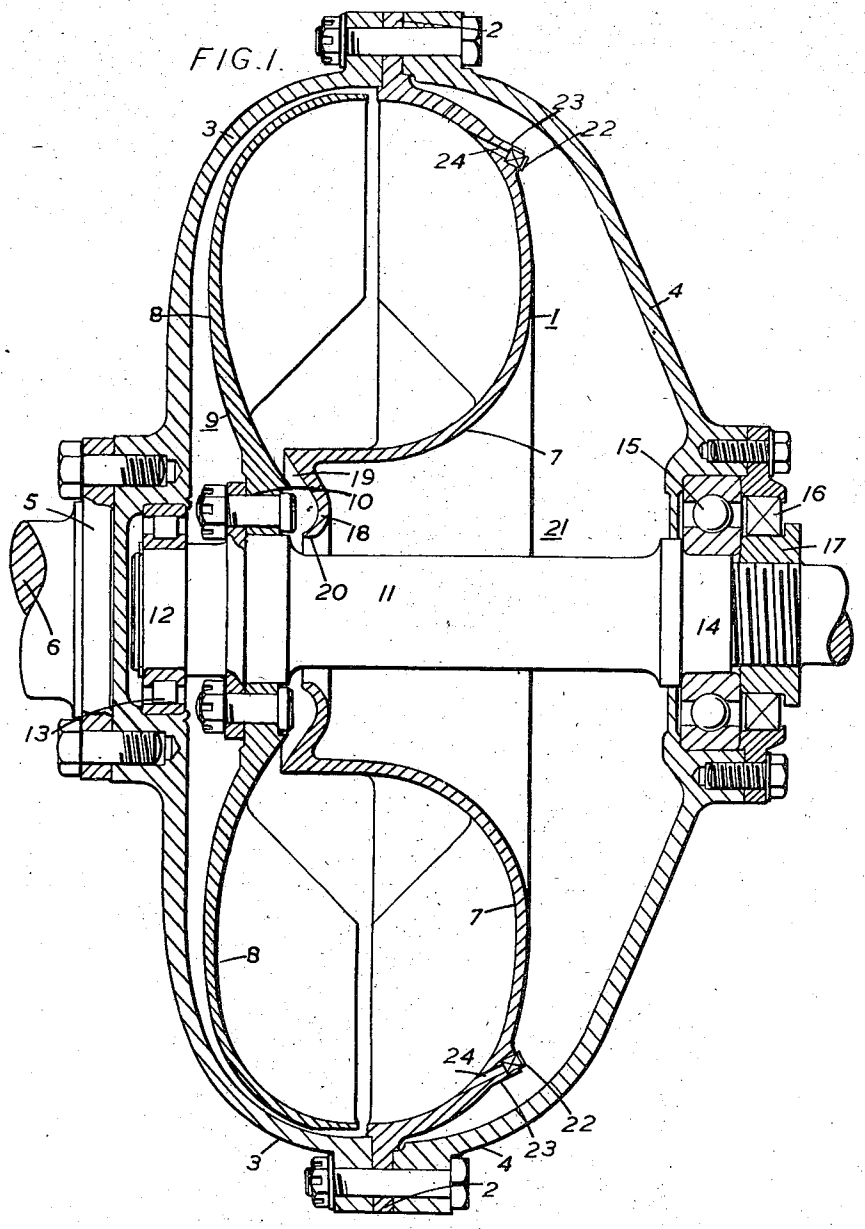
Oct. 9, 1951 R. C. CLERK 2,570,768

ROTARY TURBINE-TYPE HYDROKINETIC COUPLING

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FIG. 1.



