

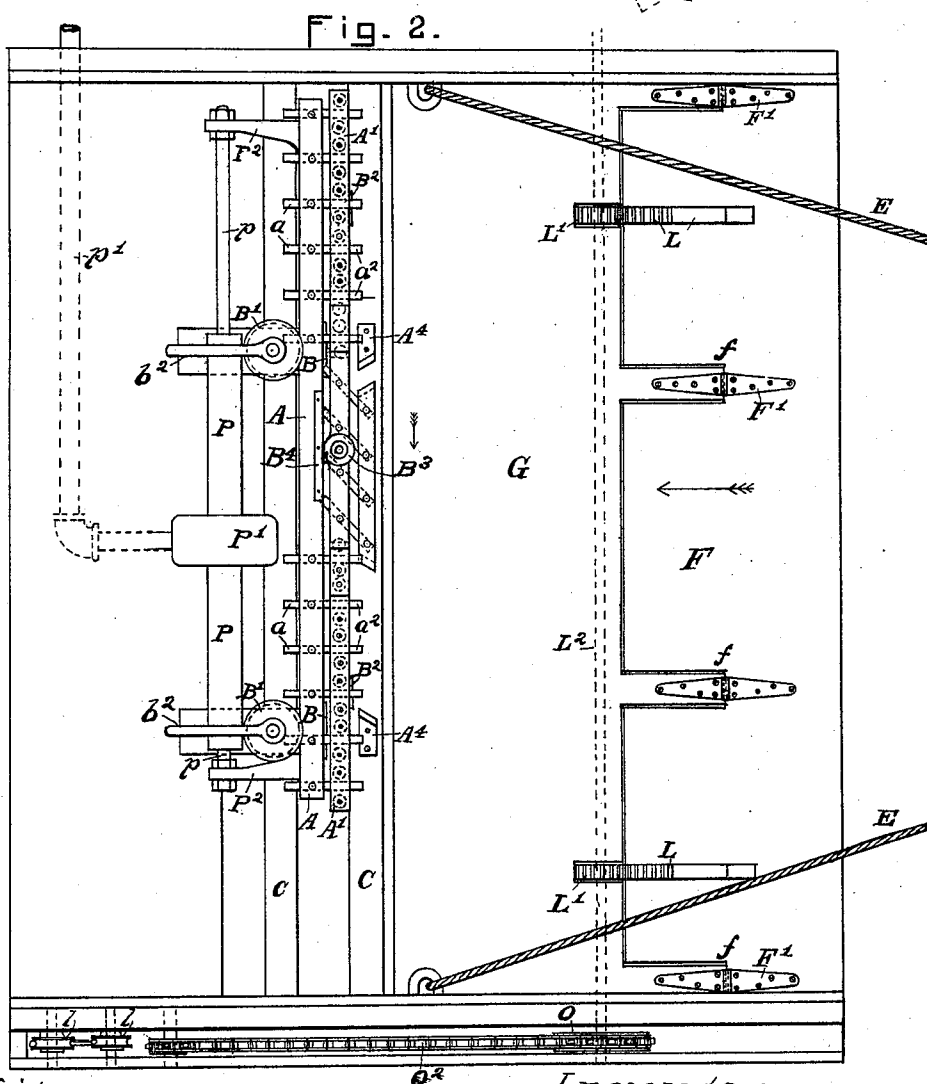
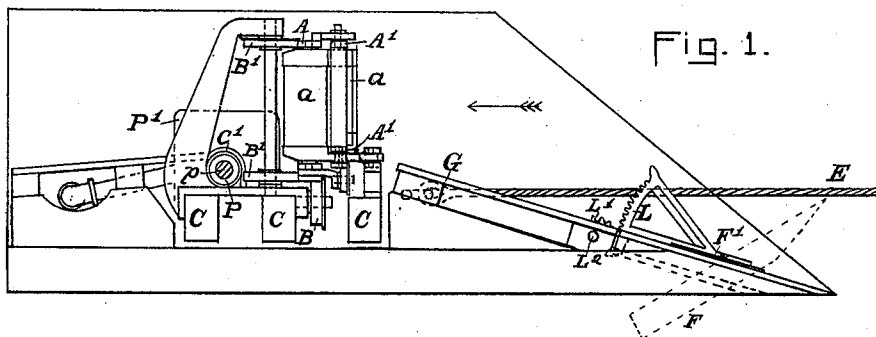
(No Model.)

5 Sheets—Sheet 1.

C. A. BARRON.
CURRENT MOTOR.

No. 578,001.

Patented Mar. 2, 1897.



Witnesses.

Frederick H. Barron
L. T. Kelsey Jr.

