March 24, 1953 O. M. KOSKINEN 2,632,396

ROTOR WHEEL

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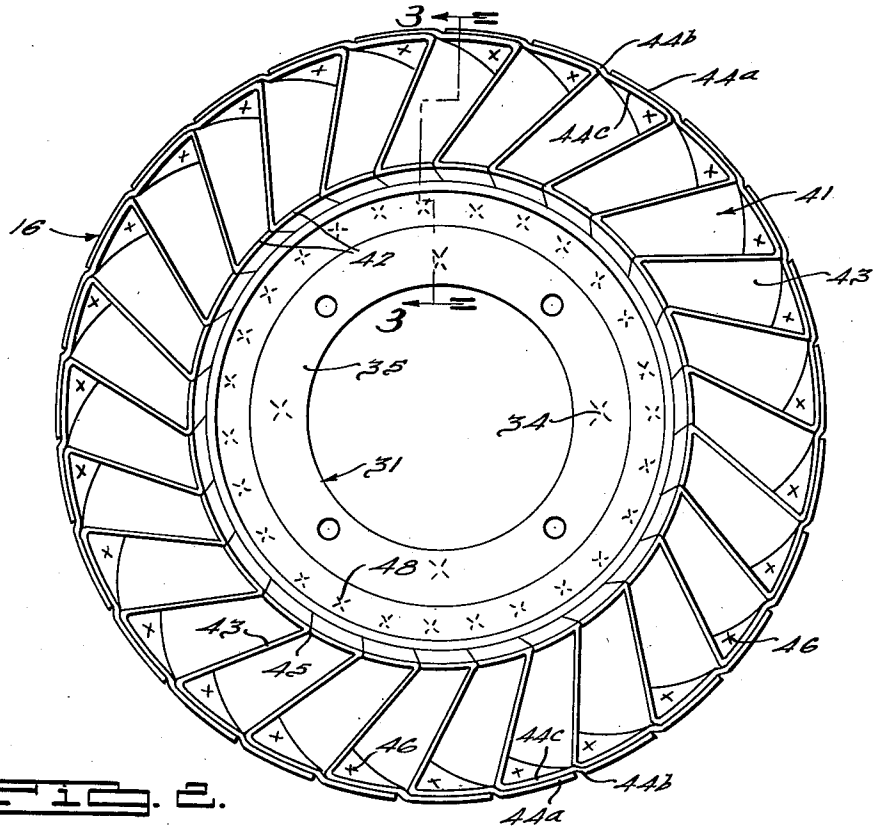

Fig. 2.

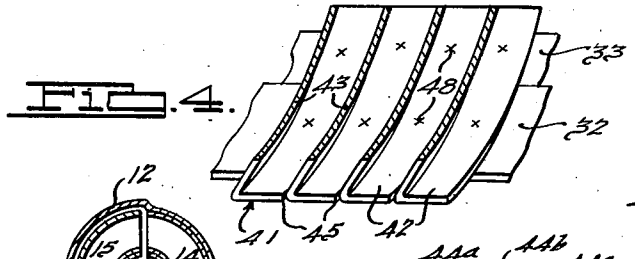

Fig. 4.

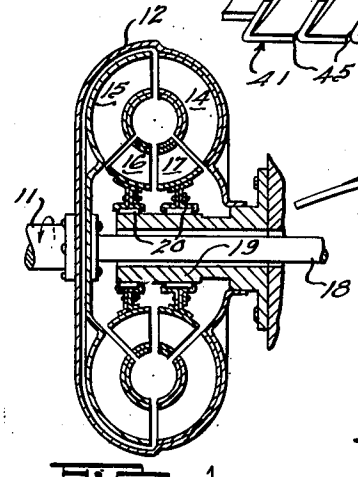

Fig. 1.

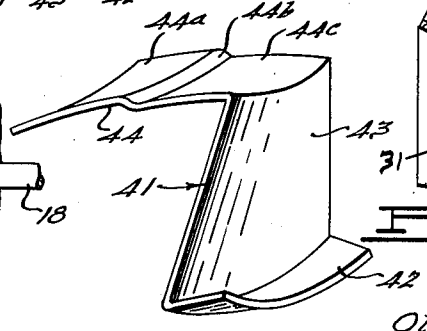

Fig. 5.

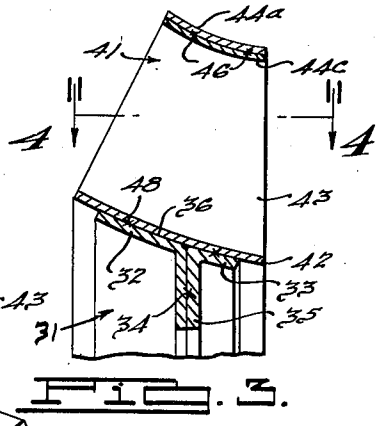

Fig. 3.

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ROTOR WHEEL

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This invention relates to bladed rotor wheels in general and is specifically concerned with the bladed reaction or guide wheels which form a basic part of hydraulic torque converter devices.

