June 11, 1935. H. FÖTTINGER 2,004,279

FLUID DRIVEN AND DRIVING APPARATUS

Filed Jan. 26, 1933 2 Sheets-Sheet 1

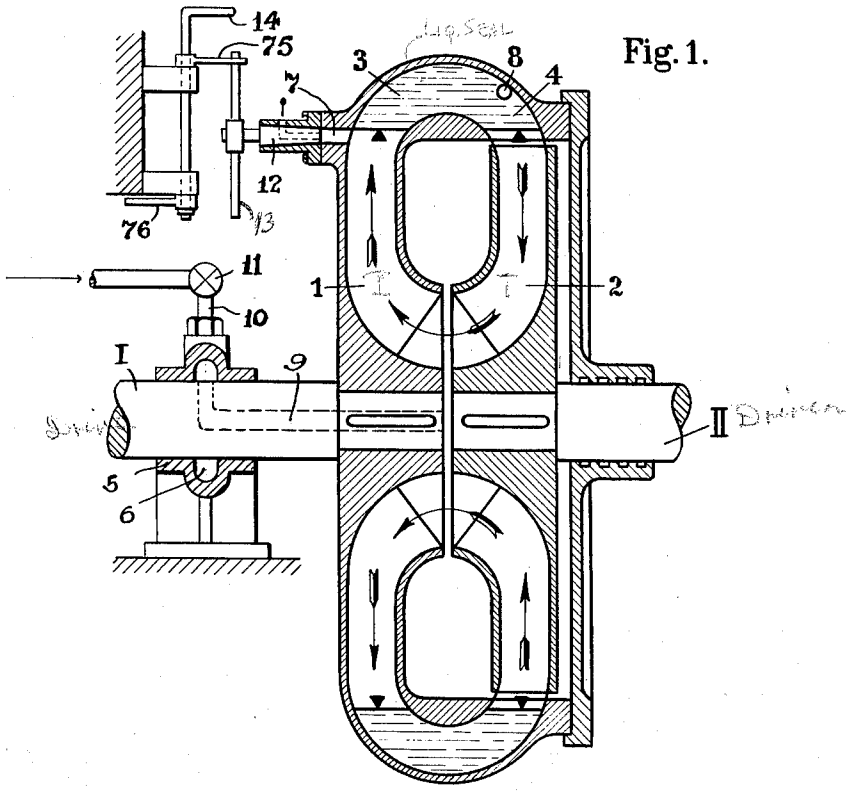

Fig. 1.

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Fig.2.

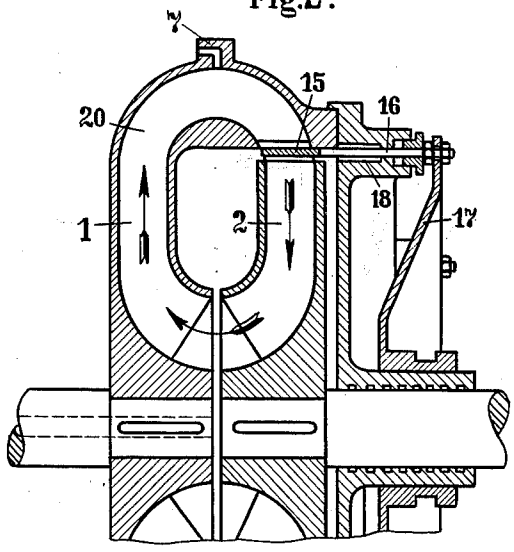
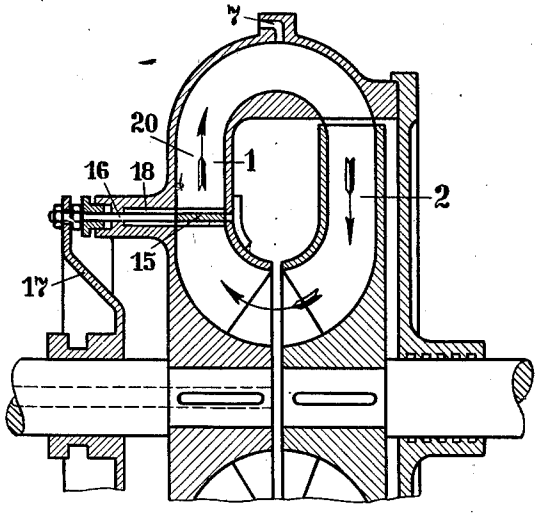


Fig.3.



