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2 Sheets-Sheet 1

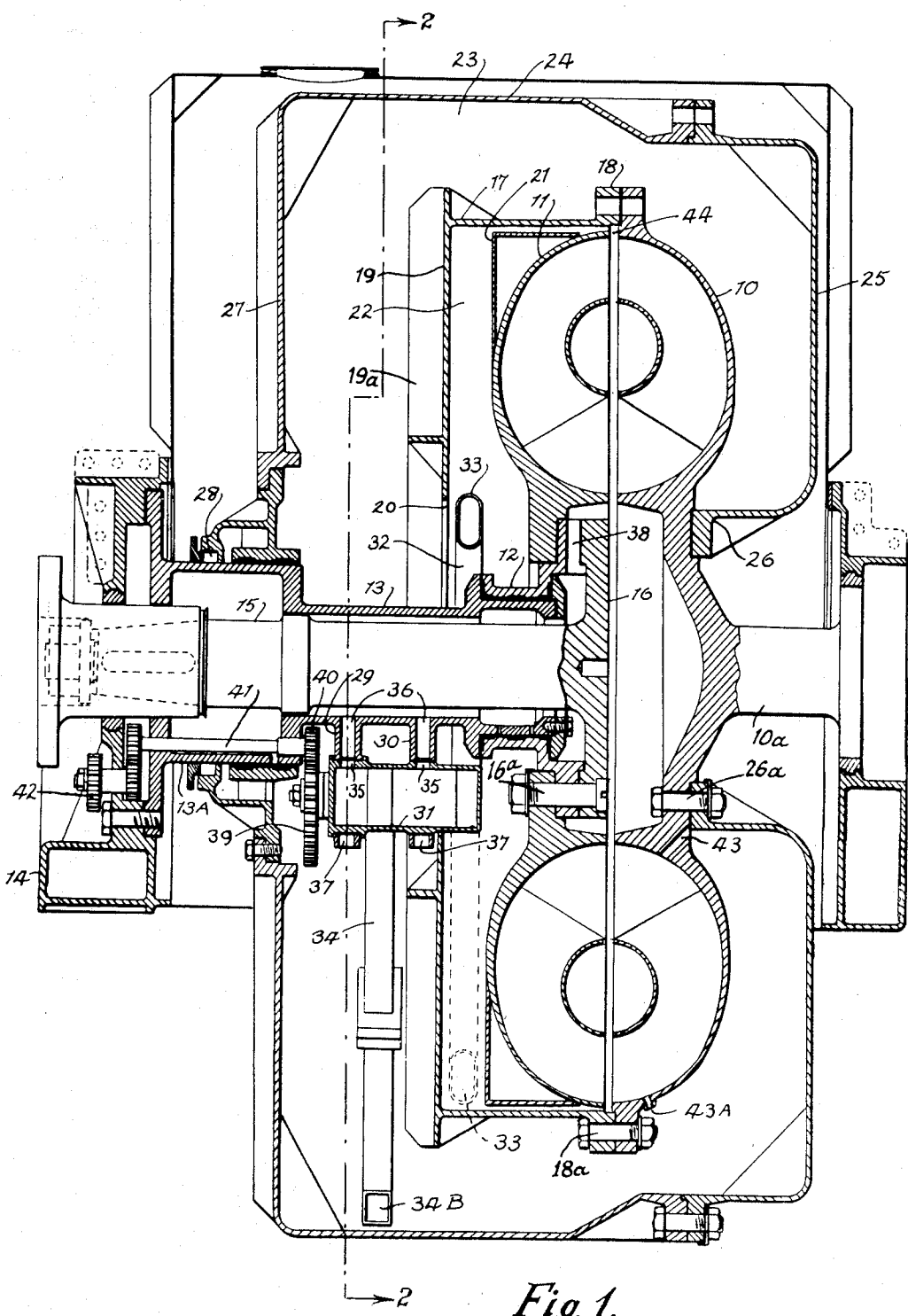


Fig. 1.

