To all whom it may concern:

Be it known that I, Arthur G. Watkins, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Water-Power Plants, of which the following is a specification.

This invention relates to the generation of mechanical and electrical power, and more particularly to that class known as hydraulic electrical power plants, which are movable and upon being anchored in a stream are actuated by the current thereof.

This application is a re-filing of a previous application comprising like drawings and writing, originally filed January 27, 1914, Serial No. 814,746, allowed August 5, 1914 and which became forfeited. That application was renewed August 3, 1916 and again allowed August 25, 1916 and has become abandoned.

The object of this invention is to provide a simple, relatively inexpensive, yet highly efficient power plant of the type described, which is particularly adapted to the needs of individual owners in rural districts, or in the neighborhoods of relatively narrow, swiftly moving streams.

Another object is to provide in such a plant improved means for taking advantage of substantially all of the power generated by a given cross sectional area of a stream, whether tidal or directional.

Another object is to provide improved means for shutting down the entire system at will, without removing the same from the stream.

A still further object is to provide in conjunction with such a plant, an electro-generating and storage system for isolated localities or farm groups, to supply electrical power for operating the various agricultural implements and machinery for lighting buildings or for other appropriate uses.

Further objects and advantages of the invention are fully brought out in the following specification with the accompanying drawings, in which:

Figure 1 is a top plan view of the invention in its preferred form, with the upper deflecting wall and paddle-wheel hood removed.

Figure 2 is a vertical section on the line 2—2 of Figure 1, showing the lower and upper deflecting walls and the paddle-wheel hood in place.

Figure 3 is a top plan view of a barge, or scow, equipped with substantially duplicate power plants at opposite ends for taking advantage of the alternate flow in tidal streams.

Figure 4 is a section on the line 4—4 of Figure 1.

Figure 5 is an enlarged detail view of one of the side deflecting wall extensions together with means for maintaining the same in operative position.

Figure 6 is an enlarged detail view of the means for vertically adjusting the upper and lower deflecting walls.

Figure 7 is a detail side elevation of the paddle-wheel hood.

Figure 8 is an enlarged detail view of one of the vanes and the method of mounting the same upon the endless power belts.

Figure 9 is a horizontal sectional view on the line 9—9 of Figure 2.

Figure 10 is an enlarged detail view of the telescoping section of the generator-driving shaft, partly in section.

Referring to the drawings, a scow, barge or other suitable float 1, is provided with the substantially parallel forward extensions 2, through which is journaled a shaft 3, carrying between said extensions a suitable paddle or bucket wheel 4. The said scow is also provided adjacent to its outer edges with substantially parallel extensions 5, longer than the extensions 2 and connected at their outermost ends to the corresponding ends of the diverging walls 6; the front wall of said scow together with the said extensions 2 and 5 and diagonal walls 6, forming compartments 7 and 8 upon the opposite sides of the front of the device and having their lower portions closed by suitable walls 9.

The shaft 3 projecting through the extensions 2 is journaled at one end in a suitable bearing 15 and adjacent thereto carries a beveled gear 16, for a purpose hereinafter described, while the oppositely pro-
jecting end portion carries a beveled gear 17 and is journaled in a suitable bearing 18, while the end proper of the said shaft carries a bevel or crown gear 19.

Located in any suitable position in the compartment 8 is a generator 20 for creating the supply of electric current desired, while in the compartment 7 are suitably located the secondary or storage cells 21 for storing up the energy from the said generator for future use when the said energy is not being put to immediate use. The necessary electrical connections between the generator, storage cells and usual switchboard are not shown, as the same form no part of the present invention.

