

Oct. 26, 1937.

L. S. McGEE

2,097,286

POWER GENERATING APPARATUS

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2 Sheets-Sheet 1

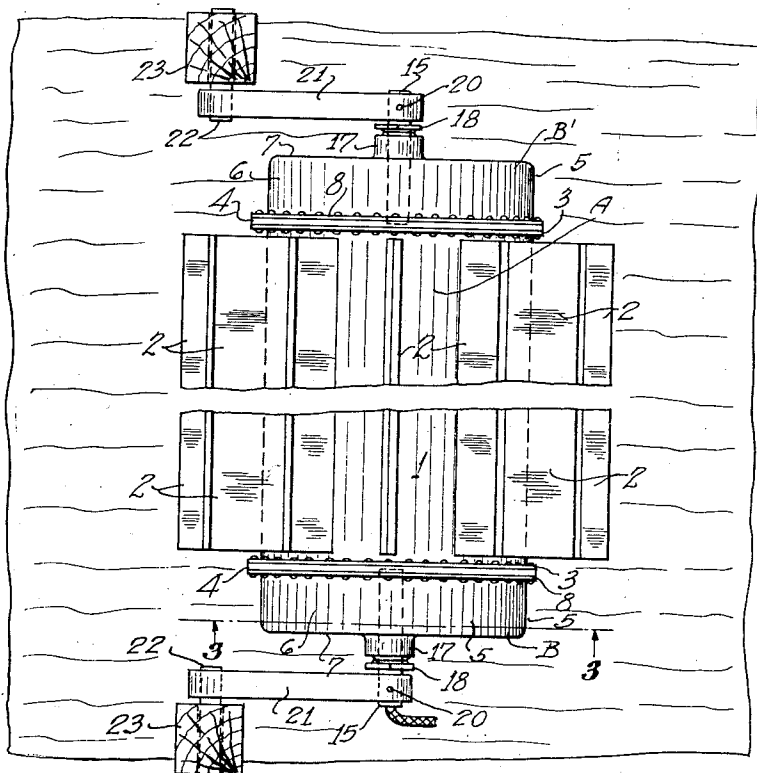


Fig. 1.

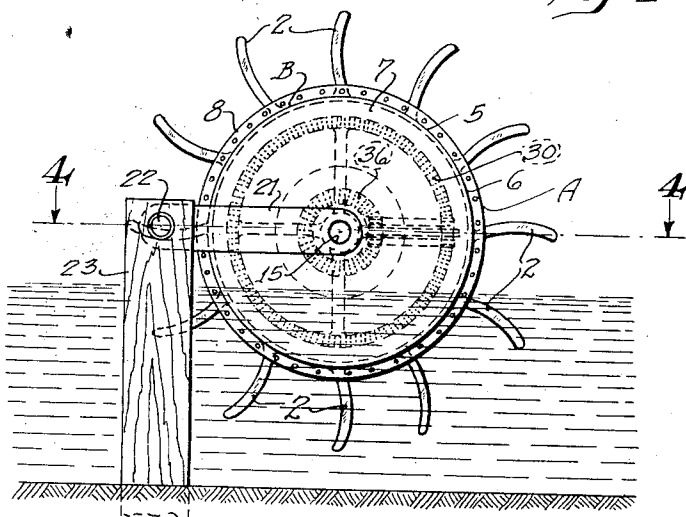


Fig. 2.

INVENTOR
Lloyd S. McGee.
BY *Carroll*
ATTORNEY

Oct. 26, 1937.

