

W. C. HOWLAND.

CURRENT MOTOR.

APPLICATION FILED FEB. 1, 1912.

1,037,255.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 1.

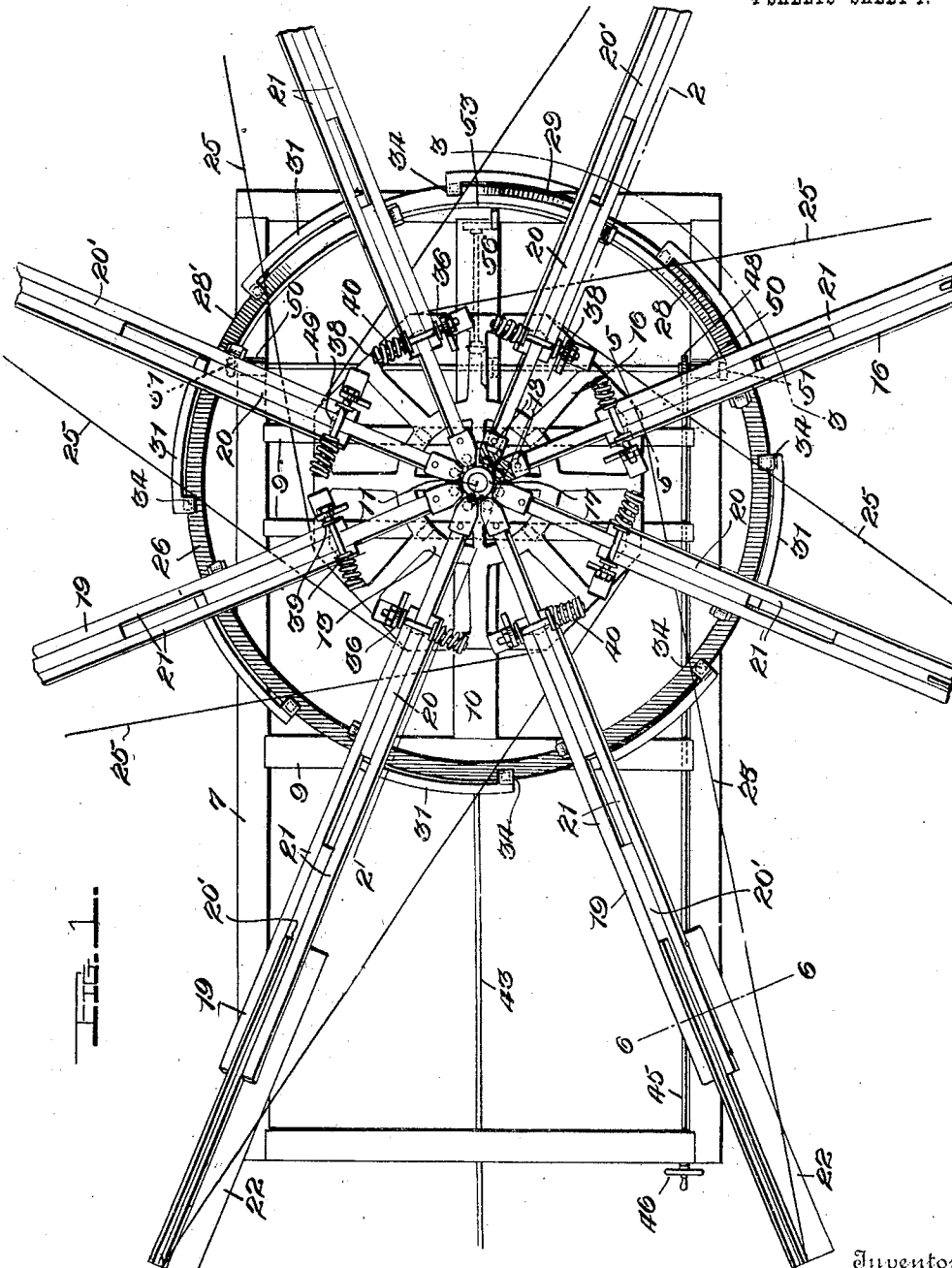


FIG. 1.