For driving generator 20 from the shaft 3, actuated by the flow of water against the paddle-wheel 4, a short countershaft 25 is provided, the same being journaled in suitable bearings 26 and carrying oppositely disposed beveled gears 27 and 28, respectively, so positioned that a longitudinal shifting of the shaft 25 operates to shift them alternately into operative relation with the beveled gear 19. The countershaft 25 is made hollow at one end and with a polygonal cross section and is adapted to receive telescopically a similarly shaped end 29 of a shaft 30, which in turn drives the movable part of the generator 20. Thus, during the longitudinal shifting of the countershaft 25, a firm relationship with the shaft 30 is constantly maintained regardless of the position of the former. The shifting of the shaft 25 is permitted for the purpose of maintaining a constantly uniform direction of revolution of the shaft 30, regardless of the way in which the paddle-wheel 4 may be revolving, the same being altered in a tidal stream with the alternate ebb and flow thereof. As shown in Fig. 1, the said shaft 25 is in the position assumed when the current in the stream is flowing from the rear toward the front of the device. With a change in the direction of the said flow, the blade or vane 35 extending downwardly into the water, will be forced in the direction of the arrow 36 in Fig. 1 by virtue of its being carried upon one end of a rod 37, in turn pivoted at 38 to a stationary part of the scow. The said rod 37 is pivotally secured at its upper end 39 to an elbow 40, pivoted at 41, and in turn pivotally secured at its opposite end 42 to a sleeve 43, which encircles the countershaft 25 preferably between the beveled gears 27 and 28. Thus, as the said vane is moved in the direction of the arrow 36, the said elbow 40 is moved in turn in clockwise direction thus removing the gear 27 out of the gear 28 into cooperation with the gear 19. Thus, while the paddle-wheel 4 of the invention as thus far described may be revolving in either direction, depending upon its position with relation to the direction of the flow of the stream in which it is located, the movable parts of the generator 20 can rotate only in one predetermined direction.

With the device hereinbefore described it is obvious that the natural flow of the stream in front of and before it reaches the device, will be greatly increased in speed as it encounters the converging walls 6 and finally impinges against the paddle-wheel 4, the effective power of a normally slowly flowing stream being thus greatly increased. For the purpose of taking advantage of the power exerted by the rush of the water against the walls 6, there are provided similar endless power chains or belts 60, carried by drums 51, in turn carried upon shafts 55 supported by bearing blocks 58, the rearmost of the said shafts extending upwardly and carrying suitable pulleys or sprocket wheels 54, connected by a belt or sprocket chain 55 with pulleys or sprocket wheels 56 mounted upon the shafts 57, which at their lower ends carry beveled gears 58, adapted to cooperate with the beveled gears 16 and 17 respectively. The outer surfaces of the belts 50 are provided with blades 60, pivotally secured as at 61, to the said belt as shown by the dot-and-dash lines of Fig. 8, yet being restrained against swinging beyond a position in a plane perpendicular to that of the said belt by a suitable chain or other member 62. Instead of depending solely upon the friction of the belts 50 against the drums 51, for turning the shafts 52, either or both of the upper and lower edges of the said part may be provided with sprocket chains 63, adapted to cooperate with suitable sprocket wheels upon the said shafts.

In addition to employing the converging walls 6 to increase the effective force of the water against paddle-wheel 4, provision is also made for additionally increasing this force as well as directing it solely against the end part of said wheel. This is accomplished by providing oppositely slanting walls 70 and 71, respectively, as shown in Figs. 1, 2, and 3, the same being revolvable about the shafts 72 and 73, respectively, while their forward ends are adjustable vertically toward and away from each other by means of a right-hand threaded shaft 74, revolutely supported by brackets 75, and in threaded relation with sleeves 78 which are in pivotal engagement with blocks 77, secured in turn to the said walls 70 and 71, respectively. Thus by manually or otherwise revolving the wheels 76 carried upon the upper ends of the shafts 74, the adjacent outer end portions of the walls 70 and 71 are brought nearer together or separated farther apart as may be desired, the outlet between the
rearmost portions of the said walls being maintained always in the same position with respect to the paddle-wheel 4.

For taking advantage of the power of the water as it rushes along the adjacent surfaces of said walls 70 and 71, similar power belts 80 are provided, which are of substantially the same construction as the power belts 60 and are carried by pulleys or drums 81 and 82 at the forward and rearward ends, respectively, of said last named walls, the said drums 82 being operative to revolve the respective shafts 72 and 73 and thus through a side belt or sprocket chain 83 to convey additional power to the shaft 3.

