

J. M. CASE.
TURBINE WATER-WHEELS.

No. 195,793.

Patented Oct. 2, 1877.

Fig. 1.

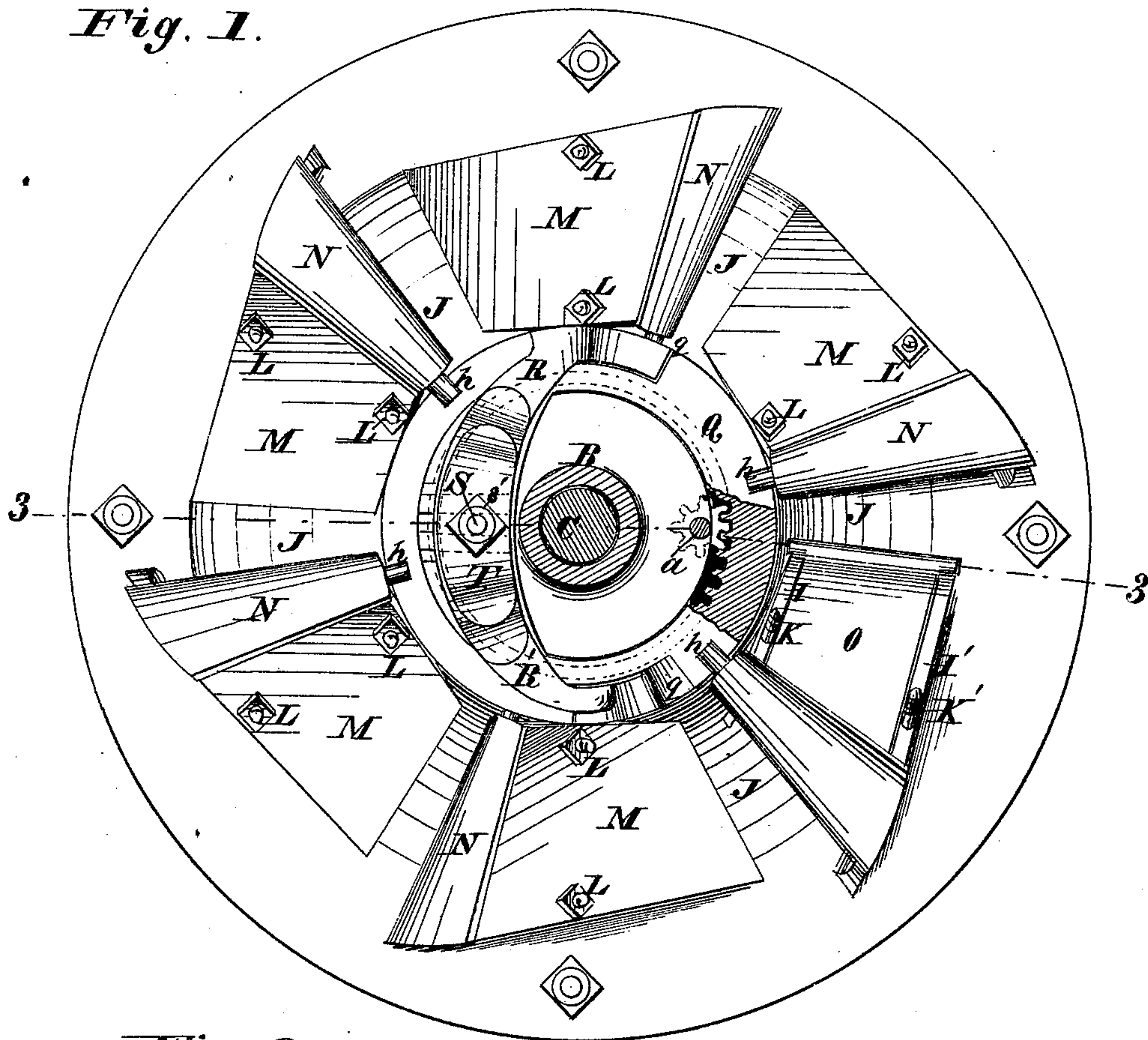
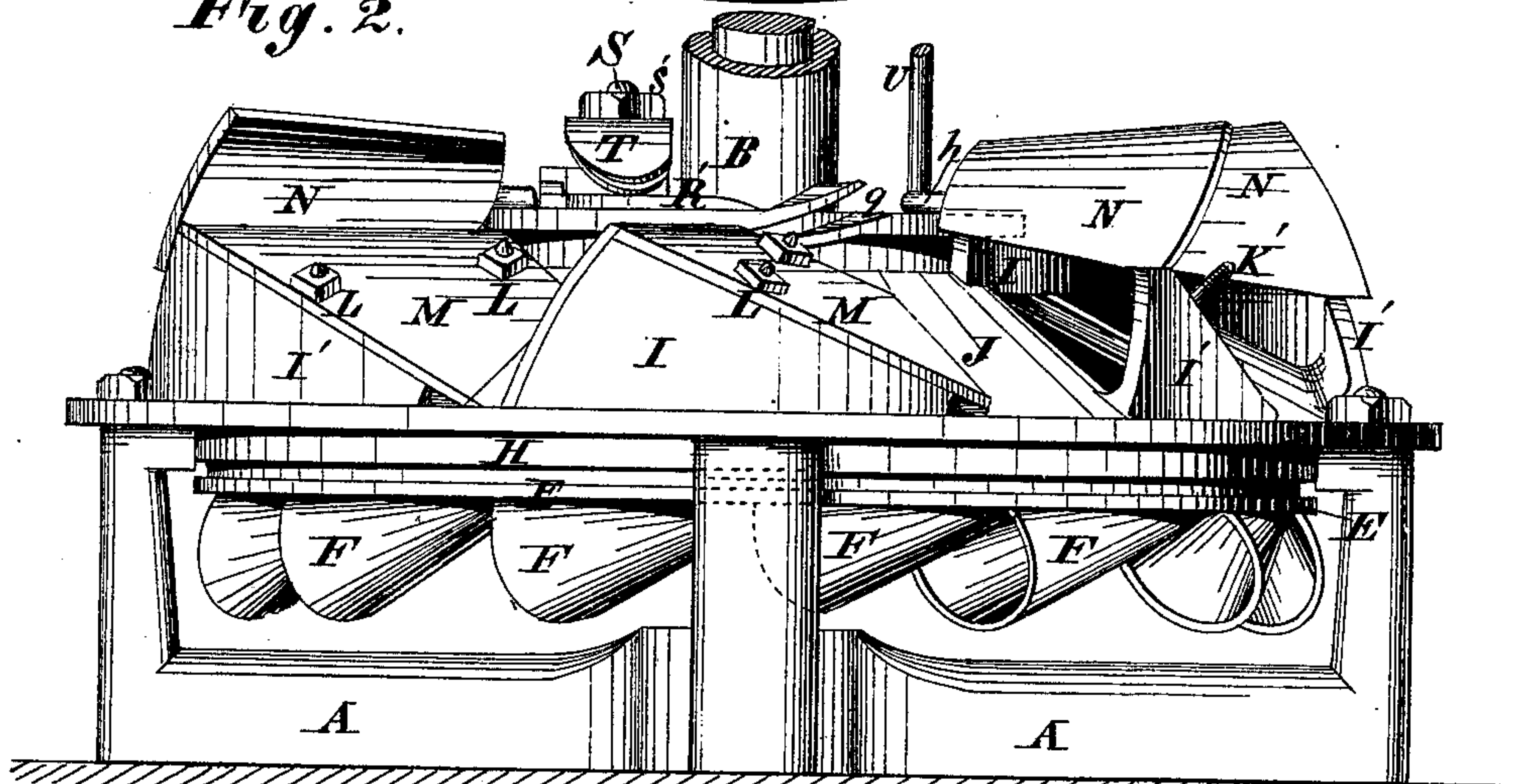


