Dec. 25, 1928. 1,696,307

C. D. JAMES

HYDRAULIC POWER TRANSMISSION DEVICE

Filed April 22, 1927

Fig. 1.

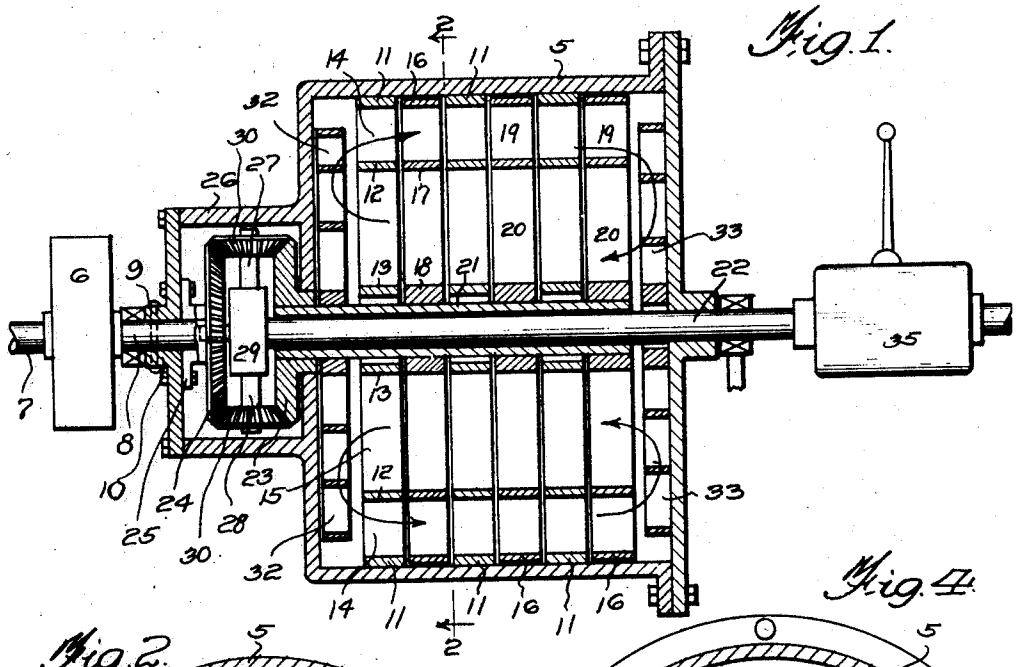


Fig. 4.

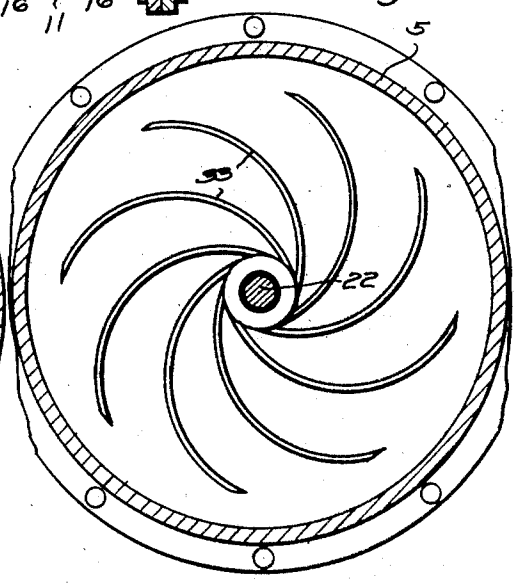
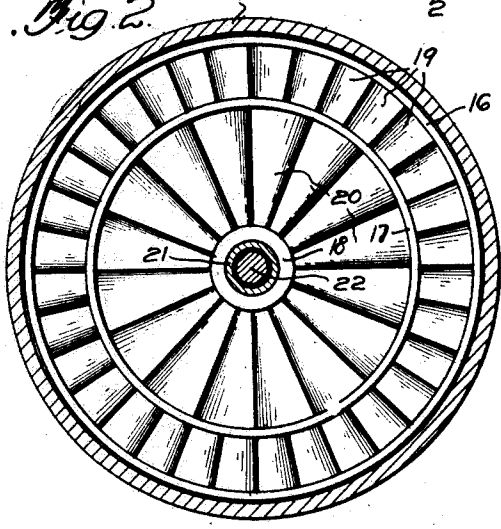


Fig. 2.