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Witnesses

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By

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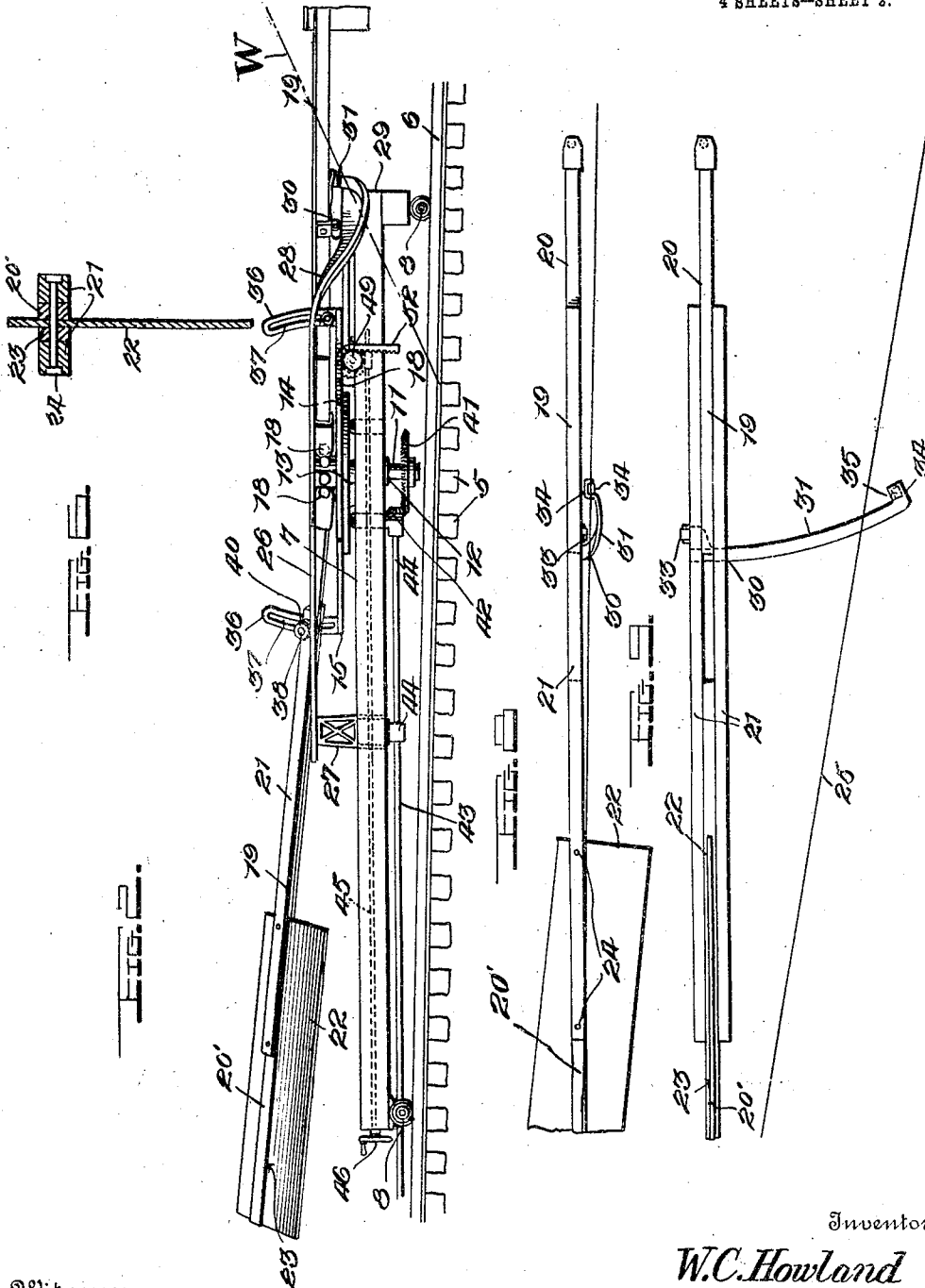
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

