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A. D. PENTZ

2,368,725

FLUID COUPLING

Filed June 2, 1943

Fig. 1

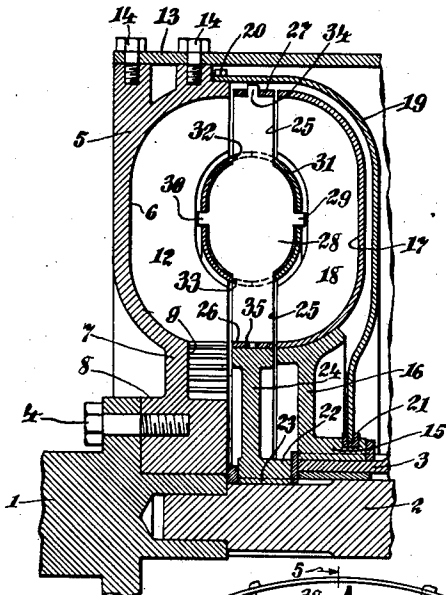


Fig. 2

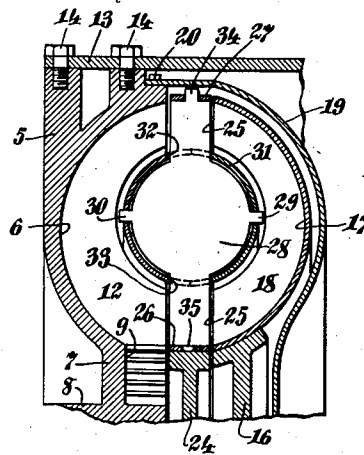


Fig. 3

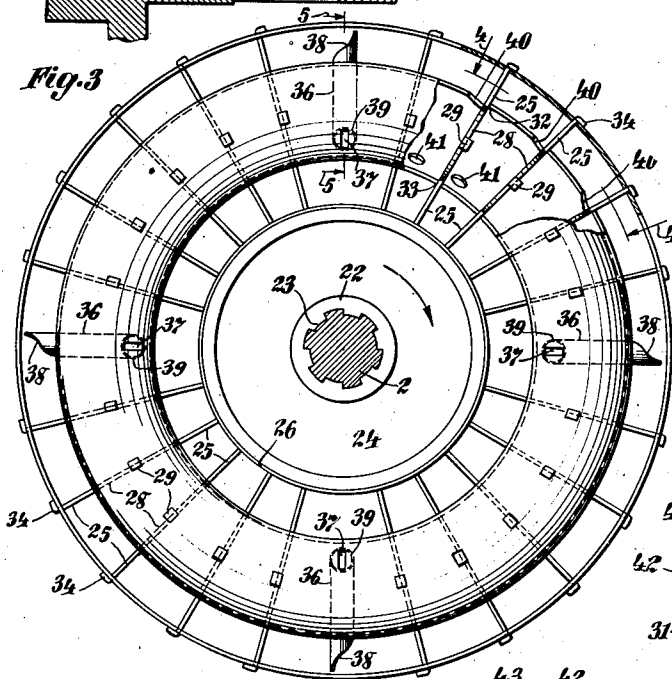


Fig. 4

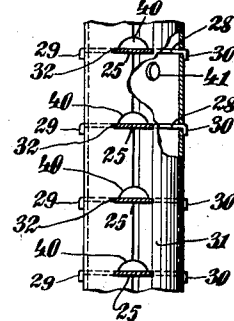


Fig. 6

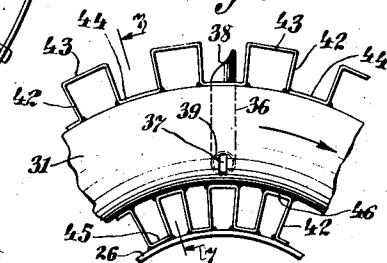


Fig. 5

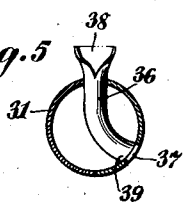


Fig. 8

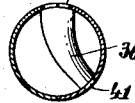
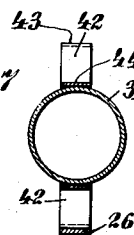


Fig. 7



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UNITED STATES PATENT OFFICE

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FLUID COUPLING

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15 Claims. (Cl. 60-54)

This invention relates to fluid couplings and, more especially to such couplings in automobile transmission mechanisms.