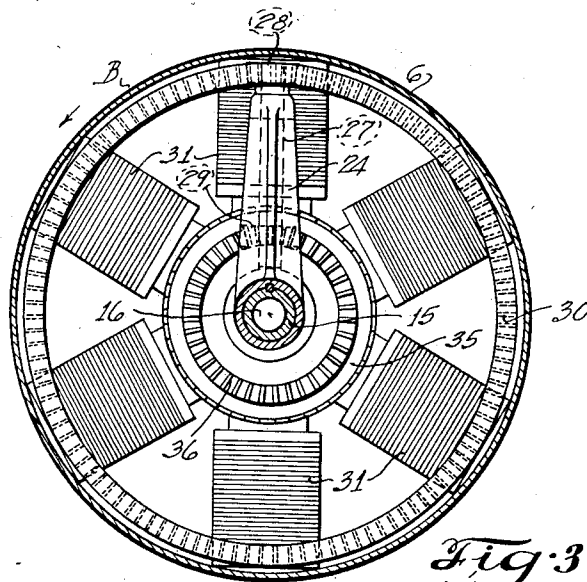
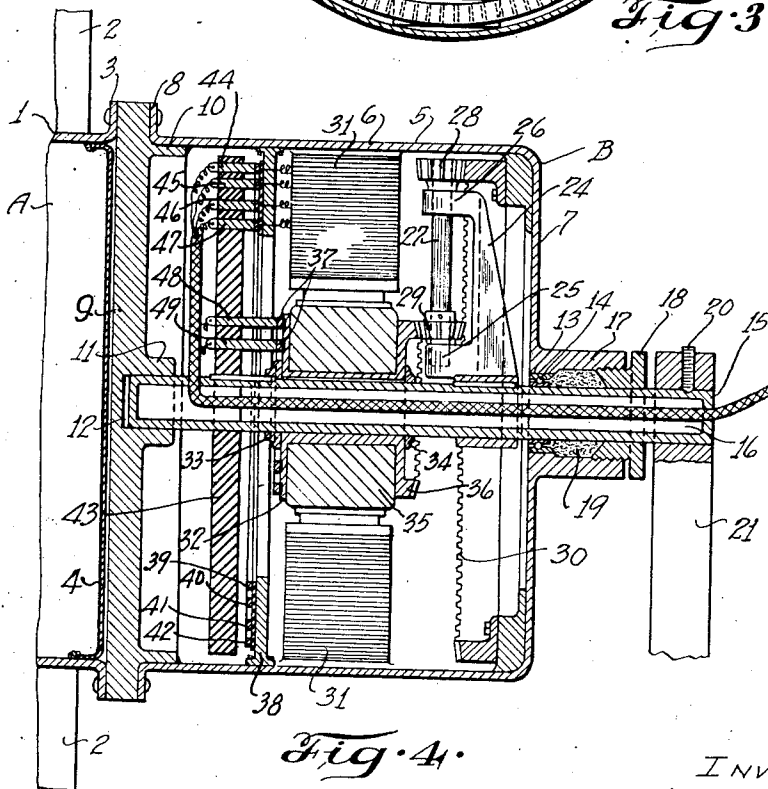
L. S. MCGEE

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2 Sheets-Sheet 2



INVENTOR
Lloyd S. McGee.
BY *Charles E. Smith*
ATTORNEY

UNITED STATES PATENT OFFICE

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POWER GENERATING APPARATUS

Lloyd S. McGee, St. Louis, Mo.

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11 Claims. (Cl. 290—54)

This invention relates generally to power generating apparatus and, more particularly, to a certain new and useful improvement in generating apparatus of hydro-electric type.

5 My invention has for its chief object the provision of apparatus of the type mentioned that is so constructed for convenient and ready installation and operation at different selected locations in a flowing stream.

10 My invention has for a further object the provision of apparatus of the type stated which is structurally simple, which may operably function with low maintenance and repair costs, and which is unique in the generation of usable power at extremely low cost per unit of developed power.

15 And with the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (2 sheets),—

25 Figure 1 is a reduced top plan view of a hydro-electric generating unit constructed in accordance with and embodying my invention;

Figure 2 is a side elevational view of the generator;

30 Figure 3 is a vertical sectional view of the generator, taken approximately on the line 3—3, Figure 1; and

Figure 4 is an enlarged fragmentary sectional view of the generator, taken approximately on the line 4—4, Figure 2.

35 Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of my present invention, the generator includes a water-tight, buoyant, structurally strong driving-drum A comprising a hollow cylindrical shell 1 having a circumferential series of spaced rigid radially outwardly disposed blades 2 extending lengthwise in parallelism with the longitudinal axis of the shell 1, the shell 1 being also provided at its ends with annular upstanding flanges 3, for purposes presently appearing, and having re-enforcing bulkheads or end walls 4 welded or otherwise sealed in its end portions, as best seen in Figure 4.

