June 23, 1942. I. C. POPPER 2,287,496

HYDRAULIC COUPLING

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Fig. 1.

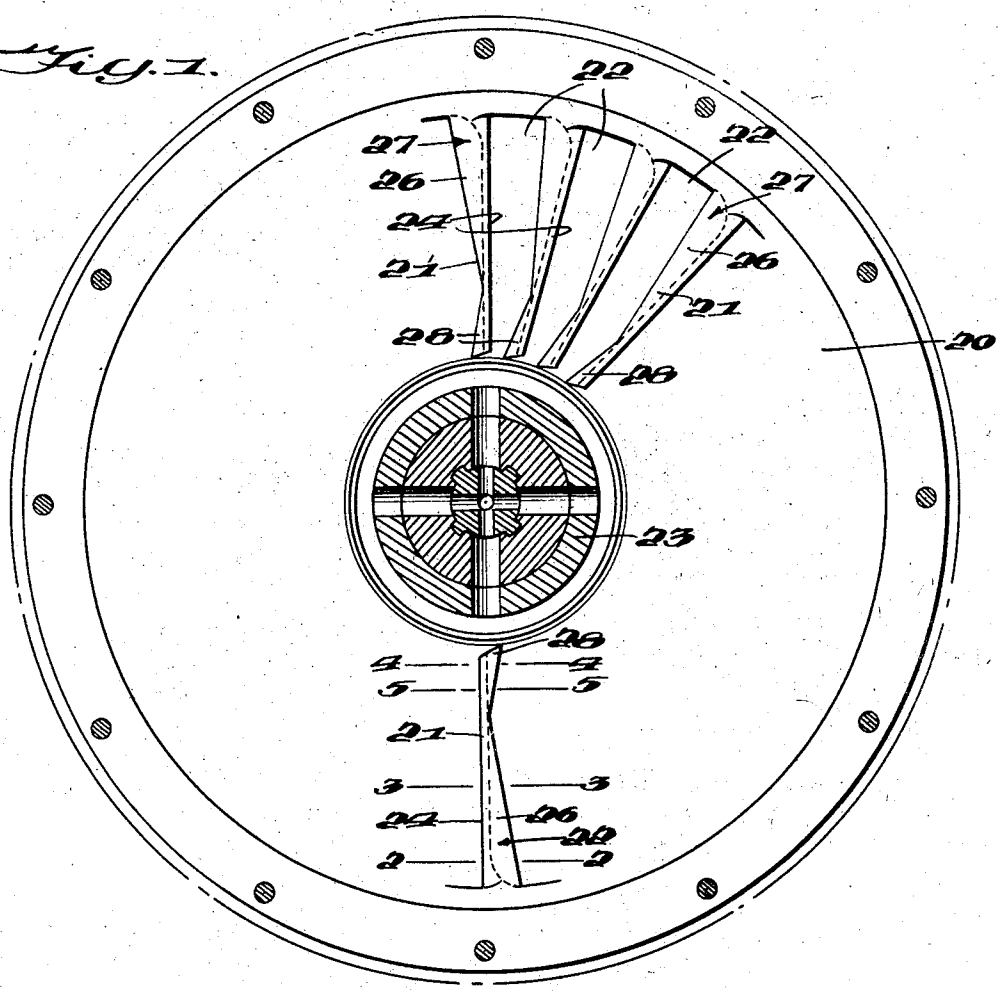
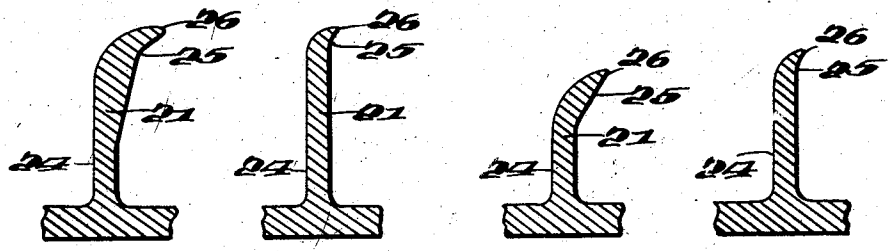


Fig. 2. Fig. 3. Fig. 4. Fig. 5.



