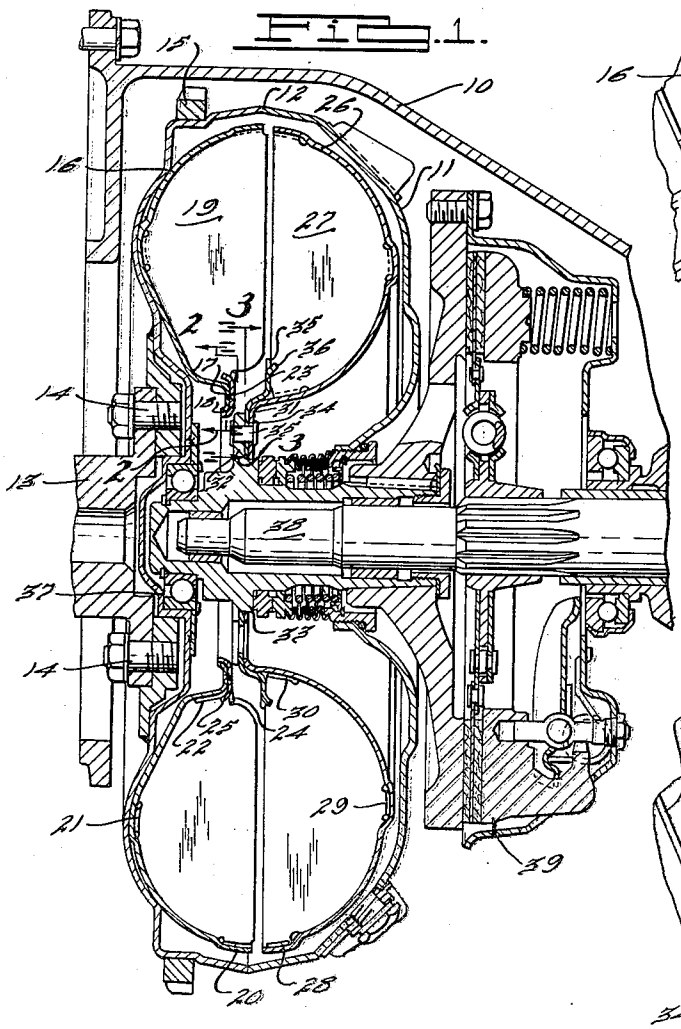
June 3, 1952 O. M. KOSKINEN 2,599,461

FLUID COUPLING ELEMENT

Filed Jan. 23, 1948 2 SHEETS—SHEET 1

Fig. 1.



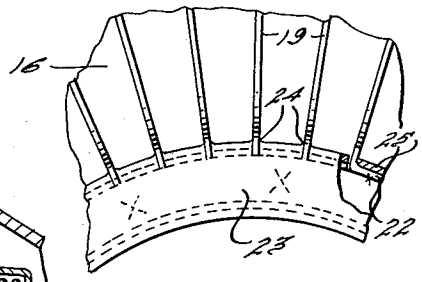


Fig. 2.

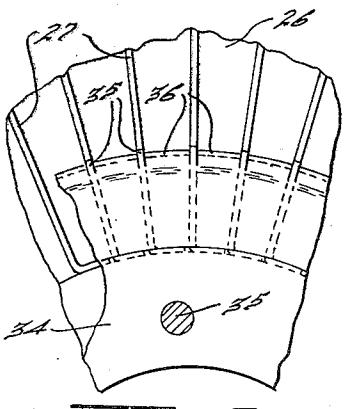


Fig. 3.

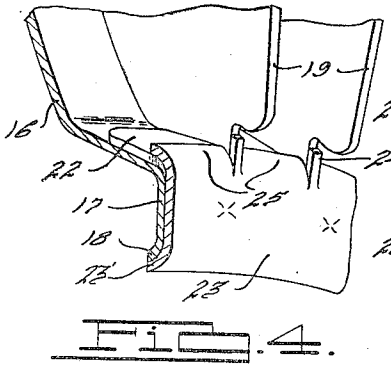


Fig. 4.

