March 24, 1953 J. JANDASEK 2,632,397

ROTOR WHEEL

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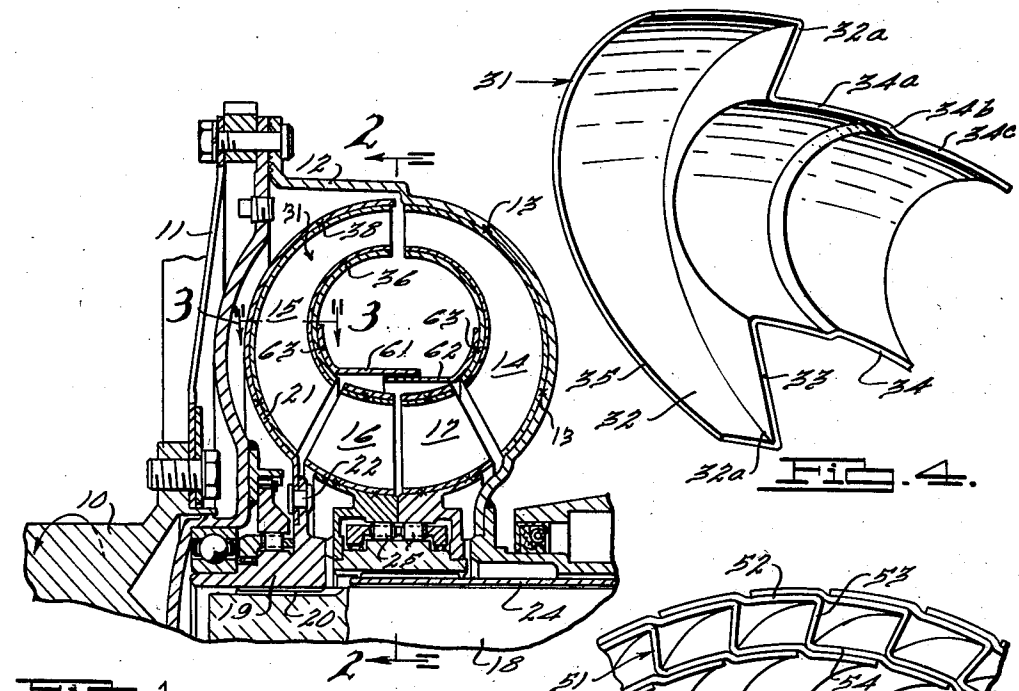

FIG. 1.

FIG. 4.

FIG. 5.