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UNITED STATES PATENT OFFICE

2,004,279

FLUID DRIVEN AND DRIVING APPARATUS

Hermann Föttinger, Berlin-Wilmersdorf, Germany

Application January 26, 1933, Serial No. 653,742
In Germany January 26, 1932

3 Claims. (Cl. 60—54)

This invention relates to hydraulic power transmitting devices of the general type shown and broadly claimed in my prior Patent 1,199,359 and in which there is employed a centrifugal pump or rotor for imparting kinetic energy to a liquid, and a turbine rotor juxtaposed thereto and caused to rotate by the kinetic energy of said liquid. The parts may be so designed and proportioned as to cause the rotors to turn in the same or opposite directions and at substantially the same or at materially different speeds.

The invention relates more particularly to that type in which the quantity of liquid in the working circuit may be varied at will to control the transmission of power and the speed of the driven rotor under varying operating conditions. In the usual apparatus of this type, the liquid may be completely withdrawn from the working circuit under no-load conditions, but the air which replaces the liquid upon the withdrawal of the latter is caused to flow by the continued rotation of the driving rotor, and therefore there is objectionable power transmission to the driven rotor and objectionable losses of energy and increase in temperature.

The object of the invention is to avoid or minimize these losses by interrupting the circulation of the air or other filling fluid within the closed circuit of the machine at one or several points by special throttling means operable at will.

This object is attained in turbine transformers or turbo-gears, such as described in the U. S. Patent 1,199,359, running without load, by adjusting throttling means, such as annular bodies, clearance sluice valves, diaphragms or the like so that the circuit in which ventilation takes place is interrupted. The throttling means are made operative after the ventilating effect has started, either by hand or otherwise.

A particularly satisfactory solution of the problem is attained by the throttling body checking the ventilation flow consisting of a fluid heavier than the fluid circulating and which at one or several points stops the circuit of the ventilation fluid.

In hydraulic power transmitting apparatus the throttling means can preferably be formed by a rotating liquid ring which is produced within one of the rotating wheels, for instance, by centrifugal force and which revolves with the same without coming into contact with the other wheel.

In the accompanying drawings, which form a part of this specification, several embodiments of the invention are represented by way of examples. In these drawings—

Fig. 1 a sectional view of a hydraulic power transmitting apparatus provided with an annular portion for a throttling liquid; and

Figs. 2 and 3 represent sectional views of a hydraulic power transmitting apparatus similar to Fig. 1 having throttling sluices adjustable from outside, at different points of the circuit.

Like numerals designate like or similar parts throughout all figures of the drawings.

Referring to Fig. 1 which represents a turbo-coupling of the kind shown in Fig. 3*a* of U. S. Patent No. 1,199,359, a primary or pump wheel 1 and a secondary or turbine wheel 2 are provided. When the secondary wheel 2 is stopped and the primary wheel 1 rotating the air or other gaseous fluid contained in the evacuated circuit will produce a sensible ventilation effect. In this instance the air, driven by wheel 1 through wheel 2, would circulate in an uninterrupted circuit. According to the present invention a liquid seal is provided for within the exterior part 3—4 of the gear, in this instance, e. g., within the primary wheel 1, so that the objectionable closed circuit flow of air is prevented from developing.

Preferably, the arrangement may simply consist in that after evacuation of the wheels 1 and 2 a suitable portion of the liquid, sufficient for throttling the ventilation flow, is left, to form the seal automatically. For this effect in the turbo-gear shown, in Fig. 1 the outlet 7 may be placed at a suitable radius smaller than the outside radius while the outside overhanging portion of the particular wheel is designed so as to afford a U-shaped or cup-like water seal.

After the space 1—2 of the coupling has been emptied, there automatically remains a definite amount of liquid in the space 3—4 which under the influence of the centrifugal force forms a ring and results in throttling the ventilation flow. In order that balancing is ensured by levels of the same height, small communication perforations 8 may be made in the bucket forming channels in the wheel. The liquid may be supplied to the operating circuit through the hollow passage in the shaft of the primary wheel 1, and this inlet and the outlet 7 may be controlled to permit the complete filling or substantial emptying of the coupling and thereby control the amount of the slippage and amount of power transmitted through the kinetic energy of the liquid.