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Fig. 6

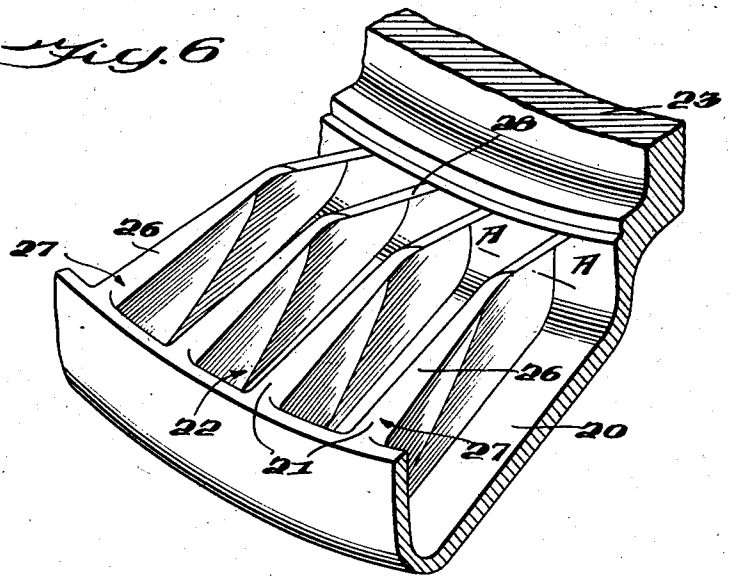


Fig. 7. Fig. 8. Fig. 9.

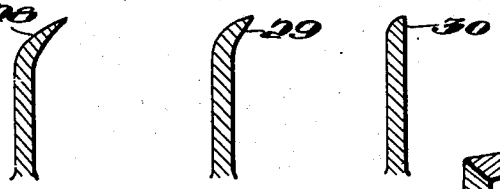
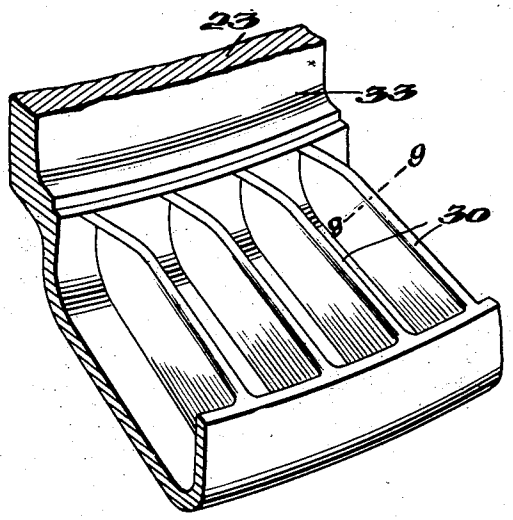


Fig. 10.



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Fig. 11.

