Sept. 15, 1931. E. SCHNEIDER ET AL 1,823,169

BLADE WHEEL WITH MOVABLE BLADE

Filed Aug. 9, 1928

Fig. 1.

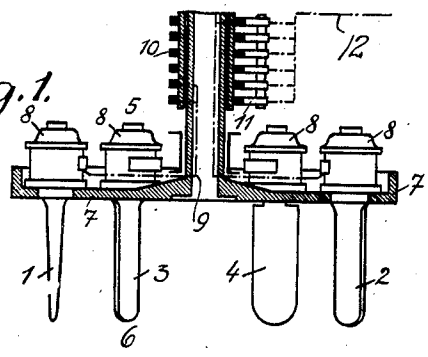


Fig. 4

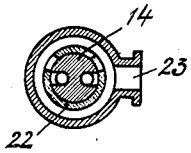


Fig. 5

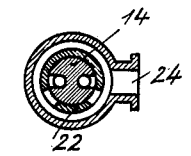


Fig. 6

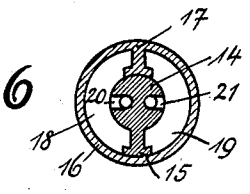


Fig. 2

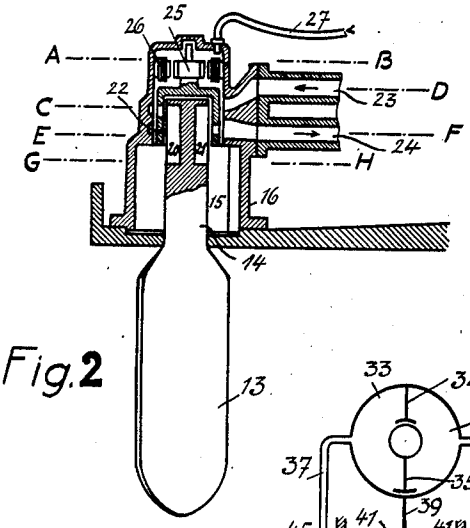


Fig. 3

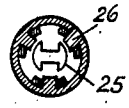


Fig. 7

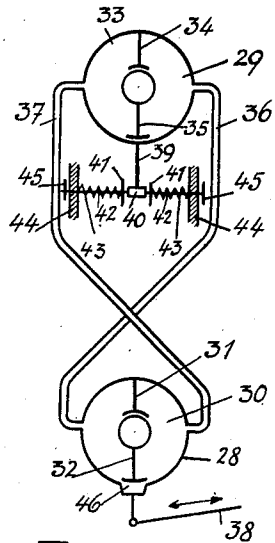
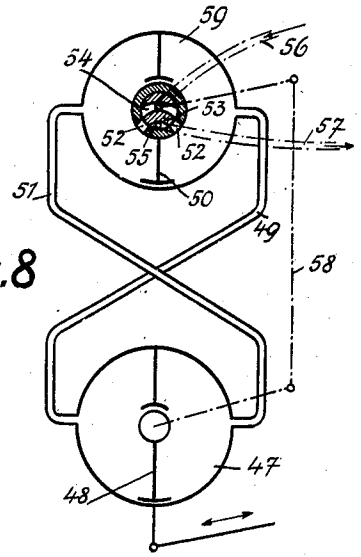


Fig. 8



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UNITED STATES PATENT OFFICE

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BLADE WHEEL WITH MOVABLE BLADE

Application filed August 9, 1928, Serial No. 298,463, and in Austria August 11, 1927.

This invention relates generally to a power drive mechanism and has for its object the provision of an improved unit of this character which has improved controlling means, the invention being in the nature of an improvement in propeller structures suitable for use in connection with vehicles, turbines, pumps, compressors and generally with engine structures operated or controlled by gases or liquids under pressure.

The invention relates to a drive mechanism embodying an improved blade wheel equipped with a plurality of blades arranged to turn with the wheel and to be operated individually and independently during the rotation of the wheel, the invention further relating to a construction and arrangement in which an individual power unit is provided for each of the blades upon the blade wheel, so as to permit the operation of each blade with the relative motion desired, and to control it in accordance with the working conditions encountered and results to be attained.

In carrying out our invention the power units are combined with the wheel body to turn therewith and are arranged to operate the blades directly; and in accordance with our invention the power units for such purpose may consist either of electric motors, or of motors adapted to be operated by gases or liquids under pressure.

A further object of our invention is the provision of a simple, compact, self-contained power drive mechanism of the character described and for the purpose set forth, one in which the operation of the blades can be regulated and controlled without the use of troublesome compensating devices such as sprockets, gearing, eccentric discs, and similar mechanical transmitting devices conventionally employed for such purpose.

With the foregoing and other objects in view, the invention consists in the improved power drive mechanism and in the form, construction, relative arrangement or arrangements of its parts, as will be hereinafter more fully described, illustrated in the accompanying drawings and subsequently incorporated in the sub-joined claims.

