(No Model.) 2 Sheets—Sheet 1.

H. AVET.

APPARATUS WITH FEATHERING BLADES FOR OBTAINING MOTIVE POWER.

No. 441,461. Patented Nov. 25, 1890.

Fig. 1.

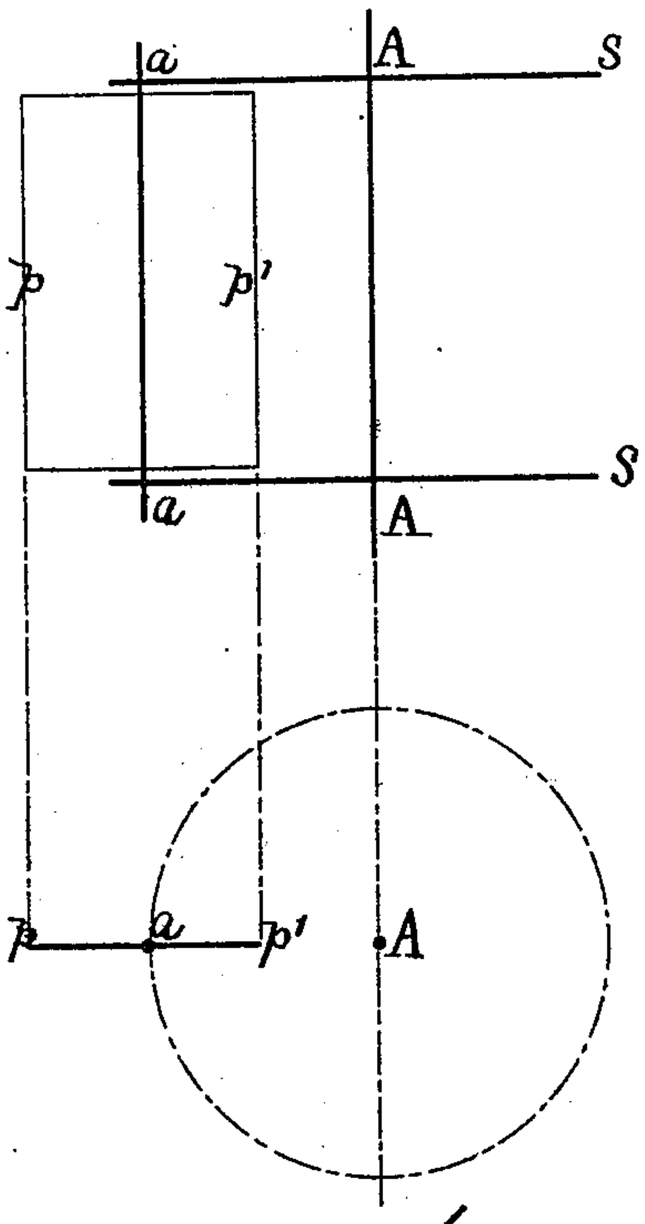


Fig. 2.

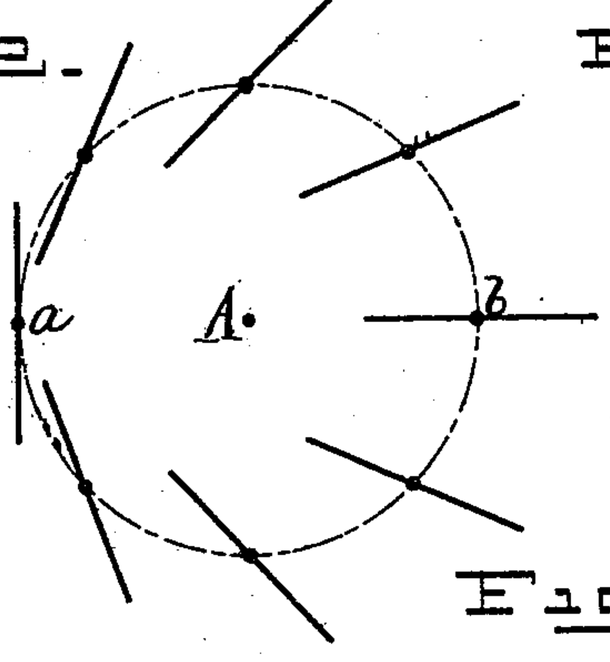


Fig. 3.

