No. 617,874. Patented Jan. 17, 1899.

W. BORRMAN.

FLUID CURRENT MOTOR.

(Application filed Aug. 9, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

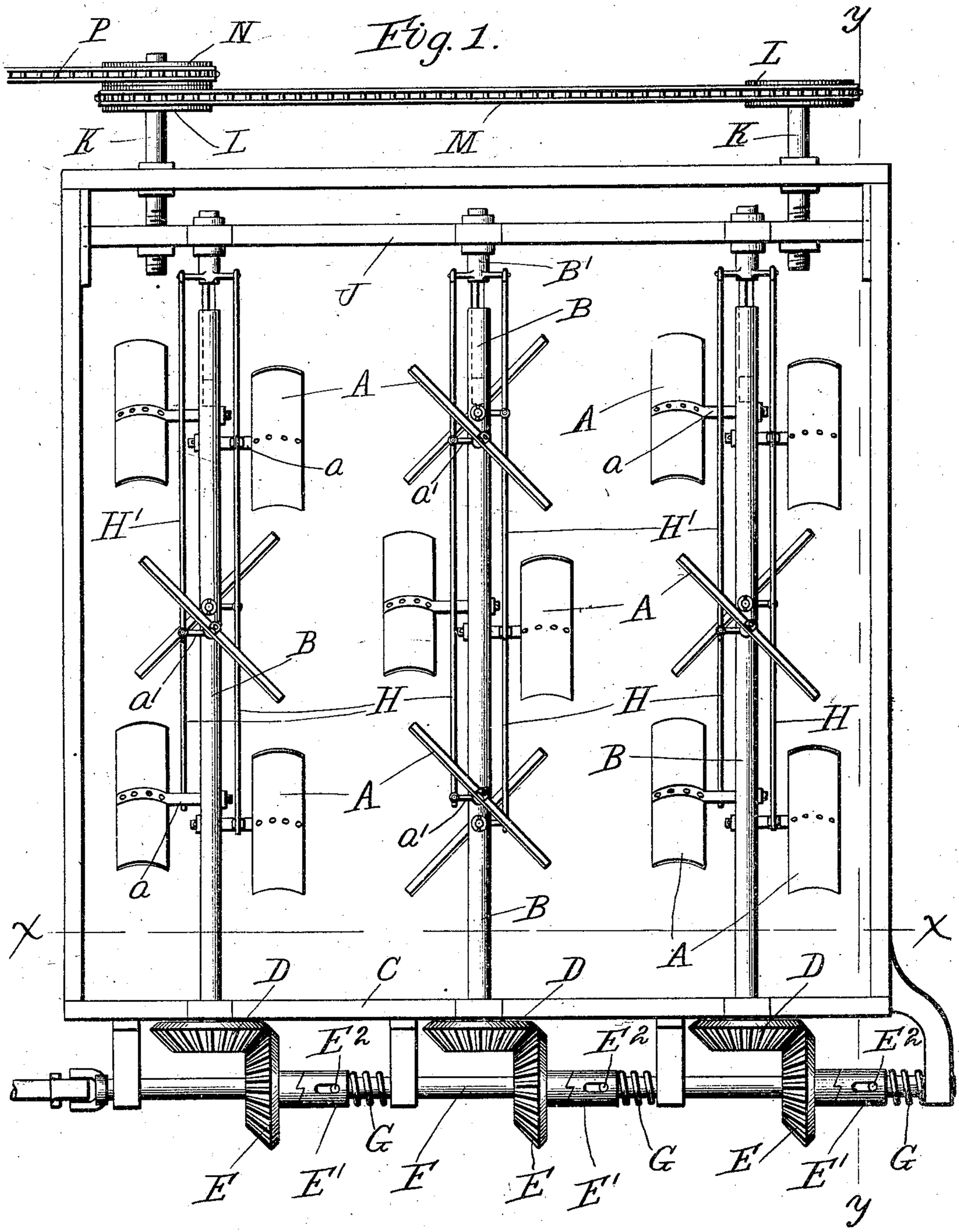

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Fig. 2.

