April 12, 1966 J. BILTON 3,245,220

HYDRAULIC TURBO COUPLINGS

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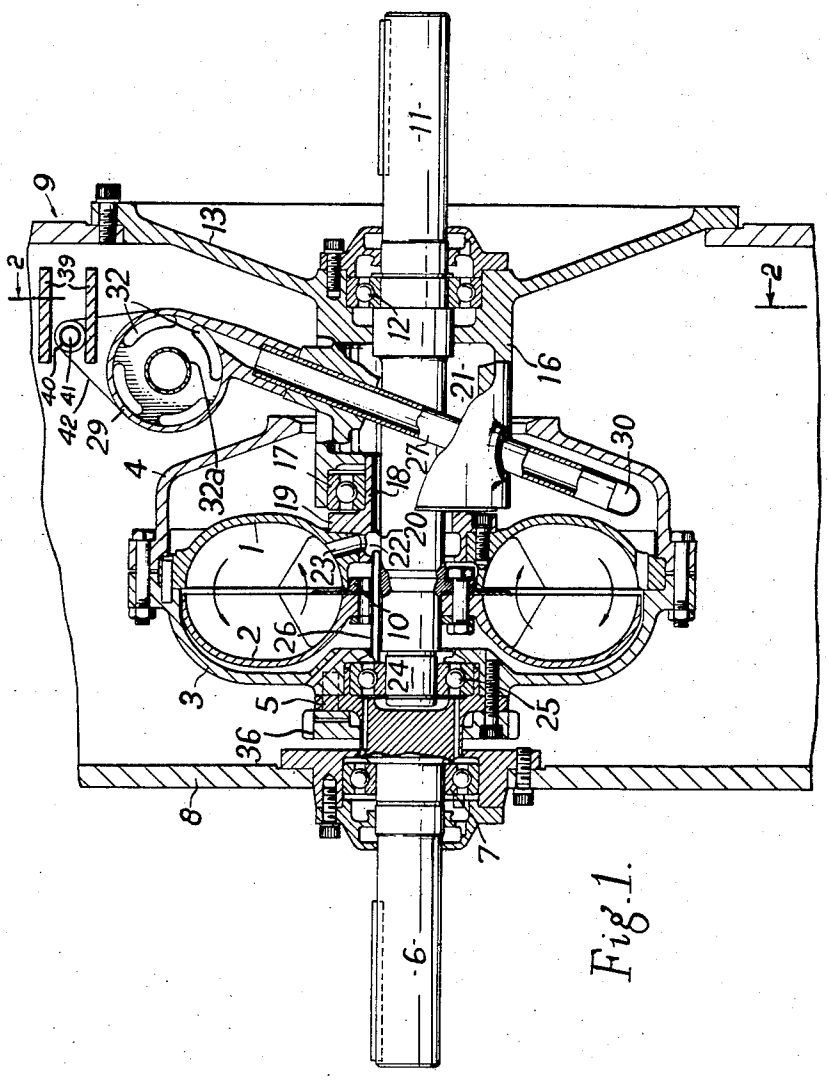


Fig. 1.

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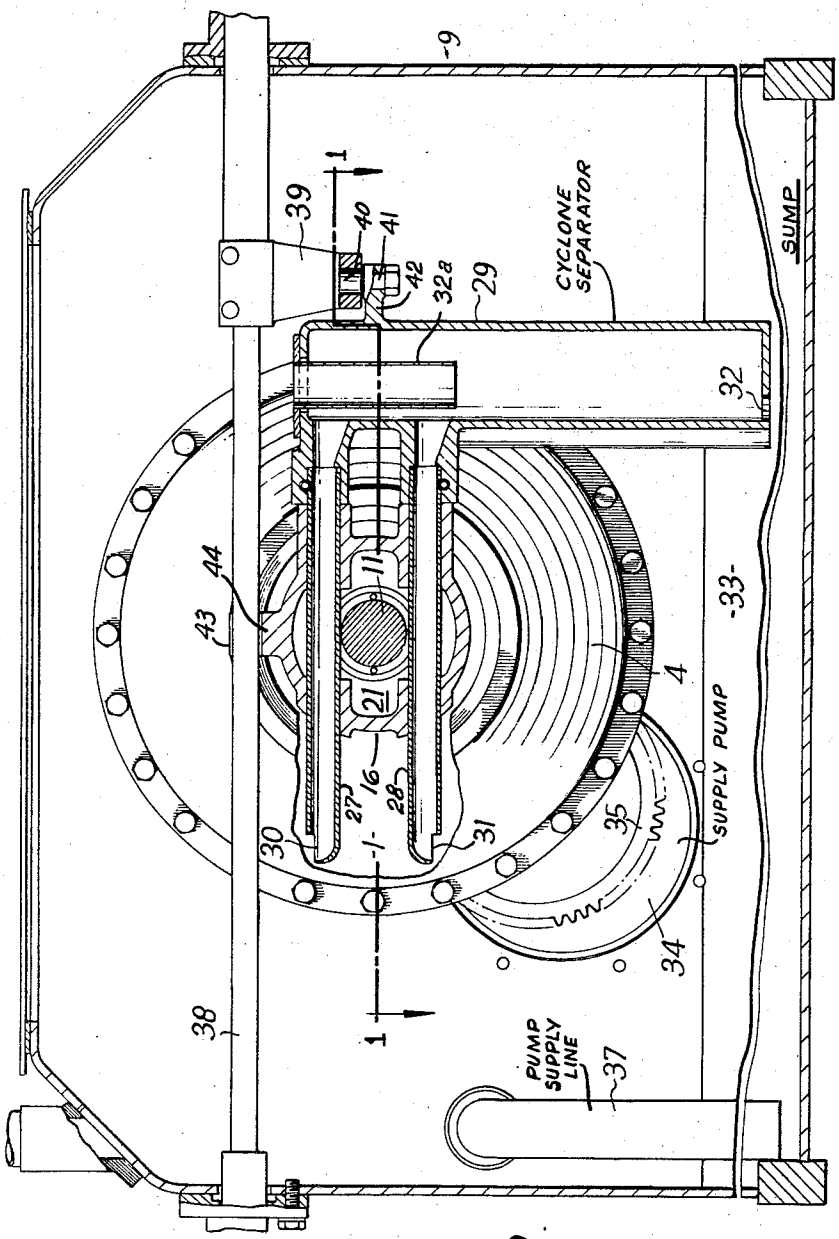


