May 31, 1932. G. BAUER ET AL 1,860,701

HYDRAULIC POWER TRANSMITTER

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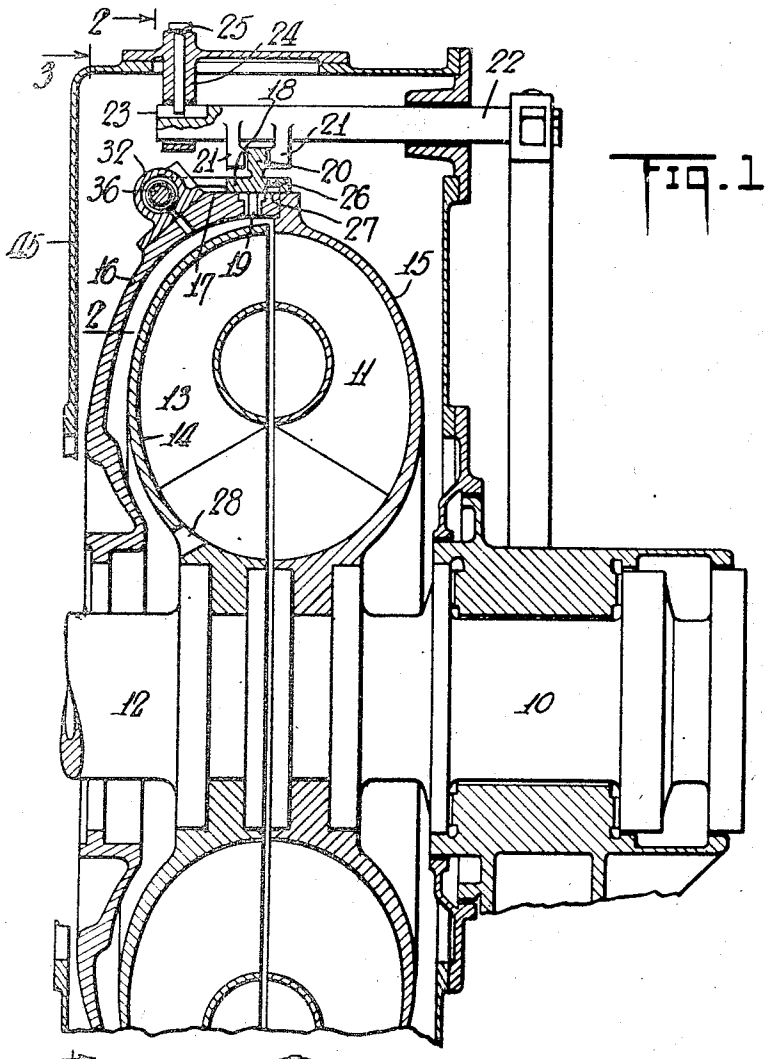


Fig. 1.

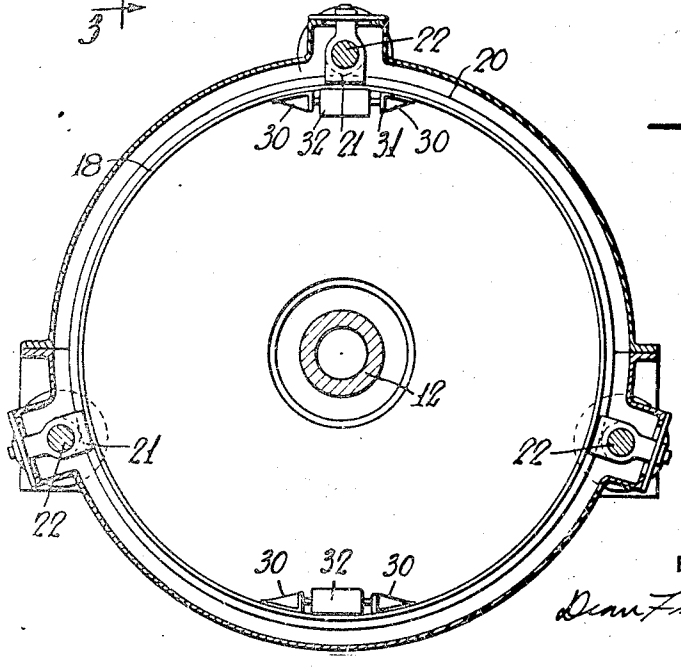


Fig. 3.