Fig. 2.



WITNESSES

Chas J. Gooch
L. Blond Burdett

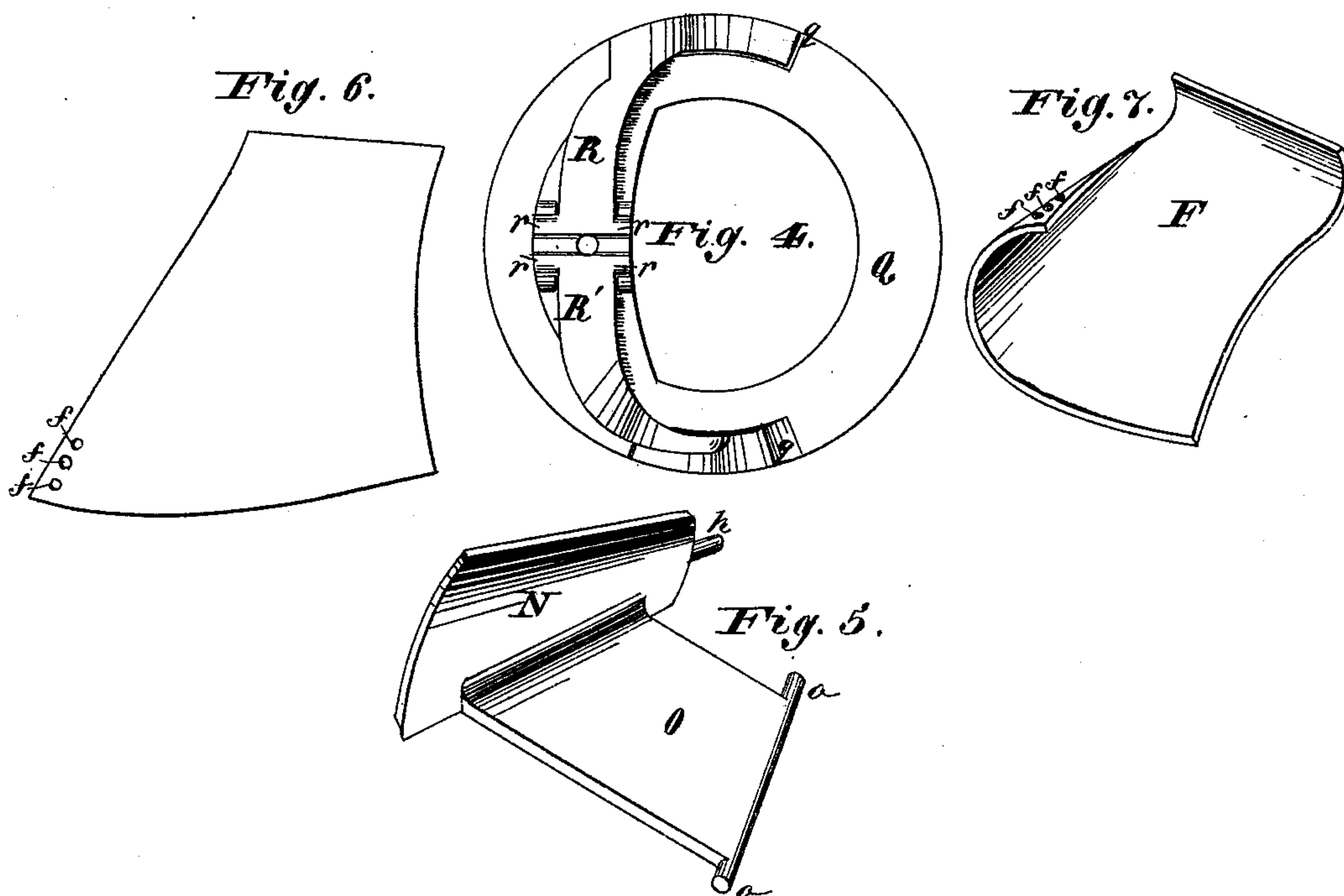
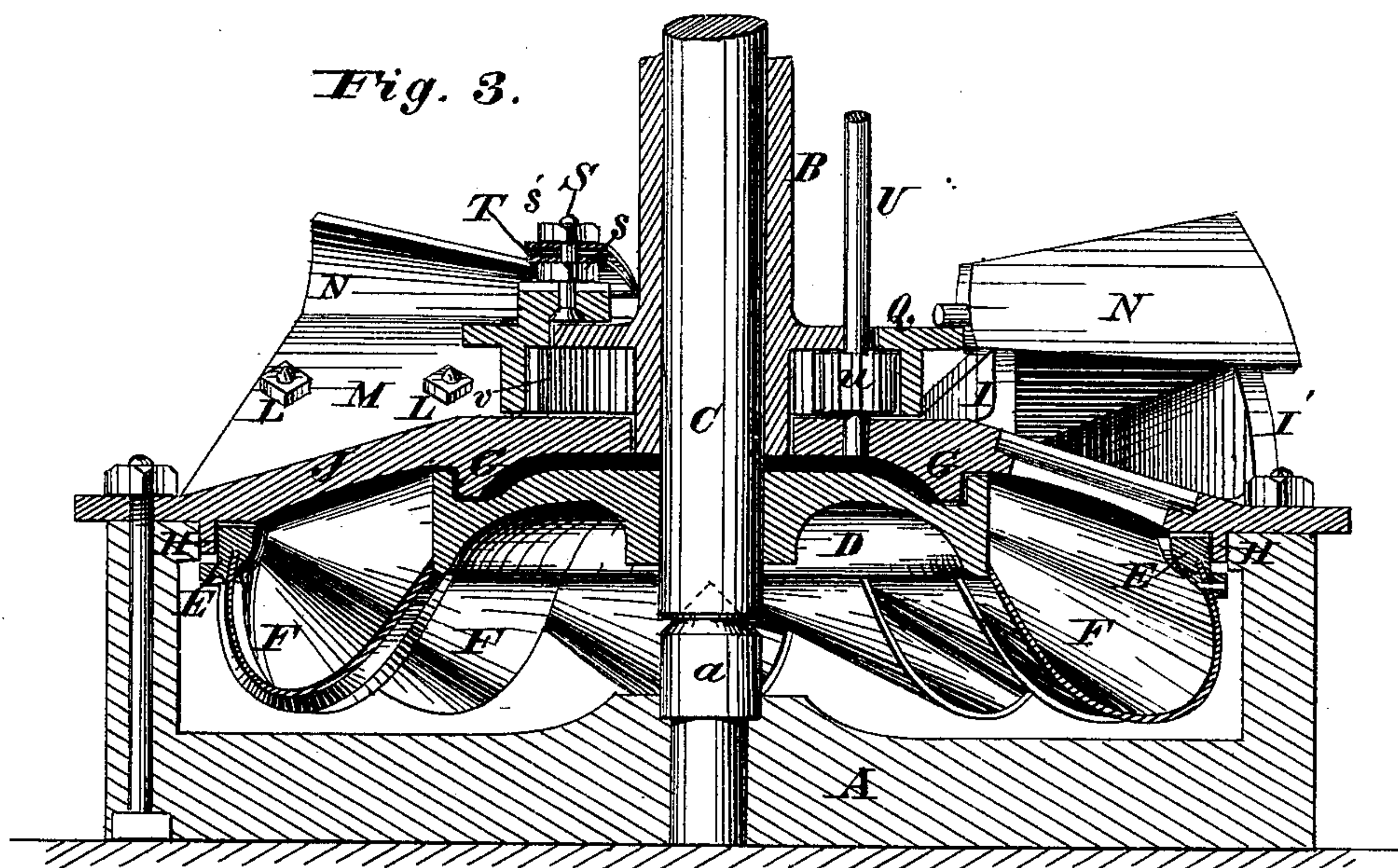
INVENTOR