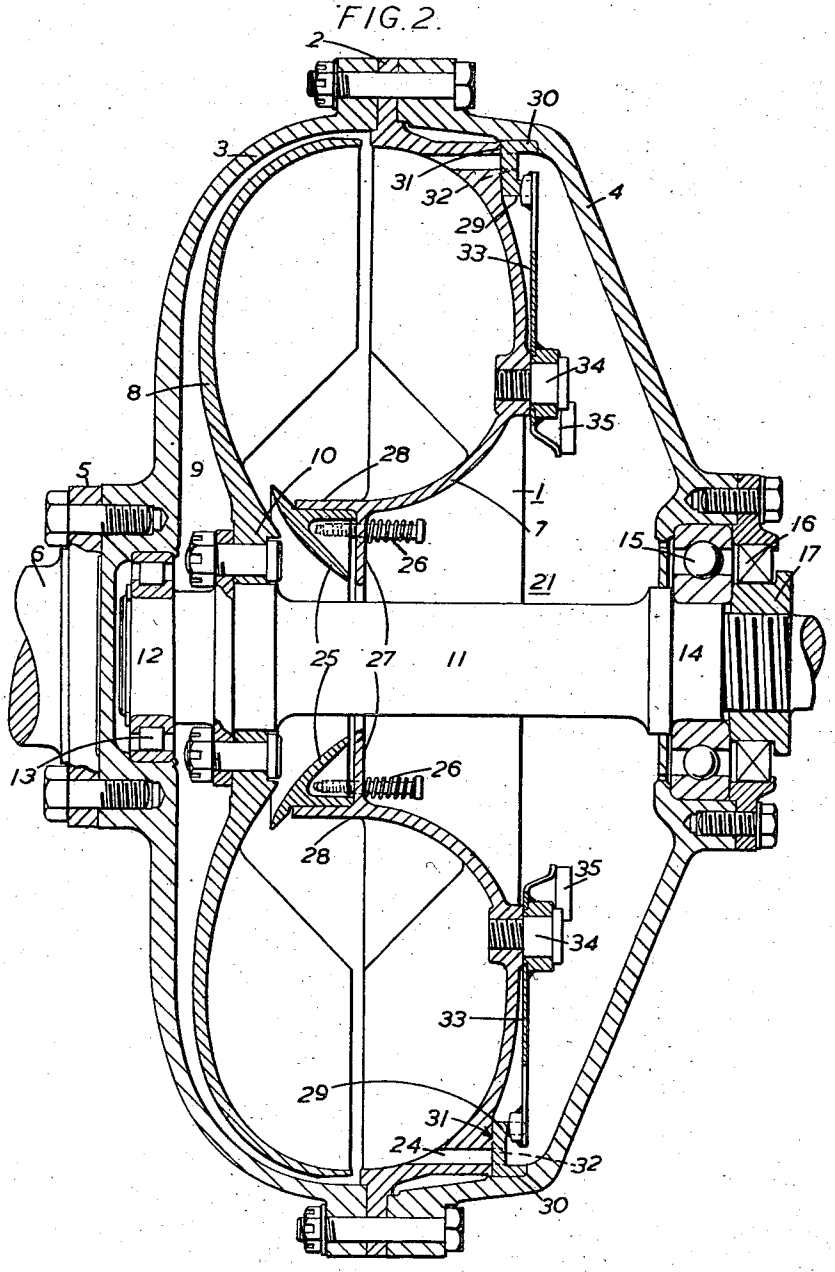

Inventor
R. C. Clerk
By
E. F. Vrenderwth
Attorney

Oct. 9, 1951 R. C. CLERK 2,570,768

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FIG. 2.




Inventor
R. C. Clerk
By
E. F. Wunderlich
Attorney

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## ROTARY TURBINE-TYPE HYDROKINETIC COUPLING

Robert Cecil Clerk, Richmond, England

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5 Claims. (Cl. 60—54)

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This invention relates to hydraulic couplings, and has reference to a power transmitting appliance in the form of a coupling, brake or gear of the so-called hydro kinetic type, that is, one in which power is transmitted by the kinetic energy of a liquid discharged by an impeller on a drive shaft against the vanes of a turbine runner on a driven shaft. The invention is concerned in particular with a hydro-kinetic coupling of the kind in which a reservoir chamber for the operating liquid, e. g. oil, is provided within the compass or confines of the rotating casing of the coupling. In prior proposals the reservoir chamber has been disposed at the rear of the runner or driven part or at the rear of the impeller or driving part, and has been connected with the working circuit of the coupling to permit of the passage of liquid from the working circuit to the reservoir, and vice versa. This interconnection has been effected hitherto by means of a number of tubes which extend between the reservoir chamber and the vortex core ring of the coupling. The uses and advantages of such a reservoir chamber are, of course, well known, the objects of the chamber being briefly to remove part of the oil from the working circuit under starting conditions thus assisting the engine to pick up the load more readily by reason of the reduction in drag torque or tendency to creep, and then when a certain speed is reached, to return the oil into the working circuit automatically, which results in a low slip value under normal running conditions. The reservoir serves also to separate air from the oil in the working circuit and to prevent undue pressure rise in the coupling by acting as an expansion chamber.

