

April 29, 1941.

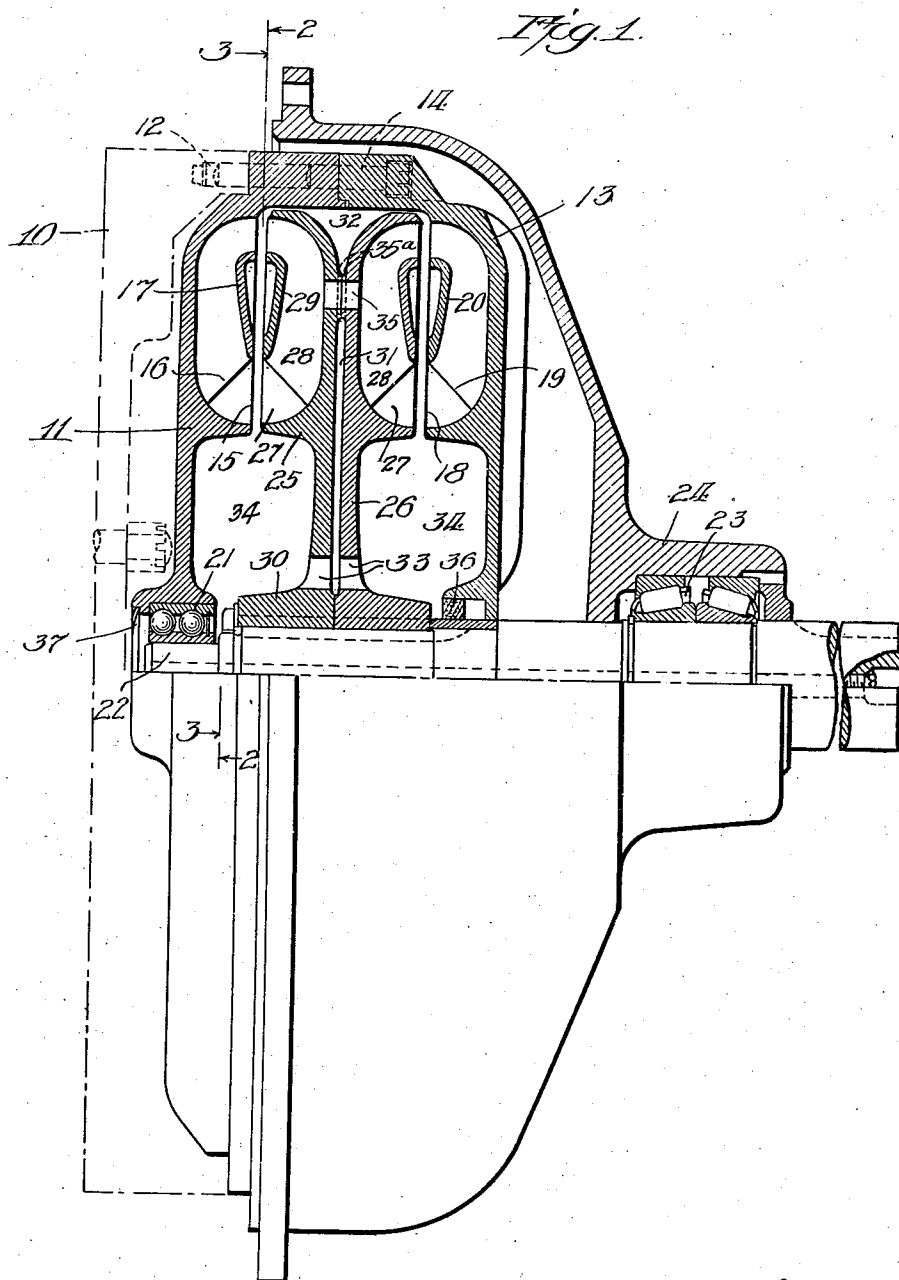
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2,240,270