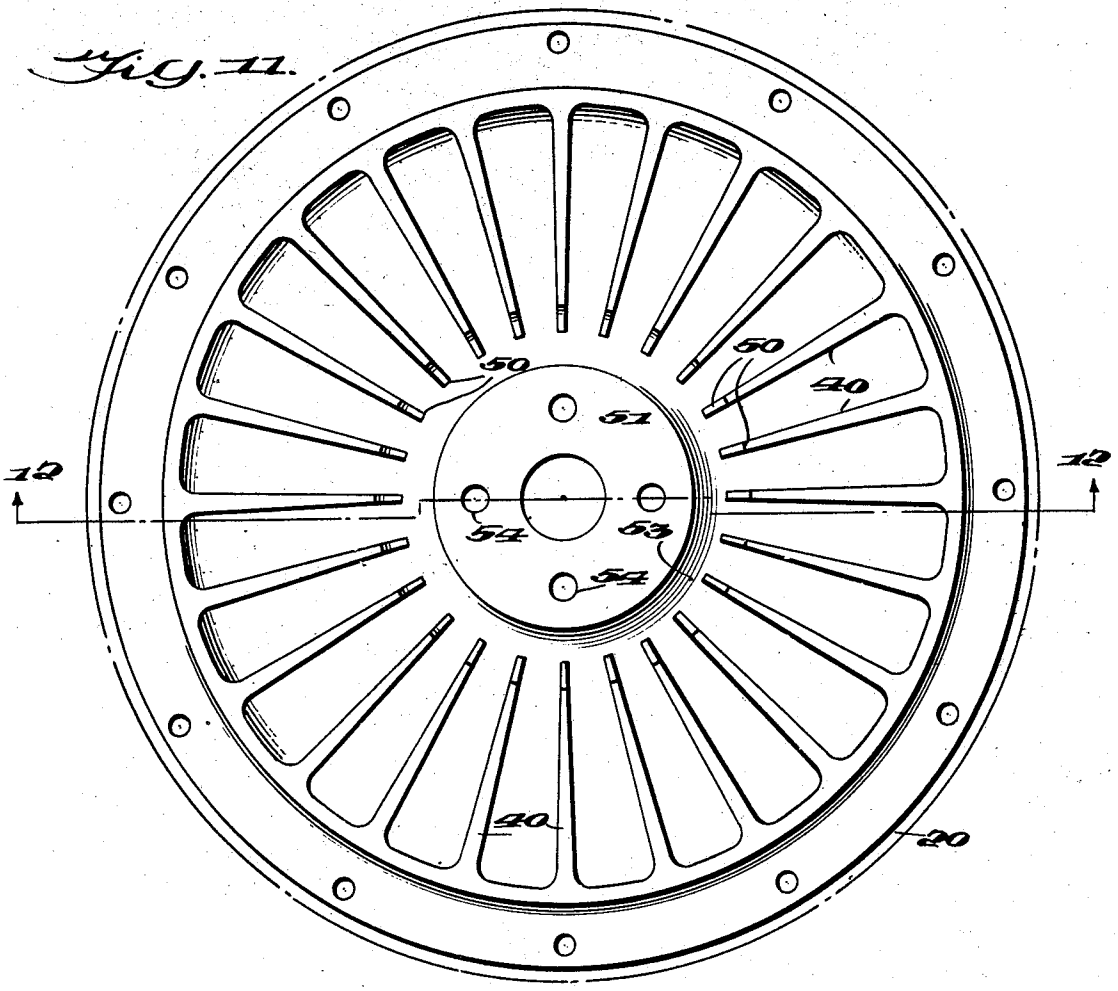


Fig. 12.

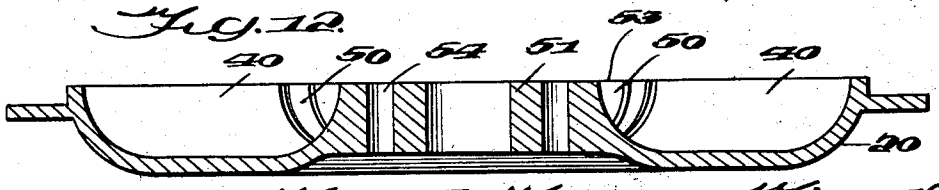


Fig. 14 Fig. 15. Fig. 16. Fig. 17.

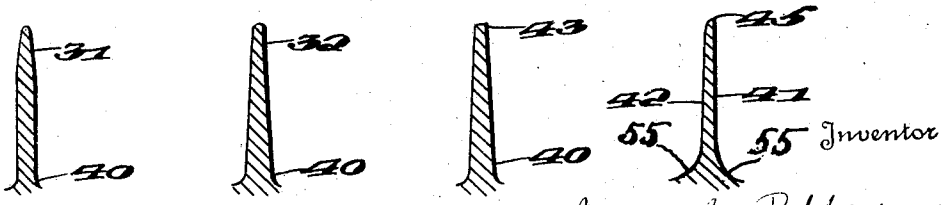


Fig. 13.



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UNITED STATES PATENT OFFICE

2,287,496

HYDRAULIC COUPLING

Isaac C. Popper, New York, N. Y., assignor to Automatic Turbine Drive Company, Inc., a corporation of New York

Application July 29, 1939, Serial No. 287,415

4 Claims. (Cl. 60—54)

My present invention relates to hydraulic couplings, and has particular reference to a novel rotor and vane construction.