40 Removably mounted on the ends of the shell 1, are drum-like end compartments B, B', each comprising a shell or housing 5 having a cylindrical side wall 6 and a preferably integrally formed end wall 7, the side wall 6 being provided at its peripheral edge with an annular radially outwardly extending flange 8, fitting flatwise across which is an end-plate 9 preferably hav-

ing substantial strength and being provided with a lateral concentric flange 10, which fits snugly, and is welded or otherwise sealed, within the housing 5, as best seen in Figure 4, the end-plate 9 being also provided centrally with a preferably 5 integrally formed bearing portion or hub 11 accurately bored perpendicularly to the plane of the end-plate 9 to provide a bearing recess 12, as best seen also in Figure 4, all for purposes presently appearing.

10 Extending through the end wall 7 of the housing 5, is a centrally disposed aperture 13, which is co-axially aligned with the bearing recess 12 and is provided internally with a suitable roller bearing member 14 for rotatively receiving a stub-shaft 15 extending through the bearing member 14, across the interior of the housing 5 and into the bearing recess 12, the shaft 15 being provided with an axially extending internal passage or bore 16 for a purpose presently described.

15 Formed preferably integrally with the end wall 7 and concentrically about the bearing aperture 13, is a stuffing box housing 17 having threadedly disposed therein a stuffing box collar 18 25 for operatively retaining suitable packing 19 about the shaft 15.

20 At its free end, the shaft 15 is rigidly and non-rotatively mounted by means of a set screw or the like 20 in one end of an arm or link 21, which is journaled at its other end upon a pivot pin 22 rigidly, in turn, mounted on a post 23 suitably embedded at its lower end in the river bottom, as best seen in Figure 2.

30 It may be pointed out that each of the bearing recesses 13, the bearing members 12, and the shafts 15 in the end members B, B', are axially aligned with the longitudinal axis of the shell 1 and the pivot pins 22 are also axially aligned with each other, so that the entire shell 1 and its associated end compartments B, B', will, when in operation, rotate freely about the shafts 15 under the impulse of the river-water flowing against the blades 2 of the shell 1, and will swing freely upwardly and downwardly upon the arms 21 about the pivot pins 22 with the rise and fall of water level of the river.

35 Rigidly and non-rotatively mounted on the shaft 15 interiorly of the end compartment B, is a bracket-arm 24 provided with a pair of aligned journals 25, 26, for rotatively supporting a shaft 27, fixed upon the outer end of which is a spur-gear 28, a second spur-gear 29 being similarly mounted upon the shaft 27 adjacent the journal 25.

Mounted rigidly in the interior of the end compartment B preferably upon the inner face of the end wall 7 and concentric with the shaft 15, is a crown-toothed ring gear 30 for meshing engagement with the spur-gear 28.

Also mounted rigidly in spaced annular disposition within the end compartment B upon the inner face of the side wall 6, is a plurality of stator-field members 31 wound and interconnected for current generation in the conventional manner of direct-current generator stator-elements.

Rotatively mounted upon the shaft 15 also interiorly of the end compartment B, is a spool 32 held against longitudinal translation along the shaft 15 by means of stationary collars 33, 34, as best seen in Figure 4, and provided with a rotor winding or armature 35 constructed in the conventional manner of direct-current generator armatures.

Preferably integrally formed on the spool 32 concentrically about the shaft 15, is a crown-toothed ring-gear 36 positioned for meshing engagement with the spur-gear 29. Also rigidly mounted on, and insulated from, an end face of the spool 32, is a plurality of armature segments 37 of conventional design and connected to the rotor windings in the customary manner.

Edgewise mounted on, and extending radially inwardly from, the inner face of the side wall 6 of the end compartment B, is a commutation ring 38, which is provided with a plurality of annular insulatedly mounted commutation rings 39, 40, 41, 42, to which are respectively connected the terminal ends of the main stator winding and the compounded or auxiliary stator winding, as best seen in Figure 4.

Rigidly fixed to the shaft 15, is a brush-plate 43 having insulatedly mounted thereon a plurality of conventional generator-brushes 44, 45, 46, 47, 48, 49, for electrical contact with the armature segments 37 and the commutation rings 39, 40, 41, 42, respectively, lead wires from the brushes being brought through the channel or bore 16 in the shaft 15 and thence out to a suitable instrument board, the latter not being shown, at which board the various lead wires may be connected for current disposal.