HYDRAULIC TRANSMISSION

Filed Dec. 2, 1933

2 Sheets-Sheet 1



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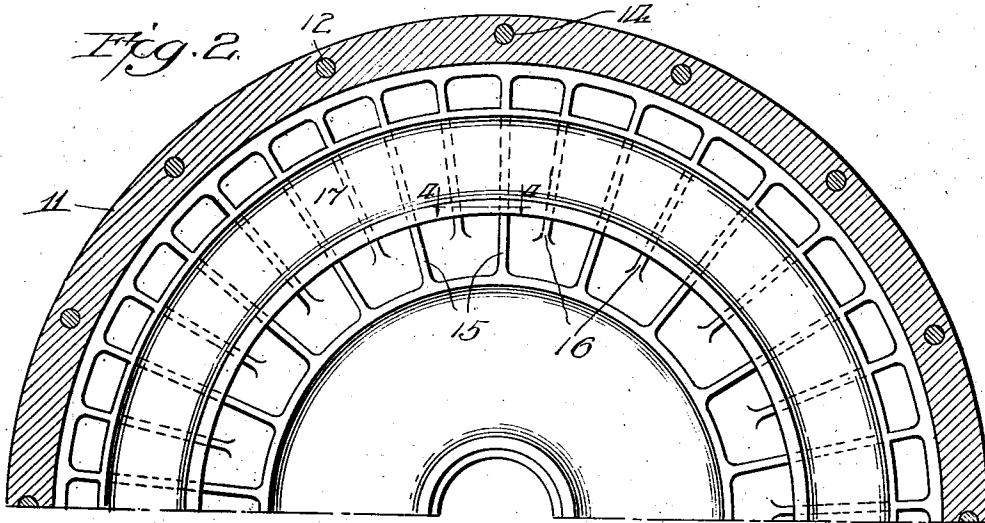
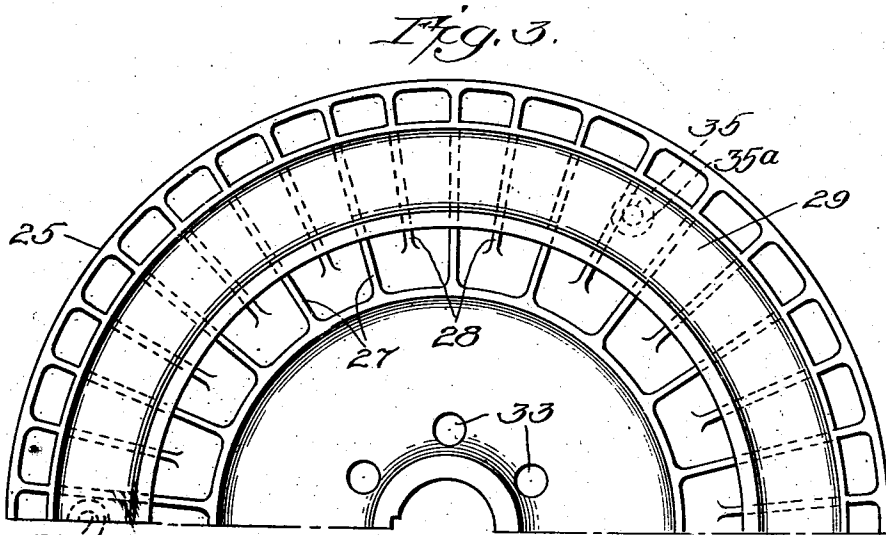
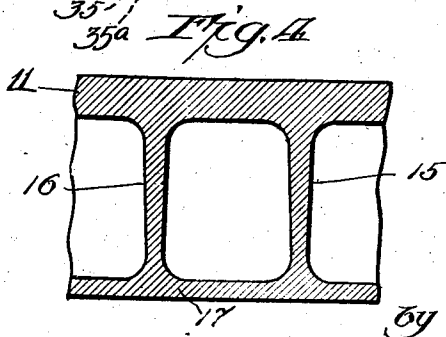
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HYDRAULIC TRANSMISSION

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2 Sheets-Sheet 2



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HYDRAULIC TRANSMISSION

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5 Claims.

(Cl. 60-54)

My invention relates to hydraulic transmissions and more particularly to that type in which power is transmitted by circulating a working fluid between a driving member in the form of a pump or impeller and a driven member arranged as a turbine part or runner.

