(No Model.) 5 Sheets—Sheet 1.

J. WILDE.

TIDE POWER.

No. 537,398. Patented Apr. 9, 1895.

Fig. 1.

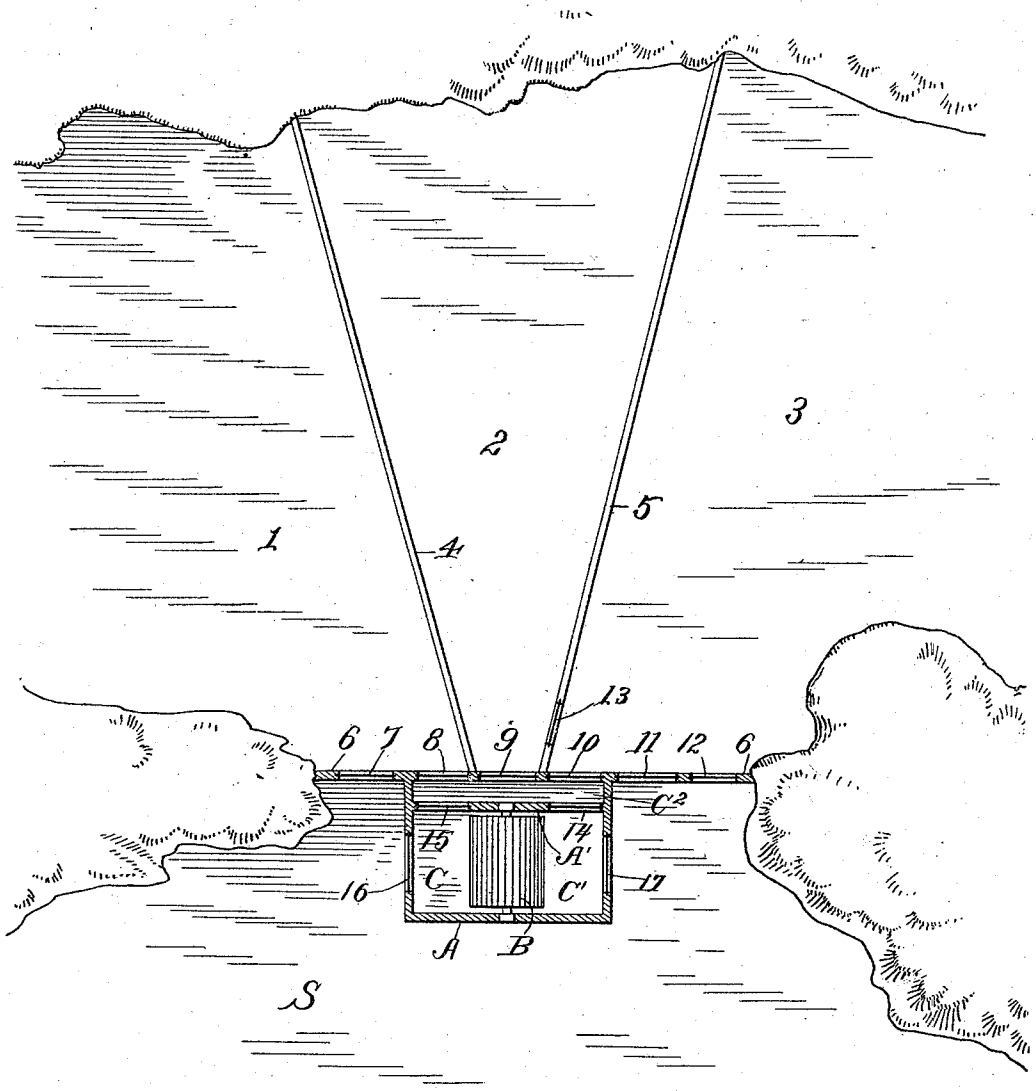

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Fig. 2.