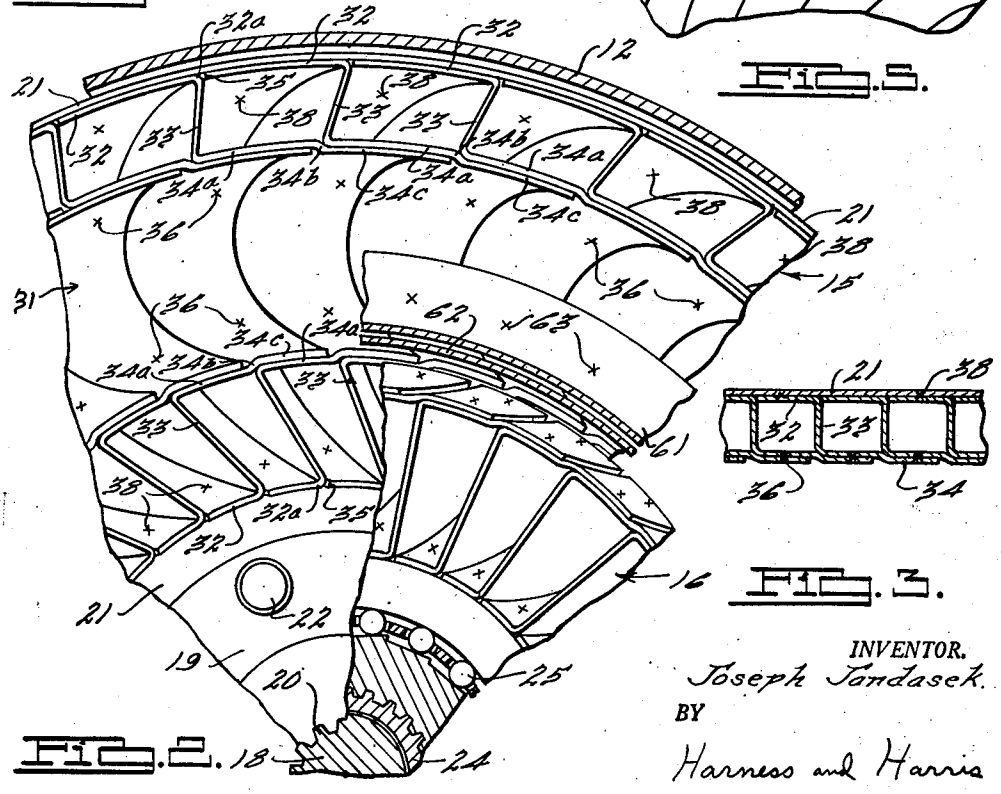

FIG. 2.

FIG. 3.

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ROTOR WHEEL

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3 Claims. (Cl. 103—115)

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This invention relates to bladed rotor wheels in general and is specifically concerned with bladed impeller ad turbine wheels which form a basic part of hydraulic torque transmitting devices.

The bladed rotor wheels of hydraulic torque transmitting devices have heretofore been constructed chiefly by casting the blade elements and their supporting shroud and web structures as integral units or by casting the blade elements separately and then mounting the blade elements in either separately cast or stamped supporting shroud and web members. Both of these methods of manufacturing bladed rotor wheels are tedious and expensive and, due to the casting processes frequently producing warped or pitted or rough surfaced products of variable porosity having untrue surfaces, the resultant wheels frequently produce undesirable vibrations or they may leak or cause undesirable turbulence in the fluid passed through the cell-shaped channels defined by the assembled blades. Accordingly, a method of economically producing an improved type of bladed rotor wheel by stamping rather than casting has been developed and is herein disclosed.

It is a primary object of this invention to provide a fluid rotor wheel in which the blade elements as well as the blade element supporting members are formed from relatively simple stampings which may be easily and economically manufactured and assembled to provide a rotor wheel of superior quality at a reduced cost.

It is another object of this invention to provide a fluid rotor wheel having stamped blade elements which are so formed that upon assembly they interfit with adjacent blade elements so as to mutually support each other and thus reinforce and rigidify the the resulting wheel assembly.

It is a further object of this invention to provide a fluid rotor wheel formed from stamped blade elements wherein the blade elements have end flange portions that interfit with adjacent blade element end flange portions in such a manner that at least one of the supporting shell members for the blades is completely formed by the interfitting end flanges. This construction eliminates one of the usually required supporting shell elements for the blades of a stamped rotor wheel and materially simplifies the assembly of the wheel.

It is an additional object of this invention to provide a fluid rotor wheel formed from stamped blade elements arranged within a supporting shell wherein the blade elements have flange portions adapted to coact with the flange portions on adjacent blade elements to insure proper spacing of the blade elements within the supporting shell.

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It is a further object of this invention to provide a rotor wheel formed from stamped elements connected together and to their supporting shell members by means which eliminates the use of the conventional interengaged slot and tab connecting elements between the wheel blades and the blade supporting shell members. As a result several punching and pressing steps have been eliminated from the method of manufacture of the wheel and the cost of production of the wheel materially reduced.

It is still a further object of this invention to provide an improved method of manufacture of rotor wheels.