FIG. 4

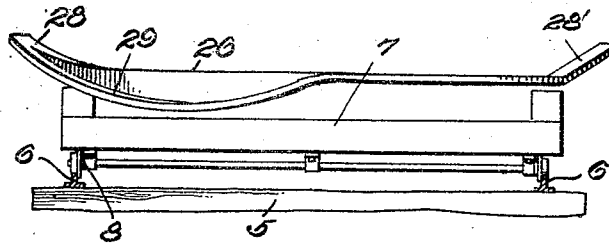


FIG. 3.

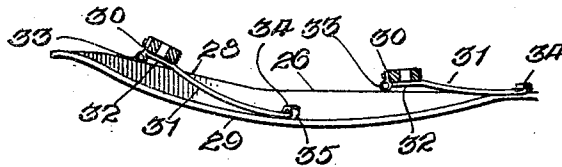
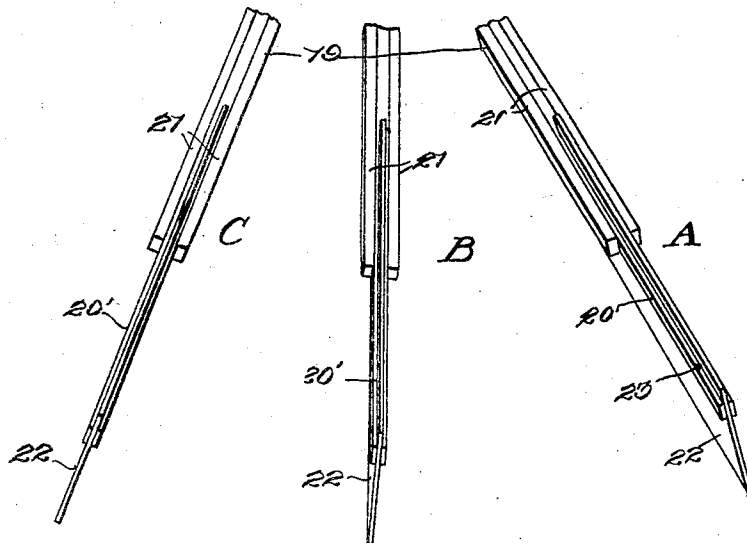


FIG. 2



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4 SHEETS—SHEET 4.

FIG. 10.

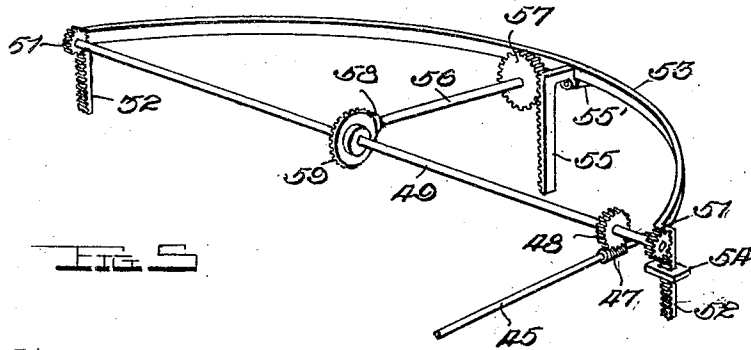


FIG. 5.

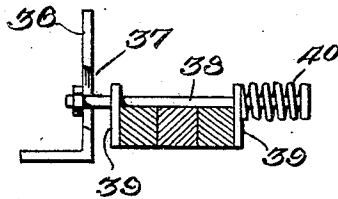


FIG. 11.

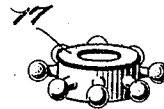


FIG. 12.

FIG. 13.