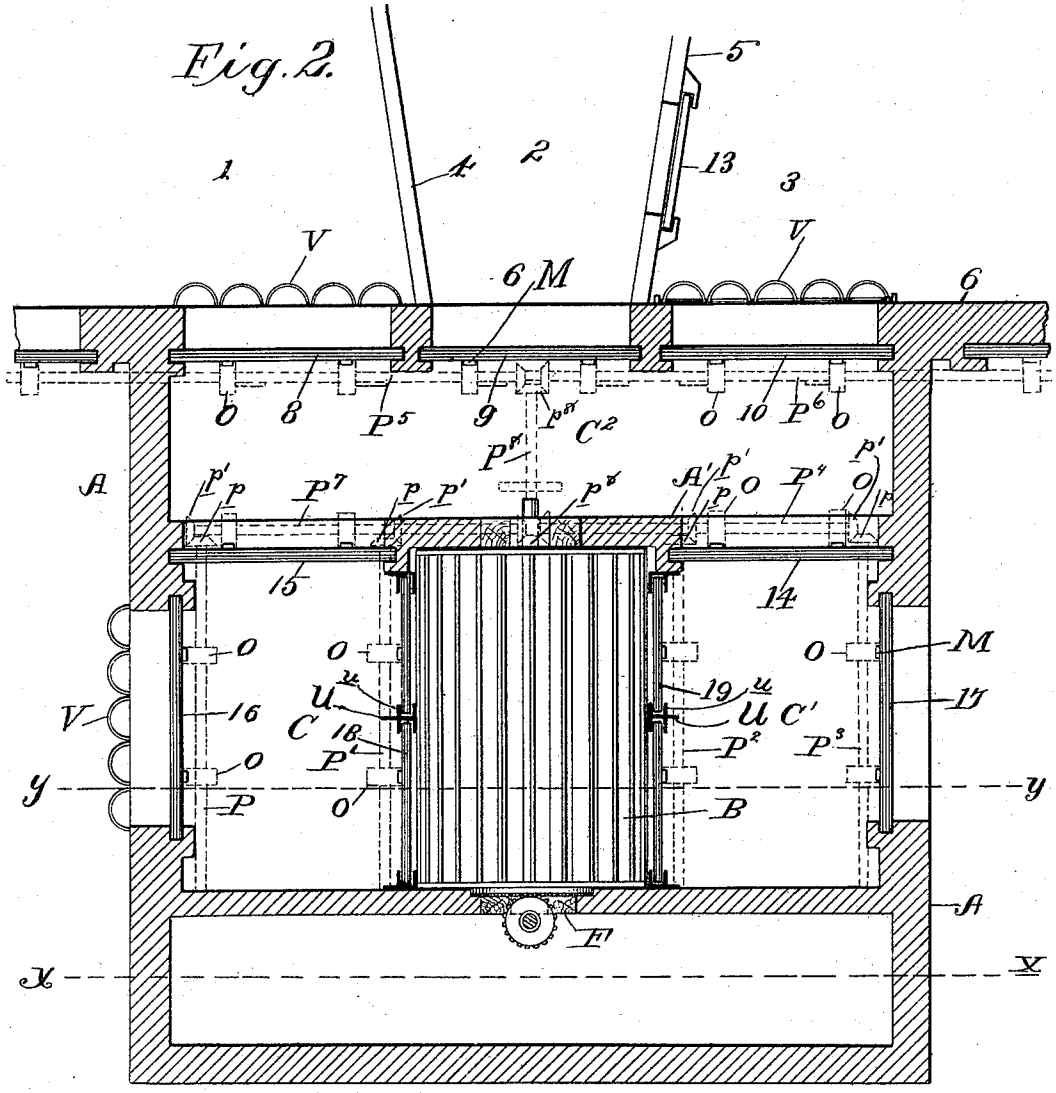

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Fig. 3.