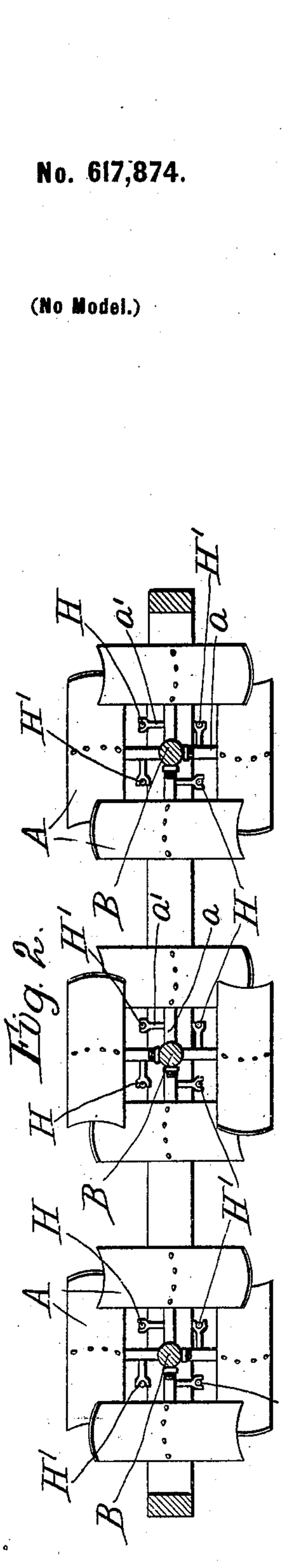


Fig. 5

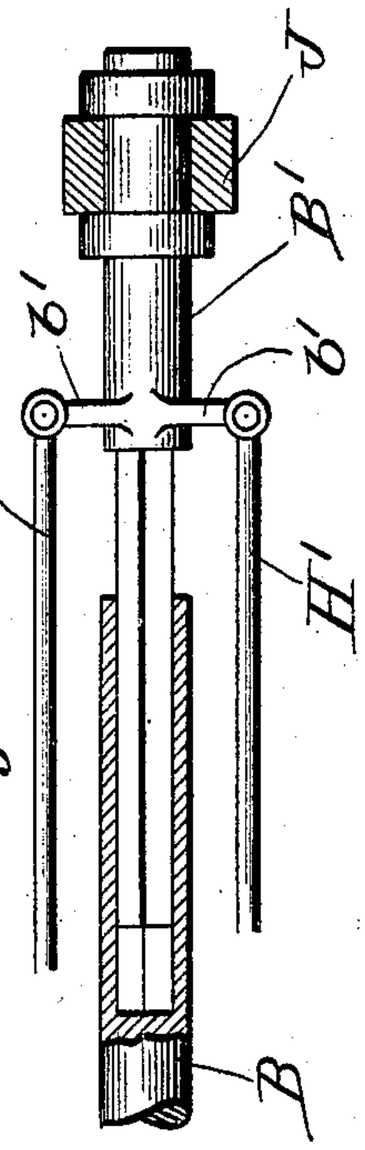


Fig. 3.

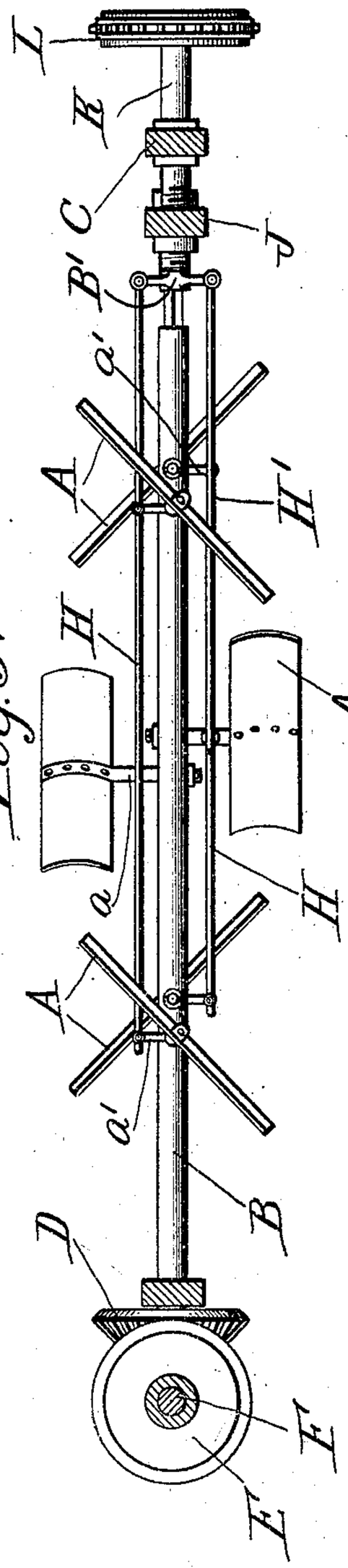
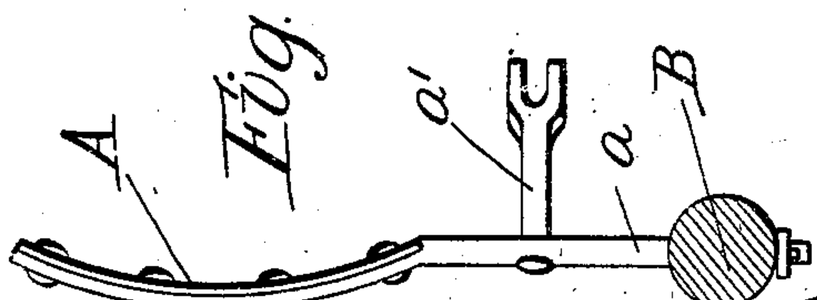