This application is a continuation in part of application Serial No. 123,704, filed February 2, 1937, now Patent No. 2,179,520, granted Nov. 14, 1939, for Automatic turbine drives.

It is the principal object of my invention to provide a rotor and vane construction which produces a controllable and more effective hydraulic thrust.

Another object of my invention is to provide a vane construction which permits or may be fashioned to permit control of the slip between the two rotors of a hydraulic coupling, so as to obtain a predetermined slip at low speeds.

Another object of my invention is to provide a vane construction which can be readily changed to suit operating requirements for hydraulic couplings used for automotive vehicle transmissions.

With the above and other objects and advantageous features in view, my invention consists of a novel method of slip control and a novel rotor vane construction more fully disclosed in the detailed description following, in conjunction with the accompanying drawings, and more specifically defined in the claims appended thereto.

In the drawings:

Fig. 1 is an elevation, parts being in section, of a novel rotor construction having a hydraulic coupling;

Fig. 2 is a section on the line 2—2 thereof;

Fig. 3 is a section on the line 3—3 thereof;

Fig. 4 is a section on the line 4—4 thereof;

Fig. 5 is a section on the line 5—5 thereof;

Fig. 6 is a perspective view, parts being broken away, showing a preferred construction for the rotor blade;

Figs. 7 to 9 inclusive are sectional views of modified vane constructions, the sections 7 and 8 being taken on the line A—A of Fig. 6, and the section 9 on line 9—9 of Fig. 10;

Fig. 10 is a perspective view of a vane construction, parts being broken away, the entire section having the vane shown in Fig. 9;

Fig. 11 is a face view of a rotor showing radial vanes without flanges with their ends 50 adjacent to the hub 51 reduced and curving downwardly as shown in Figs. 12 and 13, thereby forming an annular channel 53 around the hub;

Fig. 12 is a section on line 12—12 of Fig. 11 looking in the direction of the arrows;

Fig. 13 is a slight modification of the structure shown in Fig. 12, in which the vanes 40 are of slightly less width than those shown in Figs. 11 and 12; and

Figs. 14, 15, 16 and 17 are cross-sections through any one of the vanes shown in Fig. 11 but illustrating several different forms they may take.

It has been found desirable to utilize vanes for a rotor of a hydraulic coupling, which vanes in some instances have laterally extending edges or lips, and which are concave on the throwing or forward side, and are substantially plane on the other side, in order to obtain an effective hydraulic thrust. The use of laterally extending edges or vanes permits a control of the slip between rotors by regulation of the width of the laterally extending edge or lip, which can be cut down so as to increase the slip at low speeds to a predetermined extent. But if it be desired to have 100% slip at relatively high idling speeds, the edge or lip may be removed or omitted entirely, and the vane may, for certain automotive vehicle uses, be cut back as required, the arrangement thus being an extremely simple means for obtaining a desired amount of slip for a particular idling speed condition.

Referring to Figs. 1 to 9 of the drawings, the rotor 20, which is one of a pair of rotors for use in a fluid fly-wheel or hydraulic coupling such as described in my copending application, Serial No. 123,704, now Patent No. 2,179,520, has a plurality of vanes 21 which extend radially and thus form a plurality of tapering buckets 22 therebetween, the bucket areas decreasing towards the hub 23 of the rotor.

The vanes are preferably plane or approximately plane on the back surface 24, and are preferably concave on the forward or impelling surface 25; an overhanging flange 26 is provided at the outer vane flange, the maximum width of the flange being at the periphery, from which the outer flange portion 27 gradually decreases in width and reaches its narrowest width approximately two-thirds of the distance to the hub, and then increases in width to the hub, in reverse order to the outer flange portion 27, to provide an inner hub flange portion 28. A concavity is thus formed beneath each flange, as clearly shown in Figs. 2, 3, 4, 5 and 6. If desired, an annular connecting ring (not shown) may be provided at the points of convergence of the flanges 27 and 28. The two flange portions 27 and 28, which thus overhang in the same direction, have bevelled upper surfaces as clearly illustrated in Fig. 6, and cooperate to provide a concave bucket construction which directs an

effective hydraulic discharge from the impeller rotor to the receiving rotor to produce the desired hydraulic thrust.