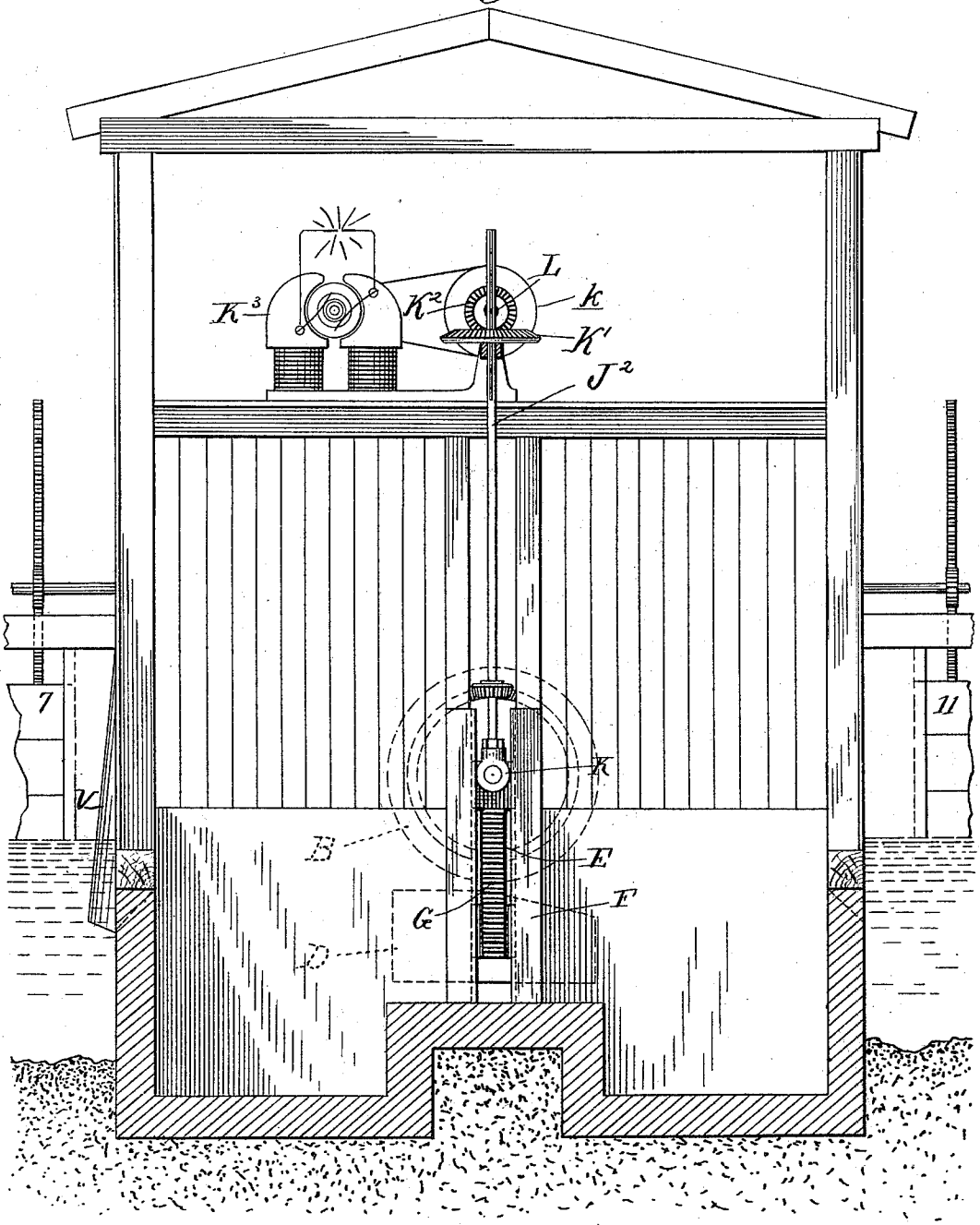

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Fig. 4.