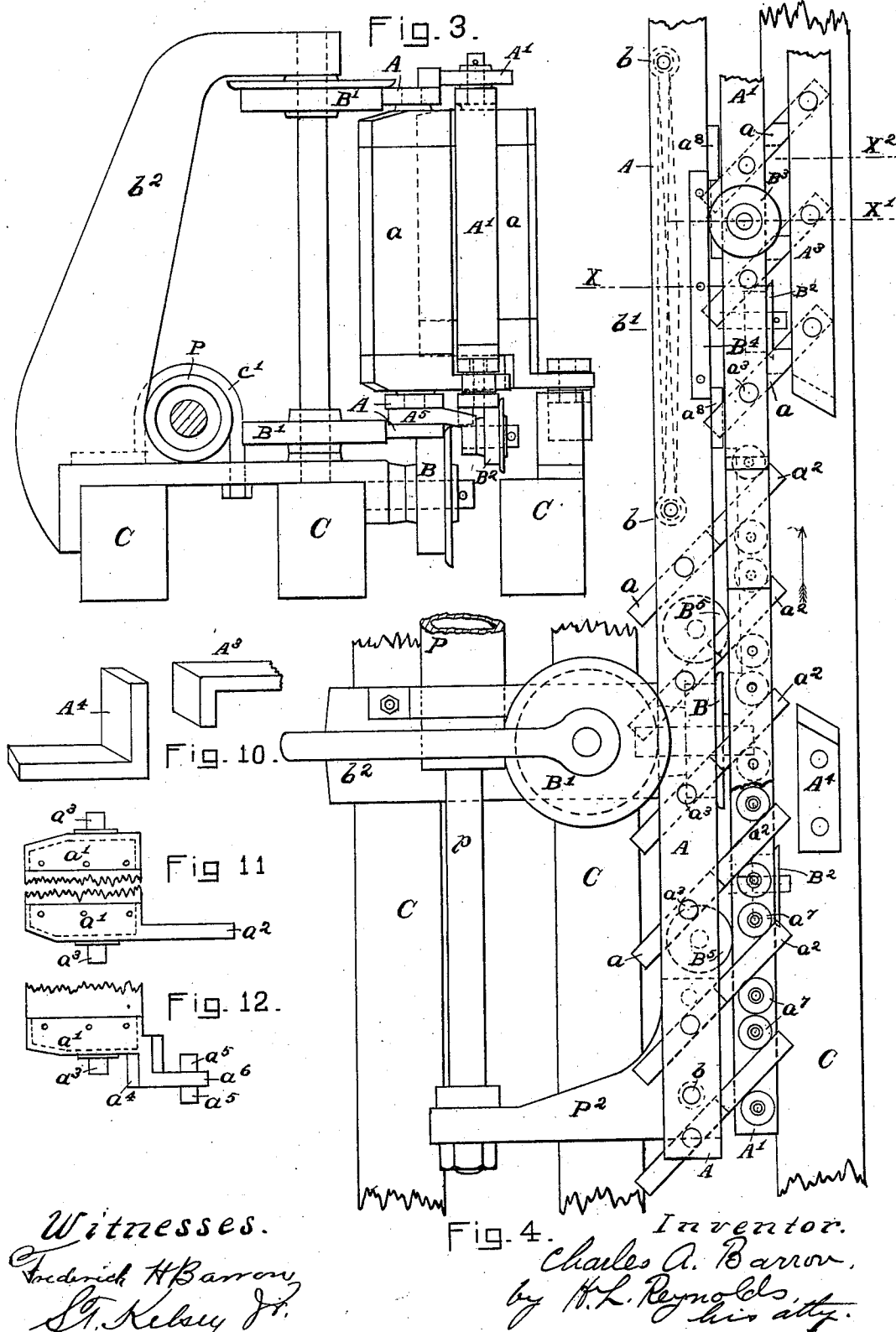
Inventor.

Charles A. Barron;
by H. L. Reynolds his atty.

5 Sheets—Sheet 2.

No. 578,001.

Patented Mar. 2, 1897.