For a full understanding of the invention, reference is to be had to the accompanying drawings, forming a material part of this application, and in which:

Fig. 1 represents a central cross section through a wheel body provided with blades and individual electric motors for the blades;

Fig. 2 represents a central cross section through a hydraulic motor with electric control and compensating means;

Figs. 3, 4, 5 and 6 are detail views taken, respectively, on the lines A—B, C—D, E—F, G—H, of Fig. 2;

Fig. 7 represents a diagrammatic view showing a modified form of construction, including a primary and secondary wheel drive and connecting means for synchronizing the operation of the same; and

Fig. 8 represents a diagrammatic view showing a modified construction for synchronizing the operation of the primary and secondary wheel devices.

With more particular reference to the accompanying drawings, and first to the exemplification shown in Fig. 1, it will be seen that the wheel body 7 is equipped with six blades, of which only blades 1 and 2 situated in the plane of the section and blades 3 and 4 situated behind the plane of the section are visible. The mobility of the blades with this wheel consists in that each blade may be turned round an axis parallel to the wheel axis. Blade 3 for instance may be turned round axis 5—6. The electric motors 8 are fastened to the wheel body 7, and their movable parts are connected with the blades. These motors may be made to operate the blades with a uniform revolution, with an uneven rotation or with a swinging motion, according to their inner construction and the momentary course of the supplied electrical current. The current is supplied to the motors over cable 9, slip rings 10, and brushes 11, through a cable 12 which leads to the generator, not shown in the drawings, and to the control devices. The number of the required slip rings and brushes depends upon the number of blades, the moving law of the blades and the type of current used.

In the form of construction shown in Figs. 2 to 6, we illustrate a hydraulic blade motor with an electric control and compensating device. The blade 13 has a stem 14 associated with a rotary piston 15, arranged in cylindrical casing 16. Casing 16 contains a radial cross wall 17 which tightens against the stem 14 so that two separate chambers 18 and 19 are formed. Cylinder chambers 18 and 19 are connected by channels 20 and 21 and by clearances in a rotary valve 22 with pipes 23 and 24 through which the pressure liquid is supplied and discharged. Rotary valve 22 is controlled by rotating magnet 25, the momentary position of which depends upon the electrical excitation of field-magnets 26. By cable 27 the field-magnets are connected with the electric control. If rotary magnet 25 turns under the influence of the control rotary valve 22 opens clearances 20 and 21 in such manner that one side of the cylinder gets into communication with the supply pipe and the other with the discharge pipe.

The pressure difference is acting now on piston 15 and turns the stem 14 with the blade in the same direction and by the same angle by which rotary magnet 25 had turned. The stem 14 having covered this angle the mutual position of the clearances in the rotary valve and in stem 14 is again the same as before the beginning of the movement, that means the current is interrupted and the movement finished. This motor thus has a compensating device whereby the movement of the blade becomes an exact copy of the movement of the rotary magnet.

The arrangements shown in the drawings represent two optional examples of possibilities for realizing the invention. We could indicate a great number of other arrangements, with a different position of the blades to the wheel and different relative movements, and further with motors and control devices totally different from the two examples shown which are deemed sufficient to illustrate a practical application of the idea of the invention.

In Fig. 7 we show a synchronizing process whereby, during the operation of the blade wheel, each blade motor temporarily receives an impulse which tends to bring the blade in a certain position; the release of this impulse from the primary machine, which belongs to this blade motor, or generally from the energy source or from the control device, is automatically done only when the primary machine is in a position which corresponds to the above named blade position.

Reference character 28 (Fig. 7) denotes the primary machine and 29 the secondary machine (blade motor) and both machines are supposed as rotary piston machines. The primary machine 28 essentially consists of a casing 30 with cross wall 31 and a rotary piston 32 of a vane form to be swung to and fro in casing 30. The secondary machine 29 likewise consists of casing 33 with cross wall 34 and rotary piston 35. The left side of the casing of primary machine 30 is connected by a piping 36 with the right side of secondary machine 29 and the right side of the primary machine by piping 37 with the left side of secondary machine 29. Rotary piston 32 of the primary machine may be moved to and fro by any suitable means, for instance by a link bar 38.

If both casings 30 and 33 and pipings 36 and 37 are filled with a pressure liquid the pressure rise produced on the left side of the machine with the rotary piston swung to the left is communicated by piping 36 to the right side of secondary machine 29 whereby rotary piston 35 of the secondary machine is swung to the left, that is to say, in the same direction as the rotary piston of the primary machine. The liquid displaced from the left side of the secondary machine flows through piping 37 to the right side of the primary machine.