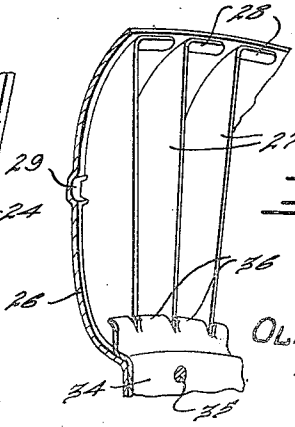


Fig. 5.

INVENTOR.
OLAVI M. KOSKINEN
BY Harness & Harris
ATTORNEYS.

June 3, 1952 O. M. KOSKINEN 2,599,461

FLUID COUPLING ELEMENT

Filed Jan. 23, 1948 2 SHEETS—SHEET 2

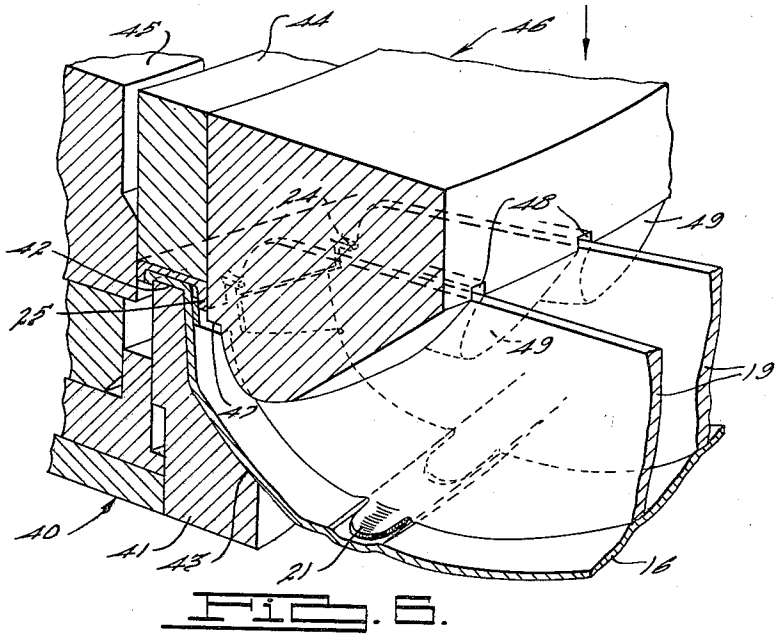


Fig. 6.

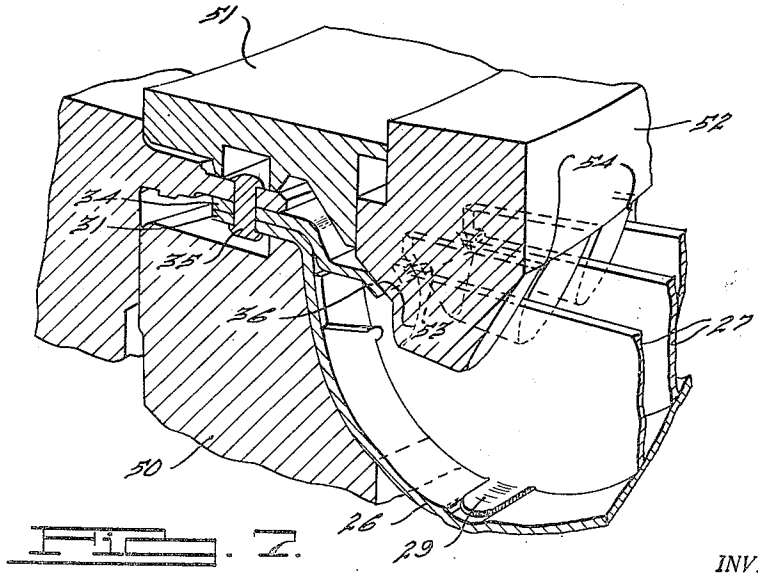


Fig. 7.

INVENTOR.
OLAVI M. KOSKINEN
BY Harness & Harris
ATTORNEYS.

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UNITED STATES PATENT OFFICE

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FLUID COUPLING ELEMENT

Olavi M. Koskinen, Detroit, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application January 23, 1948, Serial No. 3,996

5 Claims. (Cl. 103—115)

1

This invention relates to improvements in fluid couplings and in the method of making the same.