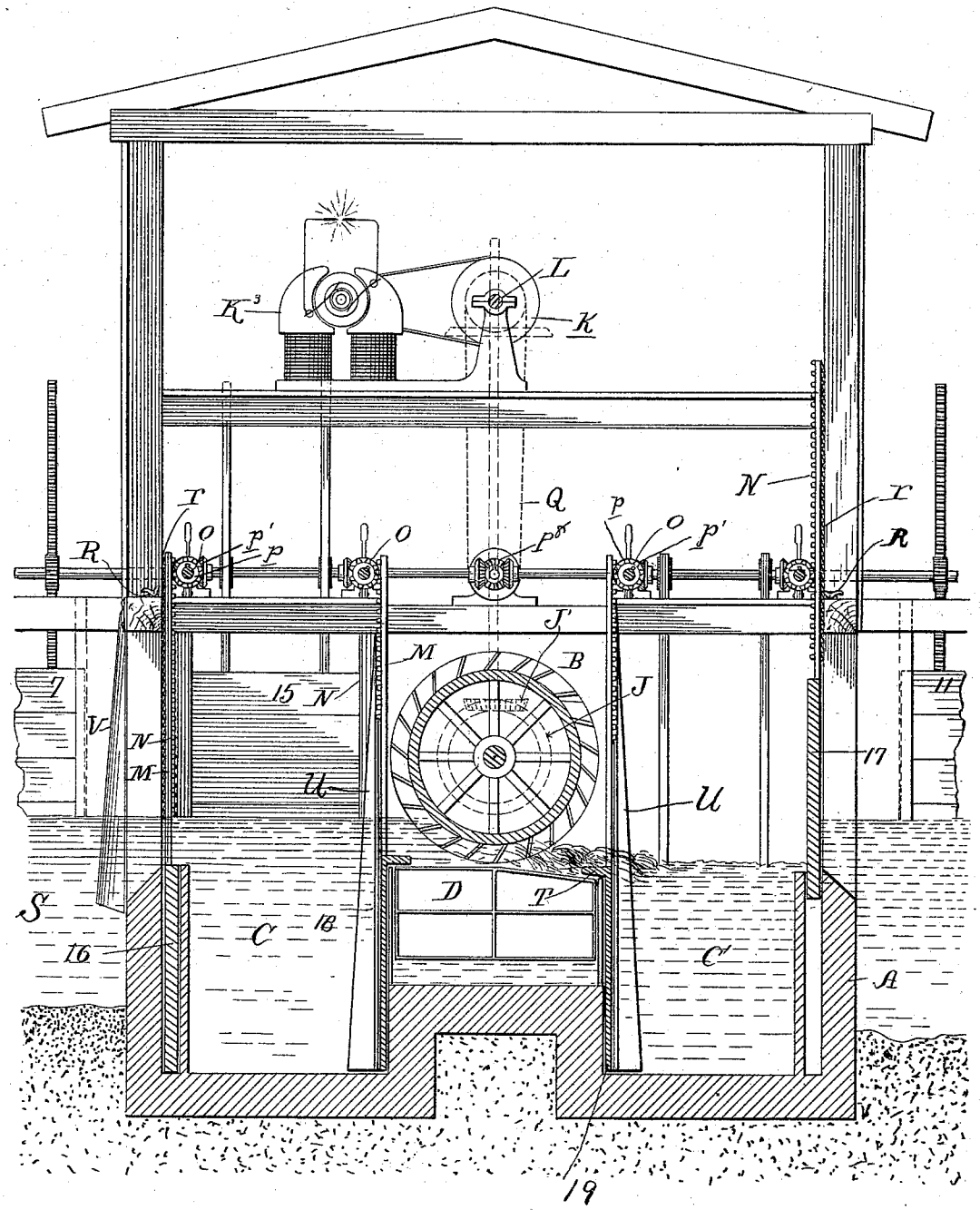

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Fig. 6.