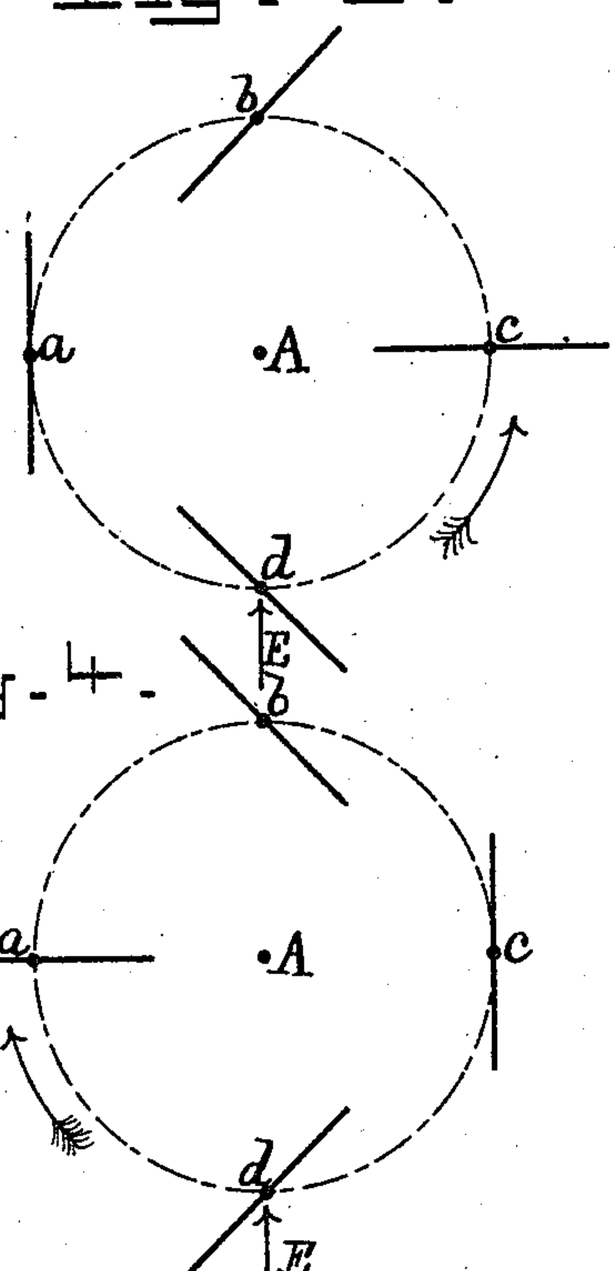


Fig. 4.

Fig. 5.