A fluid coupling of this type includes juxtaposed rotatable impeller and runner structures on rotors defining a fluid circulating circuit and in which the runner structure is driven by flow of pressure fluid impelled thereto by the impeller structure, each structure including a plurality of vanes forming fluid passages for the circuit and the pressure fluid impelled by the impeller impinging against the vanes of the runner to drive the latter. Each of these structures may be formed from sheet metal components, in the interest of economy, and include a vane carrier or support having an annular dished section in which a plurality of radially extending, circumferentially spaced fluid passage-forming vanes are seated.

An object of the invention is the provision of an improved arrangement for securing the vanes to the carrier or support therefor and more particularly to provide an arrangement in which a vane retainer is secured to the vane carrier and is so structurally interlocked with the vanes as to prevent displacement thereof in a direction circumferentially and in a direction normal to the latter direction. More specifically the invention provides a vane retainer having a plurality of tabs or spacers respectively disposed between adjacent vanes and acting thereon to prevent displacement thereof; and to provide a retainer having notches respectively receiving the vanes, and a tab at each notch engaging the vane received therein.

A further object of the invention is the provision of a structural connection between the vane retainer and carrier which effectively resists the tendency of these parts to separate under the influence of centrifugal force developed during operation of the coupling.

It is desirable in a fluid coupling to control the flow of fluid between the passages of the impeller and runner structures by means of a baffle, for example, and a further object of the invention is the provision of a vane retainer as aforesaid which also functions as a baffle.

Another object of the invention is to provide improvements in the method of making a vane structure, for example a fluid coupling rotor, the method being particularly directed to securing vanes to a carrier therefor by a retainer and comprising the feature of utilizing the vanes when positioned relative to the carrier as an implement for cutting or notching the retainer into vane retaining tongues.

2

Other objects and advantages of the invention will be more apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary sectional view in side elevation illustrating a fluid coupling embodying the invention.

Fig. 2 is a fragmentary elevational view, partly in section, taken on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary elevational view taken as indicated by line 3—3 of Fig. 1 with a part thereof broken away to show the underlying structure.

Fig. 4 is an enlarged, fragmentary perspective view, partly in section, further illustrating the assembly of the vanes, vane support and retainer at the inner diameter of the coupling rotor.

Fig. 5 is a view similar to Fig. 4 illustrating the assembly of the vanes, vane support and retainer at the inner diameter of the coupling driven rotor.

Fig. 6 is a fragmentary perspective view, partly in section, illustrating apparatus for effecting the assembly shown in Fig. 4.

Fig. 7 is a view similar to Fig. 6 illustrating the apparatus for effecting the assembly shown in Fig. 5.

Referring to the drawings, particularly Fig. 1, the invention is illustrated in a fluid coupling operable to transmit a drive between driving and driven shafts in the drive system of a motor vehicle, a releasable friction clutch being shown between the coupling and driving shaft. In the broader aspects, the coupling embodying the invention can be employed in drive systems other than that illustrated herein.

The fluid coupling and friction clutch are shown in a housing 10, the coupling including an annular casing 11 which may be formed by two parts welded together as at 12, and secured to a driving shaft 13 by bolts 14 for rotation therewith. Inasmuch as the fluid coupling functions as a flywheel, the same is provided with a ring gear 15. The casing 11 has a dished section to which is secured, as by welding, a vane carrier or support 16 having an annular dished section, an annular flange 17 extending radially inwardly from the latter adjacent the inner diameter of the carrier, and an annular terminal flange 18 extending generally axially. Seated in the dished section of the carrier 16 are a plurality of radially extending, circumferentially spaced vanes 19, each of which has a tab 20 at the radially outer end abutting and secured, as by welding, to the carrier at the outer diameter thereof, and a tab 21 abutting and secured, as by welding, to the

carrier intermediate the inner and outer diameters of the later. The inner end of each vane 19 has a tab 22 abutting the carrier 16 adjacent the inner diameter, it being understood that the tabs 20, 21, 22 of each vane are disposed in the space between the latter and an adjacent vane. The foregoing construction constitutes the impeller structure or driving rotor of the coupling which is driven directly from the shaft 13.