It is an object of the present invention to increase the efficiency of such fluid couplings by enabling the circulating medium to follow a true helical path indicated as the correct path in such couplings. This object is accomplished by providing a tubular ring around which the fluid is caused to flow, thereby eliminating eddies which otherwise are formed by the interference of the centripetal portion of the current with its centrifugal portion. While the advantages of such a guiding member are generally recognized, an unbroken tube of this character has heretofore not been realized because one side of the tube was made integral with the impeller and the other side with the impelled member, leaving a gap between the walls. Another object of the present invention is to reduce as far as possible the back pressure of the circulating medium on the impeller, especially at the start of the operation. When a stream of a liquid impinges on a stationary or more slowly moving surface, it produces a splash which scatters the liquid in every direction. This is exactly what takes place when the medium is put in circulation in a fluid coupling. In the type of coupling considered here, comprising an impeller, an impelled member, and a runner therebetween, the fluid driven by the impeller impinges on the blades of the runner which generally rotates more slowly than the impeller. A part of the impinging fluid flows off from the runner blades onto the blades of the impelled member, but a part ricochets onto the impeller causing a back pressure which reduces the efficiency of the coupling, especially at the start of the operation when the runner blades are stationary. It is an object of the present invention to reduce this back pressure. This object is attained by leading that portion of the impinging fluid which does not pass immediately on to the impelled blades back into circulation and doing this by a greatly shortened path of least resistance. Other objects will become apparent from the specification which follows and from the accompanying drawing.

Figure 1 is an axial cross sectional view of a fluid coupling according to the present invention, as applied to a motor vehicle transmission.

Figure 2 is a similar view for a slightly modified form of such a coupling.

Figure 3 is a side elevational view of the runner portion of the coupling shown in Figure 1, at an enlarged scale.

Figure 4 is a cross section taken along the line 4-4 of Figure 3. Figure 5 is a cross section taken along the line 5-5 of the same figure.

Figure 6 is a view similar to Figure 3 for a modified form of the invention.

Figure 7 is a cross section taken along the line 7-7 of Figure 6.

Figure 8 is a view similar to Figure 5 for still another modification of the invention.

Referring to the figures in detail, 1 is the end of the driving shaft of a motor vehicle; 2 is an intermediate shaft piloted in the shaft 1; 3 is a hollow shaft or sleeve on the shaft 2, connected with the driven shaft of the vehicle (not shown) and, for the purpose of this specification, may be considered as the driven shaft itself. The fluid coupling forming the subject of the present invention comprises an impeller 5 having a web 7 and hub 8 drivingly connected with the shaft 1, as by means of bolts 4; a runner having a web 24 and hub 22 connected with the intermediate shaft 2 by the key 23; and an impelled member having a web 16 and hub 15 keyed to the shaft 3. The impeller 5 is formed with an annular recess or pan 6. The web 7 and hub 8 define a recessed portion 9 communicating with the recess or pan 6. Radially extending blades 12 are mounted on the pan 6. A cylindrical drum 13 coaxial with the shafts 1 and 2 is removably secured to the impeller 5, as by means of bolts 14. The function of this drum, does not enter into the operation of the present device, and the drum, therefore, may be omitted. The only reason why it is shown is to connect the present invention with that disclosed in my copending application, Ser. No. 467,487, filed December 1, 1942, wherein the function of the drum is duly set forth. On the web 16 is mounted an annular pan 17 carrying a plurality of blades 18 which may, though they need not, be similar in form, number and disposition to the blades 12. The web 24 carries annular rims 26 and 27, between which are mounted the runner blades 25 secured to the rims 26 and 27 by lugs 34 and 35. The lugs 34 are bent over the rim 27, but the lugs 35 are merely inserted into openings in the rim 26. Of course, the blades 25 may be secured to the rims 26 and 27 by additional means, such as spot welding, for instance, in which case the lugs 34 and 35 may be omitted. The blades 25 have an enlarged central portion 28. The runner blades 25 support a tubular ring 31 which they traverse through openings 32 and 33 and are secured to the ring 31 by lugs 29 and 30 which extend from the blade portions 28 and are bent over the tubular ring 31, as is best shown in

Figures 3 and 4. As here shown, the central portions 28 of the blades 25 extend to the inner surface of the ring 31, thereby forming a plurality of chambers in the ring, but I do not mean to limit the invention to this particular construction, i. e., the inner space of the tubular ring 31 need not be divided into separate chambers.