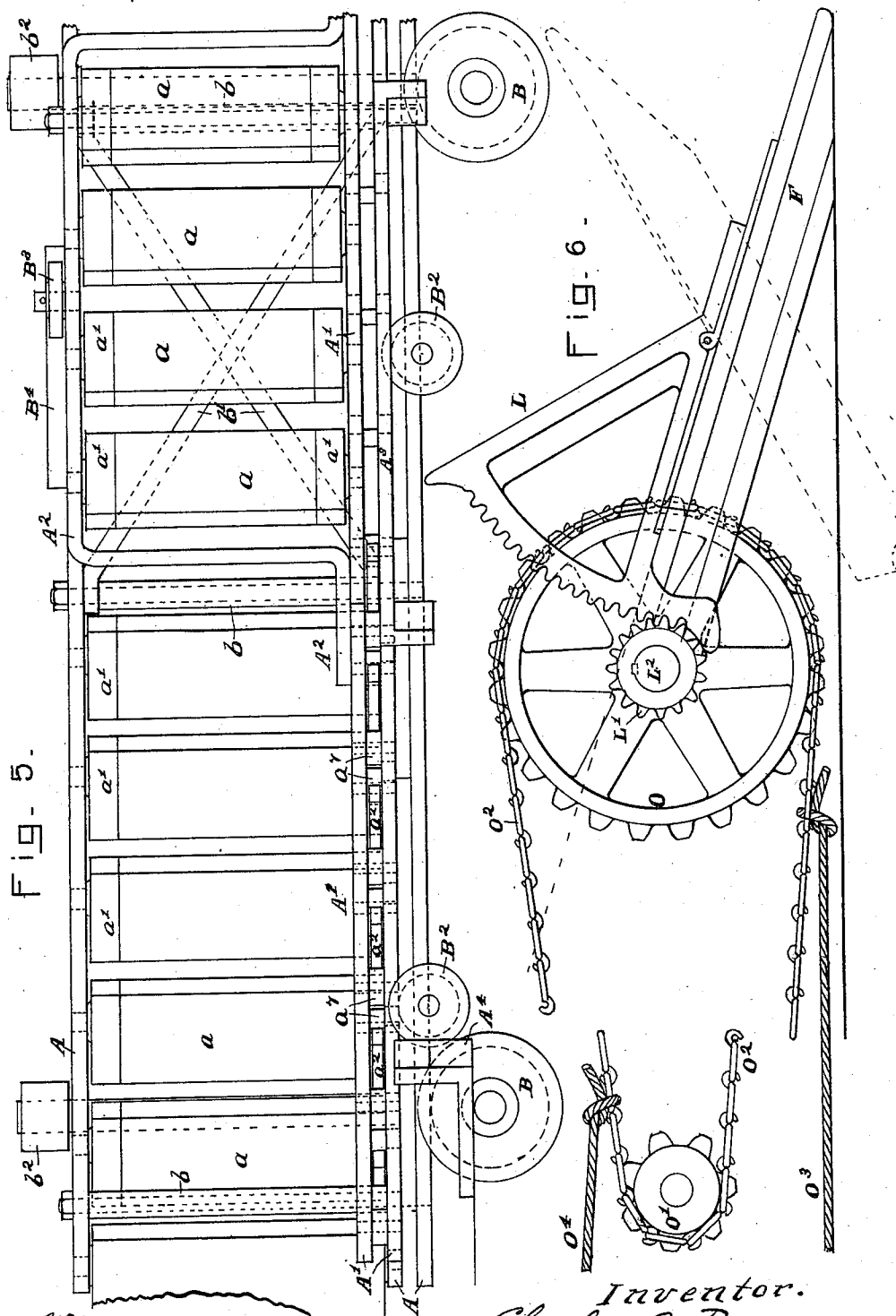
(No Model.)

5 Sheets—Sheet 3.

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Fig. 7.

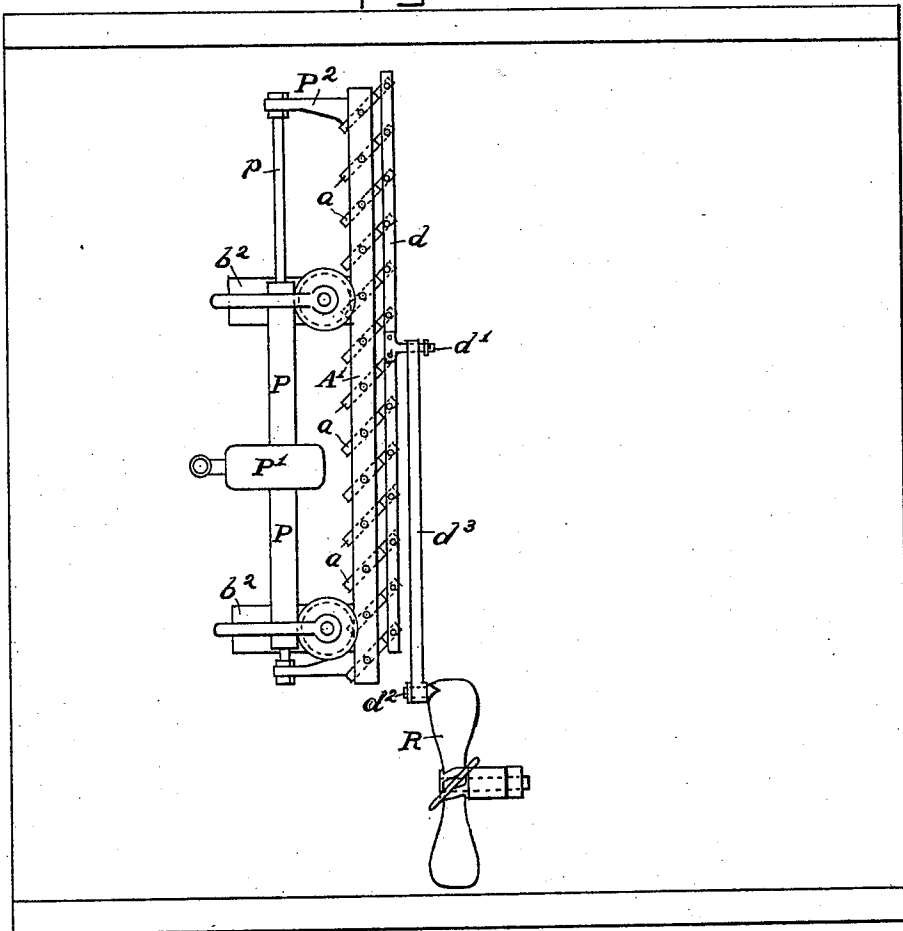
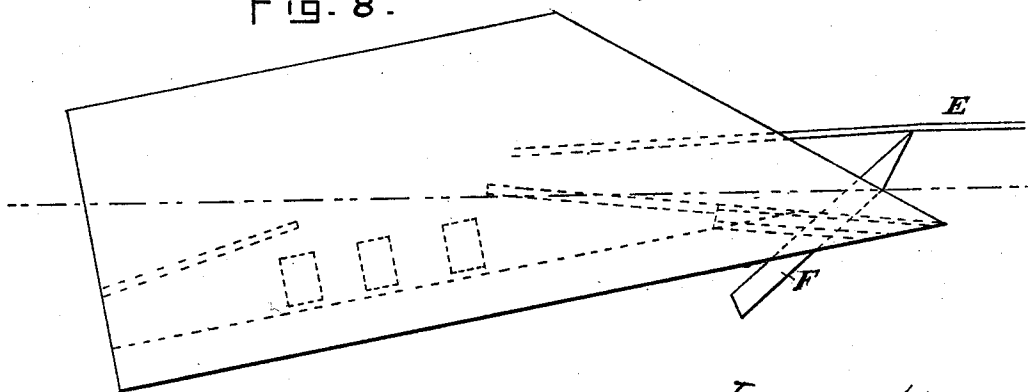