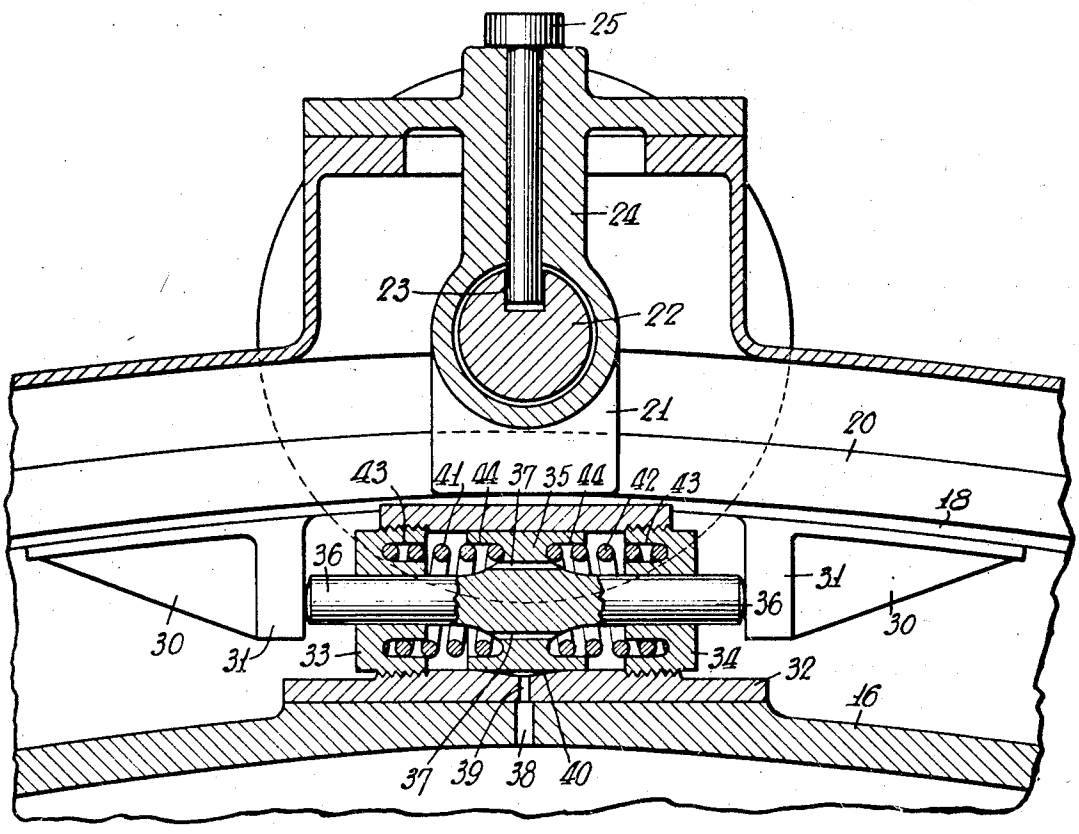
INVENTOR
Gustav Bauer
Walter Brose
BY
Dean Fairbanks Hirsch & Fraber
ATTORNEYS

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Fig. 2.



INVENTOR
Gustav Bauer
Walter Brose
BY
Dean Fairbank Hirsch & Foster
ATTORNEYS

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UNITED STATES PATENT OFFICE

GUSTAV BAUER AND WALTER BROSE, OF HAMBURG, GERMANY

HYDRAULIC POWER TRANSMITTER

Application filed June 18, 1930. Serial No. 461,932.

This invention relates to that type of hydraulic power transmitter or fluid clutch in which a pair of primary and secondary rotors are each provided with an annular series of vanes, blades or passages, and in which the two rotors are so designed and so juxtaposed that the liquid in said passages causes a rotation of the secondary rotor upon rotation of the primary rotor. Such a construction is shown, and broadly claimed in the Föttinger Patent No. 1,199,359.