The belts 80 carry blades 84 in a manner similar to the belts 50 hereinafore described, the said blades being prevented from movement beyond a certain point in one direction by suitable chains 85. By thus mounting the blades upon all of the belts the blades are permitted to fold inwardly as they move in one direction, thus offering little or no resistance to the flow of water thereby.

For discontinuing the operation of the plant by stopping the action of the paddle-wheel 4, there is provided a hood 90 having an elongated extension 91 adapted to project downwardly in front of all parts of the paddle wheel when the said hood is in its lowermost position. Said hood is braced by a suitable framework 92 provided with a recess 93, adapted to encircle the shaft 3, and it is carried as a whole by integral rearwardly extending blocks 94 adapted to slide vertically upon any suitable form of track 95, in turn secured to the outer side of the adjacent wall of the scow, said hood being raised and lowered by means of a threaded shaft 96, extending through said block 94 and supported by a suitable bracket 97, the said shaft being revoluble by a hand or other wheel 98.

When the width of a stream is considerably greater than the distance between the outermost edge portions of the walls 6, and it is desired to take advantage of a greater volume of water than would otherwise flow therebetween, extensions 100 must be provided for the said walls, and are hingedly secured thereto as at 101, while the outermost edges of the respective extensions 100 are provided with blocks 102, having oppositely extending ears 103 provided with holes 104 and 105 respectively. When in operative position, a chain or other suitable means 106 passes through and extends between the holes 104 of the respective blocks 102. When it is desired to fold or swing said extensions out of operative position, they assume the position shown on the left side of Fig. 1, and are secured by a removable pin 107 passing through holes 108, in said extension 5, and through holes 105 in said blocks, the adjacent ear 103 of each block being received in a suitable recess provided therefor in the respectively adjacent walls 5.

In the modified form of the invention as shown in Fig. 3, the hereinbefore described device is constructed in substantially duplicate form upon the opposite ends of the scow, barge or floating platform as the case may be. In this form the device is particularly well adapted to streams in which there is a periodic or occasional change in the direction of the flow of the water. Further than this it is obvious that many additional changes or modifications may be made in the form in which the invention is embodied, without departing from the spirit thereof or the scope of the appended claims, wherefore, the broadest attitude interpretive of this invention is the desire of the applicant herein.

Having now fully described this invention and explained the mode of its operation, what I claim is:

1. The combination of a floating member, with a power generator, comprising a water wheel, an electric generator operated thereby, horizontally converging walls operative to increase the power of an available current of water against said wheel, and power generating means carried upon the adjacent surfaces of said converging walls to supplement the power generated by the said water wheel for operating said electric generator.

2. The combination of a floating member, with a power generator, comprising a water wheel, an electric generator operated thereby, horizontally converging walls and vertically converging walls operative to increase an available current of water against said wheel, and power generating means carried upon the inner surfaces of said converging walls, to supplement the power generated by said wheel for operating the said electric generator.

3. In combination, a floating member, a power generator thereon comprising a water wheel, an electric generator operated thereby, vertically converging walls operative to increase an available current of water against said wheel, and power generating means carried upon the inner surface of said walls to augment the power generated by said wheel to operate the said electric generator.

4. In combination, a floating member, a power generator thereon comprising a water wheel and an electric generator operated thereby, vertically converging walls operative to increase an available current of water against said wheel, and power generating means carried upon the inner surface of
said walls to augment the power generated by said wheel to operate the said electric generator, and means operable from the water to change the connection between the said wheel and generator to maintain a constant direction of movement of the generator as the movement of the wheel changes in direction.

5. In a water power plant, the combination with a floating member, of a water wheel rotatively supported by the said member, walls arranged to direct the flowing water against the said wheel, and power generating means arranged in the path of the water upon one of the said walls and operatively connected with the said wheel to supplement the power generated by the said wheel.

In testimony whereof I affix my signature.

ARTHUR G. WATKINS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D.C."