Fig. 8.



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(No Model.)

5 Sheets—Sheet 5.

C. A. BARRON.
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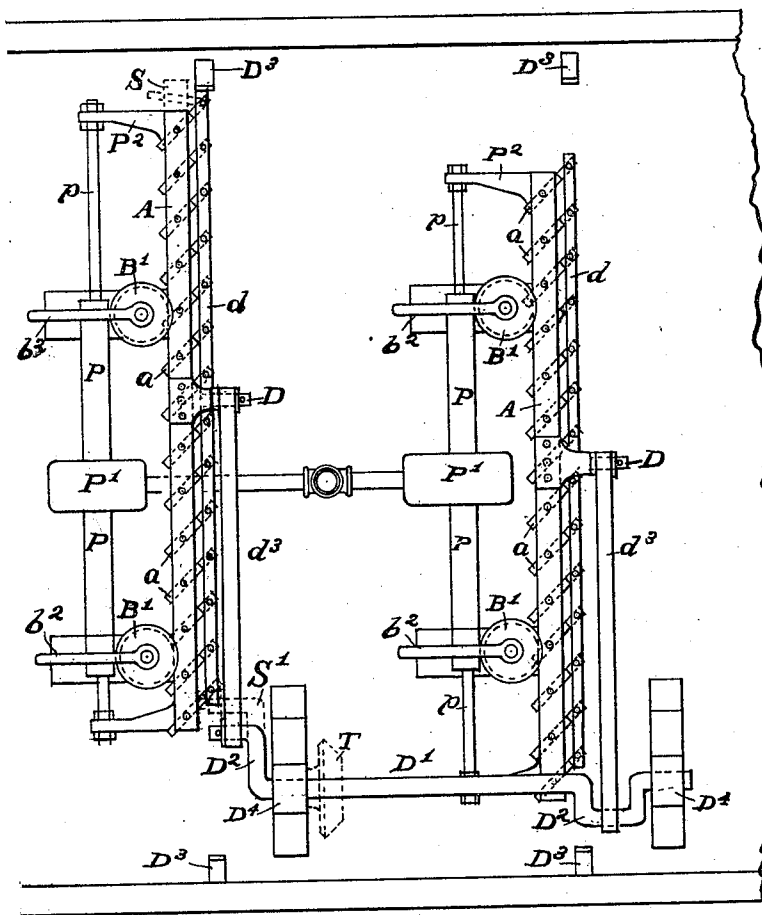


Fig. 9.

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UNITED STATES PATENT OFFICE.

CHARLES A. BARRON, OF SEATTLE, WASHINGTON, ASSIGNOR TO THE
CURRENT MOTOR COMPANY, OF SAME PLACE.

CURRENT-MOTOR.

SPECIFICATION forming part of Letters Patent No. 578,001, dated March 2, 1897.

Application filed January 27, 1896. Serial No. 576,933. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. BARRON, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Current-Motors; 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.

My invention relates to that form of current-motor in which the blades are placed at an angle with the direction of flow of the current and have a motion of transference at right angles to the direction of flow of the current.