Briefly, my improved transmission embodies a pair of fluid circuits defined by cooperating impeller and turbine elements which are so related that the hydraulic thrust set up in one circuit chamber is substantially equal and opposite to the thrust created in the other chamber, thus avoiding any necessity for providing a separate thrust bearing to absorb this load. In such devices, the working fluid ordinarily does not completely fill the machine when at rest and it is important to provide some means for removing the mass of air over the fluid, known as deaerating the transmission, shortly after the beginning of operation.

It is, therefore, one object of my invention to arrange the parts of the transmission for rapid deaeration and a directed movement and collection of the air in a portion of the apparatus where it acts as a cushion to compensate for temperature expansion of the fluid.

A further object is to provide for pressure equalization between the fluid chambers and to substantially avoid impact between the streams directed by the impeller elements toward the runners.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings, Fig. 1 is an elevation, partly in section, of my improved hydraulic transmission.

Fig. 2 is a section along the line 2-2 in Fig. 1, looking in the direction of the arrows, and showing the disposition of the vanes or blades in one impeller element of the transmission.

Fig. 3 is a section along the line 2-2 in Fig. 1, looking in the direction of the arrows, and showing the disposition of the vanes in a runner.

Fig. 4 is an enlarged section along the line 4-4 in Fig. 2, looking in the direction of the arrows, and showing one of the fluid circuits in an impeller.

Referring to Fig. 1 of the drawings, the numeral 10 designates generically a driving member, which may take the form of a flywheel, as shown, or may be simply a shaft or any other

type of rotary element. An impeller 11 is secured to one face of the flywheel by means of cap screws 12 and a second impeller 13 is secured to the impeller 11 by cap screws 14 which are arranged in alternating relation with the cap screws 12 around the periphery of the impeller 13. Projecting from the principal wall of the impeller 11 toward the right, as viewed in Fig. 1, is a plurality of vanes 15 which are disposed in alternating relation to similar but shorter vanes 16 around the impeller 13. In accordance with accepted practice, the vanes 15 and 16 are flat and are radially disposed around the impeller and intermediate portions of their right edges, as viewed in Fig. 1, are connected by an annular shroud 17 to thereby form a plurality of radial fluid passages whose outlets are located around the periphery of the impeller 11 and the inlets radially inward thereof. Similar vanes 18 and 19 project from the impeller 13 and similar passages with these vanes and the wall of the impeller are formed by an annular shroud 20. The central portion of the impeller 11 is axially bored to receive a ball bearing 21 and journaled in this bearing is one end of a driven shaft 22 that is also journaled in a thrust bearing 23 mounted in a housing 24 which encloses the transmission and which, in the present instance, may be bolted to the crankcase of the engine to which the flywheel 10 is attached. A pair of turbine runners 25 and 26 are symmetrically disposed between the impellers 11 and 13 and each runner is provided with alternating vanes 27 and 28 corresponding to the impeller vanes 15 and 16, respectively, and the former vanes are connected by a shroud 29 to thereby form a plurality of fluid passages. The fluid passages in the impeller 11 and runner 25 cooperate to form fluid turbine transmission circuits, and similar circuits are formed between the impeller 13 and the runner 26. Each runner is provided with a hub 30 that is keyed to the shaft 22 and the opposed faces of the runner disks may be spaced or recessed to form an annular passage 31 which connects the peripheral space 32 around the runners with short passages 33 in each of the runners that in turn are in communication with a reservoir 34 that extends around the hubs 30 between the impellers 11 and 13 and inwardly of the fluid circuits to which reference has already been made. Communicating openings 35 in the runners 25 and 26 provide a pressure equalization passage between the fluid circuits of the transmission. The passages 35 are not in communication with the annular pas-

sage 31 and separation thereof may be accomplished by forming a number of suitable bosses 35a on each runner which abut as indicated in Fig. 1 and through which the aforesaid passages 35 are drilled. Packing 36 is disposed around and between the shaft 22 and the impeller 13, and other packing 37 closes the central opening through the impeller 11, thus completely sealing the reservoir 34.