I have determined that the relative height of the vanes at the inner hub ends and the width of the overhanging inner flange is an important factor in controlling the slip between the rotors at idling speeds, and in facilitating easy shifting from one gear ratio to another.

As shown in Figs. 11, 12 and 13, the hub ends of the vanes 40 are reduced as shown at 50 with their tip ends preferably merging into the inner surface of the rotor, thus providing an annular chamber 53 between the hub and the vanes, which channel is in communication with the inner ends of the entire set of radial vanes.

The amount of slippage between the two rotors is readily controlled by changing the width and the shape of the vane flanges; if the forward edges of the flanges are rounded, the slippage is increased, and if the edges are made of greater width and relatively sharp, the buckets hold the hydraulic fluid and reduce slippage. Either the outer or the inner flange portion may be changed, but the hub end is preferred for this purpose.

Referring now to Figs. 7 to 9 inclusive, Fig. 7 is a section at the hub end of this form of vane, having the inner flange portion 28. If the flange portion is reduced in width, as indicated at 29, in Fig. 8, the slip is increased; if the flange portion is cut away, as illustrated at 30, in Fig. 9, there is a greater increase in slip, which becomes desirable when the idling speed is fairly high.

In the rotor shown in Fig. 11, the rotary vanes 40 are illustrated of uniform construction throughout and have no flanges at their edges; and Figs. 14, 15, 16 and 17 illustrate four of possibly many other variations in the cross-sectional shape these vanes might take, and they are designed to control and regulate the required slip. A still greater slip occurs in the construction illustrated at 30 in Fig. 9 if the vane form illustrated at 31 (see Fig. 14) is used, which form is generally straight throughout the major portion and wedge-shape at the outer edge, or if it be desired to have a generally tapering type vane throughout its entire width, a construction such as is illustrated at 32 in Fig. 15 may be used. This form might be modified by making the edge 43 of the vane straight instead of rounded. In the form shown in Fig. 17, one face 41 is perpendicular throughout to the interior surface of the rotor 20, and the opposite face 42 is shown as converging slightly and the edge 45 is shown rounded.

For automotive duty, where the load is not excessive, and approximately 100% slip at idling speeds is desirable, it is preferable to use the vane construction illustrated in Fig. 9, which is shown in perspective in a rotor section 33 in Fig. 10.

The holes 54 are drilled through the hub for the passage of the fluid.

While I have described specific constructional embodiments of some of the preferred forms and modified forms of vanes for hydraulic coupling rotors, it is obvious that changes in the dimensions of the vanes and in the number, heights, and flange arrangements may be made to suit the hydraulic thrust and the slip requirements for different types of hydraulic couplings, without departing from the spirit and the scope of the invention as defined in the appended claims.

In Fig. 17, I have shown fillets 55 at the base of the vanes, which might be of any predetermined size and curvature to produce a concaved effect, which is one of the features of my present invention.

I claim:

1. A cupped rotor for a hydraulic coupling having a hub and radial vanes, which vanes form buckets therebetween, said vanes each having a portion extending from the rotor body and a second portion extending from the first portion to the edge, the relative thickness of said portions being predetermined to obtain a desired slip.

2. A cupped rotor for a hydraulic coupling having a hub and radial vanes, which vanes form buckets therebetween, said vanes each having a portion extending from the rotor body and a second portion extending from the first portion to the edge, the second portion being of less thickness than the first portion.

3. A cupped rotor for a hydraulic coupling having a hub and radial vanes, which vanes form buckets therebetween, said vanes each having a portion extending from the rotor body and a second portion extending from the first portion to the edge, the second portion having its sides converging towards the edge.

4. A cupped rotor for a hydraulic coupling having a hub and radial vanes, which vanes form buckets therebetween, said vanes each having a portion extending from the rotor body and a second portion extending from the first portion to the edge, the second portion having a tapering or wedge shaped section.

ISAAC C. POPPER.