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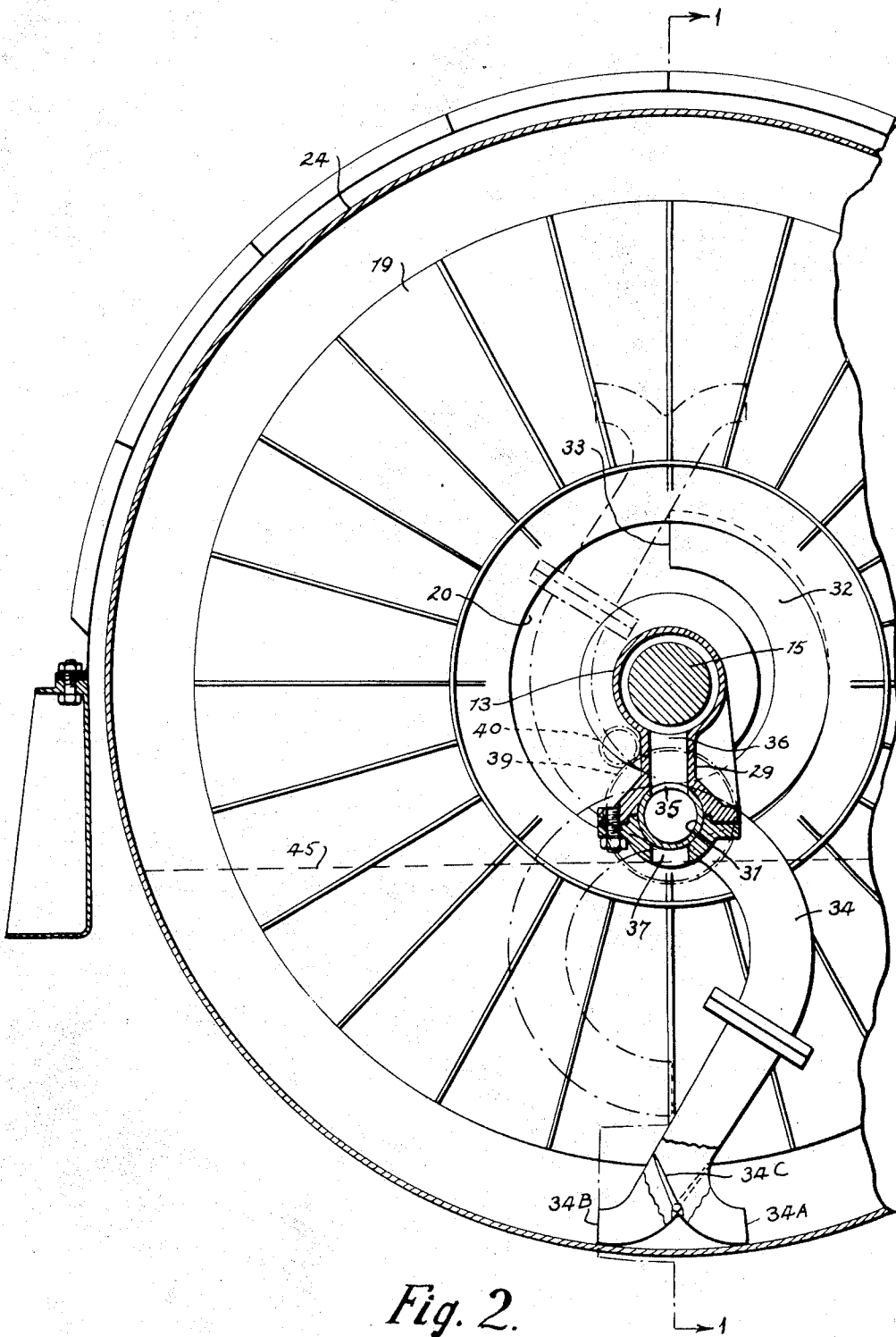


Fig. 2.

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HYDRAULIC POWER TRANSMITTER

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8 Claims. (Cl. 60—54)

The present invention relates to hydraulic power transmitters of the kinetic type and provided with scooping means whereby the liquid content of the working chamber can be varied while the transmitter is operating; scooping means are disclosed in the specification of U. S. Patent No. 1,859,607.

An object of this invention is to provide an improved scoop-controlled hydraulic power transmitter, in which the liquid content of the working chamber can be rapidly varied.

A further object is to provide such a transmitter in the form of a self-contained disengageable coupling device which is suitable for use, for example, for connecting one of a plurality of marine engines to a common propeller shaft.