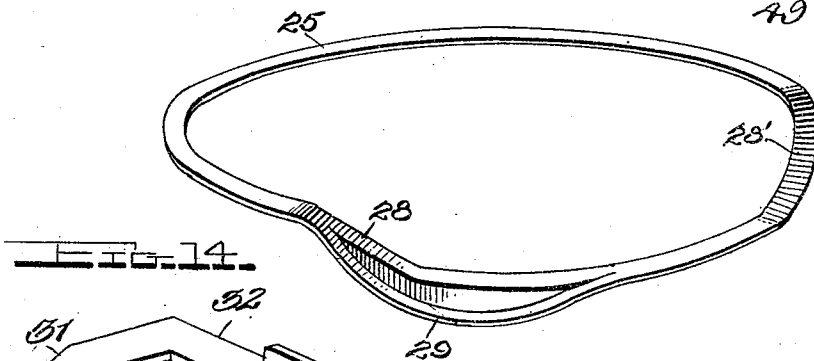
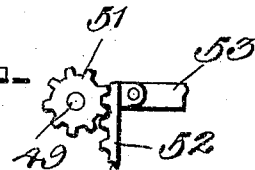
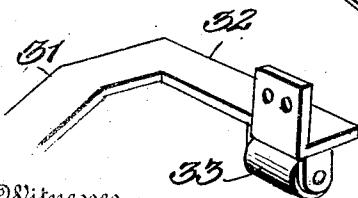


FIG. 14.



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UNITED STATES PATENT OFFICE.

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CURRENT-MOTOR.

1,037,255.

Specification of Letters Patent.

Patented Sept. 2, 1912.

Application filed February 1, 1912. Serial No. 674,677.

To all whom it may concern:

Be it known that I, WINFRED C. HOWLAND, a citizen of the United States, residing at Watertown, in the county of Jefferson and State of Wisconsin, have invented certain new and useful Improvements in Current-Motors, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to current motors and has for its object to provide a simple, durable and effective device of this character whereby a maximum amount of working power may be obtained from a minimum water pressure.

Another object of the invention resides in the provision of a plurality of radially disposed impact receiving blades universally connected to a power transmission shaft, and means for automatically lowering and raising said blades successively into and out of a stream and simultaneously varying their vertical inclination whereby the full strength of the current is caused to act upon said blades to drive the transmission shaft.

Still another object of the invention resides in the provision of a support for the radial blade carrying arms mounted upon the transmission shaft, an annular guide track for the arms having oppositely inclined portions, and means carried by the arms co-acting with means arranged upon the support to permit of the free movement of the arms in a vertical plane and assist in their movement up one of the inclined portions of the track as the same emerge from the water.

A further object of the invention is to provide means for elevating the arms at the point of their effective travel to dispose the same in an inoperative position.

With the above and other objects in view, the invention consists of the novel features of construction, combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a top plan view of a current motor constructed in accordance with the present invention; Fig. 2 is a section taken on the line 2—2 of Fig. 1; Fig. 3 is a section taken on the line 3—3 of Fig. 1; Fig. 4 is an end elevation, the blade carrying arms being removed; Fig. 5 is a detail section taken on the line 5—5 of Fig. 1; Fig. 6 is a detail section taken on the line 6—6 of Fig. 1; Fig. 7

is a diagrammatic view illustrating the several angular positions of each blade with relation to the current as they move through the water; Fig. 8 is a side elevation of one of the blade carrying arms; Fig. 9 is a plan view thereof; Fig. 10 is a perspective view of the vertically movable plate and operating means therefor; Fig. 11 is a detail perspective view of the ball carrying sleeve; Fig. 12 is a similar view of the track; Fig. 13 is a detail perspective view of one of the vertically movable racks and a fragment of the movable plate; Fig. 14 is a similar view of one end of the arm supporting truck.