Fig. 4.



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UNITED STATES PATENT OFFICE.

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FLUID-CURRENT MOTOR.

SPECIFICATION forming part of Letters Patent No. 617,874, dated January 17, 1899.

Application filed August 9, 1897. Serial No. 647,559. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BORRMAN, a citizen of the United States, residing at Norfolk, in the county of St. Lawrence and State of New York, have invented a certain new and useful Improvement in Fluid-Current Motors, of which the following is a specification.

My invention relates to means for utilizing the power of fluid currents or streams for running machinery.

My invention can be employed in connection either with currents of air or other gases or with currents of water or other liquid, but it is particularly adapted for liquid currents.

Prominent objects of my invention are to produce a simple, practical, inexpensive, and efficient current-motor, to arrange for the regulation of the same with reference to different speeds of current and also with reference to different loads imposed upon the motor, to prevent injury to the machinery resulting from sudden stoppages of the motor by obstacles in the stream or current, to dispense with the necessity of employing either sluiceways or dams, and to provide certain novel features and details of construction tending to increase the efficiency and utility of current-motors.

In carrying out my invention I arrange a series of revoluble propelling blades or paddles in the stream or current and at such an angle with its direction of flow that they are revolved by the force of its impact against them. These blades or paddles are connected with suitable power-transmitting connections, so that their rotation is communicated to and utilized in operating the machinery to be driven, a preferred arrangement being to arrange a plurality of groups of such blades upon a series of rotary shafts arranged longitudinally in the stream and to gear-connect such shafts to a suitable rotary driving-shaft. The revoluble propelling-blades are also connected so that their angles with the stream or current can be varied with reference to the strength of the latter and also with reference to the load imposed upon the motor, and they are provided with means whereby such angles can be simultaneously and correspondingly shifted.

In the accompanying drawings, Figure 1 is a plan of a fluid-current motor embodying my invention. Figs. 2 and 3 are vertical sections taken on lines $x\,x$ and $y\,y$, respectively, in Fig. 1. Fig. 4 is an end elevation of one of the revoluble propelling-blades on an enlarged scale, and Fig. 5 is an enlarged detail view illustrating the mechanism for shifting the angles of the propelling-blades.

The revoluble propelling-blades A are understood to be submerged in a fluid stream or current and when submerged are arranged at a corresponding angle to the direction of flow of such stream or current, so that the force of the impact of the fluid against them causes them to revolve in a direction at right angles to such direction of flow. These blades A could be of any suitable form or construction; but as a preferred arrangement they are long and transversely curved, so as to substantially form cylindrical sections, since when so constructed they present a large surface to the fluid of the stream or current. They can be easily cleaned and repaired and can be simply and inexpensively made. They can be arranged in the stream or current in any suitable manner, but are preferably grouped together so as to form pairs, with the members of each pair arranged in parallel longitudinal planes and half a revolution apart. The pairs of blades thus formed are desirably arranged so as to form one or more (but preferably three) series, each extending longitudinally in the stream and each comprising a plurality—as, for example, three—of pairs of blades arranged in alinement with one another in the direction of flow of the stream or current. The blades or paddles thus grouped could be connected so as to allow the utilization of their rotation in any suitable manner. However, as a preferred arrangement and matter of further improvement the three longitudinal series are respectively arranged upon three longitudinally-extending rotary shafts B, which latter are conveniently mounted in a rectangular frame C, adapted to afford bearings for the opposite ends of the shafts B and to support the same in position in the stream or current. In this way each rotary shaft B is driven by a plu-

rality of symmetrically-arranged paddles or blades, so that it is rotated evenly and smoothly and always kept in perfect balance.