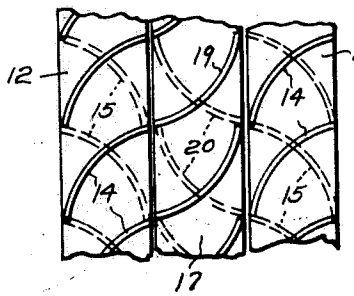


Fig. 3.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC POWER-TRANSMISSION DEVICE.

Application filed April 22, 1927. Serial No. 185,851.

This invention relates to a hydraulic power transmission device, and more particularly to a power transmission device adapted for use in conjunction with internal combustion engines. It is a well known fact that the internal combustion engine operates with the greatest efficiency and economy when run at a certain rate of speed.

One of the primary objects of the present invention is to provide a hydraulic power transmission device of such a nature that the driving element may be operated at a uniform rate of speed and consequently, at the maximum efficiency, while permitting the driven element to vary its movement in accordance with load conditions, said driven element moving at low speed and with high torque when the load is heavy and with lower torque and higher speed as the load decreases.

Further objects and advantages of the invention will be set forth in the detailed description which follows.

In the accompanying drawing:

Fig. 1 is a vertical sectional view of a power transmission device constructed in accordance with the invention.

Fig. 2 is a transverse vertical sectional view on line 2—2 of Fig. 1.

Fig. 3 is a detail view illustrating three of the associated vane carriers, hereinafter described, and

Fig. 4 is a transverse sectional view through the drum adjacent one end thereof and illustrating one of the impellers that are carried by said drum.

Like numerals designate corresponding parts in all of the figures of the drawing.

The device of the present invention comprises a circular drum 5, which, in the particular embodiment shown, constitutes the driving element. 6 designates a universal joint by which the drum 5 may be connected to the shaft 7 of an internal combustion engine which constitutes the source of power. A stub shaft 8 of the universal joint may be secured by a pin 9, or otherwise, to a hub 10 of the drum. A plurality, in the present case three, vane carriers are secured to the interior of the drum and rotate therewith. These vane carriers comprise the outer rings 11, intermediate rings 12 and inner rings 13. Vanes 14 extend between the rings 11 and 12 and vanes 15 extend between the rings 12 and 13, and by referring to Fig. 3 it will be seen that the vanes 14 and 15 are of opposite pitch.

A plurality of driven vane carriers are disposed between the driving vane carriers. That is to say, the driving and the driven vane carriers alternate, there being first a driving vane carrier, then a driven vane carrier, then a driving vane carrier, then a driven vane carrier, etc., and there may be as many of these vane carriers as may be desired within reasonable limits. The driven vane carriers comprise outer rings 16, intermediate rings 17 and inner rings 18. Vanes 19 are disposed between the rings 16 and 17 and vanes 20 are disposed between the rings 17 and 18 and by referring to Fig. 3 it will be seen that the vanes 20 are of opposite pitch to the vanes 19. The rings 18, and consequently, the entire driven vane carrier structure, are secured to a sleeve 21 which is mounted to turn upon a shaft 22. Shaft 22 carries one of the bevel gear wheels 23 of a conventional type of differential mechanism, the other gear wheel of said mechanism, indicated at 24, being mounted upon the stub shaft 8 and being secured by a collar 25 to the end wall of a housing extension 26 of the drum 5. Bearing studs 27 and 28, which project radially from a block 29 of the shaft 22, carry pinions 30 which mesh with the gears 23 and 24 in a usual and well known way.

Radially acting impellers 32 and 33 are mounted at the opposite ends of the drum 5, impeller 32 being secured to sleeve 21 and impeller 33 being secured to the drum, and serve a purpose which will be hereinafter set forth.

In operation the drum is filled with oil or other suitable fluid and if the engine shaft 7 be operated at a uniform rate of speed, a corresponding rate of rotation will be given to the drum 5. This will result in setting up a circulation of the oil in the drum in the direction indicated by the arrows. That is to say, the outer driving vanes 14 will drive the oil longitudinally along the outer sides of the drum in one direction and the inner driving vanes will force the oil in the opposite direction, since the pitch of these inner and outer vanes is reversed. It will be noted that the inner vanes are considerably longer than the outer vanes, but there are twice as many

outer vanes as there are inner vanes and it is intended to so design the structure that the effectivee area of the two sets of vanes will be the same. It will be clear that the motion transmitted through the oil or other fluid by the driving vanes, will cause said oil to act upon the driven vanes to tend to turn the sleeve 21 in the direction of rotation of the drum 5.