In operation, the driving drum A, together with the attached end compartments B, B', will sink into the water to a predetermined level depending upon the difference between the buoyancy of the shell 1 and the total weight of the generator compartment B and associated parts, so that the river water will flow against and beneath the blades 2 of the shell 1, as shown in Figure 2, thereby effecting rotation of the shell 1 in a counter-clockwise manner upon the shafts 15, which latter are rigidly held against rotation by the arms 21. The end compartment B will, of course, rotate in the same manner with the shell 1, causing the ring-gear 24 to actuatingly mesh with the spur-gear 28, producing corresponding rotation of the shaft 27 and the spur-gear 29. Since the spur-gear 29 is in mesh with the ring-gear 36 of the armature, the armature will rotate in a clockwise direction. It will, therefore, be evident that the field-coils 31 and armature 35 are moving in relatively opposite directions, thereby producing electric current in the usual manner. Further, it should be noted that the ratio of the various gears is such that the speed of the armature 35 relatively to the field-coils 31 is very great, thereby producing a large quantity of usable electric power.

It may also be pointed out in this connection that, if alternating current rather than direct current is desired, the generator windings may be accordingly arranged, although it is preferable to utilize a direct current generator and convert the developed direct current into alternating current by means of a conventional type of rotary converter or alternator at the substation.

In the event of breakdown or mechanical difficulty in the generator or moving parts, the arms 21 may be readily removed from the pins 22 and the structure swung down stream out of the current, thereupon the end compartment B may be detached and a new one quickly replaced, thus restoring the unit to service quickly and efficiently. Finally, the entire structure may be readily detached from the mounting posts 23 and either towed or transported to a different locality.

Thus, I provide a simple, economically constructed hydro-electric generating apparatus, which may be readily set up in any stream or river having an appreciable flowing current, which may be readily transported to various selected locations, which may be installed in any stream having a substantial current without the necessity for expensive dam construction and without attendant flooding of adjacent bottom lands, which may be constructed in any practical size, large or small, with equally satisfactory results, and which is efficient in the performance of its intended functions.

It will be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the generator may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. An hydro-electric apparatus comprising a rotatable drum, fluid actuated propulsion means on the drum, and electric generator means disposed within the drum for rotatory actuation thereby.
2. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, and electric generator means mounted on the shaft within the drum and mechanically driven thereby.
3. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, water-impellable blades mounted on the drum, and electric generator means mounted on the shaft within the drum and mechanically driven thereby.
4. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, and an armature mounted on the shaft in electro-magnetic juxtaposition to the field element.
5. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft for rotation thereabout in electro-magnetic juxtaposition to the field element, and means for driving the armature relatively to the field element.
6. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted

upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft for rotation thereabout in electro-magnetic juxtaposition to the field element, and means for driving the armature in an opposite direction relatively to the field element.

7. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft for rotation thereabout in electro-magnetic juxtaposition to the field element, and means operatively actuated by the drum for driving the armature relatively to the field element.

8. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft for rotation thereabout in electro-magnetic juxtaposition to the field element, and means for driving the armature relatively to the field element, said driving means including a ring-gear mounted in the drum, a radial bracket non-rotatively mounted on the shaft, a radial shaft journaled in the bracket, a first spur-gear mounted on the radial shaft for engagement with the ring gear, a second spur-gear mounted on the radial shaft for rotation therewith, and a driven gear mounted on the armature for engagement with the second spur-gear.

9. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft

in electro-magnetic juxtaposition to the field element, commutation means mounted on the field element, and brush-supporting means mounted rigidly on the shaft having operatively disposed therein a plurality of commutator brushes for electric contact with the respective commutation means.

10. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, an electric generator field element mounted within the drum for rotation therewith, an armature mounted on the shaft for rotation thereabout in electro-magnetic juxtaposition to the field element, and means for driving the armature relatively to the field element, said driving means including a ring-gear mounted in the drum, a radial bracket non-rotatively mounted on the shaft, a radial shaft journaled in the bracket, a first spur-gear mounted on the radial shaft for engagement with the ring-gear, a second spur-gear mounted on the radial shaft for rotation therewith, a driven gear mounted on the armature for engagement with the second spur-gear, commutation means mounted on the field element, commutation means mounted on the armature, and brush-supporting means mounted rigidly on the shaft having operatively disposed therein a plurality of commutator brushes for electric contact with the respective commutation means.

11. An hydro-electric apparatus comprising a non-rotatable shaft, a drum rotatively mounted upon the shaft, fluid actuated propulsion means mounted on the drum, a removable compartment mounted on the drum for rotation therewith, and electric generator means mounted within the compartment and being mechanically driven by the rotation of the drum.

LLOYD S. MCGEE.