If now by any leakages or through other occurrences the exact synchronism of the two rotary pistons 32 and 35 becomes deranged, it will be automatically re-established and this may be done in the following manner:

At the axis of rotary piston 35 of the secondary machine an arm 39 is arranged at the end of which is a head 40 situated between the stops 41 of rods 42 which slide in their longitudinal direction and are loaded by springs 43 in such a manner that the stops 41 are pressed against head 40 of arm 39. The outer ends of rods 42 are provided behind the gearings 44 with stops 45 limiting the movement of rods 42 in the direction of head 40, so that when the head 40 is in the middle position the springs 43 do not exert any pressure on it.

Casing 30 of the primary machine has a canal 46 which, when rotary piston 32 is in the middle position, connects the right and left side of the casing with each other so that in this middle position an equalization of pressure between the two piston sides may take place. Therefore as often as rotary piston 32 of the primary machine reaches this middle position both piston sides are temporarily connected with each other and the one-sided pressure exerted on secondary piston 32 temporarily will cease so that, if in this moment rotary piston 35 should be in one or the other direction outside of its middle position, one of the two springs 43 can bring arm 39 and thus also rotary piston 35 into the middle position.

However the rotary piston 32 of the primary machine shuts down at once again

pressure equalizing canal 46 forcing the secondary piston 35 to move in the same direction. The described arrangement has only the effect that with every movement to and fro, as often as the primary piston arrives in its middle position, the wrong position of the secondary piston is corrected. In Fig. 8 the primary machine 47 and secondary machine 59 are developed as rotary piston machines and also in this case the side on the left of rotary piston 48 of the primary machine is connected by piping 49 with the side on the right of rotary piston 50 of the secondary machine, and the right side of the primary machine with the left side of the secondary machine by piping 51. The trunnion of rotary piston 50 of the secondary machine is hollow and has two openings 52, of which each is situated on one side of piston 50. Inside of the hollow trunnion a rotary valve 53 has been arranged having two canals 54 and 55 and between them a bridge. This bridge normally closes the two openings 52 of the piston trunnion; canal 54 is connected through piping 56 (shown in dash-dotted lines) with a pressure-liquid tank (perhaps an air tank of a liquid pump) and canal 55 through piping 57 (shown in dash-dotted lines) with the discharge. Rotary valve 53 is connected with the trunnion of rotary piston 48 of the primary machine by a gearing 58 in such a manner that rotary valve 53 moves exactly like rotary piston 48.

As long as a perfect synchronism exists between the two rotary pistons 48 and 50 no relative displacement will occur between rotary valve 53 and rotary piston 50 of the secondary machine, because rotary valve 53 as shown by the example through rods 58 follows forcibly the movements of rotary piston 48 so that with perfect synchronism openings 52 remain always closed, and because rotary valve 53 and rotary piston 50 are moving quite in the same way. Should, however, the movement of rotary piston 50 fail to synchronize when the movement of rotary valve 53 one of the openings 52 is put into communication with canal 54 and the other one with canal 55 thus causing the correction. If for instance rotary piston 50 remains back when rotary piston 48 moves to the left canal 54 will come into communication with the right handed opening 52 and thus with the right side of the secondary machine, and the pressure liquid from piping 56 will exert its pressure on the right side of the secondary machine in such a manner that rotary piston 50 will receive a correcting impulse. Canal 55 simultaneously comes into communication with the left handed opening 52 of the hollow trunnion and therefore pressure liquid can discharge from the left side of the secondary machine through piping 57 into the open air thus allowing the synchronizing impulse to be exerted without difficulty. With the re-establishment of synchronism, the openings 52 are closed again. The more rotary piston 50 remains back behind piston 48 and rotary valve 53, the greater becomes the impulse, which has to re-establish the synchronism, and vice-versa, and this synchronizing impulse will occur on every place of the way of the piston wherever an asynchronism should occur, contrary to the proceeding shown by Fig. 7 where the correcting impulse can take place only at a determined place of the way, which place, it is true, can be chosen now optionally after the constructive execution of the device.

Figs. 7 and 8 only serve for explanation of the two above mentioned methods, however it shall not be pretended that this synchronizing process may be performed only with machines of the above mentioned type and only with the indicated constructive means.

Claims.

1. In a device of the character described, the combination with a rotary wheel body, of a plurality of independently operable propeller blades, carried thereby and therewith movable, and individual motor means for the blades supported by the wheel body, and connected with the blades for operating the same directly by the motor means and independently of the operation of the wheel body.

2. In a device of the character described, embodying a rotary wheel body, a plurality of blades and of pistons carried by the wheel body, said pistons and blades being constructed and arranged to provide for the direct operation of the blades by the pistons and independently of the operation of the wheel body, and means for operating the pistons.

3. In a device of the character described, embodying a rotary wheel body, a plurality of blades and pistons carried by the wheel body, said pistons and blades being constructed and arranged to provide for the direct operation of the blades by the pistons and independently of the operation of the wheel body, rotary valves controlling the operation of the pistons, and means, including a rotary magnet, controlling the operation of said valves.