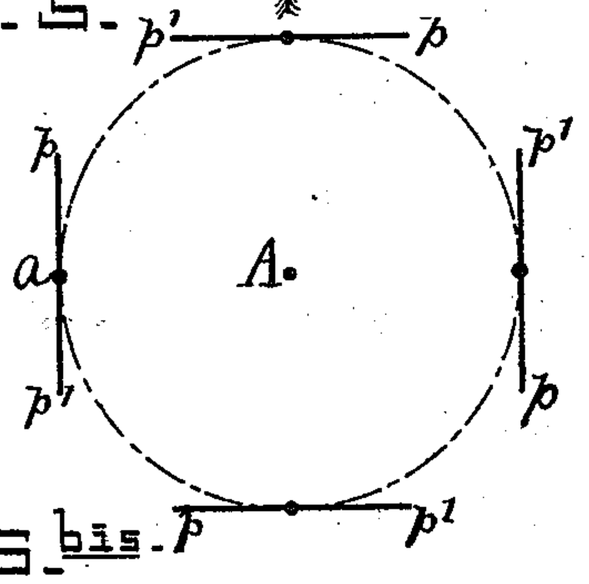
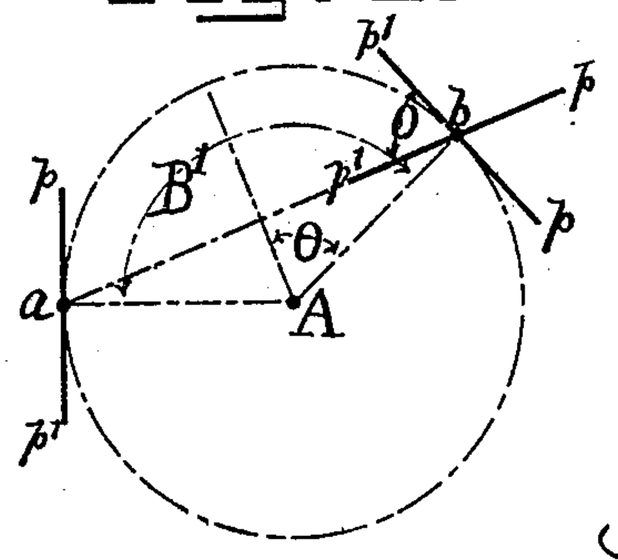