It consists, essentially, of a power-frame movable in guides across the current and containing a series of fins or blades in the form of planes extending across the frame and pivoted at each end near the point which will leave them in perfect balance. These fins or blades are connected so that they will be held at the same angle while at work, and at the end of each stroke the direction of inclination is reversed, so that the power-frame will move in the opposite direction.

Figure 1 is a side elevation of my motor with one side of the anchorage or flume removed, so as to show the mechanism. Fig. 2 is a top plan view of the motor. Fig. 3 is an elevation of the immediate supporting-frame and the power mechanism, taken across the current or from the end of the power-frames. Fig. 4 is a top plan view of the same with certain portions broken away at one end and the back. Fig. 5 is an elevation from the upstream side of the power-frames, also broken at one end. Fig. 6 is a side elevation in detail of the means by which the motor as a whole is raised or sunk in the stream. Figs. 7 and 9 are slightly-modified forms of motors in which the reversal of the fins is accomplished in different ways. Fig. 8 is a side or cross-current elevation of the anchorage, showing its position when raised and supported by the current. Fig. 10 is a perspective of the fixed tappet-bar and the end of the fin-connecting bar on the reversing-frame. Fig. 11 is a detail of the castings forming the top and bottom sockets for the insertion of the boards forming the fins of the main power-frame.

Fig. 12 is the bottom socket for the lower end of the fins of the reversing-frame.

The object of my invention is to provide means whereby the power contained in a swiftly-moving current of water may be practically utilized for the purpose of pumping water or of delivering power for any desired purpose; also, that these results may be accomplished by mechanism which shall be of a low first cost, easily managed, not liable to derangement, and thus capable of running for long periods without attention, and which shall be of a high efficiency and capable of construction in sizes which will generate any amount of power liable to be required.

Figs. 4 and 5 do not show the full length of the power-frame, about one-third of one end being broken off. The center of the various portions of the device is indicated in Fig. 4 by the broken lines X, X', and X². The machine as shown in Figs. 1 to 6, inclusive, will first be described.

The fundamental feature of my invention is a power-frame represented by A A', &c., in the various figures and modifications shown, which frame carries a series of pivoted fins or blades *a*. This frame consists of top and bottom members composed of flat bars which are spaced the right distance apart by spacing-bolts which consist of rods *b*, passing through a section of pipe. It is also braced in the middle of its length by diagonal braces *b'*. This main power-frame has fins only for about a third of its length at each end, leaving the center blank. This forms a convenient space for bracing it by the rods *b'*.

The power-frame is carried on the rollers or wheels B, which are pivoted to a part of the framework of the machine. These wheels are flanged so as to prevent the frame from being displaced. The backward pressure of the current upon this frame is resisted by the rollers B', mounted to rotate in the post *b*² and bearing against the top and bottom members of the reciprocating power-frame. There are two of these posts *b*², having a flat base adapted to be secured to the timber framework of the anchorage or flume. They are placed so that the ends of the frame in its travel in one direction will neither run off of the rollers nor overhang too far.

The term "anchorage" as used herein is applied to the wooden construction forming the bottom and sides upon which the device is carried. In one sense this is also a flume, as the sides serve to confine the water against deflection sidewise. The anchorage will be more particularly described later.

The fins a , which are placed within the power-frame, as shown in the drawings, are composed of two cast socket-pieces a' , adapted to receive the ends of a board and having pivots a^3 so placed that the effect of the current upon the front or upstream portion will be a little greater than upon the rear or downstream portion, and so will tend to hold it in such position when it is once thrown over at an angle. The drawings all show this pivot as being forward of the center. This has been found to be necessary when placed in frames close together, as the effect of the current is much greater in proportion to area upon the front portion of the fin than upon the rear portion. The pivoted socket-piece for the bottom end of the fins has an arm a^2 , extending forward. This arm passes between the two bars forming the lower portion of the reversing-frame A' . This reversing-frame has between these two bars a series of small rollers a' , turning upon short pipe-sections or hollow cylinders, through which a bolt or rivet passes to secure the two bars together. In Fig. 4 a portion of the upper bar is broken away to show these clearly. The arms a^2 , extending from the lower socket-pieces, extend between these rollers and are engaged by them to reverse the fins in the main power-frame when the reversing-frame A' is moved relatively to the main frame A . Stops a^8 upon the main and the reversing frames limit the amount of this motion. It is also limited by the levers or arms a^2 , binding between two adjacent rollers. The lower member of the reversing-frame A' acts as a connecting-bar to connect the fins of the main frame, so that they may be handled together.

The reversing-frame A' has an upper member consisting of a flat bar A^2 , bent down at each end and attached to the lower member. Between the two are pivoted fins a , which are similar to those in the main frame and are placed in front of the central blank space of the main frame. The lower socket-pieces of these fins, however, differ somewhat from those used in the main frame. They have a forwardly-extending lever or arm a^6 , which is, however, dropped to a lower level than for the others. It has pivot-lugs a^5 , which engage connecting-bars A^3 , so that all the fins are connected to move together. The sides of the vertical portion a^4 engage the reversing-frame and the connecting-bars to limit the angle of the fins.