The inner ends of the vanes 19 are secured to the carrier 16 by an annular retainer 23 which abuts the carrier flange 17 and is welded thereto. The retainer extends over the edge of the vanes 19 and is notched at the free edge thereof at those portions thereof respectively registering with the vanes 19 to receive the latter. That portion of the material displaced in forming each notch constitutes a tongue 24 which overlies an edge of the registering vane. This notching of the retainer provides a plurality of tongues 25 respectively registering with the space between adjacent vanes, each tongue 25 being deflected to overlie and engage that vane tab 22 which lies in the aforesaid registering space between adjacent vanes. The tongues 25 prevent circumferential displacement of the vanes and form a structural interlock between the vanes and the retainer which is in turn secured to the carrier. In order to insure against displacement of the retainer relative to the carrier under the influence of centrifugal force developed during operation of the coupling, the retainer 23 at the inner diameter thereof has a flange 23, which extends over and abuts the radially inner periphery of the carrier flange 18. In effect, the flanges 17, 18 and adjacent portion of the dished section of the carrier define in cross section an axially opening channel which is nested in a correspondingly open channel defined by the retainer and this provides a form of structural interlock operable to prevent relative separation of the carrier and retainer under the influence of centrifugal force.

The centrifugal force developed during operation of the impeller or driving rotor tends to deflect the carrier 16 radially outwardly at the outer diameter thereof and this produces a tendency of the vanes 19 to rock or fulcrum about an axis at the intermediate tabs 21, with a resulting tendency of the inner ends of the vanes 19 to move in a direction generally longitudinally of the axis of rotation of the impeller or driving rotor, that is, to the right as viewed in Fig. 1. This tendency is opposed by the retainer through the tongues 24 acting on the edges of the registering vanes and the tongues 25 acting on the vane tabs 22. Any tendency of the vanes 19 to move generally radially outwardly will be resisted by the tongues 25 acting on the tabs 22.

The runner structure or driven rotor of the coupling includes a vane carrier or support 26 having an annular dished section opening toward and disposed in jutaposed relation to the impeller structure. Seated in the dished section are a plurality of radially extending circumferentially spaced vanes 27, each having a tab 28 at the outer end secured, as by welding, to the section at the outer diameter of the latter, and a tab 29 similarly secured to such section intermediate the inner and outer diameters of the latter. A third tab 30 of each vane abuts the carrier 26 adjacent the inner diameter thereof. The carrier has an annular flange 31 which overlaps a flange 32 of a hollow shaft 33. An annular member 34 has a part which extends between the flanges 31, 32 and together with flange 31 is secured by rivets 35 to flange 32. Thus the carrier, vanes and member 34 are rotatably connected to shaft 33.

The member 34 has a part which extends radially inwardly over the edge of the vanes 27 at the inner ends thereof and over the space between adjacent vanes and is notched at each vane to receive the latter and to provide relatively small tongues 35 respectively registering with an abutting such vane edge, and a plurality of relatively large tongues 36 which respectively extend into the space between adjacent vanes. The tongues 36 retain the inner ends of the vanes 27 against circumferential displacement and the engagement of each vane edge by its registering tongues 35 and by the member 34 at the base of the registering notch prevents movement of the adjacent vane ends in a direction to the left as viewed in Fig. 1, it being understood that the runner structure or driven rotor is subjected to the action of centrifugal force as set forth in connection with the impeller structure. Rocking action of the vanes under the influence of such force is opposed at the inner vane ends by the member 34.

The impeller and runner structures at the dished, vaned sections provide a chamber for the circulation of a fluid medium, such circuit including a fluid passage between adjacent vanes of each structure. In this type of coupling the runner is driven by flow of pressure fluid impelled thereto by the impeller structure, such fluid moving from the impeller to the runner in the region of the outer diameter of the chamber and being returned to the impeller in the region of the chamber adjacent the inner diameter thereof. That portion of the member 34 which extends across the passages between adjacent vanes in the runner structure acts as a baffle to interrupt the flow of fluid from the runner to the impeller when the coupling is operating under relatively high slip between the impeller and runner, for example, when the impeller is rotating at a relatively low speed. When the coupling is operating under a relatively low slip condition the fluid circuit at the inner diameter moves outwardly beyond the region of the baffle and the latter does not exert any appreciable influence on the flow of fluid. This control of fluid flow by the baffle is particularly desirable when, for example, the coupling is employed in a motor vehicle drive including a change speed transmission which is conditioned to transmit drive when the vehicle is at rest. Under such circumstances the interruption of fluid flow by the baffle prevents creeping of the vehicle.

