No. 669,289. Patented Mar. 5, 1901.

A. F. SPARKS.

WATER WHEEL.

(Application filed Dec. 31, 1896.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

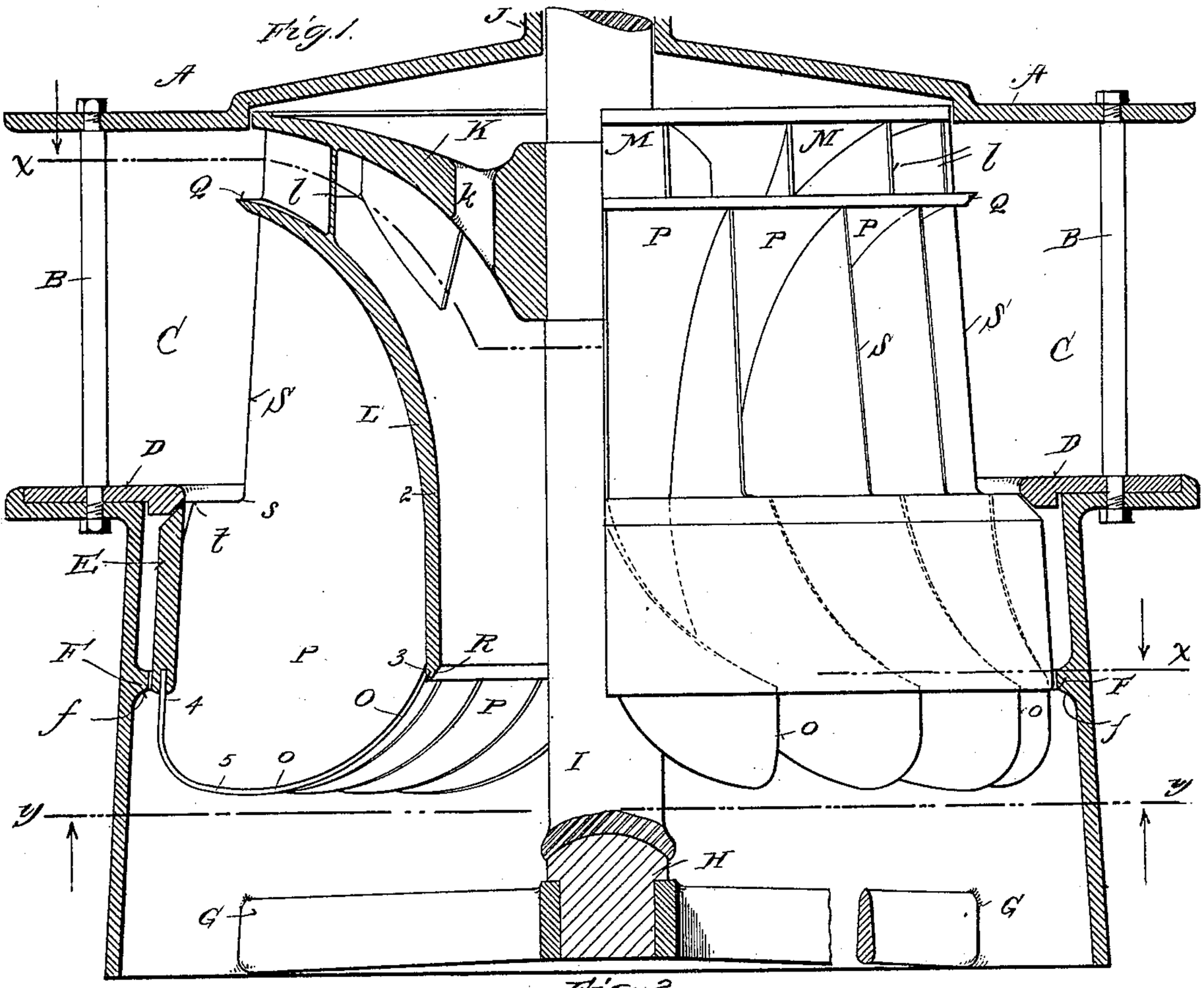
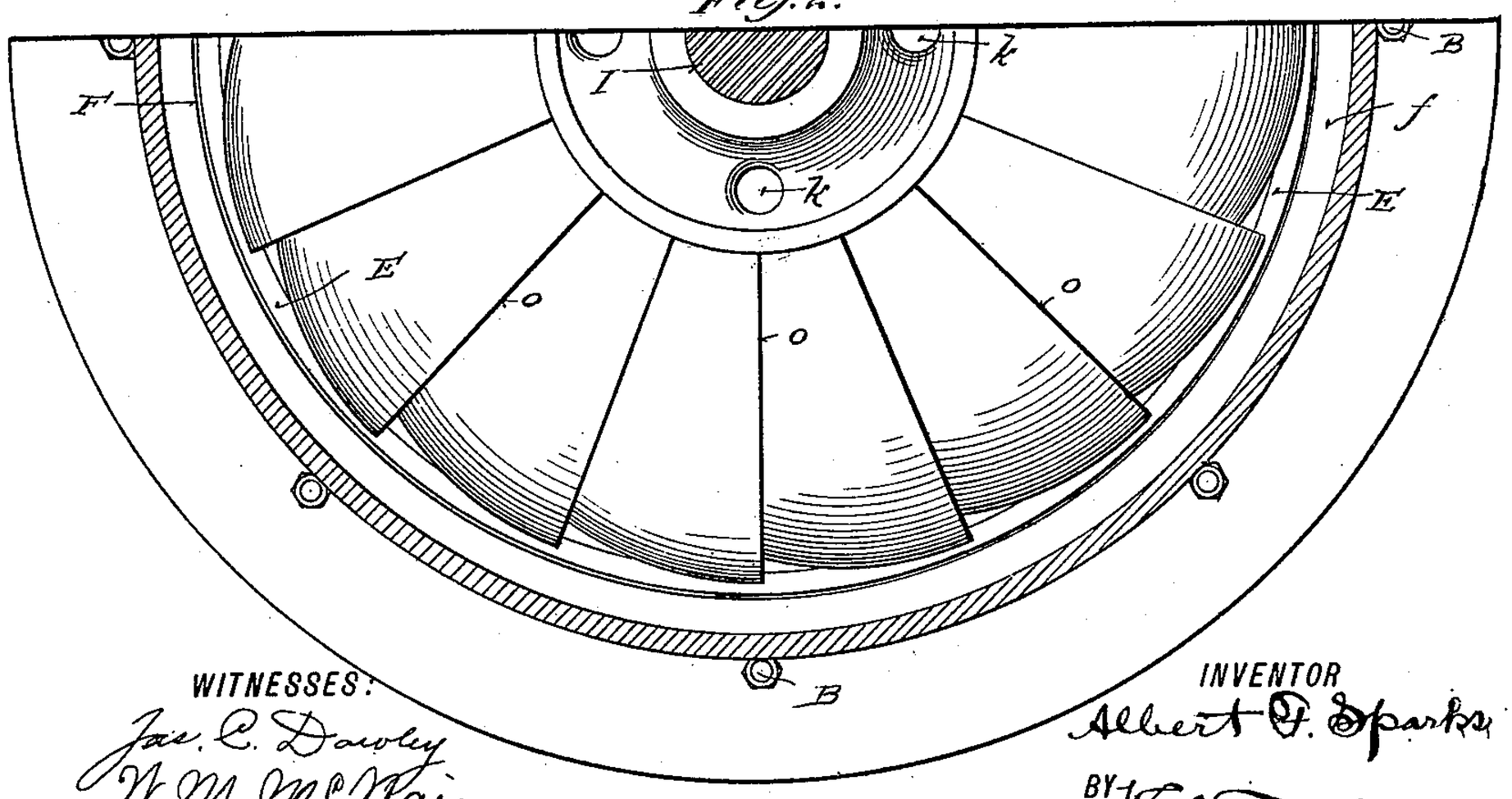


Fig. 2.