It is an object of the present invention to provide a simple and sturdy construction of hydraulic coupling of the hydro-kinetic type which possesses all the advantages which accrue from the provision of a reservoir chamber within the rotating casing thereof without having to incorporate tubes specially provided on either the impeller or the runner for engaging the operating liquid contained within a part of the coupling which is rotatable with the complemental member (i. e. the runner or the impeller as the case may be) for the purpose of withdrawing said liquid from the working circuit of the coupling.

Another object of the present invention is to provide a hydro-kinetic coupling having the characteristics already referred to without the necessity of using a vortex core-ring, which has

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hitherto been the part of the working circuit of the coupling between which and the reservoir chamber the liquid withdrawing means has extended.

A further object of the invention is to provide a hydro-kinetic coupling constructed so as to permit the operating liquid to move freely into the reservoir under starting conditions and to return automatically to the vortex chamber when the coupling is rotating at or above a predetermined regulatable speed.

The foregoing and other objects of the invention and a fuller understanding thereof may be had by referring to the following description and the accompanying drawings in which Figures 1 and 2 are similar longitudinal cross sections, partly in elevation, showing two suitable constructional forms of the coupling.

In the construction illustrated in Figure 1, the impeller 1 has a peripheral flange 2 by means of which it is clamped between the joint faces of the two halves 3, 4 of a transversely split casing, one side of the casing half 3 being bolted to an end flange 5 of a drive shaft 6. Adjacent to the peripheral flange 2' of the impeller 1 a trough 7 of approximately semi-elliptical form is provided, and opposed to this is arranged the outer approximately semi-elliptical trough 8 of a runner 9. The runner 9 is anchored by means of a centrally apertured plate portion 10 to a driven shaft 11, which extends centrally through the casing and is rotatably supported coaxially with the driving shaft 6 by an extension 12 running in an anti-friction bearing 13 mounted in casing half 3, i. e. on the driving shaft side of the casing, and by a journal 14 running in an anti-friction bearing 15 mounted in the casing half 4. An oil retaining seal 16 is provided around a collar 17 on the runner shaft 11 on the outside of the bearing 15. The impeller 1 is provided with a centrally apertured flange 18 somewhat similar to the plate 10 of the runner 8 and the flange 18 and plate portion 10 of the impeller 1 and the runner 8 respectively are spaced apart to form a duct 19. The general direction of the duct 19 is disposed so as to be substantially or approximately tangential to the cross section of the vortex, so that oil may freely leave the circulating vortex without setting up any disturbance in the vortex flow. The inner edge 20 of the impeller flange 18 forms a weir over which oil flows directly into the reservoir chamber 21. The edge 20 of the impeller 1 is curled back toward the duct 19 and thus provides behind the flange 18 an an-

nulus within which turbulence of the oil is set up. This turbulence has the effect of opposing the flow of oil between the vortex chamber and the reservoir. The outer part of the casing lies in proximity to the outer part of the clamped impeller 1, the reservoir 21 being provided in the region of the inner part of said impeller. One or more centrifugally operating valves 22 of any suitable construction may be carried in bosses 23 formed on the rear side of the impeller 1, each valve 22 serving to control a passage 24 which opens into the vortex space between the opposed impeller 1 and runner 8; each passage 24 is formed and disposed so as to ensure that any oil passing from the reservoir 21 through the valve 22 when it is opened by centrifugal action at a predetermined speed enters smoothly by a tangential inflow movement into the circulating vortex. These control valves 22 are optional.