The present invention is particularly adapted to that type of Föttinger hydraulic transmitter in which means are provided for the evacuation of the chambers and passages of the fluid operating circuit whereby the driving of the secondary rotor from the primary rotor may be interrupted at will. In this type of hydraulic transmission system a discharge control ring may be provided which is rotatable with one or the other of said rotors, and which is relatively shifted axially with respect to its rotatably associated rotor in order to selectively fill or evacuate the chambers and passages of said fluid circuit. Such an apparatus is shown in Patent No. 1,613,154 and the Bauer British Patent No. 296,969. In operation, however, the primary rotor may be subjected to varying driving forces or other torsional influences which cause accelerating and decelerating movements and tend to produce oscillations between said discharge control ring and its rotatably associated rotor. The usual positive rigid connecting means, such as keys between said discharge control ring and its associated rotor, permits axial movement of the control ring and the drive of the latter in the direction of rotation of the rotor. Thus the control ring is subjected to oscillations imposed on the rotor, and the driving connections are subjected to stresses and wear which develop lost motion and knocking.

The present invention omits the usual rigid connections and in place thereof provides means which permit yieldingly restrained, relative rotational movement therebetween. Thus the torsional variations of the rotor are not transmitted to the ring, but the ring is normally held in such position that its ports may be moved into or out of registry with the ports of the rotor or casing upon axial movement.

The invention still further provides fluid actuated means for yieldably connecting the discharge control ring and one of the rotors for associated rotational movement, said means being automatically replenished with actuating fluid from the operating circuit of the rotor impelling fluid.

In its preferred form our invention involves one or more double acting damper devices mounted and connected in such a manner that they damp the pulsations but at the same time permit free axial displacement of the control ring in the usual manner.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the appended claims, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof.

Fig. 1 is a central longitudinal section showing a concrete exemplification of the present invention.

Fig. 2 is a section taken on line 2—2 of Fig. 1, but on a larger scale.

Fig. 3 is a section taken on line 3—3 of Fig. 1, but on a smaller scale.

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring particularly to the accompanying drawings in which a specific embodiment of the present invention is shown there is provided a primary rotor comprising a primary shaft 10 which may be driven by any suitable source of power such as an internal combustion engine (not shown) and which has attached thereto a series of blades 11 constituting the driving elements of the system. Disposed in co-operative relationship with said

primary rotor is a secondary rotor comprising a secondary shaft 12 which has associated therewith a series of blades 13 confined in a casing 14 and constituting the driven elements of the system. The blades 11 are confined in a casing 15 the outer edge of which has secured thereto an outer casing 16 for rotational movement therewith. This outer casing 16 has a cylindrical surface 17 which is embraced by a discharge control ring 18 and which is provided with a plurality of openings 19 which lead from the fluid operating circuit of the system.

In order to provide means for effecting the axial movement of the control ring 18 along the surface 17, said ring is provided with an annular flange 20, which is engaged on both sides thereof by a pair of jaws 21 constituting part of a reciprocally mounted spindle 22. One end of this spindle 22 is provided with a groove 23, and is supported at this end in a bearing 24. Passing vertically through said bearing is a pin 25 which has the lower end thereof extending in said groove 23 and which serves to prevent the rotational movement of the spindle 22.

In order to obviate the jamming of said ring 18 against axial movement, a plurality of such spindles 22 and associated jaws 21 are provided. These spindles 22 are approximately equally spaced along the ring 18 and are connected together by a suitable linkage system so that they can be shifted in unison.

The ring 18 has a plurality of port openings 26 which lead into an enlarged inner annular groove 27 provided in said ring, said enlarged groove serving to ensure the connection of said openings 26 with the openings 19 when the ring 18 is shifted axially to effect the evacuation of the fluid circuit. The refilling of the fluid circuit can subsequently be effected by the delivery of the impelling liquid through openings 28 into one of the members defining the fluid operating circuit.