The above and other objects, advantages and novel features of this invention will be apparent from the following description when read in connection with the accompanying drawings wherein:

Fig. 1 is a sectional view of a hydraulic torque converter having bladed impeller and turbine wheels embodying this invention;

Fig. 2 is an enlarged sectional elevation of the torque converter shown in Fig. 1 taken along the line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation of the turbine wheel of the torque converter herein disclosed taken along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged perspective view of one of the blade elements used to fabricate the impeller and turbine wheels of the torque converter herein disclosed; and

Fig. 5 is a fragmentary side elevation of a modified form of my invention wherein the blade element flanges are adapted to form both the inner and outer supporting shells for the rotor wheel.

Fig. 1 shows a hydraulic torque converter unit wherein a driving shaft 10 is connected by an axially flexible drive plate 11 to a torque converter casing 12 within which are mounted the bladed rotor wheels 14, 15, 16 and 17. Wheel 14 is the driving or impeller wheel and it is drivingly connected by welding or the like 13 to the torque converter casing 12 so that it will be rotated by the driving shaft 10. Wheel 15 is the driven or turbine wheel which is adapted to be driven by the impelled fluid that is circulated within the converter casing 12 due to rotation of driving shaft 10. Turbine wheel 15 is drivingly mounted on the forward end portion of driven shaft 18 by means of a hub 19 splined to shaft 18 at 20 and riveted to the turbine wheel outer shell or shroud 21 as shown at 22. Mounted concentrically about the driven shaft 18, and extending within the converter casing 12, is a fixedly mounted sleeve 24 which is adapted to rotatably support the guide or reaction wheels 16 and 17. The guide wheels 16 and 17 are connected to the fixed sleeve 24 through separate one-way roller

brakes 25 which permit only forward rotation of the wheels 16 and 17, that is in the normal direction of rotation of the shaft 10 and driving wheel 14, and prevent reverse rotation of the wheels 16 and 17. The manner of operation of this hydraulic torque converter unit is thought to be obvious and as the operation of the converter forms no part of this invention a detailed description thereof will be omitted.

It has been customary practice in the past to cast the converter impeller and turbine wheels 14 and 15 but this method of manufacture has been expensive, time consuming, and tedious and the resulting wheels have not always been of the highest quality due to inherent defects associated with the casting processes. This invention provides an improved, simplified, rotor wheel which is completely formed from stamped elements that may be easily, accurately, and economically assembled to provide a rotor wheel of superior quality.

The rotor wheel 15 shown in Figs. 1–4 is composed of a ring-like, outer, supporting shell or shroud member 21 having a dish-like cross section, and a plurality of substantially Z-shaped blade or vane elements 31 concentrically mounted within the shell or shroud member 21.

The blade elements 31 are preferably stamped elements of substantially Z-shaped cross sectional configuration and each includes a base or outer flange portion 32, a transversely extending blade or web portion 33, and an inner flange portion 34 spaced from the base flange portion 32 and extending in an opposite direction with respect thereto. It will be noted that the spaced flange portions 32, 34 are curved about axes extending normal to the blade portion 33 so as to provide inner and outer curved shell portions for the blade portion.

The base flange portion 32 of each blade element 31 extends transversely to the blade portion 33 and is shaped to conform to the inner surface contour of the outer shroud or shell member 21 and is adapted to be connected thereto by welding, riveting, brazing or the like as shown at 38.

The blade portion 33 of each blade element 31 is substantially normal to the base flange portion 32 and extends outwardly from one side edge 32a thereof. The blade portion 33 is preferably curved about axes normal to the base flange portion 32 but the blade portion 33 could be a perfectly flat surface if so desired.

The other or inner flange portion 34 of each blade element 31 extends transversely of the blade portion 33 and is spaced radially from the outer flange 32 and disposed on the opposite side of the blade portion 33 from that mounting the base flange portion 32. Flange portion 34 is composed of a pair of offset portions 34a and 34c connected by a step formation 34b.