John M. Case
By *Knights* Attorneys

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Chas. J. Loock
Edmond Burdett,

INVENTOR

John M. Case
By *Knight* Attorneys

UNITED STATES PATENT OFFICE.

JOHN M. CASE, OF COLUMBUS, OHIO.

IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **195,793**, dated October 2, 1877; application filed March 27, 1877.

To all whom it may concern:

Be it known that I, JOHN M. CASE, of Columbus, in the county of Franklin and State of Ohio, have invented a new and useful Improvement in Turbine Water-Wheels, of which the following is a specification:

My invention has for its object to construct a water-wheel which shall give a high percentage of the power of the water, both at full and part gate, and which shall be simple and cheap in construction, durable, and convenient of access in case of repairs, or the removing of flood-wood or other obstructions which may get into the wheel.

It also has for its object to so construct the gates and chutes that the water may be so applied as to use it with the greatest economy when working the wheel at part gate, and to so arrange the gates that should one or more become obstructed they will not prevent the balance from closing, as is the case with other turbines, and to accomplish these results in a simple and practical manner.

It consists, first, in the construction of a casing or cover to the wheel, having the walls to the chutes and a part of the floor of the same cast solidly with the inner and outer parts of the case or cover, the top of the chute being left open to enable the gates to be hinged without bolts. By this construction I am enabled to cast the casing without cores, and to fit it up with much less expense than could be done with the whole of the chute cast solid, having only to bolt on the cap to complete the chute, and also hinge the gate.