In order to permit limited oscillation of the ring 18 in respect to the casings 15 and 16 there is provided a plurality of yieldable connection means each of which includes a pair of brackets 30 rigidly carried by said control ring 18, portions of said brackets constituting abutments 31. Secured to the outer casing 16 is a cylindrical member 32, the ends of which are closed by heads 33 and 34. Mounted for reciprocal movement in said cylinder 32 is a piston 35 having piston rods 36 which extend from both sides thereof, and which pass through the cylinder heads 33 and 34 into engagement with the abutments 31 so that any relative movement between the control ring 18 and the casing 16 is transmitted to the piston 35.

In order to yieldably react against the movement of piston 35 and the cylinder 32, the cylinder on both sides of said piston is filled with suitable liquid. One or more ducts 37 are provided which serve as connection means between the chambers on opposite sides of the piston 35. These are preferably in the piston. By means of this arrangement, when the piston 35 is moved in either direction in the cylinder 32 in response to the relative movements of the ring 18 with respect to the casing 16, the fluid in said cylinder will react against said movement of the piston, but will permit said piston to move very slowly while the fluid escapes through the ducts 37 from the compressing chamber into the adjoining chamber. Each cylinder 32 may be maintained continuously replenished with pressure fluid by providing the casing 16 with an opening 38 which is aligned with a corresponding opening 39 in the cylinder 32, and which leads into the interior of said cylinder through passageway 40 formed by tapering grooves in the adjacent portion of said cylinder. In this manner each cylinder 32 is automatically replenished with actuating fluid seeping through the passageway 40 from the operating circuit of the rotor impelling fluid. In order to urge the ring 18 to a normal circumferential position with respect to the casing 16, resilient means may be provided, which include springs 41 and 42, the ends of which are disposed in grooves 43 and 44 of the cylinder heads 33, 34, and the piston 35 respectively. These springs 41 are preferably wound in different directions in order to balance the torsional tendencies acting on the piston 35, and thereby obviate its rotational movement in the cylinder 32. These springs 41, 42, also serve to yieldably restrain the relative rotational movement of the ring 18 and the casing 16. It should be noted that the length of the piston 35 and the limit of compressibility of the springs 41 and 42 are such that the openings 38 and 39 are covered when said piston is in its central or normal position. However, this arrangement does not preclude the impelling fluid in the operating circuit from seeping through the passageway 40 into the cylinder 32 to replenish said cylinder in any position of the piston. A more rapid flow is permitted when the piston is moved toward either end.

In the operation of the system, when it is desired to suspend the operation of the secondary rotor, the discharge ring 18 is shifted axially by the shifting of the spindles 22. This ring 18 is shifted thereby until the port openings 26 are positioned in line with the port openings 19. When in this position the impelling fluid instead of traveling within the operating circuit defined by the casings 14 and 15 will find its way out through the space between these casings and out through the ports 19 and 26, into an outer stationary casing 45 to a reservoir or other storage place. The abutments 31 are long enough so that re-

gardless of any axial position of the ring 18, said abutments will be in continuous engagement with the ends of the piston rods 36.

It should be noted that the cylinder 32 is shown as mounted on casing 16, and the abutments are shown as mounted on the discharge control ring 18, but this relative positioning is not essential and may be changed without departing from the spirit of the invention.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A hydraulic power transmitter including a primary rotor, a secondary rotor, a discharge control ring mounted for associated rotation with one of said rotors, means for effecting the relative axial movement of said ring with respect to its associated rotor to discharge liquid from said rotors, and means for yieldably restraining relative rotational movement of said ring and its associated rotor.

2. A hydraulic power transmitter including a primary rotor, a secondary rotor, an axially movable discharge control ring mounted for associated rotation with said primary rotor, and means for yieldably restraining relative rotational movement of said ring and said primary rotor while permitting controlled axial movement of said ring.

3. A hydraulic transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for axial movement with respect to said primary rotor, and means connecting said discharge ring and said primary rotor for associated rotational movement while permitting yieldingly resisted limited relative rotational displacements therebetween.

4. A hydraulic transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for axial movement with respect to said primary rotor, means connecting said discharge ring and said primary rotor to effect associated rotational movement while permitting limited relative rotational displacements therebetween, and retarding means for yieldably restraining said relative displacements.

