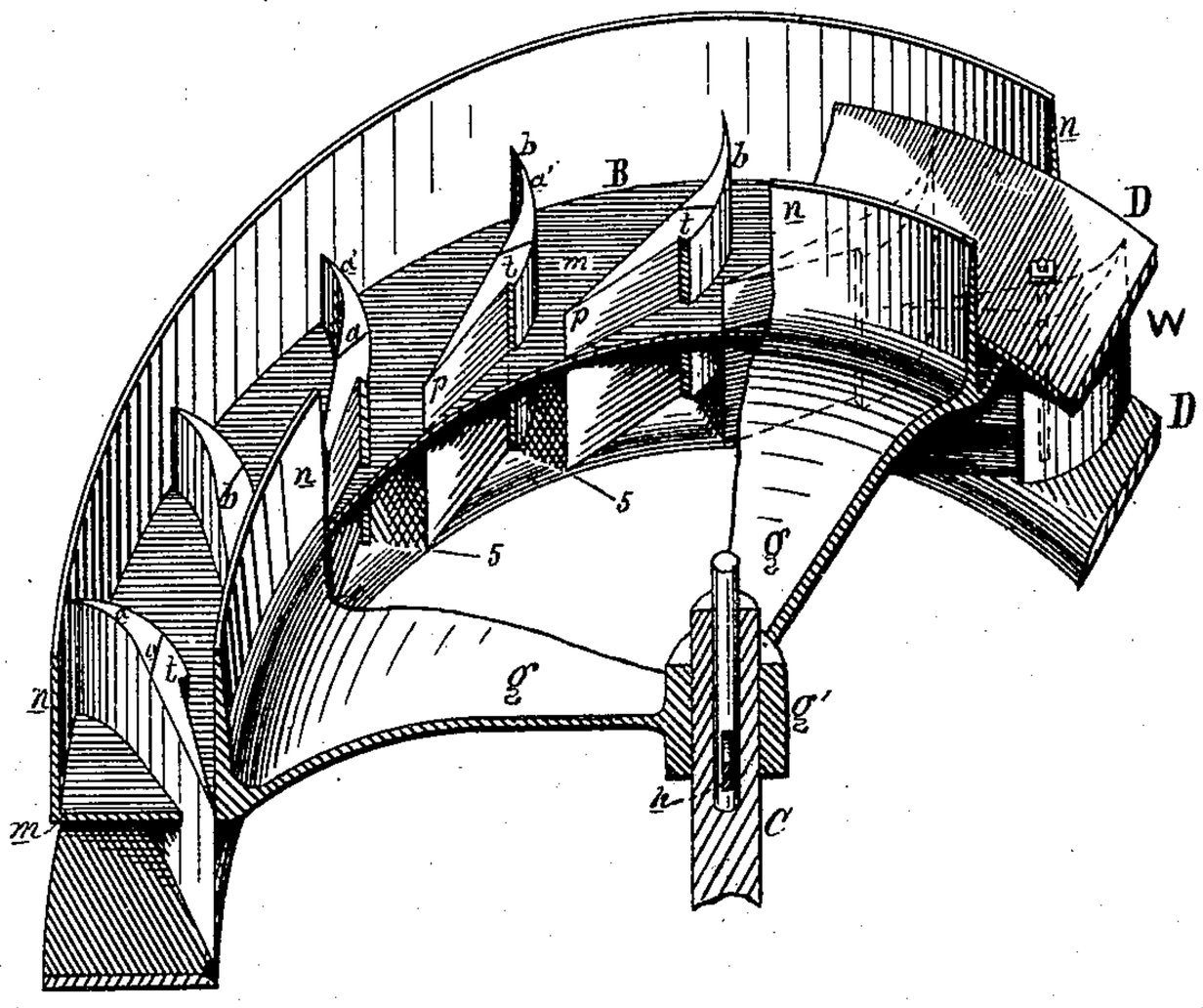

FIG 5

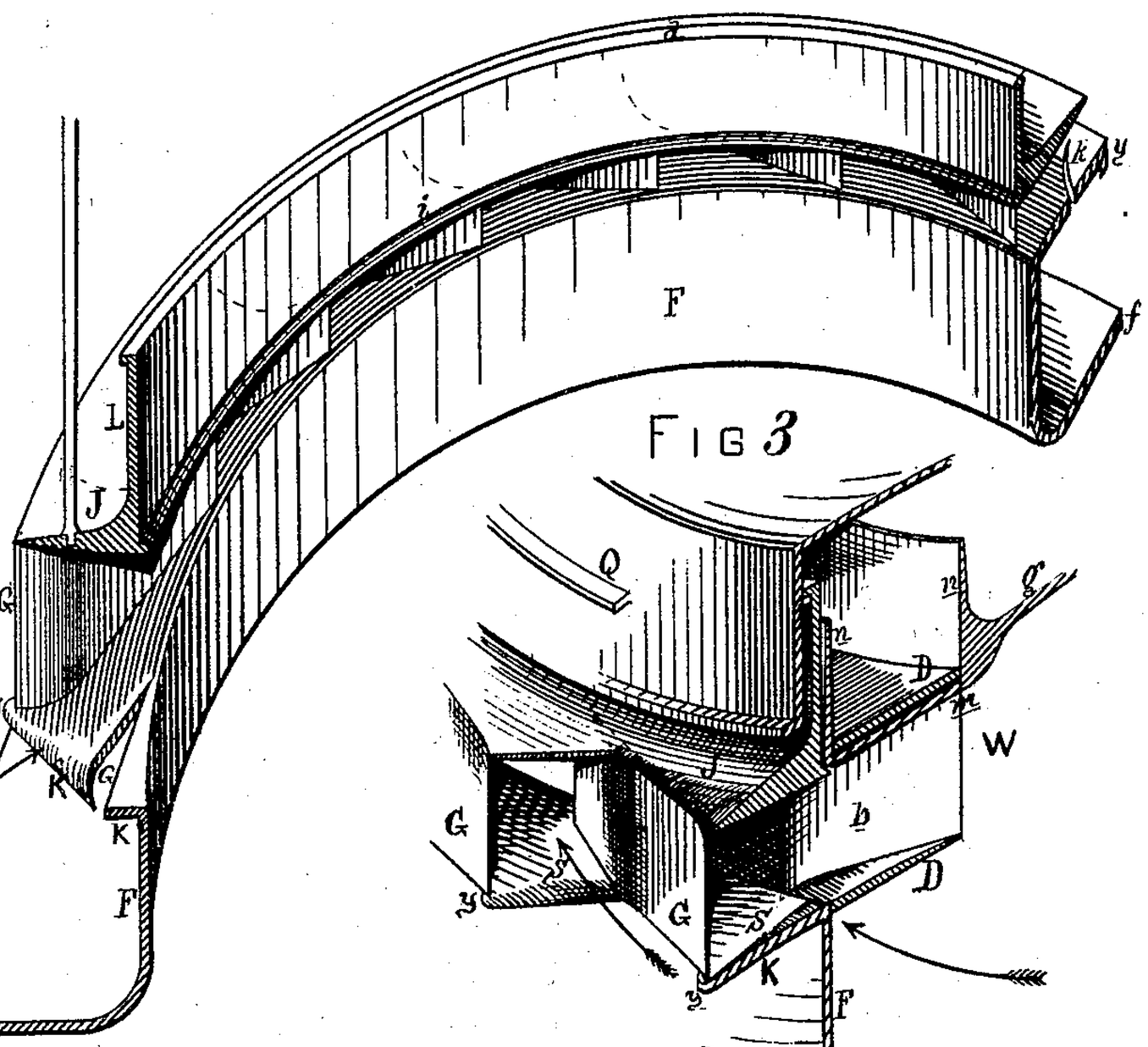

FIG 3

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UNITED STATES PATENT OFFICE.

SILAS WALTON, OF MOORESTOWN, NEW JERSEY.

IMPROVEMENT IN TURBINE WHEELS.

Specification forming part of Letters Patent No. **152,958,** dated July 14, 1874; application filed May 20, 1874.

To all whom it may concern:

Be it known that I, SILAS WALTON, of Moorestown, in the county of Burlington and State of New Jersey, have invented a new and useful Improvement in Turbine Wheels; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the said improvement, reference being had to the accompanying drawings, which form a part of this specification, and in which—

Figure 1, Sheet 1, is a vertical section taken through the axis of the shaft of my improved turbine wheel, and showing the gates closed; Fig. 2, Sheet 2, a partial plan, broken away so as to show the chutes, the buckets, and crown-plate P of the wheel, and the diaphragm and crown-plate *g* of the inner gate. Fig. 3, Sheet 3, is a perspective view, partly in section, of a portion of the curb, wheel, and both gates when fully open; Fig. 4, Sheet 3, a similar view of a portion of the wheel, showing the inner gate broken away and partly open; and Fig. 5, Sheet 3, a similar view of a portion of the curb and outer gate, the latter being partly open.