The connecting-bar A^3 at each end is bent down and also twisted, as clearly shown in Figs. 2, 4, and 10. Short bars A^4 , similarly bent, are fixed to the anchorage or stationary

framework in such a position that in the reciprocation of the main and reversing frames they will engage the downwardly-projecting ends of the connecting-bar A^3 and reverse the fins of the reversing-frame. The current acting on the fins of the reversing-frame will then move it in the opposite direction, and it will, through the connections described, reverse the fins of the main frame, and the whole will then be reversed. This occurs at the end of each stroke.

The current, acting upon the fins of the reversing-frame, assists the forward motion until the fins are parallel with the current. To insure a certain and a prompt reversal, however, the reversing-frame should be carried a little beyond until the current shall get a good hold on the fins to carry them to the reversed position. This is secured by its connection to the fins of the main frame. Their tendency is to continue the forward motion of the reversing-frame. This tendency is, however, not so strong but that the fins of the reversing-frame will overcome it as soon as they are set at their working angle, when they will carry the fins of the main frame to the same angle. There should be as few fins in the reversing-frame as will insure a prompt reversal of the fins of the main frame for the reason that during their reversal their power is subtracted from the working power of the machine as a whole.

To obtain a working machine, it is necessary to have a reversing power independent of the working power, or, as might more properly be stated of the construction described, be able to detach and use only a small portion of the working power to reverse with. The main frame would not do any work and reverse its fins by contact of their connecting-bar with a tappet, because before the fins got to the point where the current would throw them over the power would be less than the work. The power decreases to nothing when the fins are straight with the current, and they must be thrown a little beyond this point.

The reversing-frame is carried on rollers B^2 , which are journaled on arms A^5 , attached to the main frame. The rearward pressure of the current is taken by rollers or wheels B^5 at the bottom and a single wheel B^3 at the top. These wheels bear on short tracks or projecting flanges B^4 upon the bottom of the reversing-frame for the bottom rollers and on top of the main frame for the upper roller.

In using this motor for pumping purposes the pump piston-rod p is connected to the main frame by an arm P^2 . There are two single-acting pump-cylinders P , connecting to a valve and air-chamber P' , of any approved construction, located in the middle of the machine, and the piston-rods are connected to arms P^2 at each end of the main or power frame A . This might be reversed, having a single arm P^2 connected to the power-frame at the center and the pumps at each end.

The discharge-pipe p' may be led away in any convenient manner, either vertically or to either side.

If it is desired to use this device for compressing air, it will only be necessary to run a supply-pipe up to the air. It will make a very efficient air-compressor, as the pump-cylinder and pipes will be surrounded with running water, which will thoroughly cool the air during compression. The water following the back side of the piston will also prevent leakage by the piston.

In Figs. 1 and 2 the reversing fins or vanes are shown in the reversed position, moving in the direction of the small arrow. The fins of the main or power frame are in their central position and are being thrown over by the reversing-frame.

Figs. 3 and 5 show the reversing fins reversed, but the reversal not yet started on the power-frame. Fig. 4 shows them all acting in the same direction.

The working parts of my device are mounted upon what I call the "anchorage." This has the two vertical sides and the bottom. The upstream edge of the bottom is brought to a sharp edge, from which point it slopes up to the vanes, forming a sloping apron. The whole is attached to a cable E at each side, which unite above the machine and are carried upstream and attached to something sufficiently firm to hold the machine against the current. The machine is intended to lie on the bottom of the stream. Whether that bottom is level or not will make no difference with its working. The current flowing over the sloping apron G will hold the machine firmly to the bottom and prevent any movement sidewise due to the action of the water on the vanes or fins. Any motion of this sort is also resisted by the pressure of the high vertical sides against the water.

The forward section F of the sloping apron is pivoted at points f , Fig. 2, just back of its center, so that it may be swung thereon in the position shown by dotted lines in Fig. 1 and by full lines in Fig. 8. The result of this is that the current getting under the machine, acting upon the sloping surfaces, will raise the whole to the surface, where it will remain in substantially the position shown in Fig. 8 and can be readily examined and repaired. If then the pivoted section is turned with the point down, the whole will sink again to the bottom and commence working. The means for accomplishing this are shown in detail in Fig. 6. A vertical view of these is shown in Fig. 2 and a portion is shown in Fig. 1. A shaft L^2 extends across the anchorage just back of the hinged portion and has keyed to it pinions L' . As many of these may be used as are found necessary, two being shown in the drawings. These pinions mesh with the toothed circular segments L , which are fixed to the hinged or pivoted portion F . When the shaft and pinion are revolved, the section F is turned on its pivots. There is a projecting

tooth or lug at each end of the segment, which prevents overtravel. A sprocket-wheel O is keyed to one end of the shaft L^2 , and a sprocket-chain O^2 passes over this and an idler O' , some distance away. To the opposite sides of this chain are fastened the lines O^3 and O^4 . It is evident that the pinion L' may be rotated and the section F swung on its pivot in either direction by pulling upon one or the other of these cords. These cords are carried over guide-pulleys ll and then ashore. By this means the machine may be raised or lowered in any depth of water and at any distance from the operator. When raised to the surface, it will float in about the position shown in Fig. 8.