5. A hydraulic transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors and fluid containing retarding means yieldably connecting the discharge control ring and one of said rotors to effect associated rotational movement, said means being automatically replenished with fluid from the operating circuit of the rotor impelling fluid.

6. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, a double acting hydraulic cylinder connected to said primary rotor, a piston mounted for reciprocation in said cylinder, and means for effecting reciprocation of said piston in response to the relative circumferential displacement of said discharge control ring and said primary rotor, said piston being provided with a duct passing therethrough whereby the compressed fluids slowly pass from one side of the piston to the other.

7. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, a double acting hydraulic cylinder connected to said primary rotor, a piston reciprocally mounted in said cylinder, and means for effecting the slidable movement of said piston in response to the relative circumferential displacement of said ring and said primary rotor, said piston and cylinder being so constructed that the compressed fluids can slowly pass from one side of the piston to the other.

8. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, a double acting hydraulic cylinder connected to said primary rotor, a piston mounted for reciprocation in said cylinder, means permitting passage of liquid from one side of the piston to the other, and means for sliding said piston endwise in said cylinder in response to the relative rotational displacement of said discharge control ring and said primary rotor, said cylinder being provided with a passageway which leads into the primary rotor, said piston serving to control said passageway.

9. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, abutment members on said control ring, a cylinder connected to said primary rotor, and having cylinder heads on both ends thereof, a piston mounted for reciprocal motion in said cylinder, piston rods extending from both sides of said piston and engaging said abutment members, and means associated with said cylinder and piston for yieldably restraining their relative movements.

10. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative

axial movement with respect to said rotors, abutment members on said control ring, a cylinder connected to said primary rotor, and having cylinder heads on both ends thereof, a piston mounted for reciprocal motion in said cylinder, piston rods extending from both sides of said piston and engaging said abutment members, and springs disposed in said cylinder between the cylinder heads and the piston whereby said control ring is constantly urged circumferentially into a predetermined normal position with respect to the primary rotor.

11. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, abutment members on said control ring, a cylinder connected to said primary rotor and having cylinder heads on both ends thereof, a piston mounted for reciprocal motion in said cylinder, piston rods extending from both sides of said piston and engaging said abutment members, means associated with said cylinder and piston for yieldably restraining the relative rotation displacement of said discharge control ring and the primary rotor, and means for preventing the rotational movement of said piston about its axis.

12. A hydraulic power transmitter, including a primary rotor, a secondary rotor, a discharge control ring mounted for relative axial movement with respect to said rotors, abutment members on said control ring, a cylinder connected to said primary rotor and having cylinder heads on both ends thereof, a piston mounted for reciprocal motion in said cylinder, piston rods extending from both sides of said piston and engaging said abutment members, means associated with said cylinder and piston for yieldably restraining the relative rotation displacement of said discharge control ring and the primary rotor, and a pair of springs disposed in said cylinder between the cylinder heads and the piston, said springs being wound in opposite directions whereby the torsional actions of the springs on the piston are balanced.

13. A hydraulic power transmitter of the Föttinger type, including a rotor, a discharge control ring mounted on said rotor for controlling the discharge of liquid therefrom, a member mounted on said rotor, means permitting, but yieldingly resisting relative circumferential movements of said member in respect to said rotor, and means permitting axial, but preventing relative circumferential movements of said member and said ring.

14. A hydraulic power transmitter of the Föttinger type, including a rotor having a discharge control ring rotatable therewith, means for damping circumferential oscillations, but permitting axial movement of said ring, said means including a pair of members, one secured to said rotor and the other having sliding connections with said ring axially of the latter, and means for yieldingly resisting relative movements of said members circumferentially of said rotor.

15. A hydraulic power transmitter of the Föttinger type, including a rotor having a discharge control ring rotatable therewith, means for damping circumferential oscillations, but permitting axial movement of said ring, said means including a pair of members, one secured to said rotor and the other having sliding connections with said ring axially of the latter, and a pair of oppositely acting springs for yieldingly resisting relative movements of said members circumferentially of said rotor.

Signed at Hamburg, Germany, this 15th day of May, 1930.

DR. GUSTAV BAUER.
WALTER BROSE.