WITNESSES:
Jas. C. Dawley
W. M. McClain.

INVENTOR
Albert F. Sparks
BY H. A. Toulmin,
his ATTORNEY.

No. 669,289. Patented Mar. 5, 1901.

A. F. SPARKS.

WATER WHEEL.

(Application filed Dec. 31, 1896.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

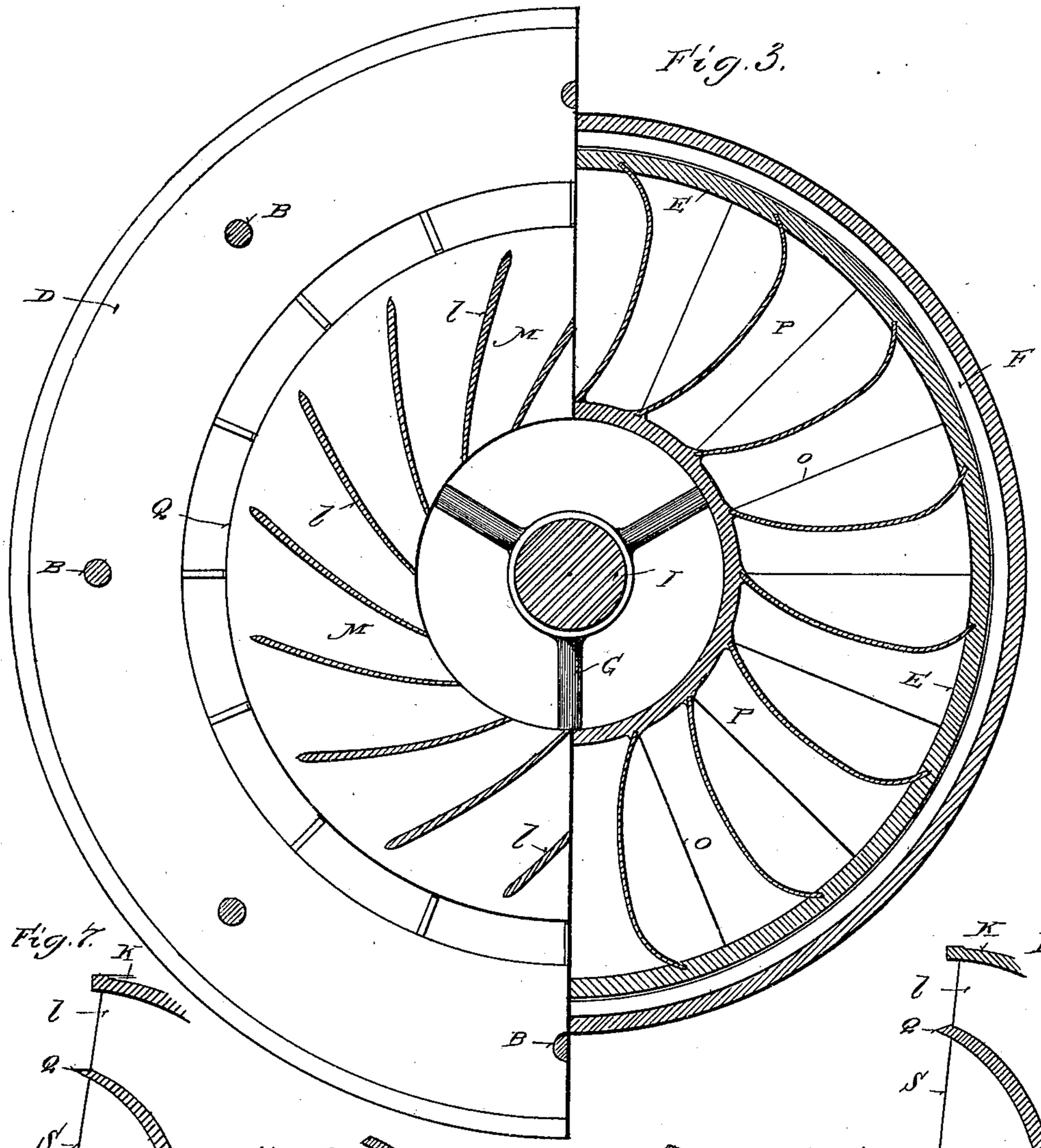


Fig. 7.

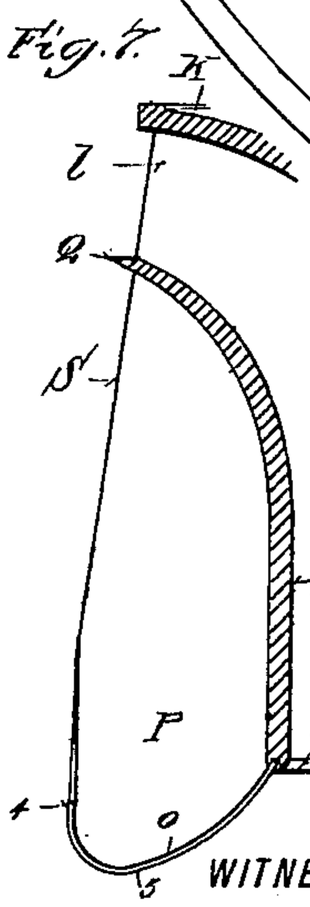


Fig. 5.

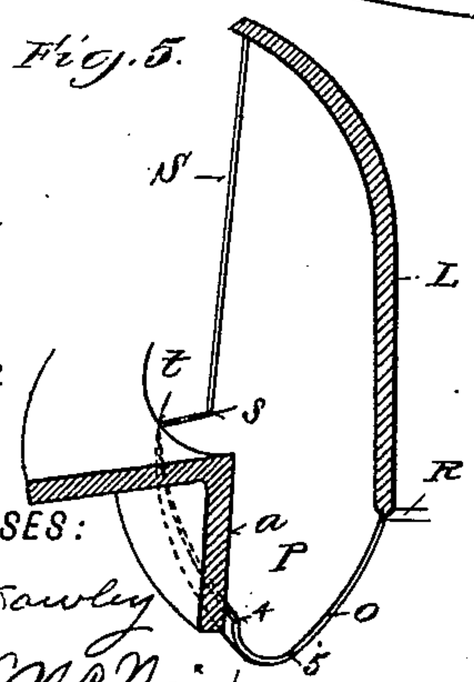


Fig. 4.

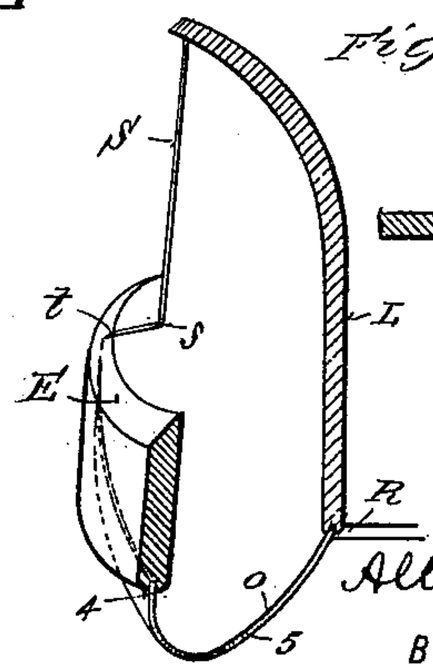
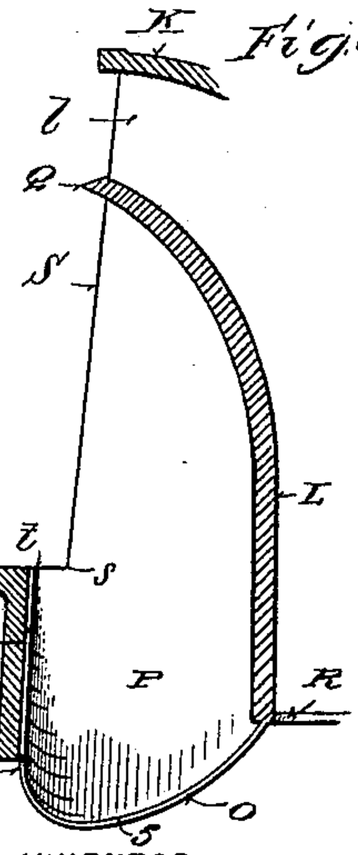