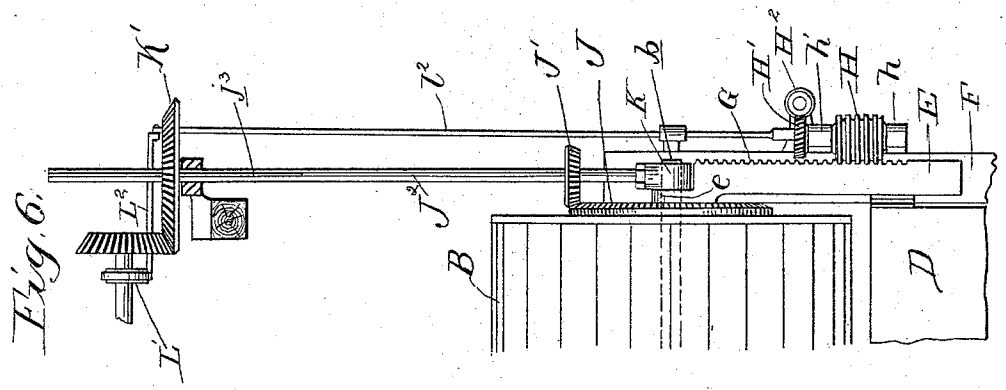
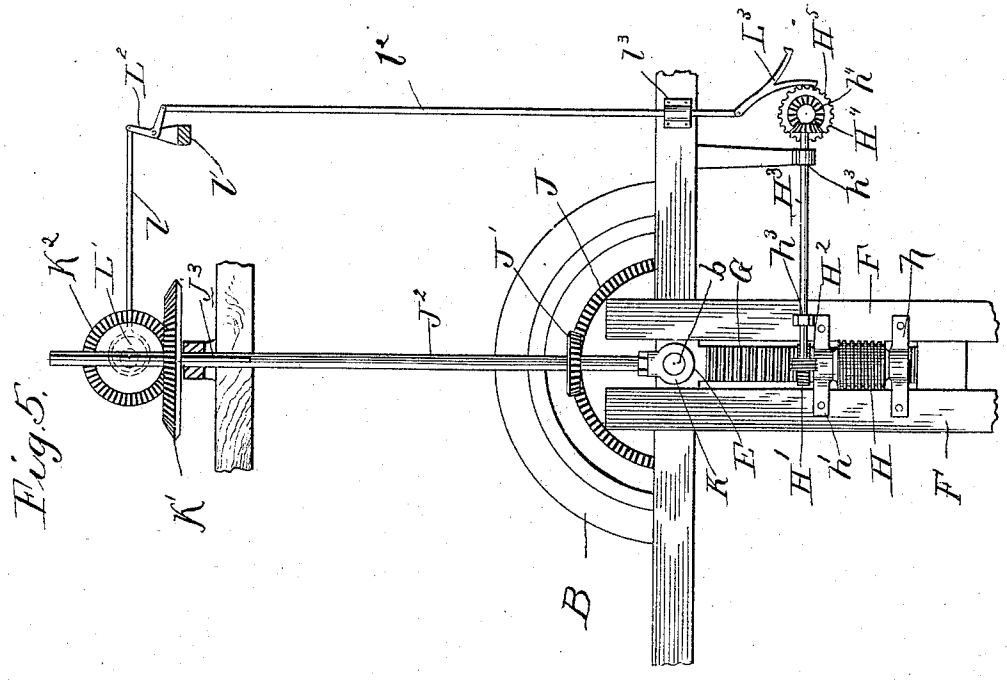


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN WILDE, OF PROVIDENCE, RHODE ISLAND.

TIDE-POWER.

SPECIFICATION forming part of Letters Patent No. 537,398, dated April 9, 1895.

Application filed April 2, 1894. Serial No. 506,085. (No model.)

To all whom it may concern:

Be it known that I, JOHN WILDE, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Tide-Powers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved method of and apparatus for deriving power from tide water, and it consists in the several steps, and in the construction and arrangement of the apparatus hereinafter described and definitely pointed out in the claims.

The aim and purpose of the invention is to so control, regulate, and utilize tide water, that a practically constant power is derived, unlimited in its duration and invariable.

A further object is to provide an apparatus which will embody the essential and necessary features for carrying out the method referred to in an expeditious, reliable and satisfactory manner.