According to this invention the improved hydraulic power transmitter comprises a working chamber including driving and driven vaned elements, a rotatable reservoir chamber co-axial with the working chamber, a scoop device in the working chamber adapted to transfer liquid therefrom to the reservoir chamber, and a scoop device in the reservoir chamber adapted to transfer liquid therefrom to the working chamber, wherein these scoop devices are capable of angular displacement eccentrically with respect to the axis of rotation of the transmitter, so that their scooping lips are displaced radially with respect to this axis, and control means are provided for displacing the scoop devices alternatively in such a direction that their lips are displaced radially outwards.

The working chamber may be of the Vulcan type, formed by one vaned element and a shell attached to the periphery of this element and shrouding the back of the other vaned element, the first-mentioned scoop device being disposed in the space between this shell and the vaned element that it shrouds.

The two scoop devices are conveniently arranged to rotate about a common axis under the control of a common actuating member, so that they are constrained to move radially simultaneously in opposite senses. The control member may be capable of holding the scoop devices in various positions along their range of displacement, and thereby maintaining various constant degrees of filling of the working chamber.

The invention will be further described by way of example, with reference to the accompanying drawings, as applied to a Vulcan hydraulic coupling suitable for connecting a marine oil engine to a pinion of mechanical reduction gearing by which the propeller shaft is driven.

In the drawings Fig. 1 is a section on the line 1—1 in Fig. 2, and

Fig. 2 is a section on the line 2—2 in Fig. 1.

The vaned impeller 10, which is adapted to be connected to the engine crank-shaft through shaft 10a, is juxtaposed to the vaned turbine runner 11 the hub 12 of which is journaled on the outside of a fixed sleeve 13 carried by a bracket 14. A driven shaft 15 passes with radial clearance through this sleeve and is secured by a flange 16 and bolts 16a to the runner 11. A chamber 22 hereinafter referred to as a scoop chamber is formed by a shell having a cylindrical portion 17 bolted by a flange 18 and bolts 18a to the periphery of the impeller 10. At the other end the cylindrical portion 17 merges into a flat end wall 19 having webs 19a and provided with a central aperture 20 larger than the external diameter of the sleeve 13. This shell and the impeller form between them the working chamber, which comprises the working circuit between the juxtaposed pump impeller 10 and turbine runner 11 and a scoop chamber 22 bounded by the back of the runner 11 and the shell 17, 19. Liquid can pass between the scoop chamber 22 and the working circuit through the gap 44 between the impeller and runner. When the coupling is operating a certain amount of liquid always remains in the scoop chamber 22 owing to pressure within the working circuit, and if this liquid is removed the working circuit will be progressively emptied.

The back of the runner 11 is preferably provided with a filling piece 21 or is otherwise so shaped as to leave between the runner and the shell wall 19 a short scoop chamber 22 the radially outer part of which has the shape of a thin ring of rectangular section.

The reservoir chamber 23 is formed between the wall of the working chamber and a rotary casing. This casing has a cylindrical or substantially cylindrical portion 24 merging at one end into a wall 25 shrouding the back of the impeller and having an intumed central portion 26 bolted by bolts 26a to the impeller hub. The other end of the cylindrical casing portion 24 merges into an end wall 27 having at its centre means for preventing leakage from the reservoir along the outside of the fixed sleeve 13, such for example as a stuffing box gland 28.

Two bosses 29 and 30, spaced along and projecting in axial alignment from the fixed sleeve 13, form bearings for a tubular scoop shaft 31 having closed ends. This shaft is thus capable of angular displacement about an axis parallel

to the axis of the fixed sleeve and of the main shafts. The inner end of the scoop shaft 31 projects through the aperture 20 in the shell portion 19, and in this end of the scoop shaft is fixed a scoop tube 32 of approximately semi-circular shape, as viewed along the coupling axis. This scoop tube is accommodated in the scoop chamber portion 22 of the working chamber and is capable of angular displacement from a radially inner position (shown in full lines) in which it partly encircles the fixed sleeve 13 to a radially outer position (shown in dotted lines) in which its scooping lip 33 is adjacent to the cylindrical portion 17 of the shell.

The hollow scoop shaft 31 also carries a scoop tube 34 with a mouth 34A, the whole having the shape of a reversed curve, as viewed axially of the coupling axis. This scoop tube is accommodated in the reservoir chamber 23 and is so mounted on the scoop shaft that, when the working-chamber scoop 32 is in its radially outer position, the reservoir-chamber scoop 34 is in its radially inner position, and vice versa. The scoop shaft 31 may be arranged to act as a valve for by-passing the scoop tubes when they are displaced to their radially inner positions, so that liquid picked up by the operative scoop tube is offered an alternative path to that through the other tube. Then the shaft 31 is provided with one or two ports 35 co-operating with passages 36 and 37 in one or both of the bosses 29 and 30, these ports and passages being so arranged that, when the working-chamber scoop 32 is operative, most of the liquid which it picks up is discharged through one or more passages 37 opening directly to the reservoir, and, when the reservoir-chamber scoop 34 is operative, most of the liquid which it picks up is delivered through one or more passages 36 to the interior of the fixed sleeve 13 and passes thence to the working chamber through ducts 38 formed in the runner boss.