Fig. 5 bis.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

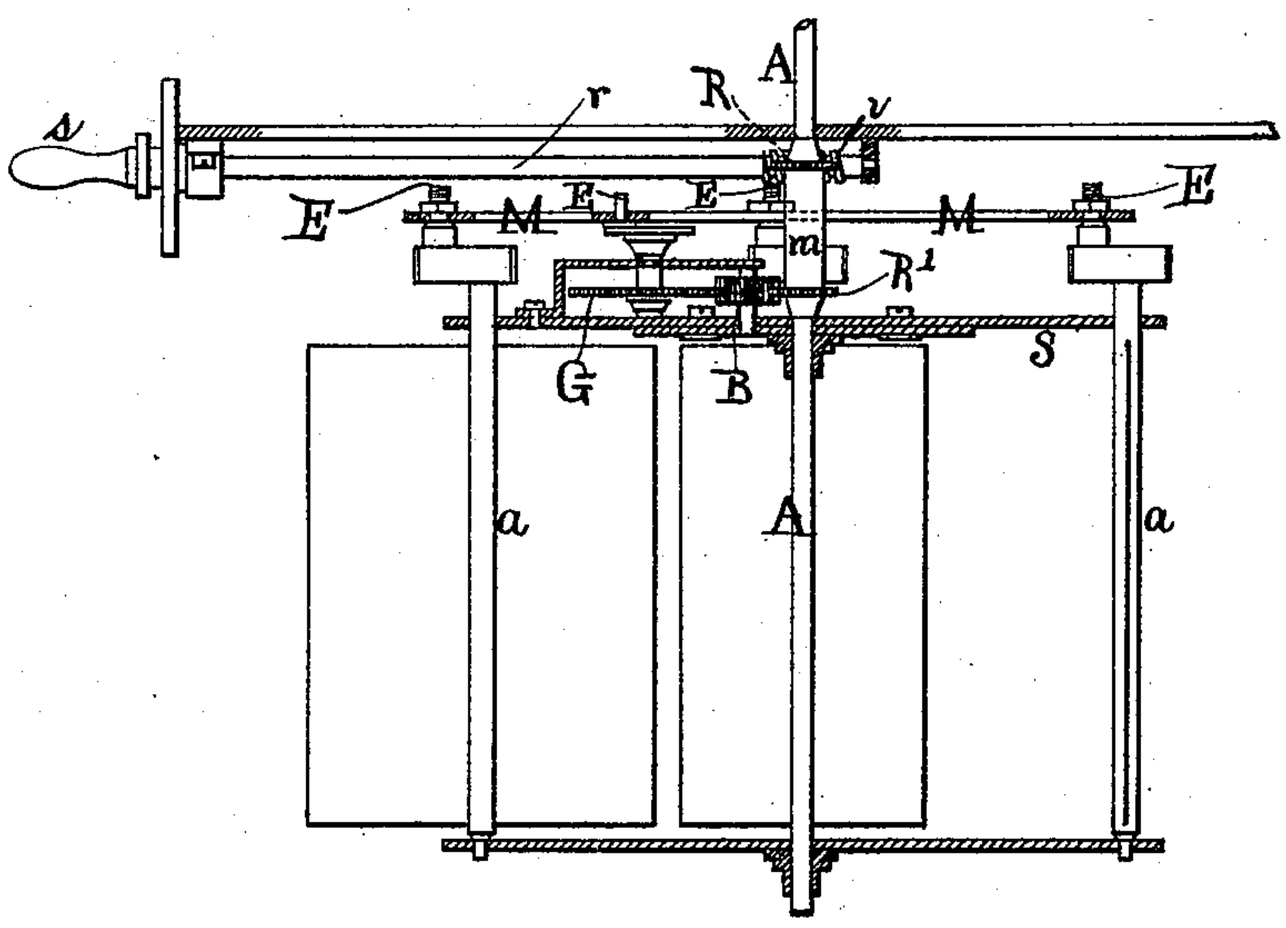
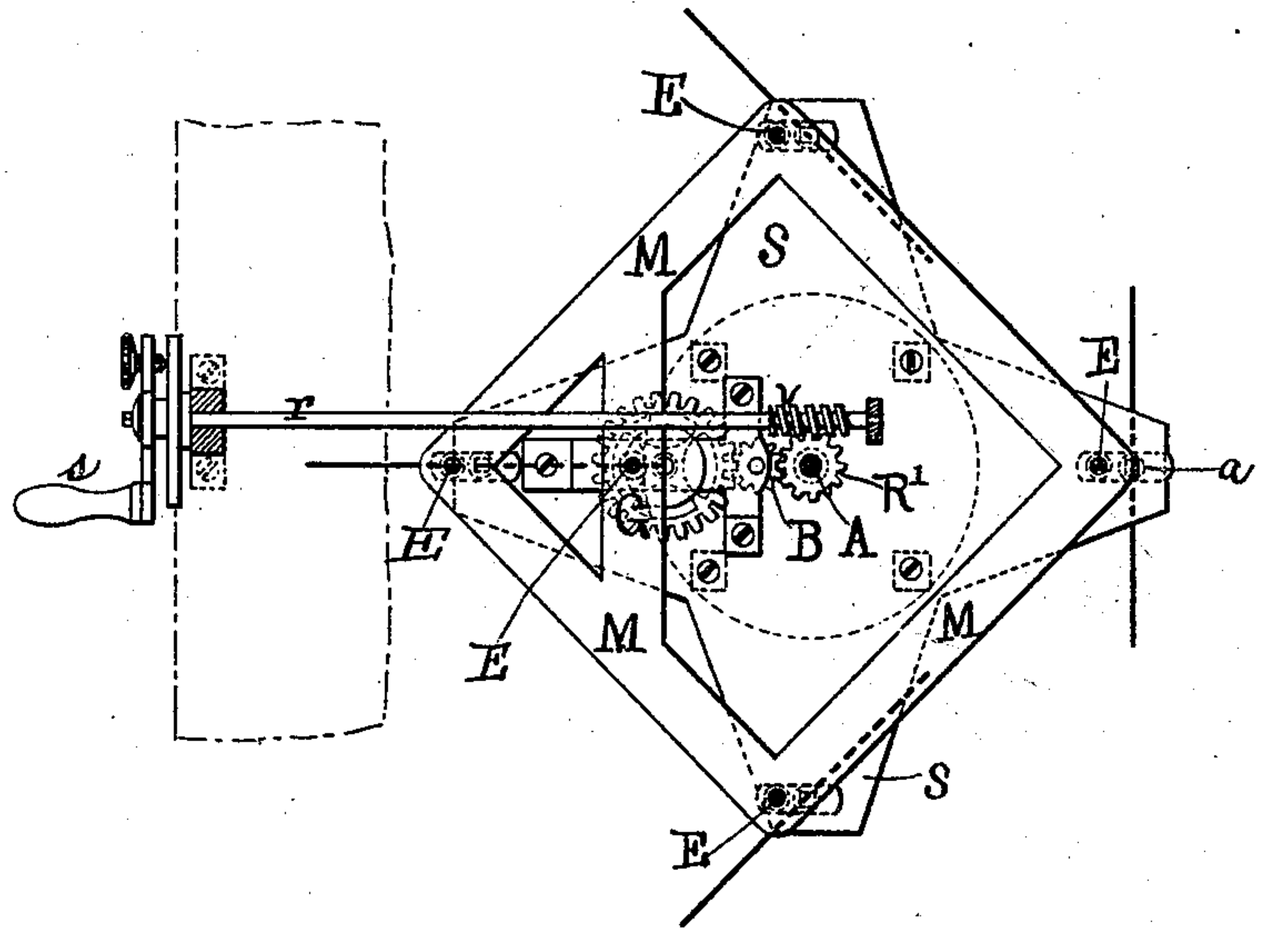