Fig. 2.

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HYDRAULIC TURBO COUPLINGS

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4 Claims. (Cl. 60—54)

This invention relates to scoop-trimmed turbo couplings, that is to say hydraulic turbo couplings comprising vaned impeller and runner elements which together define a toroidal working circuit for liquid, a casing connected to the impeller for rotation therewith and extending round the runner, a scoop chamber connected to the impeller or the impeller casing for rotation therewith, the outer parts of the working circuit being in free communication with the scoop chamber, an adjustable scoop tube extending into the scoop chamber and arranged to trim off liquid from the scoop chamber into a sump and means for returning liquid from the sump to the working circuit. Scoop-trimmed couplings are particularly suitable for providing variable slip at comparatively high speeds, for example at 3,000 r.p.m.

In operation of such couplings, particularly when the working circuit is only partially filled with working liquid, appreciable aeration of the liquid occurs. The liquid trimmed off by the scoop into the sump therefore contains an appreciable quantity of air and this may not have time to escape from the liquid before it is returned to the working circuit, for example through a pump. The presence of air in the liquid reduces the efficiency of the pump and also reduces the degree of filling of the working circuit to a value below that intended for a given setting of the scoop tube.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a horizontal section of a preferred embodiment and FIG. 2 is a cross-section in the direction of the arrows 2—2 of FIG. 1.

Referring to FIG. 1 of the drawings, the coupling shown includes a vaned impeller and a vaned runner 2 which together define a toroidal working circuit. An impeller casing 3 enclosing the runner 2 and a scoop chamber 4 are bolted to each other and pinned to the impeller.

The impeller casing 3 is bolted to a flange 5 at one end of an input shaft 6 which is supported in a ball bearing 7 in a front wall 8 of a stationary casing 9 which totally encloses all the working parts of the coupling.

The runner 2 is bolted to a flange 10 on an output shaft 11 supported in a ball bearing 12 in a cover 13 closing a circular opening in the rear wall 15 of the casing 9.

The hub of the cover 13 extends inwards into the casing interior to form a scoop tube housing 16 and to support in a ball bearing 17 an impeller sleeve 18 having a flange 19 bolted to the hub of the impeller 1.

An annular filling port 20 is defined between the impeller sleeve 18 and the output shaft 11 and serves to convey liquid from a filling chamber 21 to an annular recess 22 in the impeller hub. The liquid enters the working circuit from the recess 22 through filling passages 23 in the impeller hub.

A reduced diameter portion 24 on the end of the output shaft 11 is supported in a ball bearing 25 carried in the flange 5. Liquid is fed from the recess 22 to the bearing 25 by lubrication scoop tubes 26 carried by the output shaft 11. These scoop tubes deliver oil at a rate dependent on the amount of slip, that is the difference

in the revolutions per minute between the impeller and the runner.

A pair of horizontal trimming scoops 27 and 28 are mounted for sliding movement in bores in the scoop tube housing 16 and carry a de-aerating chamber 29 which moves with the scoop tubes 27 and 28.