In Fig. 7 is shown a modification of my device in which a small screw-propeller is used for reversing the fins. In this form all the fins or vanes are pivoted in one frame and the levers on the fins are connected by a bar d . This bar carries a pin d' , which is connected by a connecting-rod with a pin d^2 , placed upon one blade of a propeller-wheel R . This propeller is mounted upon a fixed support and is revolved by the current. The diameter of its crank-pin circle is about the same as the stroke of the power-frame, in reality slightly greater. At the end of each stroke the propeller gives the slight pull necessary to reverse the fins. A very slight force at the propeller will exert considerable force at the pin d' , as the connecting-rod is just passing the center and it and the propeller-blade act as a toggle-joint. In this form of construction the levers a^2 should be on the upper ends of the fins.

In Fig. 9 is still another form of construction. In this form there are two power-frames of the same construction as is Fig. 7, that is, with all the fins in one frame and connected by a common connecting and reversing bar. In this case the reversing-bar would preferably be at the lower ends of the fins.

The power-frames have pins D attached to them and connecting by connecting-rods d^3 with cranks D^2 , set quartering on the shaft D' , which turns in fixed bearings D^4 on the frame of the anchorage. Fixed tappets D^5 engage the connecting-bars d at the end of each stroke and reverse the fins. The power-frame is forced to travel far enough to insure reversal of the fins by being connected to a crank with a positive travel, which at that particular time is acted upon by the other power-frame, and with the relative position of the cranks such that the least power is required.

The position shown in Fig. 9 is that when contact has just been made between one of the reversing-bars and its tappet. The ultimate position of the power-frame and the crank is shown in dotted lines. This form of construction adapts itself readily to the transmission of power by other means than by pumping air or water. I have shown in dotted lines a bevel-gear upon the shaft D' , to which

another gear and a shaft may be connected to convey power to the shore. This may also be done by means of a chain or cable running over a wheel, either upon the shaft D' or on a shaft connected to this gearing, in a manner which would be obvious to any engineer or mechanic.

The propeller-wheel of Fig. 7 may be used to operate two power-frames by placing one in front of the other, as in Fig. 9, and providing another crank-pin at right angles to the first and a little length of shaft and connecting these to the reversing-bar of the second frame. It can as readily handle two as one, as the time of work for each would alternate.

In situations where the machine would be located permanently and its size would warrant, the style of float or anchorage shown might be done away with and permanent means adopted for anchoring it.

There are numerous ways in which the reversing of the fins may be accomplished. As has been explained, it is necessary that this be done by other power than that derived from the fins or vanes being reversed to make a successful working machine of it. The central idea in my machine is a reciprocating power-frame carrying reversible fins and an independent means for reversing these fins.

The chief use for my machine will be for pumping water. Throughout the western portion of the United States, from the eastern slopes of the Rocky Mountains to the Pacific Coast, there are large areas of land too dry for agricultural purposes except under irrigation and so situated that the cost of gravity-ditches prohibits their use. As a rule these are situated near a stream of water which, as a rule, has a rapid current. In cases where the current is slow it is often easy to partially dam the stream and produce a rapid flow at some convenient point.

It is universally admitted that there is a great deal of power in a rapid-flowing stream. There has heretofore been a great deal of difficulty in utilizing this with any form of wheel built on the plan of an undershot wheel. These are very costly when built in any size, are difficult to handle, and are liable to injury from floating driftwood or ice. If built on permanent foundations, they become drowned and ineffective in high water, while if put on floats they require shifting with a change in height of water. My motor can be built of a large size without being cumbersome or with a disproportionate increase in cost. Being at the bottom of the river and entirely submerged, it is clear of any damage from floating driftwood or ice. An increase in depth of water does not decrease its efficiency. In fact I have found that its efficiency is increased thereby, being in general greater the greater the submersion. The power is nearly proportionate to the depth of submersion. This will of course be affected somewhat by the decrease of speed of the water close to the bottom and similar causes, but actual experi-

ments have proven that the weight or head of water acting on the blades has an important influence on the power developed.

The power-frame has a reciprocating motion, and hence can be connected direct to the pump. As there are no joints or bearings about it which require an accurate fit, it may run for long periods without any attention. All the moving parts being submerged, the water forms a good lubricant.

By attaching a supply-pipe to the pump the machine may be made to pump water coming from some other source than the stream which is operating the machine. A stream of impure water can thus be made to furnish power while the water pumped can be drawn from a pure supply.

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

1. In a current-motor, the combination with a set of fins placed at an angle with the current and constrained to a reciprocating motion across the current of means deriving their power from the current, for reversing the angle of the fins at the end of each reciprocation, substantially as shown and described.