The reversal of direction of flow of the oil at the opposite ends of the casing is aided by the radial impellers 32 and 33, the blades of the latter being pitched to draw the oil inwardly toward shaft 22 and the former being pitched to thrust the oil away from the shaft 22.

The movement of the sleeve 21 is transmitted through gear 23, pinions 30, stub shafts 27 and 28 and block 29 to the shaft 22, which is the driven element and this shaft may have applied thereto any conventional clutch and reverse mechanism 35.

I am aware of the fact that it has heretofore been proposed to drive a driven shaft from a driving shaft through the medium of a fluid body acted upon by impellers and in turn acting upon vanes. However, as far as I am aware I am the first to devise a structure of this character wherein the fluid is in working action in both directions of travel. It is manifest that this idea might be embodied in many mechanical forms without departure from the basic idea of the invention. Consequently it is to be understood that the invention is not limited to the precise construction set forth but that it includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention what I claim is:

1. A device of the character described comprising a driving drum adapted to receive a body of fluid, a plurality of vane carriers secured within said drum in spaced relation to each other, each of said vane carriers comprising radially aligned inner and outer vanes of reverse pitch, a plurality of driven vane carriers between and alternating with the driving vane carriers each comprising radially aligned inner and outer vanes of reverse pitch and a driven element by which the driven vane carriers are carried.

2. A device of the character described comprising a driving drum adapted to receive a body of fluid, a set of driving vane carriers secured within and to said drum in spaced relation to each other, each of said vane carriers comprising inner and outer vanes of reverse pitch, a plurality of driven vane carriers between and alternating with the driving vane carriers comprising inner and outer vanes of reverse pitch, a driven element by which the driven vane carriers are carried and impellers at the ends of the drum and acting radially upon the oil to direct it outwardly at one end of the drum and inwardly at the other end of the drum.

3. A structure as recited in claim 1 wherein the driven element comprises a sleeve, a shaft mounted to turn in said sleeve, a bevel gear wheel upon the sleeve, pinions meshing with said bevel gear wheel, bearings for said pinions carried by said shaft a gear wheel meshing with said pinions, and means for connecting said gear wheel to the drum.

4. A device of the character described comprising a drum, means for imparting rotation to said drum from a source of power, a driven shaft upon which said drum is mounted to turn, a sleeve upon the driven shaft, a differential mechanism between the drum, sleeve and shaft, a plurality of driven vane carriers secured to the sleeve, a plurality of driving vane carriers secured to the drum and inner and outer sets of vanes carried by the several vane carriers, the pitch of the outer set of vanes being reversed with respect to the pitch of the inner set of vanes.

5. A structure as recited in claim 4 in combination with a rotary impeller carried by an end wall of the drum and acting radially upon the oil in the direction of circulation thereof and a second impeller secured upon the sleeve and acting radially upon the oil in the direction of circulation thereof.

6. A structure of the character described, comprising an oil containing drum, a plurality of driving vanes therein, disposed, with respect to each other, at intervals along the length of the drum, and comprising radially aligned inner and outer portions of reverse pitch, and annular or ring like members separating said inner and outer portions, a plurality of driven vanes which alternate with the driving vanes, each of the driven vanes comprising radially aligned inner and outer portions of reverse pitch, and annular members which separate said inner and outer portions, the annular members of both the driven and driving vanes being longitudinally aligned with each other to thereby create inner and outer longitudinally extending passageways, across which the said vanes extend, the end vanes being separated from the end wall of the drum to permit the passage of the oil outwardly at one end of the drum and inwardly at the other end of the drum, and means upon the end walls of the drum for causing the oil to travel outwardly at one end of the drum and inwardly at the other end of the drum, so that a circulation of oil will be set up in said drum which will act upon the driven vanes in both directions of travel, and will be acted upon by the driving vanes in both directions of travel.

In testimony whereof I affix my signature.

CLAYTON D. JAMES.