The mouths 30 and 31 of the scoop tubes 27 and 28 form scoping orifices arranged to trim off liquid from the chamber 4, each mouth being effective for one direction of rotation of the impeller, thus rendering the coupling suitable for use with a reversing motor or engine, and also simplifying the supply of such couplings from stock since they are immediately available for use for either direction of rotation. Liquid collected by either scoop tube enters the de-aerator chamber 29 tangentially at a speed to form a fast moving rotating film on the wall thereof, thus giving entrained air a good opportunity to escape by centrifugal separation.

The de-aerated liquid leaves the chamber 29 through orifices 32 which are below the surface of the liquid in the bottom of the casing 9 which forms a sump 33. The air released by the liquid escapes through an air escape tube 32*a* fixed in the upper part of the de-aeration chamber 29 coaxially therewith.

Liquid is returned to the filling chamber 21 (through a cooler if desired) and thence to the working circuit by a pump 34 driven by a gear 35 meshing with a gear 36 on the input shaft. The pump is bidirectional and has a suction inlet pipe 37 preferably fitted with a strainer.

In the position shown in the drawings, the operative scoop tube will maintain the working circuit substantially empty so that the coupling would transmit little if any torque.

To increase the transmitted torque, the scoop tubes and de-aerator chamber 29 are moved to the right (FIG. 2) by sliding movement of a control rod 38 which carries a guide block 39 formed with a guide channel which embraces a roller 40 mounted for rotation on a pin 41 carried by a lug 42 on the chamber 29.

The control rod 38 is of rectangular section and slides in a corresponding guideway 43 in an upstanding web 44 carried by the top of the scoop tube housing 16. Movement of the control rod to the right (FIGURE 2) moves the guide block 39 with it. The engagement of the roller 40 in the guide channel of the guide block 39 constrains the assembly comprising the scoop tubes 30 and 31 and the de-aeration chamber 29 to move to the right also. Since the scoop tubes 30 and 31 move at an angle to the direction of movement of the control rod 38, the latter being at right angles to the coupling axis, the roller 40 travels along the guide channel in the guide block 39. The scoop tubes 30 and 31 are thus progressively withdrawn from the scoop chamber 4 so that the quantity of working liquid remaining in the working chamber is progressively increased, thus increasing the torque transmitted by the coupling.

Correspondingly, movement of the control rod 38 to the left (FIGURE 2) moves the scoop tubes further into the scoop chamber thereby reducing the quantity of liquid in the working circuit and thus reducing the torque transmitted by the coupling.

What is claimed is:

1. A scoop-trimmed hydraulic turbo-coupling comprising:

impeller and runner elements, said impeller and runner elements together defining a toroidal working circuit for liquid; an impeller casing connected to said impeller for rotation therewith, said casing extending around said runner;

a scoop chamber connected for rotation with said impeller, the radially outer partion of said working

circuit being in free communication with said scoop chamber;

an adjustable scoop tube extending into said scoop chamber and positioned to trim off liquid from said scoop chamber;

a sump adapted to hold a body of said liquid;

a de-aeration chamber having an outlet discharging into said sump, said de-aeration chamber having an internal wall surface in the form of a surface of revolution and having an inlet arranged to discharge liquid from said scoop onto said wall surface in a direction having a component tangential to said wall surface, said de-aeration chamber including an air outlet;

and means for returning liquid from said sump to said working circuit.

2. A hydraulic turbo-coupling according to claim 1 and including a stationary casing totally encasing said impeller and runner elements, said impeller casing, scoop chamber, scoop tube and de-aeration chamber, the lower part of said casing forming said sump and said de-aeration chamber being secured to said scoop tube for movement therewith.

3. A hydraulic turbo-coupling according to claim 1 wherein said de-aeration chamber includes an air escape tube extending in an axial direction in the region of said scoop tube discharge inlet and communicating with said air outlet.

4. A scoop-trimmed hydraulic turbo-coupling comprising:

vaned impeller and runner elements together defining a toroidal working circuit for liquid;

an impeller casing connected to said imepller for rotation therewith, said casing extending around said runner;

a scoop chamber connected for rotation with said impeller, the radially outer portion of said working

circuit being in free communication with said scoop chamber;

an adjustable scoop tube extending into said scoop chamber and positioned to trim off liquid from said scoop chamber as said scoop chamber rotates;

a stationary casing totally encasing said impeller and runner elements and said impeller casing, scoop chamber and scoop tube the lower part of said stationary casing forming a sump;

a substantially cylindrical de-aeration chamber secured to the discharge end of said scoop tube, for movement with said scoop tube within said stationary casing, the axis of said de-aeration chamber being substantially vertical, said scoop tube discharging into the upper part of said de-aeration chamber in a substantially tangential direction adjacent the inner wall thereof to form a rotating oil film on said inner wall, said de-aeration chamber including an air escape tube extending coaxially with the de-aeration chamber in the region of the discharge end of the scoop tube, said air escape tube opening at its upper end into the interior of the stationary casing;

and means for returning from said sump to said working circuit, liquid which is discharged from said scoop tube through said de-aeration chamber into said sump.

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