4. In a device of the character described, embodying a rotary wheel body, a plurality of blades and pistons carried by the wheel body, said pistons and blades being constructed and arranged to provide for the direct operation of the blades by the pistons, and independently of the operation of the wheel body, said blades having integral stems provided with ports for the admission of pressure fluid to the pistons, rotary valves

for said ports and means for operating said valves.

5. In a device of the character described, the combination of a rotary body in the form of a wheel member, a plurality of electric motors mounted to one side of the wheel member for rotation with the wheel member, individual propeller blades for the motors, each attached at one end to its motor to be directly operated thereby and independently of the rotation of the wheel member, and each propeller blade operating in an opening in the wheel member and extending beyond the side of the wheel member opposite its motor, and with its projecting portion entirely exposed.

6. A device of the character described having, in combination, an operative wheel member, a plurality of blades carried thereby for independent operation, a rotary piston associated with each blade to provide means for operating the same, together with a supply pipe for pressure liquid and a discharge pipe, a rotary valve controlling the supply of pressure liquid to the piston and also the discharge, and an electric control for each valve.

7. A device of the character described having, in combination, an operative wheel member, a plurality of blades carried thereby for independent operation, a rotary piston associated with each blade to provide means for operating the same, together with a supply pipe for pressure liquid and a discharge pipe, a rotary valve controlling the supply of pressure liquid to the piston and also the discharge, a magnet control for each valve, each magnet being connected with the valve controlled thereby to actuate the valve and hence cause actuation of the associated blade substantially in movement with the magnet.

8. In a device of the character described, the combination with a rotary wheel body, of a plurality of independently operable propeller blades, carried thereby and therewith movable in an orbit, individual motor means for the blades supported by the wheel body, and connected with the blades for operating the same directly by the motor means and independently of the operation of the wheel body, and means for actuating the motor means, to give each blade the same relative position as it passes the same point on the orbit.

9. In a blade wheel, the combination of a plurality of blades one following the other around on an orbit and having their axes substantially parallel with each other and with the axis of the orbit, said blades also being swingable individually on their axes, individual motor means directly connected with the blades for swinging each blade on its axis, and means for actuating the motor means to swing the blades on their axes while the blades move on the orbit.

10. In a blade wheel, the combination of a plurality of blades one following the other around on an orbit and having their axes substantially parallel with each other and with the axis of the orbit, said blades also being swingable individually on their axes, individual motor means directly connected with the blades for swinging each blade on its axis, means for actuating the motor means to swing the blades on their axes while the blades move on the orbit, relative movable control means separate from the blades, and means for transmitting the movement of the control means to the motor means, whereby the movement of the control means moves the blades in synchronism therewith.

11. In a blade wheel, the combination of a plurality of blades one following the other around on an orbit and having their axes substantially parallel with each other and with the axis of the orbit, said blades also being swingable individually on their axes, individual motor means directly connected with the blades for swinging each blade on its axis, means for actuating the motor means to swing the blades on their axes while the blades move on the orbit, relative movable control means separate from the blades, means for transmitting the movement of the control means to the motor operating means whereby the relative movement of which control means moves the blades in synchronism therewith for controlling the movement of the blades, and means for correcting any asynchronism between the control means and the motor actuating means.

12. In a blade wheel, the combination of a plurality of blades, one following the other around on an orbit and having their axes substantially parallel with each other and with the axis of the orbit, said blades also being swingable individually on their axes, individual motor means directly connected with the blades for swinging each blade on its axis, means for actuating the motor means to swing the blades on their axes while the blades move on the orbit, a piston valve, a second piston valve, each having cylinders, and actuating-fluid pipes connecting the cylinders of the piston valves for conveying the operating fluid, each pipe connecting one side of one cylinder with the alternate side of the other cylinder, whereby the operation of the first piston valve moves the second piston valve in synchronism therewith.

13. In a blade wheel, the combination of a plurality of blades, one following the other around on an orbit and having their axes substantially parallel with each other and with the axis of the orbit, said blades also being swingable individually on their axes, individual motor means directly connected

with the blades for swinging each blade on its axis, means for actuating the motor means to swing the blades on their axes while the blades move on the orbit, a piston valve, a second piston valve, each having cylinders and pipes connecting the cylinders of the piston valves for conveying the operating fluid, each pipe connecting one side of one cylinder with the alternate side of the other cylinder, whereby the operation of the first piston valve moves the second piston valve in synchronism therewith, a by-pass in one cylinder, and a checking device operated by the other cylinder, whereby, upon the movement of the piston valves in asynchronism, compensation in the operating fluid takes place to bring the movement of the piston valves into synchronism.

In testimony whereof we affix our signatures

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