Means for controlling the displacement of the scoop tubes include a gear wheel 39 fixed to the scoop shaft 31 and meshing with a pinion 40 fixed to a control shaft 41 journaled in an enlarged part 13A of the fixed sleeve, around which the said gland 28 is disposed. The control shaft 41 is actuated by control means, including gearing 42, which are capable of holding the scoop tubes fast in a variety of different positions.

Restricted drain ports 43 may be provided in the working chamber to allow fluid to discharge from the working circuit into the reservoir 23, for example near the boss of the impeller and positioned to direct liquid on the adjacent end wall 25 of the reservoir chamber, or in the radially outer part of the working chamber, as shown at 43a, and positioned to direct liquid on the peripheral wall 24 of the reservoir chamber. This wall may have a circumferential bulge in way of the scoop tube 34.

If, when the engine is started, the reservoir-chamber scoop 34 is in its radially outer position, the lip 34A of this scoop faces in such a direction that liquid in the reservoir chamber 23 is transferred to the working chamber. Where drain ports such as 43 are provided, a continuous small discharge occurs from the working chamber, being replaced by the scoop 34, so that in order to maintain a good quantity of liquid in the working chamber the scoop 34 must dip into the liquid in the reservoir chamber 23 an amount sufficient to make up for the discharge through ports 43 and 43a. With this arrangement where a continuous circulation of liquid is maintained

advantage is taken of the heat lost through the reservoir wall for cooling the liquid in the working chamber.

If the scoop tubes are now displaced through their full range of movement, the working-chamber scoop 32 engages the liquid in the scoop chamber 22, which communicates with the vortex circuit part of the working chamber by the gap 44 between the impeller and the runner, and the lip 33 of this scoop faces in such a direction that this scoop transfers substantially the whole liquid content of the working chamber to the reservoir chamber very rapidly. To re-engage the coupling it is merely necessary to displace the scoops to the other end of their range of movement.

The dimensions of the reservoir chamber are preferably such that, when the coupling is at rest, the whole liquid content thereof can be accommodated in the reservoir chamber below the aperture 20, as indicated by the liquid surface level 45 in Fig. 2.

If while the working chamber is full the engine is stopped, as soon as the speed approaches zero the ring of liquid in the working chamber collapses and more than half of it escapes through the aperture 20 to the reservoir 23. The coupling is therefore partly disengaged automatically, which ensures that the torque load imposed on the engine when it is restarted is substantially reduced.

Where the engine is of the direct reversing type, the reservoir scoop tube 34 may be provided with two mouths 34A and 34B pointing in opposite directions, so as to enable the working circuit to be refilled when running astern also, a flap valve 34C being provided which automatically closes whichever of the mouths is inoperative.

The casing of the reservoir chamber may be so arranged that its end wall nearer the driving shaft is fixed to the periphery of the impeller, so that the back of the impeller is exposed, and in this case the drain ports, if provided, may be placed near this end wall in the outermost part of the working chamber.

Where the invention is applied to a coupling intended to operate continuously at various partial degrees of filling of the working chamber, the valve ports 35 in the scoop shaft may be omitted and either the scoop tubes may communicate directly with each other as shown in the drawings, or they may be associated with separate passages leading to the respective chambers.

We claim:

1. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber, a rotatable reservoir chamber co-axial with said working chamber, a scoop device in said scoop chamber for transferring liquid therefrom to said reservoir chamber, a scoop device in said reservoir chamber for transferring liquid therefrom to said working chamber, said scoop devices being capable of angular displacement eccentrically with respect to the axis of rotation of the transmitter, so that their scooping lips are displaced radially with respect to said axis, and control means operable for displacing said scoop devices alternatively in such a direction that their lips are displaced radially outwards.

2. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber, said working chamber being formed by

one of said elements and a shell attached to the periphery of this element and shrouding the back of the other of said vaned elements, a rotatable reservoir chamber co-axial with said working chamber, a scoop device disposed in said scoop chamber for transferring liquid from said working chamber to said reservoir chamber, a scoop device in said reservoir chamber for transferring liquid therefrom to said working chamber, said scoop devices being capable of angular displacement eccentrically with respect to the axis of rotation of the transmitter, so that their scooping lips are displaced radially with respect to said axis, and control means operable for displacing said scoop devices alternatively in such a direction that their lips are displaced radially outwards.

3. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber, a rotatable reservoir chamber co-axial with said working chamber, a scoop device in said scoop chamber for transferring liquid therefrom to said reservoir chamber, a scoop device in said reservoir chamber for transferring liquid therefrom to said working chamber, said scoop devices being capable of angular displacement about a common axis, eccentrically with respect to the axis of rotation of the transmitter, and common control means operatively connected to said scoop devices for displacing their scooping lips radially simultaneously in opposite senses.

4. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber, a rotatable reservoir chamber co-axial with said working chamber, a scoop device in said scoop chamber for transferring liquid therefrom to said reservoir chamber, a scoop device in said reservoir chamber for transferring liquid therefrom to said working chamber, said scoop devices being capable of angular displacement about a common axis, eccentrically with respect to the axis of rotation of the transmitter, and common control means operatively connected to said scoop devices for displacing their scooping lips radially simultaneously in opposite senses and capable of holding said scoop devices in various positions along their range of displacement so as to maintain various constant degrees of filling of said working chamber.

5. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber having an end wall having a central aperture, a transmission shaft penetrating said aperture and carrying one of said elements, a rotatable reservoir chamber co-axial with said working chamber and enclosing at least said apertured end wall, a fixed sleeve in said reservoir chamber and surrounding said shaft, a hollow control shaft journaled on said sleeve eccentrically with respect to said transmission shaft, and two scoop tubes mounted on and communicating with the interior of said control shaft, said scoop tubes being disposed in said scoop and reservoir chambers respectively and positioned to be alternatively displaced, on rotation of said

control shaft, in such a direction that their mouths approach the peripheries of the respective chambers.

6. A hydraulic power transmitter of the kinetic type comprising a working chamber including driving and driven vaned elements and a scoop chamber having an end wall having a central aperture, a transmission shaft penetrating said aperture and carrying one of said elements, a rotatable reservoir chamber co-axial with said working chamber and enclosing at least said apertured end wall, a fixed sleeve in said reservoir chamber and surrounding said shaft, a bearing on said sleeve, a hollow control shaft journaled in said bearing eccentrically with respect to said transmission shaft, and two scoop tubes mounted on and communicating with the interior of said control shaft, said scoop tubes being disposed in said scoop and reservoir chambers respectively and positioned to be alternatively displaced, on rotation of said control shaft, in such a direction that their mouths approach the peripheries of the respective chambers, and said control shaft having a port co-operating with at least one passage in said bearing to form a valve for bypassing at least one of said scoop tubes when its mouth is displaced to its radially inner position.

7. A hydraulic coupling comprising two vaned members, a casing attached to the periphery of one of said vaned members to form therewith a working chamber, said casing shrouding the back of the other of said vaned members and having a central aperture, a rotary reservoir chamber enclosing at least said casing, a fixed sleeve in said reservoir chamber and penetrating said aperture, a bearing on said sleeve, a transmission shaft passing through said sleeve and carrying the other of said vaned members, a hollow control shaft journaled in said bearing eccentrically with respect to said transmission shaft, and two scoop tubes mounted on and communicating with the interior of said control shaft and disposed in said reservoir and working chambers respectively, said control shaft having a port registrable alternatively with a port leading to the interior of said sleeve and with a port opening directly to said reservoir.

8. A hydraulic coupling of the kinetic type comprising a working chamber including a scoop chamber, a rotary reservoir chamber surrounding at least part of said working chamber, a leakage port in said working chamber positioned to permit a continuous slow discharge of liquid therefrom to said reservoir chamber, a scoop in said reservoir chamber and communicating with said working chamber for transferring liquid from said reservoir chamber to said working chamber, and a scoop which is capable of displacement eccentrically with respect to the axis of rotation of the coupling, which is disposed in said scoop chamber and which communicates with said reservoir chamber, displacement of said second-mentioned scoop to its radially outer position causing rapid evacuation of liquid from said working chamber.

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