In assembling a rotor wheel of the type herein disclosed the ring-like blade supporting shroud member 21 is used as an assembly fixture and then a plurality of the substantially Z-shaped blade elements 31 are concentrically mounted within the inner surface of shell 21 after which the blade elements 31 are fixedly connected to the shell 21 by the connections 38. With this arrangement it will be noted that separate fixtures for mounting the blades 31 in the shell 21 are dispensed with and neither the shell 21 nor blades 31 carry preformed tabs or slots that must be interengaged during assembly of the rotor wheel. Accordingly, this rotor wheel is quite simple and economical to manufacture.

The blade elements 31 are so shaped that the outer base flange portions 32 accurately fit the contour of the inner surface of the shell 31 and extend circumferentially along this surface a distance equal to the desired spacing of the blade elements. The free end 35 of each blade element base portion 32 abuts against the end 32a of the base flange portion 32 of an adjacent blade element and this accurately spaces the blade elements within the shell 21 and rigidifies the wheel unit as a whole. Because the base flanges 32 extend between the adjacent blades and form a surrounding shell for the blades it is obvious that the separate outer shell member 21 need not be of as heavy or as rigid material as would otherwise be the case. The blades in reality serve as beams to carry the load and relieve the outer shell 21 of a part of its load. Accordingly, the outer shell 21 may be made of lighter material than usual. It is necessary that the impeller and turbine wheels be quite rigid in a torque transmitting device of the type disclosed for the converter unit has a tendency to breathe or expand and contract in an axial direction and this must be resisted by a relatively rigid wheel construction of the type herein disclosed.

The inner flange portion 34 of each of the blade elements 31 is arranged to overlap portions of the corresponding flange of an adjacent blade element. It will be noted that the portion 34a of one blade element interfits with and overlaps a portion 34c of an adjacent blade element. The overlapped arrangement is such as to provide a smooth inner supporting shell about the inner flanges 34 of the blades which shell is twice the thickness of the flanges of the blade elements. This relatively thick inner shell formed by the overlapping design of the flanges 34 of the blade elements 31 rigidifies the blade assembly and provides a smooth, integral, inner semi-toroidal shell which makes it unnecessary to connect a separate inner web member to the assembled blade elements. The overlapped inner flange portions 34 of the blade elements 31 are suitably connected together by welding, riveting, brazing or the like as indicated at 36. The step formations 34b in the flanges 34 are so located that they form seats for and accurately space the inner edges of the blade portions 33 of the blade elements 31 and assure an accurate assembly of the blade elements within the shell member 21. It will be noted that the circumferential length of the inner flange portions 34 is equal to twice the spacing of the blade portions at their inner edges, therefore each overlapping double thickness, inner flange 34 extends the complete distance between each blade element and the next adjacent blade element and a continuous inner torus ring of double flange thickness is formed by the flanges 34 of the blades 31.

It is obvious that this overlapped flange construction may be applied at either or both of the flanged edges of the blade elements if so desired. If applied to the outer base flanges, as well as the inner flanges, then the structure can be accordingly modified to compensate for the increased thickness of the overlapped base flanges of the blade elements. Such a construction is shown in Fig. 5 where the blade elements 51 are substantially Z-shaped stampings comprising offset outer base flange portions 52, blade portions 53 and offset inner flange portions 54. With a construction of this type the overlapped inner and outer flanges provide both the inner and outer shells for the blades and separate web

and shroud members for the wheels are unnecessary.

It is obvious that suitable baffle plates, such as the plates 61 and 62 (see Figs. 1 and 2) may be connected to the inner blade flanges 34, by spot welding 63, or the like, if such plates are required. The plates 61 and 62 provide additional means for tying together the assembled, interlocked blade elements and add to the rigidity of the wheel construction.