As a simple and convenient arrangement for transmitting the power of the rotating shafts B to any desired locality their forward ends are respectively provided with bevel gear-wheels D, which mesh with similar gear-wheels E, arranged upon a suitable transversely-arranged rotary driving-shaft F, which is mounted in bearings at the forward end of the frame C and is understood to extend to the machinery to be driven. In order to allow the rotary driving-shaft F to run uninterruptedly, so as to prevent injury to such machinery when one or more of the blade-shafts B are suddenly stopped by the interference of obstacles in the stream, the gear-wheels E have an elastic clutch connection with such shaft F. A simple arrangement is to mount said wheels E loosely upon the shaft F and to respectively back them with sliding clutch-sleeves E′, which are caused to rotate by pins E^2 and are normally forced into engagement or clutch with their gear-wheels E by suitable springs G, arranged upon the shaft F. By such arrangement upon the stoppage of any one of the blade-shafts B the gear-wheel E, meshing with its wheel D, can remain stationary, while its clutch-sleeve E′ rotates and until the trouble is remedied.

The blades or paddles A are attached to the shafts B in such a manner that their angularity with reference to the direction of flow of the stream can be varied, a convenient arrangement being to provide them with laterally-projecting pivot-rods *a* and to extend the latter through suitable sockets formed transversely in the shafts B and to secure them loosely therein, so as to permit of their axial rotation. The blades or paddles are also provided with means whereby the angularity of all the blades can be simultaneously and correspondingly shifted. In this way the motor can be adjusted with reference to streams of various strength and also with reference to various loads imposed upon it. For instance, when the strength of the stream is so great as to cause the motor to run too rapidly the angularity of the blades to its direction of flow is lessened, and when its strength is such as to cause the motor to run too slowly the angularity of the blades is increased. In like manner if the load is varied so as to cause the motor to run too rapidly or too slowly the angularity of its blades is lessened or increased, as the case may be. Also when it is desired to stop the motor the angularity of its blades can be so shifted as to cause them to lie parallel to the direction of flow of the current, thereby dispensing with the necessity of employing friction-brakes or locking devices or of removing the motor entirely from the stream or current. As an exceedingly simple and efficient arrangement for thus shifting the angularity of the propelling-blades I provide the blade pivot-rods *a*, respectively, with laterally-projecting arms *a′*, Figs. 2, 3, and 4, which can be engaged and drawn in a direction backward and forward along the shafts B, so as to swing the blades about their pivotal rods *a*. For instance, the projecting arms *a′* of the blades forming the end pairs of each longitudinal series can be engaged by a couple of longitudinally-adjustable rods H H, while the arms *a′* of the blades forming the intermediate pairs can be similarly engaged by another couple of longitudinally-adjustable rods H′ H′. These adjustable rods H H H′ H′ can be extended to the rear of the motor, and those controlling each series of blades can be attached to the arms *b′*, with which the longitudinally-adjustable ends B′ of the shafts B are respectively provided. These adjustable ends B′ are formed with square or like polygonal portions, which work in suitable correspondingly-shaped sockets formed in the opposing ends of the remaining portions of the shafts and are mounted in a transversely-arranged bearing-bar J. The bearing-bar J has its ends supported in suitable guideways formed in the sides of the frame C, so as to be laterally adjustable backward and forward in the direction of current-flow, and engages the longitudinally-adjustable ends B′, so as to permit them to rotate and also to adjust them longitudinally in accordance with its lateral adjustment, in which way a lateral adjustment of the bearing-bar J will operate to simultaneously and correspondingly shift the angularity of all the propelling-blades.

The bearing-bar J is conveniently adjusted by means of a couple of adjusting-screws K K, which extend through it near its ends and work in bearings formed in the rear end of the frame C and which are desirably connected with one another, so as to be simultaneously adjustable, by means of sprocket-wheels L L, mounted upon them, and a sprocket-chain M, arranged over and in engagement with the wheels L L. As an arrangement whereby both of said adjusting-screws K K can be operated from a distance one of them is provided with a second sprocket-wheel N, and a sprocket-chain P is arranged over the same and extended to such distant point, where it is understood to be operated by any suitable contrivance.

It will be observed that the arrangement thus set forth is particularly well adapted for utilizing the power of rivers and the like, since its frame can be arranged upon the river-bed, and its energy communicated to the shore by the rotary driving-shaft F, and its speed regulated therefrom by the sprocket-chain P. It will be understood, however, that such arrangement can be modified, as by increasing or decreasing the number of blades or paddles, or by varying their arrange-

ment, or by substituting other power-transmitting connections, without departing from the spirit of my invention.