While the retainer 23 has the tongues 24 and the member 34 has the tongues 35, all arranged as aforesaid, nevertheless such tongues may be omitted from each and the disposition of the vanes in the respective notches in engagement with the base thereof can be relied upon to retain the inner ends of the vanes against displacement in response to tendency to rock under the influence of centrifugal force as aforesaid.

The carrier and vanes of the impeller and runner structures are preferably formed from sheet metal and the vane tabs at the outer diameter and at the intermediate location may be satisfactorily welded to the carrier. However, inasmuch as the spacing of the vanes decreases from a maximum at the outer diameter of the carrier to a minimum at the inner diameter, the space between adjacent vanes at the inner end so restricts the size of the tabs at this region that welding of the same to the carrier would

not produce a strong tie therebetween due to the injurious effect of the welding operation on this small tab. The tab at the inner end of the vanes provides a seat which rests on the carrier and while these tabs may as in the impeller structure be engaged by the tongues **26** of the retainer, such engagement is not necessary, as shown in the runner structure, and the tongues **36** thus may be utilized as the baffle.

The sleeve shaft is journalled at **37**, receives the driven shaft **38**, and is releasably connected thereto by a friction clutch, generally designated by the numeral **39**, of the conventional type. When employed in a motor vehicle drive, for example, the driven shaft **38** may constitute the input shaft of a change speed mechanism, not shown.

Referring to Fig. 6, there is shown apparatus by which the vane retainer **23** is operated on to provide the tongues **24, 25** to engage the tongues **25** with the respective vane tabs **22**, and to flange the support **16** and retainer at the radial inner extremity thereof, to thereby produce the structural arrangement shown in Fig. 4. These operations are performed, the vanes **19** have been seated in the dished section of the support **16**, the tabs **20, 21** have been welded to the support **16**, and the retainer **23** welded to the support **16**. The forming apparatus includes a support or anvil, generally designated by the numeral **40**, having a section **41** on which the driving rotor assembly is placed with the radially inner end portion of the support **16** overlapping the top face **42** of section **41** sufficient to provide the flange **18**. The side face **43** of section **41** has a curvature which conforms to the curvature of the support **16** and engages therewith. In this assembly that portion of the retainer which overlaps the adjacent vane ends and provides the tongues **25**, and that portion which provides the radial inner flange which overlaps the flange **18** both project beyond the respective opposite edges of the face **42**.

The movable part of the apparatus includes a pressure pad and stripper **44** registering with the top face **42**, a flanging punch **45** and a lancing punch **46**. With the part **44** positioned as shown, the punch **45** is moved in a direction normal to face **42** to thereby flange the adjacent ends of the retainer **23** and support **16**. The punch **46** has a lancing face **47** which registers with that extremity of the retainer which overlaps the adjacent ends of the vanes **19**, and which projects beyond the face **42**. A plurality of slots **48** respectively register with a vane **19** and a combined support and spacer **49** is provided intermediate each pair of adjacent slots. When the punch **46** is initially positioned each vane is received in its registering slot **48** and is thereby properly located, a spacer **49** extending between each pair of adjacent vanes. As the punch **46** is moved the face **47** thereof presses the registering extremity of the retainer **23** against the inner vane ends to cause the latter to lance or cut such extremity into tongues **24**, which respectively engage the edges of the inner vane ends, and tongues **25** which are respectively deflected into the space between adjacent vanes and into engagement with the vane tab **22** in such space. During this lancing and deflecting operation the vanes **19** and support **16** react against the section **41** and the vanes are retained against deflection under the force of the punch **46** by the support spacers **49**. The pressure pad and stripper is held in position until the punch **46** is retracted.