Fig. 6.



WITNESSES:

Jas. C. Dawley

W. M. McNair.

INVENTOR

Albert F. Sparks.

BY H. A. Toulmin,

his ATTORNEY.

UNITED STATES PATENT OFFICE.

ALBERT F. SPARKS, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE JAMES LEFFEL & CO., OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 669,289, dated March 5, 1901.

Application filed December 31, 1896. Serial No. 617,553. (No model.)

To all whom it may concern:

Be it known that I, ALBERT F. SPARKS, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in water-wheels of the class known as "turbine," and is particularly designed as an improvement upon the water-wheel patented September 27, 1892, to Francis M. Bookwalter and W. W. Tyler, which patent is numbered 483,133. In that patent one of the features is that of making the wheel in two diameters for the purpose of causing the central-discharge buckets thereof and the downward-discharge buckets thereof to run at substantially equal speeds, notwithstanding the fact that the nature of the central-discharge buckets is to run at less speed than the downward-discharge buckets. That patented wheel has in practice produced marked results in efficiency by reason of said feature. One part of this present invention carries that general feature to still further perfection. This part consists in the provision of a general conical contour of the wheel along the entering edge of the lower buckets, thence upward, so that the diameter of the wheel in the zone of the upper set of buckets is relatively less than the diameter of the wheel in the zone of the lower set of buckets, whereby the natural slow tendency of the upper set of buckets is further overcome and greater speed is given to such buckets, which makes them approximate more nearly in their speed qualities to the speed quality of the lower set of buckets, which latter by nature are of higher speed. Another feature of said patent relates to the substantial equidistant location of the body or shell, so as to increase the radial measurement of the lower set of buckets in their lower portion and so as to increase the discharge area of said buckets and give them a freer discharge of water. Another part of this present invention is the location of said shell or body still farther inward and approximately one-third the distance between the axis of the wheel and the outer edges of the lower buckets, which increases the radial measurement, and hence increases the length of the discharge-line of the lower set of buckets, and also so contracts the discharge-passage formed by the inside of said shell for the upper set of buckets as to increase the velocity of the water passing therethrough and endow such discharging water with greater draft action or capacity, which greater draft action extends its influence upon the water discharging through the outer buckets and increases the rapidity and freedom of its discharge also, thereby forming a general combined effect, which gives the wheel marked increased efficiency. Another part of this invention, a provision not covered or embraced by or in said patent, is that of embodying in the one wheel a set of upper central and downward discharging buckets and a set of lower downward and outward discharging buckets, whereby there is the feature of an increased length of discharge edge to the lower buckets due to carrying such edge outward and upward to form the outward-discharge factor.

Other parts of this invention consist of an annular projecting water-dividing edge between the base of the upper buckets and the top of the lower buckets, of a band around the outer edge of the lower buckets above the discharge edge, and an annular web which with said band forms a guide for the outwardly-discharging water.