Fig. 7.



WITNESSES:
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UNITED STATES PATENT OFFICE.

HENRI AVET, OF TURIN, ITALY.

APPARATUS WITH FEATHERING-BLADES FOR OBTAINING MOTIVE POWER.

SPECIFICATION forming part of Letters Patent No. 441,461, dated November 25, 1890.

Application filed January 10, 1890. Serial No. 336,599. (No model.)

To all whom it may concern:

Be it known that I, HENRI AVET, retired general, of 17 Corso Vinzalio, Turin, Italy, have invented new or improved rotary apparatus with feathering vanes or blades to be employed for obtaining motive power, propelling vessels, measuring the flow of fluid, or other similar purposes, of which the following is a specification.

My invention relates to an apparatus constructed in the form of a wheel carrying vanes or blades which are caused by a suitable combination of mechanism to rotate on their own axes as they are carried aronnd the central axis of the wheel, the relation between the rotary motion of the vanes or blades on their own axes and the motion by which they revolve around the common center being regulated and controlled according to the principles hereinafter described with reference to the accompanying drawings.

Figure 1 is a diagram showing the relative positions of the axis of the vane to the central axis. Figs. 2 and 5bis are diagrams showing various positions which the vane may take during each revolution. Figs. 3, 4, and 5 are diagrams showing the relative positions of the different vanes. Fig. 6 is a vertical section, and Fig. 7 a plan of the mechanism for rotating the vanes.

p p' (see Fig. 1 of the accompanying drawings) is a vane capable of rotation on an axis or shaft *a*, carried by supports *s s*. These supports are secured to a central rotating shaft A A, and in certain cases the planetary shaft *a a* may be supported at one end only on the same side of the vane, so that the latter is left quite free, at the same time insuring sufficient support to the shaft *a*. When the central shaft A rotates, the vane *p p'* revolves around the shaft as a center, and through the action of mechanism (hereinafter described) acting on the shaft *a a* is obliged at the same time to rotate on its own axis in such a manner as to take successively-inclined positions, as shown in Fig. 2—that is, to say, it stands tangentially to the circle of rotation when at a point *a*, Fig. 2, and in all the other positions a prolongation of its plane surface invariably passes through this same point *a*, Fig. 2.