Referring in detail to the drawings 5 designates the rail supporting ties which are laid upon the bank and bed of the stream. Upon these ties the supporting rails 6 are secured upon which the bed frame 7 is mounted, said frame carrying the trucks 8 the wheels of which are disposed for movement upon the track rails. This frame 7 is of elongated rectangular form in plan and includes a plurality of transverse beams 9 and an intermediate longitudinal beam 10. A vertically disposed power transmission or drive shaft 11 is rotatably mounted in a suitable bearing 12 arranged centrally in the longitudinal beam 10. A horizontally disposed table 13 is fixed upon the shaft 11, and rests upon the anti-friction rollers 14 which are mounted upon the transverse frame beams 9. An octagonal-shaped ring 15 is arranged in concentric relation to the table 13 and is connected thereto by means of a plurality of rigid arms or bars 16. A collar or sleeve 17 is keyed or otherwise rigidly fixed upon the upper end of the shaft 11 and carries the male members of the ball and socket joints 18 whereby the radially disposed blade carrying arms 19 are connected to the shaft 11 at their inner ends for universal movement. Each of these arms consists of a body bar 20 to the inner end of which the female socket member is secured. The outer end of this body bar is disposed between the parallel bars 21, said bars being secured together in any approved manner. Between the outer ends of the parallel bars 21 a bar 20' is arranged and is provided with a longitudinal slot 23 to receive the blade 22. The slot in the bar 20' is of sufficient length to receive the entire length of the blade so that the outer end of said blade is flush with the end of the bar. The bar 20' is held between the bars 21 and the blade is rigidly

fixed in said first named bar by means of a plurality of bolts 24 which are disposed through said bars and rigidly secure the same together. The blades are further
 5 braced and strengthened by means of the cables 25 which are connected to said blades at their outer ends and have their inner ends suitably secured to the corners of the octagonal ring 15.

10 An annular track 26 is mounted above the bed frame 7, a suitable support 27 being arranged upon the intermediate transverse frame bar 9 to maintain a portion of said track in an elevated position slightly above
 15 the plane of the upper end of the drive shaft 11. This track upon one side of the shaft 11 is provided with oppositely inclined downwardly extending portions 28 and 28', the inclined portion 28' being of
 20 greater length than the portion 28. At the approach to the lower end of the inclined portion 28 of this track, a downwardly curved cam portion 29 is formed therein which extends below the plane of the upper
 25 surface of the bed frame 7. Each of the blade carrying arms 19 is mounted upon a supporting truck 30, which consists of a metal bar 31 disposed in spaced concentric relation to the track 26 and exteriorly there-
 30 of. On one end of this bar a lateral extension 32 is formed upon which the blade carrying arm rests. A roller 33 is suitably mounted upon this bar and bears upon the inner portion of the surface of the track
 35 26. The other end of the bar 31 is disposed at a right angle and extends over the annular track as indicated at 34. In this angularly disposed end of the bar a second roller 35 is mounted which moves upon the
 40 outer portion of the track surface.

Upon the octagonal ring 15 the vertically disposed inwardly curved standards 36 are mounted, said standards corresponding in
 45 number with the blade carrying arms 19. These standards are longitudinally slotted as indicated at 37 to receive one end of a bolt 38 mounted upon each of the arms in the upstanding lugs 39 which are fixed to the inner ends of the parallel bars 21. This
 50 bolt is loosely disposed through these lugs and upon one end thereof a coiled spring 40 is arranged, said spring bearing at its ends against a head on the end of the bolt and one of the lugs 39. By loosely mount-
 55 ing the blade carrying arms upon the frame 15 in this manner, it will be seen that they may move freely thereon in a vertical plane, and may also be angularly disposed with relation to the transverse axis of the drive
 60 shaft 11. A beveled gear 41 is fixed upon the lower end of the shaft 11 and meshes with the teeth of a pinion 42 which is secured upon the end of a power shaft 43 mounted in suitable bearings 44 on the
 65 under side of the bed frame 7. This shaft

transmits the power from the shaft 14 to the machine which it is desired to operate, any approved coupling or connecting means between said shaft and the machine being employed.

7 As thus far described, the operation of my improved motor is substantially as follows. The device is moved upon the sup-
 75 porting rails 6 into the current of the stream or other body of water, until the blades on one side of the shaft 11 extend over the water so that they will successively move into and beneath the surface thereof. The water level is indicated in Fig. 2 by
 80 the line W and the blades 22 upon that side of the shaft 11 farthest away from the water are elevated and extend upwardly at a slight angle from the shaft 11, said blades being also disposed at a slight transverse
 85 inclination toward the cables 25 which connect the same with the frame 15.