It consists, second, in the construction of a circular rim or disk having inclined cams formed upon opposite sides, so arranged that they engage with pins or projections formed upon the gates, and by rotating which the gates are opened, two at a time, upon opposite sides, thus enabling that part of the wheel which is working to be filled, and the pressure due to the head kept up, thus enabling the water to be used with economy at part gate.

It consists, third, in the construction of press-cams in connection with the disk or circular rim, having a suitable spring for forcing the gates down, so arranged that should one or more of the gates be obstructed with flood-wood or otherwise the spring will allow the

cam to rise and pass the gate thus obstructed, and will close all the balance. In the case of most other turbines, if flood-wood or grass obstructs one gate, the whole are held open, either preventing the stopping of the wheel or causing it to leak badly.

It consists, fourth, in the construction of a gate having pins cast or otherwise formed upon the lower end, constructed to fit into suitable recesses formed in the casing or cover, the same being held in position by a cap secured upon the top of the walls of the chute, thus enabling the gates to be hinged without bolts or other fitting, and also enabling the gates to be easily removed in case it becomes necessary to remove obstructions from the wheel.

It consists, fifth, in the construction of the wheel and buckets in such a manner as to be easily molded, and cheap in construction, having the buckets so formed as to give the greatest possible working surface, and enable the water to be discharged in such a manner that it will not obstruct the working power of the wheel. I accomplish this by forming the buckets of sheet metal, and bending into suitable form, so that all parts of the bucket form an incline plane or working surface, the outside of the bucket being made in a semicircle, which causes the main body of the water to be discharged upon the extreme periphery of the wheel, and directly in the opposite line from the wheel's rotation, thus giving the reacting power of the water the greatest possible effect upon the wheel. The buckets thus formed are molded with the inside core and outer rim of the wheel, in the manner hereinafter more fully described.

It consists, sixth, in the combination of the wheel and casing, constructed as hereinafter described.

In the accompanying drawings, Figure 1 is a plan or top view of the wheel, partly in section. Fig. 2 is an elevation of the same. Fig. 3 is a vertical section on the line 3 3, Fig. 1. Fig. 4 is a detached plan or top view of the annular cam mechanism employed for opening and closing the gates. Fig. 5 is a perspective view of one of the gates with its attaching arm or plate. Fig. 6 is a diagram of a blank adapted for the formation of a sheet-metal

bucket. Fig. 7 is a perspective view of the sheet-metal portion of the bucket in readiness for application, which is done by casting the hub and rim of the wheel on an assembled set of the said buckets, as hereinafter described.

A may represent a spider or bridge-tree of any suitable form; B, a box or bearing, and *a* a step-pivot supporting the lower end of the shaft C. The wheel consists of a hub, D, and an outer rim, E, which may be cast at one operation upon the assembled set of sheet-metal buckets F. The form of the said buckets is clearly represented in Figs. 2, 3, and 7, Fig. 6 representing the blank cut in flat form, of proper outline for bending into the bucket represented in Fig. 7, and with holes *f* near its prominent corner, which will be filled, in the act of casting, with the metal which forms the outer rim E.

It will be observed that the bucket-blank shown in Fig. 6, if opened in one direction, will form a bucket for a right-hand wheel, as illustrated in Fig. 7, or, if bent in the opposite direction, will form a bucket for a left-hand wheel, such as is represented in Figs. 1, 2, and 3 of the drawings. A bucket of this construction possesses great practical value in the economy with which it may be made, and, further, in its adaptation to cause a discharge of the water chiefly at the periphery of the wheel, where its effect can be most fully utilized. The principal portions of the chute frame or casing, beneath which the wheel works, may be cast in one piece. This casing consists of an inner rim, G, an outer rim, H, and a set of vertical chute-walls, I I', one pair for each gate, and inclined radial arms or plates J, located between the successive pairs of chute-walls, serving as the floors of the chutes, and also connecting the inner and outer rims G H of the casing. The outer chute-walls I occupy vertical planes tangential, or nearly so, to the periphery of the wheel, by which means the water is applied in contracting veins, striking the buckets in line with their rotation, and without being impeded by deflection from its natural line of motion, as is the case in scroll-formed chutes. From the upper edges of the chute-walls I I' project vertical stud-bolts K K, for the reception of nuts L L, which confine caps M, forming the tops of the chutes. N N are the gates, on either the upper or lower edges of which are formed horizontal arms or plates O, each having at its extremity a pair of gudgeons, *o*, which constitute the pivots on which the gates rise and fall. If the arms or plates O are applied to the upper edges of the gates, the said arms or plates will work above the caps M of the chutes.