In the specific construction illustrated in Fig. 1, the shaft of the driving rotor 1 is provided with a bore 9 whereby the liquid may be delivered through this bore to the inner end of the shaft I and thence into the working circuit. Surrounding the shaft I there may be provided a bracket, pedestal or collar 5 having an annular groove 6 communicating with the end of the bore 9, and liquid may be delivered to this groove and thence into the working circuit through a conduit 10 controlled by a valve 11. The outlet opening 7 of the working circuit may be provided with a valve 12 of the turning plug or any other suitable type. As shown, the valve stem is provided with a two-armed lever 13, and mounted adjacent to the path of movement of this lever, there is shown a rod mounted for oscillation about an axis which may be radial of the coupling. This rod is shown as provided with a handle 14 and a pair of control stops 75 and 76 extending in opposite directions and movable into or out of the path of movement of the opposite ends of the lever 13.

With the parts in the position shown in Fig. 1, the rotation of the coupling about its axis will cause the outer end of the lever 13 to engage the stop 75 and move the valve 12 in one direction. To reverse the position of the valve, the handle 14 is swung through the required angle to bring the stop 76 into the path of the inner end of the lever 13, and the engagement of the lever with this stop will move the valve in the opposite direction. The mechanism shown is merely typical of mechanism which may be employed for controlling the inlet and outlet ports, and the details constitute no portion of my present invention.

As a rule, the throttling body, thus also the fluid ring or its substitute, may be inserted at any point of the flow machine, in the case of power transmitting turbo-gears e. g. in a primary or secondary or stationary guide wheel. The arrangement to be provided for depends on the particular case, e. g. on whether in automobiles the primary part or the secondary part keeps moving for a longer time so as to be able to form the fluid ring.

The embodiment shown first of all refers to the turbo-coupling above referred to, but without leaving the scope of the invention it is also applicable to any general type of fluid gears based on the turbine system and to all fluid impelled or fluid impelling flow machines.

In the construction represented in Fig. 2 the circuit can be interrupted by means of a cylindric sluice 15 supported through rods 16 projecting out of a wall of the part 1. The rods 16 are arranged around the said wall and attached to a disk like carrier 17 at their outer ends, so that axial displacement of the disk 17 will place the sluice between the parts 1 and 2 or into a circular slot 18 of the wall, respectively.

In the construction of Fig. 3 the vanes 20 of the primary wheel 1 are cut to give way for the sluice 15, the other arrangement of the gear being similar to that of Fig. 3.

The present invention affords sensible advantages over the known methods for reducing ventilating in flow machines, for instance by evacuation with the aid of vacuum pumps as used for steam turbines. Nevertheless the means so far known for the reduction of ventilation (e. g. evacuation) may be used in combination with the novel means disclosed.

In order that the effect of the subject matter of the invention is not impaired by the water evaporating or splashing in the cup-like water seals, it is preferred to provide a make-up appliance which regularly replaces the water lost.

What I claim is—

1. A hydraulic coupling of the kinetic type, including a pair of annular coaxial relatively rotatable members, one serving as a liquid driving member and the other as a liquid driven member, said members having passages for the circulation of a liquid therethrough in a closed working circuit, one of said members having the radially outermost portion of its passage substantially U-shaped, means for controlling at will the admission of liquid to said circuit, independent means for controlling at will the escape of liquid from said circuit, whereby transmission of power through the kinetic energy of the liquid may be varied in accordance with the amount of liquid in said circuit, and means to prevent air circulating through said U-shaped passage upon the discharge of operating fluid from said coupling.

2. A hydraulic coupling of the kinetic type, including a pair of annular coaxial relatively rotatable members, one serving as a liquid driving member and the other as a liquid driven member, said members having passages for the circulation of liquid therethrough in a closed working circuit, means for varying the amount of liquid in said circuit and thereby controlling the transmission of power through the kinetic energy of the liquid in accordance with the amount of liquid in said circuit, and means carried by the driving member for preventing the circulation of air in said circuit when the liquid is withdrawn from said circuit.

3. A hydraulic power transmitting device of the kinetic type, including a pair of annular coaxial relatively rotatable members, one serving as a liquid driving member and the other as a liquid driven member, said members having passages for the circulation of a liquid therethrough in a closed working circuit, one of said members having the radially outermost portion of its passage substantially U-shaped with radially inwardly directed ends, means for controlling at will the admission of liquid to said circuit, and means for controlling at will the escape of liquid from said circuit and so located as to not empty said U-shaped portion, whereby one of said members may be entirely emptied and liquid retained in said U-shaped portion of the other member to form a liquid seal which prevents air circulation in said coupling.

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