In the accompanying drawings, in which like reference characters indicate corresponding parts, Figure 1 is a vertical sectional view of a water-wheel embodying my improvements. Fig. 2 is a horizontal sectional view on the line *y y* of Fig. 1 looking in the direction of the arrows; Fig. 3, a horizontal sectional view on the line *x x* of Fig. 2 looking in the direction of the arrows; Fig. 4, a detail perspective view of one of the lower buckets, a part of the shell, and a part of the band; Fig. 5, a similar view of one of the lower buckets, showing a modification as regards the band; Fig. 6, a vertical sectional view and an elevation of one of the lower buckets, showing the same modification; and Fig. 7, a detail view of an upper and lower bucket, showing a modification as to the conical construction.

The letter A designates the casing of a water-wheel, which has an upper or top piece and a circular body connected together by columns B and leaving a space C, in which are to be mounted suitable gates to control the flow of water to the wheel proper. An annulus D is an additional feature which I provide in this case to make a suitable joint with the annular band or ring E, carried by the lower buckets and revolving near the annular web or projection F, whose surface *f* forms a guide which, in conjunction with the lower part of the band E, nicely guides the outwardly-discharging water along the casing. Across the foot of the casing is a spider G, which has a step H for the lower end of the wheel-shaft I, whose upper end passes through the top plate at J. The wheel shell or structure is carried on this shaft I, and it consists of a crown K, with an orifice *k* for the discharge of water which leaks in above the crown, of a shell or body L, connected to the crown by webs *l*, between which are passages M, constituting the upper buckets, and of webs O, suitably united with or connected to the shell or body L and with the band E and forming between them spaces which constitute the lower buckets P.

In Figs. 5 and 6 I have shown a modification in respect to the band E and the annulus D, which parts are omitted and the casing arranged to form a wall along the part *a* for the outer edges of the lower buckets P, by which the water is confined and conducted on downward to the discharge edge *o* of said buckets. In this case the annular web F is also omitted. I show this modification for the purpose of illustrating that I do not confine myself to the use of the band E, though I prefer that feature, as it strengthens the lower buckets and saves also the otherwise careful fitting of the periphery of these buckets and the casing.

Between the bottom of the upper buckets and the top of the lower buckets I provide a water-cutting edge in the form of an annular part Q, reduced to a comparatively sharp edge. This is generally constructed by extending the upper end of the shell L outward, as shown. This water-dividing edge is very effective in dividing the water between the two sets of buckets and is a useful detail feature.

I prefer to flare the lower discharge extremity of the shell by beveling it, as shown at R, to liberate the water more freely at that point.

At S is shown the conical contour of the wheel, and it will be seen that a line is there shown which extends from the points *s*, on the lower buckets and thence upward, inclining inward as it proceeds. From the point *s* to the point *t* a shoulder is formed, which is the place at which the double-diameter feature of the wheel is most conspicuously indicated. This tapering or conical form it will be seen brings the zone of the wheel occupied by the upper buckets within the diameter of the lower part of the lower buckets to a greater degree than if the contour of the wheel were parallel or cylindrical upward from that part of the lower buckets which is about in the plane of the bottom of the water space or chute C. This greater contraction of the diameter of the upper set of buckets further overcomes their natural slow-speed tendency compared with the greater-speed tendency of the lower buckets, and so by this principle of neutralizing these opposite tendencies by making the nature of the upper buckets approach more nearly the nature of the lower buckets I have improved the efficiency of the wheel in speed, power, and economy of water in a marked and satisfactory manner as ascertained by tests.

Referring now to the new location of the shell L, it will be seen that I have arranged it in such wise that the portion—say 2 to 3—which acts to draw the water from the upper buckets is about one-third of the distance from the axis of the wheel to the periphery of the lower buckets. As stated in the introductory part of this specification, this contraction of the diameter of such part of the shell so accelerates the speed of the water passing through it that the draft action of such water is greatly increased, so much so that its effects energize the water discharging from the outer buckets and accelerate its movement of discharge. The result is that I increase at this point the efficiency of the wheel in power, speed, and economy of water.