These objects are attained by the construction illustrated in the accompanying drawings wherein like letters and figures of reference indicate corresponding parts in the several views, and in which—

Figure 1 is a plan view of a system of reservoirs and a diagram sectional view of the wheel pit. Fig. 2 is a sectional plan view through the wheel house, showing the gate operating shafts in dotted lines. Fig. 3 is a vertical cross-section through the wheel house on the line *x x* of Fig. 1, with adjusting mechanism omitted. Fig. 4 is a similar view on the line *y y* Fig. 1. Fig. 5 is a detail view of the wheel and float regulating means; and Fig. 6 is a side elevation of the same.

In the drawings 1, 2 and 3 represent the respective reservoirs formed by the dams 4, 5 and 6. In the dam 6 are the gates 7, 8, 9, 10, 11 and 12, while in the dam 5 is the gate 13, corresponding in size to gate 12 and forming communication between the reservoirs 2 and 3.

A represents the wall of the wheel house and pit; B, the wheel, preferably an undershot, which will be hereinafter referred to. The wheel pit is divided by a transverse wall A′, in which are the gates 14, 15, on opposite sides of the wheel. These gates correspond in size to the gates 8, 9, 10, in the dam 6, and also with the gates 16 and 17 in the outer walls of the pit.

From the construction and arrangement thus described and which is shown in the diagram, Fig. 1, and in detail section, Fig. 2, it will be seen that the wheel pit is divided into an upper channel C into which the water enters from the sea, which I have designated S, a lower or receiving channel C′ and a distributing channel C^2, with which both channels C C′ communicate. Intermediate the channels C C′ is the wheel pit proper, and between the same and the channels are a series of vertically sliding gates 18 and 19, serving to form the side walls of the pit. Within the pit proper is placed a float D, of a diameter and length substantially that of the pit in which it moves. This float has an inclined upper face, dipping from a point at or near the center to the outer or discharging edge.

The wheel B is supported on and carried by the float D, so that the blades of the wheel will be on a plane slightly above the deck of the float. To this end I rigidly secure suitable standards E to the ends of the float, which extend up and have bearings *e* formed in their upper ends, in which the shaft *b* of the wheel is journaled. These standards work in suitable guide ways at the end of the pit, formed by two uprights F which thereby prevent lateral movements of the wheel and float.

On the outer faces of the standards E are formed the worm racks G, and journaled in bearings *h h′* on the uprights F is a worm drum H meshing with the teeth of the racks. The upper journal of the drum H is extended above the bearing *h′* and has a horizontal worm H′ thereon with which a worm H^2 meshes, the latter being carried by a horizontal shaft H^3 journaled in suitable bearings h^3 and carrying on its outer end the beveled gear H^4 which meshes with a bevelled gear h^4 on a ratchet wheel H^5. The purpose of this feature of this invention is to maintain a regular vertical movement of the wheel, through instrumentalities hereinafter referred to.

To transmit the power from the wheel to a suitable mechanism or machine, I secure on the end of the wheel B at a point intermediate its center and periphery, a circular rack J with which a gear J′ engages, the latter being mounted on a vertical shaft J^2. The shaft

J^2 is adapted to move vertically by having its lower end journaled in a box K mounted on the protruding end of the axle *b* as shown in Figs. 5 and 6. The upper end of the shaft J^2 has a spline *j* thereon and at that point passes through a horizontally arranged beveled gear K′ which is held from vertical movement by any suitable support, and engages with its teeth the teeth of a vertically arranged beveled gear K^2 mounted on a longitudinal power shaft L which extends across the wheel and to near the opposite end of the wheel house, at which point a suitable pulley *k* is secured thereon. Motion is transmitted from the pulley *k* to a dynamo K^3 or other suitable machine, by a belt connection or in any other suitable manner. On the shaft L, I place eccentrics L′ with which is connected a pitman rod *l* at the outer end of which is a bell crank L^2 journaled in a suitable bearing *l*′. The opposite end of the bell crank carries a rod l^2 which extends down and passes through a suitable bearing l^3, its end being in proximity to the toothed wheel H^5. On the lower end of the rod l^2 is pivoted a pawl L^3 having two arms, each of which being adapted and arranged to engage the teeth in the wheel H^5 at different times so that a reverse movement of wheel H^5 can be had by swinging the pawl on its pivot until the inactive arm thereof engages the teeth on the opposite side of the wheel.