As heretofore pointed out, the driving rotor is annular, as shown in Fig. 2, and the forming apparatus above is likewise annular.

The apparatus shown in Fig. 7 for operation on the driven rotor of the coupling is generally similar to that shown in Fig. 6. The rotor assembly is supported by an anvil **50** and is held thereagainst by a pressure pad and stripper **51**. A lancing punch **52** has a lancing face **53** adapted to engage with the extremity of the member **34** and by pressing the same against the vane **27**, lances or cuts the portion so engaged to form tabs **35** which overlie the vane edges and tabs **36** which are deflected between adjacent vanes. The lancing punch has slots **54** respectively receiving a vane **27** and a combined support and spacer **55** between each pair of adjacent vanes. The vanes are thus properly located and supported as in the Fig. 6 showing.

The gauge of metal and the physical characteristics thereof for the vanes and the retainer, in both coupling structures, are so predetermined as to permit lancing or cutting the retainer by pressing the same against the vane faces when the vanes are positioned and supported as shown herein.

Although but one specific embodiment of the invention has herein been shown and described, it will be understood that various changes in the size, shape and arrangement of parts may be made without departing from the spirit of the invention.

I claim:

1. A fluid coupling element including a vane carrier having a dished section and an inner diameter and an outer diameter, a plurality of radially extending circumferentially spaced vanes seated in said dished section and secured to the carrier adjacent said outer diameter, said carrier adjacent said inner diameter defining in cross-section an axially opening channel, and a vane retainer secured to said carrier defining in cross-section an axially opening channel nesting said carrier channel and having a plurality of tabs in one channel flange thereof one extending into each space between adjacent vanes at said inner diameter and engaged with one of said adjacent vanes to restrain such vanes against movement under the influence of centrifugal force acting on said carrier during rotation of said one structure.

2. A fluid coupling element including a vane carrier having a dished section, a plurality of laterally spaced fluid passage forming vanes in said section, and means securing said vanes relative to said carrier including a retainer having spaced slots respectively receiving said vanes and a first series of tongues respectively abutting an edge of said vanes, and said retainer having a second series of tongues, circumferentially alternating with the tongues of the first series and respectively registering with the space between adjacent vanes and deflected from the plane of the tongues of said first series into the said registering space between adjacent vanes, the tongues of said first series projecting radially beyond the tongues of the second series.

3. A fluid coupling element including a vane carrier having an annular dished section, a plurality of radially extending circumferentially spaced fluid passage forming vanes in said section, each vane having a laterally projecting tab disposed between such vane and an adjacent vane and seated on said carrier, and means securing said vanes relative to said carrier including an

annular retainer having circumferentially spaced slots respectively receiving said vanes and a first series of tongues, one between adjacent slots and extending between adjacent vanes in overlapping abutting engagement with the tab between said adjacent vanes, and said retainer having a second series of tongues alternating circumferentially with the tongues of the first series and respectively registering with said slots and engaging an edge of that vane in said registering slot.

4. A fluid coupling element including an annular vane carrier having a central opening and including a dished section extending around the opening and a generally radially disposed part intermediate said section and opening, a plurality of laterally spaced generally radially disposed vanes in said section, and means securing said vanes relative to said carrier including an annular retainer having a part thereof abutting and secured to said radially disposed carrier part, said retainer including a second part extending over an edge of said vanes and having a plurality of slots respectively receiving said vanes and a deflected tongue extending laterally in one direction relative to said second retainer part into each space between adjacent vanes and engaged with at least one of such adjacent vanes, and a portion of said retainer extending generally laterally in said one direction into said opening and engaging said carrier part.

5. A fluid coupling element including a vane

carrier having an annular dished section, a plurality of radially disposed laterally spaced vanes in said section, each vane having a tab seated on the carrier and disposed in the space between such vane and an adjacent vane, and means securing said vanes relative to said carrier including a retainer secured to said carrier and extending over and abutting an edge of said vanes, said retainer including a plurality of tongues deflected from the plane of the vane edges one into each spaced between adjacent vanes and folded over the tab in said space.

OLAVI M. KOSKINEN.

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