Referring now to the lower buckets again, it will be seen that their discharge edges *o* extend from the shell L to the band E in one case or to the part *a* of the casing in the modified form. By carrying this edge upward to the point 4 I have provided between such point and the point 5 or near the latter a section of the discharge edge which discharges outwardly—that is, in a direction generally out and tangential to the perimeter of the lower buckets. Such outward-discharging portion of the lower buckets is virtually an extension of the discharge edge, a feature which was not possessed by the wheel of the patent above referred to, and which feature gives me in this new wheel, combined with the rest of the discharging edge of the lower buckets and combined with the upper buckets, a wheel having upper central and downward discharging buckets and lower downward and outwardly discharging buckets. Such a wheel I have ascertained by tests to be of great practical value in power, speed, and economy of water.

I wish to be understood as intending to claim, first, a wheel in which the conical contour, the extreme inward location of the shell, and the upper central and downward discharging buckets and the lower downward and outwardly discharging buckets are all united; second, a wheel in which each of these features is separately considered, and, third,

a wheel in which any two of these features are embodied.

From Fig. 7 it will be seen that the shoulder in the lower buckets may be omitted and the line S carried upward from the periphery of such buckets instead of from the inner corner of the shoulder, as in the other figures.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a water-wheel, a water-wheel proper having an upper set of buckets, and a lower set of buckets and a conical exterior contour extending from a point on the lower set thence upward to the upper set whereby the upper set is reduced in diameter relatively to the lower set.

2. In a water-wheel, a wheel proper having an upper set of buckets of one type, and a lower set of buckets of another type, and a conical contour from a point on the lower set thence upward to the upper set whereby the upper set is of smaller diameter than the lower set.

3. In a water-wheel, a wheel proper having an upper set of central and downward discharging buckets, a set of downward and outward discharging buckets, and a conical contour extending from a point on the lower set thence upward to the upper set so that the slow-speed tendency of the upper set and the faster-speed tendency of the lower set shall be neutralized, relatively.

4. In a water-wheel, a wheel proper having an upper set of centrally and downward discharging buckets, a lower set of downward and outwardly discharging buckets, an offset or shoulder forming a double diameter to the wheel, and a conical contour from the offset thence upward to the upper buckets for the purpose described.

5. In a water-wheel, a wheel proper having an upper set of inward and downward discharging buckets, a lower set of downward and outwardly discharging buckets, a shell between said sets of buckets, the lower portion of which is relatively nearer the axis than to the periphery of the lower set and having a conical contour from a point on the lower set of buckets extending thence to the upper set.

6. In a water-wheel, a wheel proper having an upper set of buckets and a lower set of buckets with a shell between said sets, the lower portion of which is relatively nearer to the axis of the wheel than to the periphery of the lower set, thus forming a discharge-passage from the upper buckets through which the water will flow at a greater velocity than it flows through the lower buckets whereby the described draft effects are produced.

7. In a water-wheel, a wheel proper having an upper set of centrally and downward discharging buckets, a lower set of downward and outwardly discharging buckets, and a shell between said sets, the lower portion of which is relatively nearer to the axis of the wheel than to the periphery of the lower set, thus forming a discharge-passage from the upper buckets through which the water will flow at a greater velocity than it flows through the lower buckets, whereby the described draft effects are produced.

8. In a water-wheel, a wheel proper having an upper set of downward and centrally discharging buckets and a lower set of downward and outwardly discharging buckets.

9. In a water-wheel, a wheel proper having an upper set of downward and centrally discharging buckets and a lower set of downward and outwardly discharging buckets, the discharging edge of the lower set having a specific outwardly-discharging portion extending substantially from the points 4 to 5.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT F. SPARKS.

Witnesses:
EDWIN L. ARTHUR,
W. M. MCNAIR.