I purpose to so time the movement of the pawls that the worm drum H will be moved and through the same, the wheel B and float, as the tides rise and fall or as it is required that the wheel should rise and fall. By this means the wheel is kept in a relative fixed position and all dashing or turmoil of the water will not affect the position of the wheel which thereby has a regulated automatic movement. It is to be understood that the regulating means are to be placed at opposite ends of the wheel.

In constructing my apparatus I employ what I should choose to term "overshot gates;" that is, gates which are wholly submerged when open, the water passing over the tops thereof. By this means I avoid the difficulty heretofore existing in the too sudden inflow of water and further the volume of the in or out moving stream can thereby be more accurately and definitely gaged and maintained.

The gates of the wheel house and dam 6, I provide with lifting bars M, each being provided with rack bars N on their sides with which pinions O engage. These pinions are mounted on shafts P, P′, P^2, P^3, P^4, P^5, P^6 and P^7 extending parallel with the respective gates. The shafts P, P′, P^2 and P^3 have miter gears *p* on their inner ends which through suitable clutch mechanism engage with like gears *p*′ on the shafts P^4 and P^7 so that the shafts P^4 and P^7 may be rotated without moving their gates and at the same time actuate shafts P, P′, P^2 and P^3, or vice versa. In relation to the gates in dam 6 I find it necessary to slide certain pinions out of engagement with the racks. The mechanism shown for raising the gates P′ P^2 is used only when the wheel pit proper is to be cleaned or when the wheel or float is to be repaired, or whenever it is necessary to draw the water from the pit and prevent its returning. The clutch mechanism also enables me to actuate any shaft separately and it consists mainly in splining the beveled gear on the shafts and moving them in or out of engagement.

To transmit power to the shafts I carry a belt Q from a pulley on the shaft L down to a pulley on a cross shaft P^8 directly below. This shaft P^8 has miter gears p^8 on opposite ends with which the gears on the shafts P^4, P^5, P^6 and P^7 engage as they are moved up. This arrangement of shafts and means for raising and lowering the gates by the movement of the power shaft L may be changed and altered in many ways as is apparent, the principle involved being utilizing the power of the wheel to actuate the gates.

When the gates are closed it is necessary to provide means for retaining them in their elevated positions with their lower edges below the edge of the opening in the dams. For this purpose I may employ a dog R which engages with teeth *r* on the bars M as shown in Fig. 4. It will be seen that the gates 18 and 19 are required to move upward with the float, so as to close the space below the float, preventing the passage of the water below. To accomplish this I flange the upper edges of these gates as at T, and project the flanges over the edges of the float. These gates are preferably of metal or other material of a specific gravity greater than water, and are thereby prevented from independently floating, but will move with the float. These inner gates I mount in stanchions U having flaring bases and tapering edges as shown in Figs. 2 and 4. These stanchions have the guides *u* in their sides and with their projecting edges form a cage to prevent any débris from entering the wheel.

To prevent ice or floating matter from rushing into the pit, I secure over the outer side of the gates 16, 10 and 8, the curved shields V which extend down and out at an incline to a point below the level of low tide, the water moving upward through the shields. The shields for gate 10 are hinged to their tops so that they may be thrown up when the water is passing through this gate into the reservoir which is necessary to prevent the water from backing.

The carrying out of my method and the operation are as follows: Assuming that the tide rises nine feet, I first allow all the water to escape from the reservoirs, and at low tide close all the gates except No. 7. When the tide has risen three feet I open gates No. 16, 14 and 10, the water passing through the wheel with a fall of substantially three feet, and discharging into reservoir 3. As the tide rises it fills reservoir 1, leaving reservoir 2 empty.