In describing the operation of my improved transmission, it will first be assumed that the apparatus is at rest and partially or almost completely filled with any desired working fluid, such as oil or water. Accordingly, there will be a mass of air in the upper portion of the apparatus above the surface of this fluid and it is necessary to shift the position of this air to secure the maximum efficient operation of the transmission. When the impellers 11 and 13 begin to rotate, the runners then being stationary, the pressure in the space 32 is lower than that in the fluid circuits. The working fluid is discharged by centrifugal action from the delivery ends of the fluid passages in the impellers into the fluid passages of the runners where the pressure and kinetic energy created and stored in the fluid by the impellers are converted into a motion of rotation. Similar fluid is also discharged into the space 32 to thus drive the air radially inward through the passage 31 into the reservoir 34 where it is liberated. Within a short time after the beginning of operation, the mass of air has collected around the hubs 29, while the heavier working fluid is maintained by centrifugal action in an annular zone within which the vanes of the impellers and runners operate.

Since the transmission circuits in the apparatus are located so that the fluid streams delivered by the impellers are directed oppositely and toward each other, there is no thrust between the impellers and the runners that requires the use of a separate thrust bearing. Thrust reactions from the load are transmitted through the bearing 23 to the housing 24. Moreover, the provision of the passages 35 provides a simple method of equalizing pressure between the circuits that may be due to variations in the casting diameters of the parts and other imperfections.

It will be particularly noted that although the streams delivered by the impellers are directed toward each other, these streams are so confined that they are forced only against the runners, so that no energy is lost by direct impacting of the streams on each other.

Easy, rapid and complete filling of the fluid transmission circuits of the apparatus is effected due to the fact that these circuits are located radially outward of the reservoir space 34, so that full use can be made of centrifugal action for filling these circuits when the transmission begins operation.

I claim:

1. In a hydraulic transmission, the combination of a casing having a pair of axially spaced impellers formed therein in facing relation, a shaft in the casing coaxial with the impellers, and a pair of oppositely facing runners mounted on the shaft in abutting relation, the impellers and runners coacting to form a pair of liquid working chambers and there being a peripheral

space between the chambers and casing, the abutting portions of the runners forming a wall that defines with the casing a pair of reservoirs and the abutting surfaces of the runners being recessed to form a deaerating passage connecting the space and the reservoirs and through which air is driven to the reservoirs during the early stages of operation.

2. In a hydraulic transmission, the combination of a casing having a pair of axially spaced impellers formed therein in facing relation, a shaft in the casing coaxial with the impellers, and wall means extending from and encircling the shaft and having on opposite sides adjacent the periphery thereof a pair of oppositely facing runners, the impellers and runners coacting to form a pair of liquid working chambers and there being a peripheral space between the chambers and casing and the wall means forming with the casing a pair of reservoirs located inwardly of the chambers, the wall means having a deaerating passage connecting the space and the reservoirs and through which air is driven to the reservoirs during the early stages of operation.

3. In a hydraulic transmission, the combination of a casing having a pair of axially spaced impellers formed therein in facing relation, a shaft in the casing coaxial with the impellers, and a pair of oppositely facing runners mounted on the shaft in abutting relation, the impellers and runners coacting to form a pair of liquid working chambers and there being a peripheral space between the chambers and casing, the abutting portions of the runners forming a wall that defines with the casing a pair of reservoirs located inwardly of the chambers and the abutting surfaces of the runners being recessed to form a deaerating passage connecting the space and the reservoirs and through which air is driven to the reservoirs during the early stages of operation.

4. A hydraulic transmission comprising a casing enclosing a pair of fluid turbine transmission circuits each composed of a pair of cooperative shells, a peripheral space being included between the casing and shells, a shaft coaxial with the casing, and wall means extending from and encircling the shaft and connected to the innermost pair of shells to form with the casing a pair of reservoirs located inwardly of the circuits, the wall means having a deaerating passage connecting the space and the reservoirs and through which air is driven to the reservoirs during the early stages of operation.

5. A hydraulic transmission comprising a casing enclosing a pair of fluid turbine transmission circuits each composed of a pair of substantially enclosed cooperating shells, a shaft coaxial with the casing, a peripheral space being included between the casing and shells, wall means extending from and encircling the shaft and connected to the innermost pair of shells to form with the casing a pair of reservoirs located inwardly of the circuits, and conduit means connecting the space and the reservoirs and through which air is driven to the reservoirs during the early stages of operation.

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