If instead of a single vane there are several—say, for example, four, as in Fig. 3—when one of these vanes stands at a tangent, as at the point *a*, then the other three assume the positions *b c d*, and on rotation each one in its turn occupies the tangential position represented at *a*. When a current of water, for example, acts on the vanes or blades thus arranged in the direction shown by the arrow E, Fig. 3, its action on each and every blade in all of their successive positions is favorable to or tends to produce a rotating movement around the center A in the direction *d c b*, except at the moment when they pass and stand at a tangent to the circle of rotation at the point *a*. Now if this position be changed so that it may be at *c*, for example, Fig. 4, instead of at *a*, (this change being readily produced by the mechanism hereinafter described,) the rotation about the center A, instead of being in the direction *d c b*, will now be in the reverse direction *d a b*. The action takes place in an analogous manner when one or more of such wheels, actuated by a motor driving the central shaft A, are employed as propellers, and by changing the point where the propeller-blades stand tangentially the direction of the propulsion produced can be changed in a horizontal plane if the wheels rotate in a horizontal plane, or in a vertical plane if rotating in a vertical plane, for example.

The operation of changing the direction can be easily effected without interrupting or modifying the action of the motor. In the first case (horizontal plane) the motion can be changed to the right or to left or backward, for example. In the second case (vertical plane) the motion can be produced in a horizontal direction as well as an ascending or descending motion. A propelling or steering action to the right or left can also be obtained by causing the two wheels, when a pair of wheels is employed, to act in opposite directions relatively to one another.

Theory of the mechanism.—If the vane *p p'*, Fig. 5, were carried round the circle of rotation without any independent motion on its own axis it would return to the point *a* after having described in space one revolution on itself. If during the movement of rotation about the center A the vane were continually moved backward on its own axis

through an angle O, Fig. 5[A], equal to half the angle B′, corresponding to the arc of a circle *a b*, which it has traversed, it will only make half of a complete revolution on its own axis by the time it has traveled once round the center A, and in all positions the vane will be in planes passing through the point *a*, and on returning to this point it will again stand at a tangent, but with its edge *p′* in front instead of the edge *p*.

Mechanism.—The mechanism for obtaining this result is illustrated in vertical section in Fig. 6 and in plan in Fig. 7 of the accompanying drawings.

R and R′ are two toothed or spur wheels connected by a sleeve or tube *m*, the internal diameter of which is a trifle longer than that of the central shaft A. This sleeve does not touch the shaft, except at its extremities, which project beyond the wheels and are of conical shape. The tube is consequently able to turn upon the shaft with very little friction. In like manner the shaft can turn with little friction in the said tube or sleeve *m*.

C is a toothed or spur wheel of a diameter double that of the wheel R′ and provided with exactly twice as many teeth as that wheel.

B is an intermediate toothed wheel or pinion, or may be a toothed cylinder movable on its axis, being similar to the pinion-wire or toothed cylinders commonly employed by clock-makers. This wheel is simply an intermediary, and its diameter is immaterial, provided that its teeth gear properly with the spur-wheels.

The wheels B and C are connected by their spindles to the support or plate S, carrying the vanes or blades. During the rotary motion (the wheel R′ being maintained stationary by mechanism acting on the wheel R) the pinion B travels round the wheel R′ in the direction of the rotation of the central shaft A and causes the wheel C to move in the opposite direction with an angular speed equal to one-half of that of the said shaft or support of the vanes.

The wheel C is connected to an eccentric or crank E. The upper end of each vane shaft or spindle *a* is provided with an exactly similar crank. These cranks are so adjusted that the crank on one vane—namely, the left-hand vane in the drawings—is in a line with the plane of the vane; but the next or second crank stands at an angle of forty-five degrees to the vane, the third at ninety degrees, and the fourth at one hundred and thirty-five degrees. The five cranks all rotate in the same direction, the crank-pins being caused to work in five corresponding holes in a movable frame M, the said holes being bored to coincide exactly with the axis of the wheel C and of the four vanes which are thus caused to turn backward on their own axes (at the point which they occupy in the circle of rotation) through an angle equal to half the angle through which they would have moved in traveling from the point at which they stand at a tangent to the circle of rotation if they had no motion about their own axes, and the crank on the wheel C being rigidly connected to the four cranks E on the vanes the latter are invariably placed at the required vane. The wheel R′ being maintained stationary by parts acting on the wheel R, the point at which all the vanes in turn are caused to stand tangentially to the circle of rotation remains in one position. This position may, however, be changed at will and shifted in either direction by rotating the wheel R, and thereby rotating the wheel R′.