In Figure 2 of the drawings an alternative construction is illustrated in which an adjustable weir ring 25 is employed instead of the static curled-edge flange 18 shown in Figure 1. The weir ring 25 is normally held by spring-loaded bolts 26 against a web 27 formed on the inside periphery of the impeller trough 7 and is maintained thus during the low speeds which prevail under starting conditions. As the speed of rotation increases during operation of the coupling the weir ring 25 slides over the seating rim 28 against the resistance of the spring-loaded bolts 26 and thus reduces the width of the duct 19, thereby producing substantially the same throttling effect as the turbulence created by the curled-edge flange 18 in the construction shown in Figure 1. This sliding movement of the weir ring 25 is brought about by the influence of centrifugal force of the oil trapped behind it and of forces due to the convergent-divergent flow of oil past the ring face and runner flange.

With this weir ring 25 the same form of centrifugally operating valve 22 may be used as illustrated diagrammatically in Figure 1, or alternatively as shown in Figure 2, a ring valve may be employed. This ring valve 29 comprises a ring 29 which is rotatable on a seating 30 in the casing half 4, in close or rubbing contact with a ported face 31 on the back of the impeller 1. The ring 29 is provided with a series of spaced apart arcuate slots 32 or equivalent openings arranged concentric to the axis of rotation of the impeller 1 and adapted on rotation of the ring 29 to align or register with the tangential passages 24 which open out on the ported face 31. A rotary movement is imparted to the valve ring 29 at and above a predetermined operating speed by connecting it to one arm of at least one bell-crank lever 33, each mounted for free pivotal movement on a pivot 34 on the back of the impeller trough 7, the influence of centrifugal force on a weight 35 on the other arm of said lever 33 being utilised to swing said lever about its pivot 34 and thus impart rotation to the valve ring 29. This form of centrifugally operated ring valve could be employed with a coupling of the construction shown in Figure 1, in lieu of the valves 22.

I claim:

1. A hydro-kinetic coupling comprising a drive shaft, a closed casing secured to said drive shaft, a driven shaft coaxial with the drive shaft and journalled within said closed casing for rotation independently thereof, a substantially semi-elliptical shaped troughed runner secured to said driven shaft and disposed with its back adjacent to the wall of one side of the closed casing, a substantially semi-elliptical shaped troughed impeller secured partition-wise within the closed casing and having a central aperture for the passage therethrough of said driven shaft, said impeller being disposed so as to form an oil reservoir between the back thereof and the other side of the closed casing, and said troughed runner and troughed impeller facing one another to form therebetween a substantially elliptical shaped vortex chamber and being constructed to constitute between them a duct which is disposed substantially tangential to the cross-section of the vortex and which forms a continuous uninterrupted flow-restricting weir around the driven shaft, over which weir operating liquid directly passes from said vortex chamber to said oil reservoir and the back of the outer peripheral portion of said impeller having a plurality of centrifugally operable ports disposed substantially tangential to the cross-section of the vortex chamber for providing a smooth tangential inflow movement of oil from said reservoir into the circulating vortex under the effect of centrifugal action.

2. A hydro-kinetic coupling as claimed in claim 1, wherein the impeller is provided with an inwardly directed flange having an incurled edge forming an annulus around the lip of the aperture through which the operating liquid flows directly into the reservoir from the vortex chamber formed between the opposed impeller and runner, said annulus setting up turbulence which opposes the flow of the liquid into said reservoir in excess of predetermined flow velocities.

3. A coupling according to claim 1, wherein a weir ring is mounted for axial displacement in the central aperture of the impeller.

4. A coupling according to claim 3, in which the weir ring is slidably mounted in the central aperture of the impeller, for axial displacement under the influence of centrifugally imparted hydraulic forces, to restrict said impeller aperture, for the purpose of throttling the flow of operating liquid from the vortex chamber into the reservoir.

5. A coupling according to claim 1, in which the porting provided in the back of the impeller is controlled by valve means constructed for admitting liquid from the reservoir into the vortex chamber, said valve means operating automatically to pass liquid therethrough when the impeller is rotating above a predetermined speed.

ROBERT CECIL CLERK.


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