By this invention an improved type of rotor wheel can be completely formed from a minimum of stamped elements with a minimum of skilled labor and the accurate assembly of the blade elements is assured due to the interlocking blade element arrangement. In addition this construction eliminates at least one of the conventional shroud and/or web elements from a rotor wheel assembly due to the overlapped, interengaged flanges providing a built-up shell unit. Furthermore, the abutting relationship of the inner and outer flanges on each blade element, with corresponding parts of adjacent blade elements, rigidifies the wheel assembly and makes additional blade covers, tie rings, and other forms of blade element supports unnecessary. At the same time the completely stamped construction assures smooth, accurately formed, blade surfaces that will create a minimum of turbulence and that will have a maximum life. With the construction shown in Figs. 1–4 the outer shell member 21 serves as a fixture for assembly of the blade elements and as it is unnecessary to match up interlocking tabs and slots and the like this wheel may be assembled in a minimum of time by the simplest processes and with unskilled labor.

The guide wheels 16 and 17, and their method of manufacture, are described in the separate application of Olavi M. Koskinen, Serial Number 72,668, filed January 25, 1949.

I claim:

1. A vaned rotor wheel for a hydraulic torque converter or the like comprising an annular, dished, outer shell member and a plurality of prefabricated, radially disposed, blade elements concentrically assembled within and mounted on the dished inner surface of the shell member so as to extend substantially normal thereto, each blade element being of substantially Z-shaped cross-sectional configuration and comprising a pair of radially spaced, circumferentially extending, inner and outer flange portions connected by a web-like, radially extending, blade portion, said outer flange portions being seated on the shell inner surface and at least the inner flange portions of each blade element having a transversely extending step formation therein halfway between the ends thereof adapted to receive in overlapped, engaged relationship a free end portion of the corresponding flange of an adjacent blade element, said inner flange of each blade element being of a length equal to twice the blade spacing and of a constant width at least equal to the width of the blade element so as to provide a continuous rim of double flange thickness about the inner periphery of the assembled blade elements, the outer flange portion of each blade element being shaped to fit the blade supporting inner surface of the shell member and being of a length equal to the blade spacing at the outer flange and so mounted on the shell member as to extend against and between the blade portion of an adjacent blade element to assist in accurately spacing the blade elements about the shell member.

2. A bladed rotor wheel comprising a dished, annular shroud member and a plurality of congruent, prefabricated, radially extending, blade elements concentrically arranged within and mounted on the inner dished surface of the shroud member so as to extend substantially normal thereto, each blade element being of substantially Z-shaped cross-sectional configuration and comprising a pair of radially spaced, circumferentially extending, oppositely directed, inner and outer flange portions connected by a radially extending blade portion, said outer flange portions being seated on the shroud member inner surface and the inner flange portion on each blade element having a transversely extending step formation therein midway between the circumferentially spaced ends thereof adapted to receive in overlapped, engaged, supporting, relationship a free end portion of the corresponding flange of an adjacent blade element, the overlapped inner flange portions of adjacent blade elements extending circumferentially a distance equal to twice the blade spacing and being of blade element width so as to provide a continuous rim of double flange thickness about the inner periphery of the assembled blade elements, said outer flange portions of each blade being of a length equal to the blade spacing at the outer flanges and extending between and against adjacent blade portions to accurately space the blade elements about the rotor wheel shroud member and a baffle plate of ring-like formation mounted on the outer side of said blade element inner flange.

3. A bladed rotor wheel comprising a plurality of blade elements of substantially Z-shaped cross-sectional configuration, said blade elements being arranged in annular formation and assembled in contiguous relationship to one another to form a pair of radially spaced shroud and web members connected by a plurality of blade portions, each blade element comprising a blade portion and a pair of radially spaced, oppositely directed flanges extending transversely of and substantially normal to the blade portion at opposite end edges thereof, each flange portion including a transversely extending step formation midway between the ends of the flange providing means adapted to receive in overlapping engagement the free end of a corresponding flange portion of an adjacent blade element, the flange portions being curved about axes extending normal to the blade portion and being of a length equal to twice the blade spacing such that the shroud and web members of the wheel are formed as continuous rims of double flange thickness that accurately space the blade elements about the rotor wheel.

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