When it reaches a point near high tide the gate 9 is opened and the required fall is thereby maintained at flood, while the gate 11 is opened and the reservoir 3 allowed to fill, at which time gates 7 and 11 are closed. After the tide has fallen three feet, the gates 9, 16 and 14 are closed and gates 10, 15 and 17 are opened, the water passing through the wheel from reservoir 3 out of the wheel house into the sea. This is continued until the tide reaches a point near low tide when gate 10 is closed and gate 8 is opened, allowing the water to pass from reservoir 1, through the wheel and discharge into the sea. At low tide the gates 11, 12 and 13 are opened, allowing the water in reservoirs 2 and 3 to run out leaving these reservoirs empty, the wheel being as stated driven by the water escaping from reservoir 1. After the tide has risen three feet the same method and steps are repeated.

In operating the gates it is to be understood that the outlet gates are always adjusted for a three foot fall of the water, thereby avoiding unusual or dangerous currents which would result from too great a fall were the pit not flooded.

It will be expressly understood that I do not limit myself to the use of one wheel, the same having been shown to avoid details. I also wish it understood that I do not limit myself to the special wheel actuating mechanism, nor to other specific details as it is apparent that many changes can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

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

1. The method of utilizing tide water, consisting of passing the incoming tide-water through a suitable motor, storing a part only of the tailings in a reservoir, discharging the remaining portion of the tailings into a second reservoir during the period of flood and immediately prior and subsequent thereto, conducting the stored tailings back through the motor, and finally allowing the water of the secondary reservoir to escape, substantially as described.

2. The method of utilizing tide water consisting of storing the tailings successively in suitable reservoirs, allowing the contents of one reservoir to pass through a wheel as the tide is falling, emptying the reservoirs, and supplying the wheel from a third reservoir while the tide is out, substantially as described.

3. The method of utilizing tide water, consisting in filling a reserve reservoir as the tide rises, introducing the tide-water through a suitable motor, discharging the tailings in separate reservoirs, storing the same in one of the reservoirs, allowing the tide to fill said storage reservoir, while the tailings are being discharged into the other reservoir, conducting the water from the tailings storage reservoir through the motor for a portion of the falling period of the tide, introducing the water from the reserve reservoir through the motor, and allowing the contents of the reservoirs containing the tailings to escape, substantially as described.

4. In a tide power apparatus, the combination with a floating wheel, of means actuated by the wheel to hold the same in its proper relative position, substantially as described.

5. In a tide power, the combination with a series of gates, of a floating wheel, and a gate raising means actuated by the wheel, substantially as described.

6. In a tidal power, the combination with a floating wheel, of a gate house therefor, outer gates for the gate house, a plurality of reservoirs, gates between the same and wheel, a channel between the reservoir gates and wheel, and gates in the channel, substantially as described.

7. In a tidal power, the combination with the gate house, of a vertically movable wheel, of gates 16 and 17 on opposite sides of the wheel, a transverse dam having gates 14, 15, therein, controlling the movement of the water on opposite sides of the wheel, and a plurality of reservoirs having gates between the same and wheel, and outer gates for the reservoirs, substantially as described.

8. In a tidal power, the combination with the wheel house, of the gate 16 therein, the opposite gate 17, channels between the gates and wheel, gates at the ends of the channel, a transverse channel, and a plurality of reservoirs having gates communicating with the transverse channel, and gates in the reservoir beyond the gate house, substantially as described.

9. In a tide power, the combination with the outlet and inlet gate, of an interposed float, a wheel carried by the float, and gates carried by the float, substantially as described.

10. In a tide power, the combination with the inlet and outlet gates, of a float, a wheel on the float, and gates on opposite sides of the float having their upper ends engaging the float, substantially as described.

11. In a tide power, the combination with a floating wheel, of overshot inlet and outlet gates, and means for raising and lowering the gates, substantially as described.

12. In a tide power, the combination of a floating wheel, of an inlet gate and a shield extending over the outer face of the gate way, substantially as described.

13. In a tide power, the combination of a floating wheel, of an inlet gate, and a hinged shield extending over the outer face of the gate way, substantially as described.

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

JOHN WILDE.

Witnesses:
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L. S. BACON.