The same parts are denoted by the same letters in all the figures.

This invention consists, first, in the construction, as hereinafter described, of the buckets of the wheel; secondly, in the combination, with the casing of the wheel, of a cylinder-gate constructed with a flange of such width that the pressure of the water below it shall counterbalance the weight of the gate and its appendages; thirdly, in the combination of the beveled bottom edge of the dome or casing with the curved surface of the adjacent gate-rim, whereby, as one approaches the other, obstructions deposited between them are displaced; fourthly, in the combination of a turbine wheel and an outer and inner cylinder-gate with the devices, substantially as shown and described, for raising or lowering both gates simultaneously, so as to increase or diminish the capacity of the buckets simultaneously with that of the chutes; fifthly, in the combination of a turbine-wheel, an inner cylinder-gate, which revolves with the wheel, and a stationary outer cylinder-gate, with the devices, substantially as shown and described, for raising or lowering both gates simultaneously, whether the wheel be in motion or at rest.

The wheel W consists of a hub, M, crown-plate P, two annular plates, D D, and partitions *b b*. The hub M is keyed to the main shaft C. The plate P is cast on the hub, and perforated with circular apertures, as shown in Fig. 2; or, instead of P, an annular rim (or sections thereof) may be employed, connected to the hub by radial arms. To this crown-plate or annular rim are bolted the upper and lower plates of the wheel D D, as shown in Fig. 1, the lower of which has fixed or cast on it a series of partitions, *b*, which extend to the upper plate, and form the curved channels or bucket-spaces B. The casing of the wheel consists of a dome, Q, supported on a curb, F, whose bottom flange *f* rests on the foundation, and supports, by means of screw-bolts, the spider 3, which is inclosed within a rib, *o*, formed on said flange. The adjustable step S rests on the center of the spider, and forms the lower bearing of the main shaft C, the upper part of which turns in a bearing supported by dome Q at its summit. The upper flange K of curb F is indented, as shown in Fig. 3, and its upper surface, inclining downward outwardly, forms the bottom of the chutes. From the edge *y* to the vertical part of curb F extend a series of slots corresponding in shape to the chute-guides G, as shown in Fig. 2, and through which the said guides move freely in a vertical direction when the gates are elevated or depressed. Between these slots the upper surface of K forms the lower surface of the chutes, which direct the water to the wheel. The dome Q is secured to curb F by means of pillars *r* passing through the enlarged portions of guides G, and its bottom edge is beveled to an edge inward to repel any obstacles that may collect on the upper side of the gate-rim J. The outer gate consists of a vertical ring or cylinder, L, with a narrow outwardly-projecting flange, *d*, at its top, and at its bottom an outwardly-projecting rim, J, indented as shown in Fig. 3, and a very narrow flange or lip, *i*, projecting slightly inward under the inner gate. This flange *i*, and the edge of the curb underneath it, form the