What I claim is—

1. A current-motor adapted for service in transmitting power derived from the action of the current of a stream or river upon reversible blades exposed thereto, and comprising a series of rotary shafts supported by a suitable body-frame or supporting structure; blades arranged in series along the rotary shafts and having spindles connected with such shafts and rotatably adjustable independently of the latter; longitudinally-movable rods arranged parallel with and alongside the rotary shafts and having crank connections with the rotary adjustable spindles upon which the blades are secured; and adjusting means by which the rods can be synchronously adjusted so as to synchronously adjust the blades belonging to all of the said shafts, substantially as described.

2. A fluid-current motor comprising a plurality of rotary shafts; a frame or support upon which the said shafts are mounted for rotation; a plurality of propelling blades or paddles adjustably mounted upon said shafts; a laterally-adjustable beam or bar arranged at right angles to said shafts; rods or the like for connecting the said beam with the said blades or paddles; and means for laterally shifting the said beam or bar for the purpose of simultaneously changing or shifting the angularity of all the blades, substantially as described.

3. A fluid-current motor comprising a plurality of rotary shafts; a frame or the like upon which the said shafts are mounted for rotation; a plurality of blades or paddles adjustably mounted upon said shafts; a laterally-adjustable beam or bar arranged at right angles to the said shafts; rods or the like for connecting the said blades with the said beam or bar, and one or more screws or the like for laterally shifting the said beam for the purpose of simultaneously adjusting the said blades; as set forth.

4. A fluid-current motor comprising a rotary shaft provided with revoluble propelling blades or paddles having therewith connections adapted to permit the shifting of their angularity, and also provided with a longitudinally-adjustable end portion having a sliding connection with said shaft; a supporting-bearing for said adjustable end portion; means for connecting the said blades with the said adjustable end portion; and means for longitudinally adjusting the said end portion for the purpose of changing the angularity of said blades, as set forth.

5. A fluid-current motor comprising a plurality of rotary shafts having extensible or longitudinally-adjustable end portions; a plurality of propelling blades or paddles adjustably mounted upon said shafts; means for connecting the said blades with the said adjustable end portions of the said shafts; and means for simultaneously and longitudinally adjusting the said end portions for the purpose of simultaneously changing the angularity of said blades or paddles, substantially as described.

6. A fluid-current motor comprising a rotary driving-shaft; a plurality of longitudinally-arranged blade-shafts gear-connected with the rotary driving-shaft, and respectively provided with a plurality of revoluble propelling blades or paddles having therewith swivel connections adapted to permit a shifting of their angularity with the direction of flow of the current or stream; longitudinally-adjustable rods connected with the blades or paddles and arranged to shift their angularity; longitudinally-adjustable blade-shaft end portions having sliding connections with the body portions of such shafts, and also having connections with the blade-adjusting rods; a laterally-adjustable bearing-block engaging said blade-shaft end portions; and means for adjusting said bearing-block so as to cause a simultaneous and corresponding shifting of the angularity of all the blades or paddles, as set forth.

7. In a fluid-current motor, the combination of a rotary shaft provided with revoluble propelling blades or paddles having therewith connections adapted to permit the shifting of their angularity with the direction of current-flow, and also provided with a longitudinally-adjustable end portion having a sliding connection therewith; an axially-adjustable bearing engaging said end portion for longitudinal adjustment; and connections between the blades and said end portion whereby the angularity of the former can be shifted by adjusting the latter, as set forth.

8. In a fluid-current motor, the combination of a plurality of rotary shafts respectively provided with one or more groups of revoluble propelling-blades having swivel connections therewith so as to permit a shifting of their angularity with the direction of current-flow, and also provided with longitudinally-adjustable end portions having sliding connection therewith; an axially-adjustable bearing-block engaging said blade-shaft end portions for longitudinal adjustment; connections between the respective end portions and the blades carried by the shafts of which they form a part, whereby the adjustment of the bearing-block causes a simultaneous and corresponding shifting of the angularity of the blades or paddles; and adjusting-screws for adjusting the bearing-block, as set forth.

9. In a fluid-current motor, the combination of a rotary blade-shaft provided with a longitudinally-adjustable end portion having a sliding connection therewith; a supporting-bearing for the said adjustable end portion; revoluble propelling-blades arranged in

groups comprising a couple of oppositely-disposed blades, and constructed with laterally-projecting swivel-rods which are extended through said shaft and are arranged to form swivel connections therewith; and a series of longitudinally-adjustable rods respectively connected with the adjustable end portion and with laterally-projecting arms with which the swivel-rods of the blades are provided, substantially as described.

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