The impeller blades 12, runner blades 25 and impelled blades 18 are all operating within a reservoir defined by the impeller 5 and a wall 19. This reservoir contains a fluid medium put in circulation by the blades of the impeller 5. The wall 19 has an outer peripheral edge sealingly secured to the impeller 5 at 20, and an inner peripheral edge rotatably sealed to the hub 15 at 21. Suitable seals prevent leakage of the fluid into other parts of the mechanism. A tap (not shown) in the wall 19 is provided for filling the reservoir to the desired level.

The tubular ring 31 is provided with inlet ports 40 and outlet ports 41 for the circulating medium. The inlet ports 40 are disposed along the median line of that portion of the surface of the ring which is farthest away from its center. The outlet ports 41 are disposed on that portion of the surface of the ring which is nearest to its center but preferably, though not necessarily along points off the median line of said surface towards the impeller. The relative positions of these ports is best shown in Figure 8 wherein the inlet ports and the outlet ports are connected by a tubular member 36'. When, as herein shown, the central portion 28 of the runner blades 25 extends to the inner surface of the tubular ring 31, thereby forming a plurality of separate chambers in the ring, there will be one inlet and a corresponding outlet in each one of such chambers. The inlet ports 40 are preferably adjacent the blades 25, as shown.

The purpose of the ports 40 and 41 is dual, namely, first to reduce as far as possible the back pressure on the impeller blades due to the ricocheting of the fluid as it impinges on the runner blades, especially at the start of the operation, and, second, to expedite the circulation of the medium, as has already been mentioned in the preamble. In some cases, it may be desirable to further enhance these effects by introducing a plurality of scoops into the picture. Such scoops are shown in Figure 3, consisting of a tubular member 36 having a mouth 38 facing the impinging stream, and an outlet 39 opening into an exit 37 in the ring 31. As shown, the tubular member of the scoop terminates at 39 on the surface of the ring 31, but it may, of course, be extended beyond this surface. Only four scoops are shown in Figure 3, but their number may be varied. Of course, where such a scoop is introduced the ports 40 and 41 would be superfluous and would be omitted. When the ring 31 is divided into separate chambers, as above explained, one such scoop may be provided for each one of a selected number of chambers. In either case, i. e. whether the ring is or is not divided into a plurality of chambers, I may provide the ring in part with ports 40 and 41, and in part with scoops 36. In some cases, the scoops may even take over the function of the runner blades, and an arrangement comprising in part blades 25 and in part scoops 36 may be found to be quite effective.

In Figure 1, the tubular ring 31 is of an oval cross section. The pans 6 and 17 are formed to correspond to this shape. In Fig. 2, the tubular ring 31 has a circular cross section, i. e., the ring 31 is a torus tube. The outer peripheries of the

blades 12 and 18 in this modification of the invention are of a corresponding circular form. Giving the ring 31 the form of a torus tube has certain advantages inasmuch as it is more in conformity with the helical path of the circulating medium.

In the embodiment illustrated in Figure 6, the runner blades do not traverse the tubular ring 31, as they do in the embodiment illustrated in Figure 3. In the modification shown in Figure 6, the runner blades are made up of two complementary parts 42 forming continuations of one another, one extending outwardly from the ring 31 away from its center, and the other one extending outwardly from the ring 31 towards its center. As shown, this construction is accomplished by ruffling a metal sheet into a succession of alternately reversed U-shaped units 42-43-42, 42-44-42, and doing likewise with a second ruffled metal sheet bent into the succession of alternately reversed U-shaped units 42-45-42 and 42-46-42. The ring 31 is held between the elements 44 and 46, to which it is secured as by spot welding or in any other standard manner. The elements 45 are similarly secured to the rim 26 of the runner. Although not so shown, the elements 43 may similarly be secured to the other rim 27 of the runner.