The diameter of the wheel R is immaterial; but the number of its teeth should be a factor or a multiple of those of the wheel R′ in order to obtain with certainty the displacements required by acting on the wheel R. The said displacements may be conveniently indicated by a needle or pointer showing on a dial the point at which the vanes stand at a tangent and indicating the displacement of the said point.

The wheel R may be moved by means of another toothed wheel or pinion, or, as in the arrangement illustrated, by means of an endless screw or worm *v* on a shaft *r*, which can be rotated by means of a crank *s* or any other suitable arrangement of mechanism.

When an apparatus operating as hereinbefore described is employed as an aerial motor, the wheel R is removed and in its place a vane is attached to the cylinder or sleeve *m*, which acts on the wheel R′ in the direction of the wind, so that the vanes or blades always present themselves tangentially in this direction. The shaft may either rotate with the vanes or may be fixed, the vanes with their supports rotating upon it.

In applying this apparatus as a propeller for ships and the like, with the wheels acting vertically, the mechanism is inclosed in a cylinder, the base of which forms a support for the shafts of the blades. This cylinder is placed in the side of the vessel, so as not to offer any resistance to its progress and to admit of rotating with the blades upon the small cylinder or sleeve *m*, and consequently on the shaft A. This shaft and that part of the cylinder which carries the wheel R alone require to pass into the interior of the vessel, where the shaft receives the movement necessary for its action, and where the wheel R or its equivalent is shifted according to the changes to be produced in the propelling action of the blades.

The construction of the parts of the apparatus illustrated in Figs. 6 and 7 of the accompanying drawings is merely given as an example in order to explain the principles of the construction and action of a working apparatus according to my invention in such a manner as to enable the said invention to be performed. The forms, dimensions, materials, and arrangement of the details must

evidently be modified according to the purposes to which the apparatus is applied.

It is evident that apparatus constructed and operating as hereinbefore described is capable of being employed with great advantage in a variety of applications in which mechanical effect is required to be produced by the action of fluids in motion, or in which mechanical action is required to be exerted on a fluid, for example, the apparatus being in either case either partly or completely submerged in the fluid.

Employed as an hydraulic motor or water-wheel, the apparatus presents the valuable advantage of admitting of being constructed so as to be conveniently transported from place to place. In the form of a propeller it admits of being worked so as to act either horizontally or vertically. In shallow waters it is capable when working horizontally of being employed with good effect in from twenty to thirty centimeters, or about one foot of water.

The apparatus may also be employed for aerial navigation, or for aiding vessels to get in or out of harbors, or as a meter for measuring the flow of currents of water, or the speed of vessels, or as a blowing or ventilating apparatus, for example.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is—

1. An apparatus comprising a supporting-frame, vanes or blades rotating on axes carried by the supporting-frame and parallel to and revolving around a central axis, cranks attached to the axes of the vanes, a frame engaging the crank-pins, mechanism for actuating this latter frame, whereby the blades are rotated, and means for changing the position of the frame in relation to the central axis, as and for the purposes set forth.

2. An apparatus consisting of a supporting-frame rotating on a central axis, blades whose axes are carried by the said frame and are parallel to the central axis, cranks attached to the axes of the vanes, another crank, a stationary cog gearing with this latter crank, and a frame engaging all the cranks, substantially as described.

3. An apparatus consisting of a supporting-frame rotating on a central axis, blades whose axes are carried by the frame, spur-wheels R′ and C, and intermediate pinion B to rotate the axes of the blades, the cog R′ normally remaining stationary, but capable of adjustment, whereby the relative positions of the blades to the central axis may be regulated.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRI AVET.

Witnesses:

ALESSANDRO MAURO,

GIOVANNI ANTONIO VANOTOGUA.