2. In a current-motor the combination with a set of fins placed at an angle with the current and constrained to a reciprocating motion across the current and means for maintaining their relative positions, of means for reversing the angle of the fins independent of the particular fins being reversed, substantially as shown and described.

3. In a current-motor the combination with a frame constrained to reciprocate across the current and a set of fins therein adapted to be held at an angle to the current, of means independent of the fins being reversed, for reversing the angle of said fins at the end of each reciprocation of the frame, substantially as shown and described.

4. In a current-motor, the combination with a power-frame, fins pivoted at their ends in said frame, and guiding mechanism which will permit said frame and vanes to reciprocate across the current, of connections between said fins whereby they are held at the same angle with the current, and means independent of the fins being reversed for reversing said fins at the end of each reciprocation of the power-frame, substantially as shown and described.

5. In a current-motor, the combination with a power-frame, fins pivoted therein and held at an angle with the current, and guiding mechanism which will permit the frame to reciprocate across the current, of means for reversing the angle of the fins at the end of each reciprocation, a power-transmitting mechanism and direct connections from the reciprocating frame to the said power-transmitting mechanism substantially as shown and described.

6. In a current-motor the combination with a power-frame, fins pivoted therein and held

at an angle with the current, guiding mechanism which will permit the power-frame to reciprocate across the current, of a pump and direct connections from the power-frame to the pump, and means for automatically reversing the angle of the fins at the end of each reciprocation, substantially as shown and described.

7. In a current-motor, the combination with a power-frame, fins pivoted therein and held at an angle with the current, and thrust-rollers placed under and at the back of the frame upon which it reciprocates, of automatic means for reversing the angle of the fins at the end of each reciprocating motion, substantially as shown and described.

8. In a current-motor the combination with a main power-frame, fins pivoted therein and held at an angle with the current, and guides upon which said frame may reciprocate, of a reversing-frame, supporting and guiding devices for the same permitting a slight reciprocation on the main power-frame, fins pivoted in said reversing-frame and held at an angle with the current, connections from the reversing-frame to the fins on the main frame for reversing said fins, and means for reversing the angle of the fins in the reversing-frame at the end of each stroke, substantially as shown and described.

9. In a current-motor the combination with a main power-frame, fins pivoted therein and held at an angle with the current, and guide-rollers upon which said main power-frame can reciprocate, of a reversing-frame supported upon the main power-frame and capable of a limited reciprocation thereon, fins pivoted therein and held at an angle with the current, connections from the reversing-frame to the fins of the main power-frame, and means for reversing the angle of the fins in the reversing-frame at the end of each stroke, substantially as shown and described.

10. In a current-motor the combination with a main power-frame, fins pivoted therein and held at an angle with the current, and guide-rollers upon which said main power-frame can reciprocate, of a reversing-frame supported upon the main power-frame and capable of limited reciprocation thereon, fins pivoted therein and held at an angle with the current, connections from the reversing-frame to the fins of the main power-frame, a bar connecting the fins of the reversing-frame, and fixed tappets at each end of the stroke to engage said connecting-bar and reverse the fins of the reversing-frame, substantially as shown and described.

11. In a current-motor, the combination with power-frames having a reciprocating mo-

tion across the current, and a common connection for said frames, of pivoted fins in said frames having a limited angular motion upon their pivots each side of the center, and means independent of the fins being reversed for reversing the angle of the fins at the extremity of their stroke, substantially as shown and described.

12. In a current-motor the combination with frames constrained to reciprocate across the current and fins or paddles pivoted therein and adapted to be held at an angle with the current, of means whereby one portion of the fins or paddles are reversed by the remainder and those first reversed are enabled to reverse the other portion, substantially as shown and described.

13. The combination with a current-motor adapted to be operated submerged, of an anchorage consisting of a frame having an apron sloping upward and backward from the upstream edge, a pivoted section thereof adapted to be turned so as to have an opposite slope, means to change its position at will and means for holding it from moving downstream, substantially as shown and described.

14. The combination with a current-motor adapted to be operated submerged of an anchorage consisting of a frame having an apron sloping upward and backward from the upstream edge, a pivoted section thereof adapted to be turned so as to have an opposite slope, a rack and segment, one upon the fixed and the other upon the pivoted section, means for turning said pinion from a distance, and means for holding the anchorage from moving downstream, substantially as shown and described.

15. The combination with a current-motor adapted to be operated submerged, of an anchorage consisting of a frame having an apron sloping upward and backward from the upstream edge, a pivoted section thereof adapted to be turned so as to have an opposite slope, a rack and segment, one upon the fixed and the other upon the pivoted section, a sprocket-wheel attached to said pinion, an idler sprocket-wheel, a chain passing over both, cords fastened to opposite sides of said chain whereby the sprocket-wheels and the pinion may be rotated in opposite directions, guide-wheels for said cords and means for preventing the anchorage from moving downstream, substantially as shown and described.

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

CHARLES A. BARRON.

Witnesses:

JAMES B. MURPHY,
H. L. REYNOLDS.