shutting surfaces of the outer gate. The width of the upper flange *d* is proportioned so that the pressure of the water under it may counterbalance the weight of the gate and its appendages. The flange *d* slides on the inside vertical surface of the dome Q, and is provided with suitable water-tight packing. The lower surface of the indented rim J curves upward outwardly at the mouth of each chute, and forms the upper surface thereof, as shown in Fig. 3. A series of guides, G, are fixed or cast on the under surface of the rim J and gate L, extending from the thickened edge *y* to the vertical part of curb F, and projecting down through the curb-flange K. The enlarged portion of these guides (shown in section in Fig. 2) may be made hollow and open, to permit the pillars *r* to pass through them, and allow the passage of water and sediment. The upper surface of rim J curves downward, as shown in Fig. 3, where it meets the guides, so as to direct the water into the chutes, and permit sediment to be carried off. The inner gate consists of an annular trough, whose bottom is designated in the drawing by *m*, and its sides by *n*, connected by a perforated crown-plate, *g*, or by radial arms, to the hub, *g'*, which is feathered, as shown at *x*, to the main shaft C, so as to revolve with said shaft, while capable of vertical motion thereupon. The bottom *m* of this trough is between the plates D D, the upper of which is inclosed by the sides *n n*, and said bottom *m* is made with slots corresponding to the partitions *b*, and not fitting water-tight to said partitions, but having clearance enough to admit water above *m*. A is a hand-wheel, which rotates between fixed bearings *w w*, supported by the frame T, which is bolted to dome Q, or to other more elevated permanent supports. H is a vertical rod, made with a screw-thread fitting a corresponding female screw in the hub of the wheel A, and rigidly attached to the spider H', from whose arms depend rods Z Z, attached to flange J of the outer gate. To the hub of the spider H' are secured the upper and lower bearings *e' e'* of the spherical head *e* of the rod R. This rod extends down within the tubular shaft C, and is secured to the hub *g'* by a pin, *h*, passing through a slot in C. The rotation of the hand-wheel thus elevates or depresses both gates simultaneously, and the ball-and-socket connection permits the inner gate to rotate with the water-wheel, while the movement of the outer gate is only vertical. The floats or partitions *b*, which form the side walls of the buckets B, are shown in plan in Fig. 2. The impact or concave side of each partition is curved inward to a distance somewhat greater than the width of the chutes S, and extends thence in an oblique line to the inner circumference of the annular plate D, forming a smooth continuous surface throughout its whole extent. The opposite or convex side, which at the outer circumference of the plate D forms a thin edge with the concave side, curves inward from said edge, and on a different center from the curve of the concave side, extending to a point, the position of which is determined by drawing to said convex side, from the inner extremity of the adjoining partition, a straight line, 5, at right angles to the oblique part of the concave side thereof. A recess or offset is made at *t*, and the remainder of the partition is a single plate, *p*, tapering to a thin edge. This recess prevents the discharging current from coming in contact with the curved side of the partition after passing the point *t*, so that the issuing liquid vein passes clear of the wall of the succeeding bucket, and does not retard the velocity of the wheel by impact or friction against it. In order to facilitate the discharge the lower plate D, which forms the bottom of the buckets B, inclines downward at its inner edge, as shown in Fig. 4. This form of bucket is applicable both to inward and to outward discharge wheels. The vertical hollow partitions or guides G, which are attached to the outer gate and move with it, are arranged round the wheel at an angle somewhat greater than a right angle to the radius, in order to throw the water to the center. The sides of the chutes formed by these guides diverge a little outwardly and end in curves *c c*, as shown in Fig. 2. The chutes being bounded by the guides G and surfaces J and K, the elevation or depression of the outer gate increases or diminishes not merely the gate area at the opening and shutting edge, but the entire capacity of the chutes. The inward projection *i*, with its shutting surface upon the curb F, enables the inner ends of the guides G to be brought close to the curb, as shown in Fig. 1, when the gate is shut, and near the buckets when it is open, thereby preventing a current round the wheel. The bottom *m* of the inner gate forms a diaphragm in the wheel W, and the bands or walls *n n*, which inclose the bucket-orifices and the upper plate D, fit tightly against and slide vertically upon the edges of said plate, forming a tight chamber in the upper part of the wheel, (except a small orifice in the lower corner of the bucket to vent mud or sediment.) Water is admitted into this chamber through the clearance of the slots in the diaphragm, as heretofore explained. The shallow channels or grooves *a*, cut in the tops of the partitions *b*, permit water to pass from one bucket into another over the diaphragm. The admission of water above the diaphragm balances the pressure from below, and keeps it equipoised at any elevation in the bucket. The heads of bolts *d' d'*, by which the upper plate D is fastened to the crown-plate P, or radial arms, form stops which prevent the diaphragm from coming into contact with said plate, and preserve more or less space and water passage at all times in the upper part of the bucket. The lower surface of *m* is slightly inclined, as shown in Fig. 1, its lowest part being at the most contracted part 5 of the bucket, from which it tapers slightly

upward in both directions, thus forming a wedge-shaped entrance into the bucket between *m* and the lower plate D, and preventing a vacuum at their surfaces when the wheel is closed.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. The combination, with the annular plates D D, of the partitions *b b*, constructed and arranged substantially as shown and described.

2. The combination, with the casing of the wheel, of the gate L, constructed with a flange, *d*, of such width that the pressure of the water below it shall counterbalance the weight of the gate and its appendages, substantially as shown and described.

3. The combination of a beveled bottom edge of dome Q and the curved upper surface of the gate-rim J, operating, as one approaches the other, to displace obstructions deposited between them.

4. The combination of a turbine wheel and an outer and inner cylinder-gate with the devices, substantially as shown and described, by which both gates are raised or lowered simultaneously, and the capacity of the buckets thereby increased or diminished simultaneously with that of the chutes.

5. The combination of a turbine wheel, an inner cylinder-gate which revolves with the wheel, and a stationary outer cylinder-gate with the devices, substantially as shown and described, by which both gates are raised or lowered simultaneously, whether the wheel be in motion or at rest.

SILAS WALTON.

Witnesses:
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WILLIAM PARENT.