In the present illustration I have shown them applied to the lower edge of the gates and introduced beneath the caps within the chutes. On the inner ends of the gates are formed lugs or studs *p*, by means of which the gates are raised by the action of cams, as hereinafter described. Each gate N, with its arm or plate O, gudgeons *o*, and lug or stud *p*,

forms a single casting, the form of which is clearly illustrated in Fig. 5. I prefer to employ an even number of gates, so that they may operate in pairs, the two of each pair being precisely opposite to each other. They are raised or lowered by means of a cam-ring, Q, constructed with inclined ways or flanges *q*, and with a pair of independently-hinged cap-plates, R R', the free ends of which, when in their normal position, are parallel with the upper surfaces of the inclined flanges *q*, so as to constitute, in connection therewith, inclined grooves, through which the lugs *p* rise or descend when the gates are opened or closed.

The cap-plates R R' are hinged at their meeting ends by means of studs *r*, formed upon them, and held down in suitable sockets by means of a nut or cap, *s*, of any suitable construction, which may work on a vertical stud-bolt, S. The stud-bolt S also receives a nut, *s'*, the function of which is to confine springs T, which may have the simple construction of semi-elliptic carriage-spring plates, and serve to hold the cap-plates R down to their normal position, except in the event of either of them receiving a strong upward pressure by reason of the lodgment of a piece of flood-wood or other solid matter beneath the gate, so as to prevent the closing thereof.

The cam-ring Q is rotated by a vertical pinion-shaft, U, the pinion *u* of which engages with a rack, *v*, on the inside of the cam-ring. The pinion U is rotated by a hand-wheel, in customary manner.

Operation: For working with a full head or volume of water, all the gates are opened by turning the cam-ring Q to its fullest extent from left to right. To adapt the wheel to work with best effect with a reduced volume of water, two or more of the gates are closed by a reverse movement of the cam-ring, the first effect, to close one pair of gates precisely on opposite sides of the wheel, so that the remaining gates will be wide open, and, being located precisely opposite to each other, will balance the effect on the wheel. If the volume of water passing through the wheel is still further reduced, another pair of buckets will be closed in like manner, and so on until the limit of capacity is reached; but it will be understood that in all cases such gates as are opened are wide open, so that the successive buckets coming under the effect of the open chutes receive the full force of the water in the most advantageous and effective manner, and an open gate on one side of the wheel is always balanced by an open gate on the opposite side.

The vertical chutes formed between the horizontally-converging vertical walls I I', the floors J, and the caps operate to apply the water to the best advantage in tangential lines with a very slight downward inclination, so that the first impact of the water is received directly in line with the motion, and applies the full force of its weight in descending, and leaves the wheel at the periphery in lines as

nearly as possible opposite to the motion of the buckets.

There are various ways of constructing and hinging the gates. They may be hinged upon the outside, at any suitable point on the cap M, and constructed with double or single hinging-arms, any form of which may be operated by the cams *q* and the combination of parts as herein set forth; but the manner of hinging herein more fully described is believed to be the best.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The casing or cover constructed, substantially as herein described, with inner part G, an outer part, H, radial arms or chute-floors J, and vertical chute-walls I I', cast together, and adapted for the reception of chute-caps M and gates N O, substantially as set forth.

2. A chute constructed with an outer wall tangential to the wheel, or nearly so, and an inner wall converging therewith, placed upon the top of the casing, and in combination with

a hinged gate, operating substantially as herein described.

3. The annular cam Q, formed with paired inclines *q q*, for operating gates on opposite sides of the wheel simultaneously, as set forth.

4. The combination of the pressure-cams R and springs T with the gates N and lugs *p*, as and for the purpose set forth.

5. The gates N, constructed with arms O and pivot-gudgeons *o o*, substantially as and for the purpose set forth.

6. The buckets constructed, as described, from sheet-metal plates, cut substantially as shown in Fig. 6, bent in the form represented in Fig. 7.

7. The combination of the wheels D E F, and casing G H I I' J M, and gates N O, constructed substantially as herein described, for the purposes set forth.

JOHN M. CASE.

Witnesses:

OCTAVIUS KNIGHT,
LE BLOND BURDETT.