Referring now more particularly to Fig. 7, A indicates the position of the blade when the arm reaches the end of the decline 28' in the track 26. It will be noted that the
 90 blade is angularly disposed toward the strengthening wire or cable 25. This angular disposition of the blade is caused by the roller or wheel 35 of the arm supporting truck being disposed upon the decline of
 95 the track. The blades are preferably arranged in the bars 20' with their major portions depending below said bars so that substantially the entire surface of the blade is presented across the current of the stream,
 100 and the force of said current acting upon the blade tends to move the same downwardly as well as to push the blade through the water. Thus when the roller 35 reaches the foot of the decline 28' of the track, this
 105 angular position of the blade is decreased until the same is disposed at substantially right angles to the direction of the current as indicated at B. As the roller or wheel 35 moves into the cam portion 29 of the
 110 track, the angle of the blade is changed so that it slants away from the cable 25, and the pressure of the water has a tendency to raise the blade and thereby assist in its movement up the inclined portion 28 of the
 115 annular track. When the blade reaches the top of this incline it is disposed as shown at C wherein the angle of the blade is reversed to that shown at A. This latter angular position of the blade is caused by
 120 the roller or wheel 35 on the arm 21 being at the foot of the incline 28 of the annular track while the other of said rollers is at the top thereof. As the lower roller gradu-
 125 ally ascends the incline the angle of this blade is correspondingly lessened and when said roller reaches the top of the incline the angle of the blade is again reversed so that it inclines toward the cable 25. The coiled
 130 springs 40 on the rods 38 being placed under

compression as the arms move down the decline 28' in the track, act to accelerate the movement of the arms up the incline 28 thereof. By thus changing the transverse angular positions of the blades, the strength of the current of the stream is utilized to its fullest extent whereby a maximum of working power is derived therefrom.

In addition to the foregoing I have also devised means whereby the device may be easily and quickly rendered inoperative. This means consists of a longitudinally disposed shaft 45 having a hand wheel 46 on one end and a worm 47 on its other end. This worm meshes with the teeth of a worm gear 48 secured upon a transverse shaft 49 which is mounted in suitable bearings 50 upon the longitudinal side bars of the bed frame 7. Upon each end of this transverse shaft a cog 51 is secured, and these cogs mesh with the vertically disposed rack bars 52 pivoted to the ends of a plate 53 which is arranged within the annular track 26 and in concentric relation thereto. The rack bars 52 are movable through guide members 54 which are arranged upon the longitudinal bars of the frame 7. A rack bar 55 supports the central portion of the curved plate 53 which rests upon a roller 55' on the upper end of said rack bar. A short longitudinally disposed shaft 56 is mounted upon the frame 7 and carries a cog 57 to mesh with the teeth of the rack bar 55. A pinion 58 is fixed on the inner end of this shaft and engages with the teeth of a beveled gear 59 secured centrally upon the transverse shaft 49. By this construction it will be obvious that when the shaft 49 is rotated, the rack bars 52 will be raised to elevate the ends of the curved plate 53. Through the medium of the gearing 57, 58 and 59, the rack bar 55 is also raised but to a greater extent than the bars 52 whereby the central portion of the plate 53 is elevated above the plane of the end portions thereof. It consequently follows that in the movement of the blade carrying arms as they approach the water, they will be gradually elevated after moving off of the highest portion of the track 26 and as the central portion of said plate 53 is elevated to the plane of the horizontal portion of the track, the blades will be maintained out of contact with the water until the arms come to a full stop.