The operation of the device follows clearly from the above specification if the purposes of the invention are duly noted in conjunction with the specification, these purposes having been set forth in the preamble, and it is therefore deemed unnecessary to further expand on the subject, except to mention that the examples shown and explained are meant mainly to serve as illustrations of the invention and do not preclude the variations possible in several of the details within the scope and the spirit of the invention. For instance, the tubular ring 31 may be slit along the median line of its surface, in which case the narrow gap between the severed halves of the ring serves both, as inlet and as outlet ports for the fluid medium.

I claim:

1. A fluid coupling comprising an impeller, an impelled member, a runner intermediate said impeller and said impelled member, and a circulating fluid medium, blades on said runner, a tubular ring supported by said blades, inlet ports for said fluid medium on that portion of the surface of said ring which is farthest away from the center of the ring and disposed along the median line of said surface, and outlet ports on that portion of the surface of said ring which is nearest to its center but disposed off the median line of said surface towards said impeller.

2. A fluid coupling according to claim 1 wherein each inlet port is connected with the corresponding outlet port by a tubular member.

3. A fluid coupling according to claim 1 wherein the inlet ports are adjacent the runner blades.

4. A fluid coupling comprising an impeller, an impelled member, a runner intermediate said impeller and said impelled member, and a circulating fluid medium, a tubular ring forming a part of said runner, a plurality of scoops penetrating said ring in a direction normal thereto and provided with exits on the surface of said ring facing its center at points off the median line of said surface towards said impeller, the mouths of said scoops facing the incoming stream of said fluid medium.

5. A fluid coupling comprising an impeller, an impelled member, a runner intermediate said im-

5 peller and said impelled member, and a circulating fluid medium, blades on said runner, a tubular ring supported by said blades, scoops between consecutive blades penetrating said tubular ring and provided with exits on the surface of said ring facing its center at points off the median line of said surface towards said impeller, the mouths of said scoops facing the incoming stream of said fluid medium.

6. A fluid coupling comprising an impeller, an impelled member, and a runner intermediate said impeller and said impelled member, blades on said runner, and a tubular ring supported by said blades substantially midway between their ends, said blades penetrating said tubular ring and the portions of said blades within said tubular ring entirely extending to the inner surface of said ring, thereby forming a plurality of chambers therein, each one of said chambers being provided with an inlet port on that portion of the tubular ring farthest away from its center and with an outlet port on that portion of the tubular ring nearest its center.

7. A fluid coupling according to claim 1 wherein the runner blades extend through the tubular ring and wherein the portions of the runner blades within the tubular ring extend to the inner surface of said ring, thereby forming a plurality of chambers, each chamber being provided with one of said inlets and its corresponding outlet.

8. A fluid coupling according to claim 5 wherein the runner blades extend through the tubular ring and wherein the portions of the runner blades within the tubular ring extend to the inner surface of the ring, thereby forming a plurality of chambers, each scoop being contained in one of said chambers.

9. A fluid coupling including a runner in the central zone of the coupling, a tubular ring forming a part of said runner, a circulating medium, 40

inlet ports for said medium on the portion of said ring farthest away from its center and disposed along the median line of its surface, and outlet ports on the portion of said ring nearest to its center.

10. A fluid coupling including a runner in the central zone of the coupling, blades on said runner, a tubular ring supported by said blades substantially midway between their ends, a circulating fluid medium, inlet ports on that portion of said ring which is farthest away from its center and disposed along the median line of its surface, and outlet ports on the portion of said ring nearest to its center.

11. A fluid coupling including a runner in the central zone of the coupling, a circulating fluid medium, a tubular ring forming a part of said runner, and a plurality of scoops traversing said ring having mouths facing the stream of the incoming fluid and exits on the portion of said ring nearest to its center.

12. A fluid coupling including a runner in the central zone of the coupling, a circulating fluid medium, blades on said runner, a tubular ring supported by said blades, and scoops between consecutive blades penetrating said tubular ring having mouths facing the stream of the incoming fluid and exits along the surface of said ring nearest to its center.

13. A fluid coupling according to claim 9, wherein one or more of the inlet ports are connected with corresponding outlet ports by ducts.

14. A fluid coupling according to claim 10, wherein one or more of the inlet ports are connected with the corresponding outlet ports by ducts.

15. A fluid coupling according to claim 6, wherein the inlet port of one of the chambers is connected with the outlet port of said chamber by a duct.

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