From the foregoing it is thought that the construction and operation of my improved current motor will be fully understood. By means of the construction and arrangement of parts above described, a maximum of power may be obtained from a current having small impelling force and the full power of the current utilized. By providing the bracing cables 25 for the blades, most of the strain devolves upon said cables and the

frame 15, thus materially reducing the liability of breakage of the blades at their point of connection to the carrying arms 19. It will of course be obvious that a greater or less number of the arms and blades or paddles may be provided than I have illustrated in the accompanying drawings. It will also be understood that the invention is susceptible of a great many minor modifications in the form, proportion and arrangement of the parts without departing from the essential feature or sacrificing any of the advantages thereof.

Having thus described the invention what is claimed is:—

1. In a current motor, a drive shaft, radially disposed blades connected to said drive shaft to rotate the same, and means for moving said blades in gradually varying vertically inclined planes as they are impelled through the water by the current.

2. In a current motor, a drive shaft, radially disposed blades connected to said drive shaft to rotate the same, and means for moving said blades vertically during a portion of each revolution of said shaft, and simultaneously disposing the blades in vertically inclined planes with relation to the current.

3. In a current motor, a drive shaft, radially disposed blades connected to said drive shaft to rotate the same, and means for successively disposing said blades in longitudinally and vertically inclined planes during the intermediate portion of their movement through the water.

4. In a current motor, a drive shaft, radially disposed blades connected to said shaft for universal movement, means rigidly fixed on the shaft and connected to the blades whereby the shaft is rotated, means for successively lowering and raising the blades during a portion of each revolution of the shaft and simultaneously moving the blades to dispose the same in longitudinal and transverse inclined planes with relation to said shaft and automatically reversing the transverse inclination thereof as the blades are lowered and raised respectively.

5. In a current motor, a drive shaft, radially disposed blade carrying arms connected to said shaft for universal movement, a supporting track for the arms whereon said arms are normally disposed upwardly at an inclination to the shaft supporting trucks for said arms movable on the track, said track having oppositely inclined portions to lower and raise the blade carrying arms and also dispose the same in transverse inclined planes, the movement of the trucks from one of the inclined portions of the track onto the other inclined portion automatically reversing such transverse inclination of the blades.

6. In a current motor, a drive shaft, ra-

dially disposed blade carrying arms connected to said shaft at their inner ends for universal movement, a horizontally disposed track to support the arms in upwardly inclined positions with relation to the shaft, supporting trucks for the arms movable on said track, said track having oppositely inclined downwardly extending portions on one side of the shaft, the movement of the supporting trucks upon said inclined portions successively lowering and raising the blade carrying arms in each revolution of the shaft to vary their longitudinal inclination with relation thereto and simultaneously dispose the blades in transverse inclined planes, said track having a cam portion to receive the arm supporting trucks whereby the transverse inclination of the blades is automatically reversed as the arms ascend one of the inclined portions of the track.

7. In a current motor, a drive shaft, radially disposed blade carrying arms, universal connections between said arms and the shaft, a frame rigidly mounted on the shaft, means connecting said arms to the frame whereby the shaft is rotated, a horizontally disposed supporting track for the arms, said track having oppositely inclined, downwardly extending portions on one side of the shaft, the movement of said arms upon the inclined portions of the track successively lowering and raising the blades into and out of the water, and means carried by the arms for accelerating their movement up one of the inclined portions of the track and upon the horizontally disposed portion thereof.

8. In a current motor, a drive shaft, radially disposed arms, blades fixed in the outer ends of said arms, universal connections between the inner ends of said arms and the shaft, a frame fixed on the shaft, vertical guide members for the arms mounted on the frame, a track supporting said arms for circular movement, supporting trucks for the arms movable on said track, and a cam portion in the track to receive said trucks whereby the blades are automatically disposed in transverse inclined planes.

9. In a current motor, a drive shaft, radially disposed arms, blades on the outer ends of said arms, universal connections between the inner ends of the arms and said shaft, vertical guide members for the arms movable with the shaft, a horizontally disposed track, supporting trucks for the arms movable on the track, said track having oppositely and downwardly inclined portions on one side of the shaft, the movement of said trucks upon the respective inclined portions of the track lowering and raising the blades into and out of the water and simultaneously disposing the same in relatively

opposite transverse inclined planes, and means carried by the arms to accelerate their movement up one of the inclined portions of the track and upon the horizontal portion thereof.

10. In a current motor, a drive shaft, radially disposed arms, blades fixed in the outer ends of said arms, universal connections between the inner ends of the arms and said shaft, a frame rigidly mounted on the shaft, vertical guide members for the arms fixed upon the frame, an annular supporting track for the arms having oppositely and downwardly inclined portions on one side of the shaft, the movement of the arms upon the respective inclined portions of the track successively lowering and raising the blades into and out of the water, and truss cables connected to said frame and to said blades.

11. In a current motor, a drive shaft, radially disposed arms, blades fixed in the outer ends of said arms, universal connections between the inner ends of the arms and said shaft, a frame rigidly mounted on the shaft, vertical standards fixed upon the frame having longitudinal slots therein, bolts loosely mounted upon the arms and disposed for movement in said slots, a horizontal track having oppositely and downwardly inclined portions upon one side of said shaft, trucks supporting the arms for movement on said track, the movement of the trucks upon the respective inclined portions of the track successively lowering and raising the blades into and out of the water, and coiled springs mounted on the bolts carried by said arms to accelerate the movement of the arms up one of the inclined portions of the track and upon the horizontal portion thereof.

12. In a current motor, a drive shaft, radially disposed arms having blades fixed in their outer ends, universal connections between the inner ends of said blades and the shaft, an annular supporting track for said arms having inclined portions upon one side of said shaft whereby the blades are lowered and raised into and out of the water, and manually operable means arranged beneath the arms to engage and support said blade carrying arms out of engagement with the inclined portions of the track whereby the blades are maintained in their elevated positions.

13. In a current motor, a drive shaft, radially disposed arms having blades fixed in their outer ends, universal connections between the inner ends of said blades and the shaft, an annular supporting track for said arms having inclined portions upon one side of said shaft whereby the blades are lowered and raised into and out of the water, a vertically movable plate arranged in concentric relation to the track beneath the arms, and manually operable means to raise said

plate and elevate the arms whereby the blades are maintained above the water in the circular movement of the arms.

14. In a current motor, a drive shaft, radially disposed arms having blades fixed in their outer ends, universal connections between the inner ends of said blades and the shaft, an annular supporting track for said arms having inclined portions upon one side of said shaft whereby the blades are lowered and raised into and out of the water, a plate arranged in concentric relation to the track and beneath the arms, and manually operable means for raising the central portion of said plate to the plane of the horizontal portion of the track whereby the arms are supported off of the inclined portions of the track and the blades maintained in position above the water in the circular movement of the arms.

15. In a current motor, a drive shaft, radially disposed arms having blades fixed in their outer ends, universal connections between the inner ends of said blades and the shaft, an annular supporting track for said arms having inclined portions upon one side of said shaft whereby the blades are lowered and raised into and out of the water, a plate arranged in concentric relation to the track and adjacent the inclined portions thereof, a vertical rack bar pivoted to each end of said plate, guides for said rack bars, manually operable means co-acting with said rack bars to raise the end portions of the

plate, and additional means to simultaneously raise the central portion of said plate and to a greater extent than the end portions thereof whereby the arms are elevated and the blades carried thereby maintained in position above the water in the circular movement of the arms.

16. In a current motor, a drive shaft, radially disposed arms having blades fixed in their outer ends, universal connections between the inner ends of said blades and the shaft, an annular supporting track for said arms having inclined portions upon one side of said shaft whereby the blades are lowered and raised into and out of the water, a plate arranged in concentric relation to said track and adjacent the inclined portions thereof, vertical rack bars pivoted to the ends of said plate, guide members for said rack bars, a rack bar supporting the central portion of said plate, and manually operable means co-acting with said rack bars to raise said plate to the plane of the horizontal portion of the track whereby the arms are supported off of the inclined portions of the track and the blades maintained in position above the water in the circular movement of said arms.

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

WINFRED C. HOWLAND

Witnesses:

FRED C. WAERZKE,
FRANK SELL.