The bladed rotor wheels of hydraulic torque transmitting devices have heretofore been constructed chiefly by casting the blade elements and their supporting 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, pitted, products of variable porosity which may be formed with untrue surfaces, the resultant wheels may produce undesirable vibrations or they may leak or cause turbulence in the fluid passed through the cell-shaped channels defined by the assembled blades. Accordingly, a method of producing an improved type of bladed rotor wheel by assembling stamped or prefabricated wheel elements, rather than casting the wheel as an integral unit, 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 assembled to provide a rotor wheel of superior quality.

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 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 flange portions that interfit with adjacent blade element flange portions in such a manner that at least one of the peripheral supporting members for the blades is completely formed by the interfitting flanges. This construction eliminates one of the usually required supporting 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 assembled about an annular hub portion 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 about the wheel hub portion.

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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 diagrammatic sectional view of a hydraulic torque converter having bladed rotor wheels embodying this invention;

Fig. 2 is an enlarged side elevation of a bladed guide or reaction wheel for the torque converter shown in Fig. 1;

Fig. 3 is a fragmentary sectional elevation of the guide wheel taken along the line 3—3 of Fig. 2;

Fig. 4 is another fragmentary sectional elevation of the guide wheel taken along the line 4—4 of Fig. 3; and

Fig. 5 is a perspective view of one of the blade elements used to fabricate the guide wheel.

Fig. 1 shows diagrammatically a hydraulic torque converter unit wherein a driving shaft 11 carries a converter casing shell 12 within which are mounted the bladed rotor wheels 14, 15, 16 and 17. Wheel 14 is the impeller wheel and it is drivingly connected to the casing 12 so as to be rotated by the driving shaft 11. Wheel 15 is the runner 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 shaft 11. Turbine wheel 15 is drivingly mounted on the end portion of driven shaft 18 that is located within the casing 12. Mounted concentrically about the driven shaft 18 and extending within casing 12 is a fixedly mounted sleeve 19 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 19 through separate one-way roller brakes 20 which permit only forward rotation of the wheels 16 and 17, that is in the normal direction of rotation of the 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 therefore a detailed description thereof will be omitted.

It has been customary practice to cast the converter guide wheels 16 and 17 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 process. This invention provides an improved, simplified, rotor wheel which is completely formed from stamped elements that may be easily, accurately, and economically manufactured and assembled to provide a rotor wheel of superior quality.

The rotor wheel 16 shown in Figs. 2–5 is composed of an annular hub or supporting member 31 and a plurality of substantially Z-shaped blade or vane elements 41 concentrically mounted about the hub member 31.

The hub or supporting member 31 is formed from a pair of annular, ring-like, stampings 32 and 33, each of substantially L-shaped cross sectional configuration, which stampings are suitably joined together by welding or the like 34 to form a unitary hub structure. The radially extending portion 35 of hub member 31 is adapted to carry the outer race for an overrunning or one-way brake 20 which is usually associated with a rotor wheel of this type when it is incorporated in a hydraulic torque converter as a guide wheel. The outer peripheral surface 36 of hub member 31 is formed by the oppositely disposed legs of the L-shaped stampings 32 and 33. The peripheral surface 36 is adapted to have mounted thereon the substantially Z-shaped blade elements 41.

The blade elements 41 are stamped elements of substantially Z-shaped cross sectional configuration and each includes a base flange portion 42, a blade or vane portion 43 and an outer flange portion 44 spaced from the base flange portion 42 and extending in an opposite direction with respect thereto.

The base portion 42 of each blade element 41 is shaped to conform to the contour of the outer peripheral surface 36 of the hub member 31 and is adapted to be connected thereto by welding, riveting, brazing or the like as shown at 46.

The blade portion 43 of each blade element 41 is substantially normal to the base portion 42 and extends outwardly from one side edge thereof. The blade portion 43 is preferably curved about an axis normal to the base portion 42 but it could be a perfectly flat surface if so desired.

The outer flange portion 44 of each blade element extends transversely of the blade portion at the outer end thereof and is disposed on the opposite side of the blade portion from that mounting the base portion 42. Outer flange portion 44 is composed of a pair of offset portions 44*a* and 44*c* connected by a step formation 44*b*.

In assembling a rotor wheel of the type herein disclosed the hub or supporting member is first placed in a fixture and then a plurality of the substantially Z-shaped blade elements 41 are concentrically mounted about the outer peripheral surface 36 of the hub member. The blade elements 41 are so shaped that the base portions 42 accurately fit the contour of the hub surface 36 and extend about this surface a distance equal to the desired spacing of the inner ends of the blade elements. The free end 45 of each blade element base portion 42 abuts against the inner end of the blade portion 43 of an adjacent blade element and this accurately spaces the blade elements and rigidifies the wheel unit. The outer flange 44 of each of the blade elements 41 is arranged to overlap portions of the outer flange of an adjacent blade element. It will be noted that the portion 44*a* of one blade element interfits with and overlaps a portion 44*c* of an adjacent blade element. The overlapped arrangement is such as to provide a smooth outer

rim about the outer edges of the blades which rim is twice the thickness of the blade elements. This relatively thick rim portion formed by the overlapping design of the outer flanges of the blade elements rigidifies the blade assembly and provides a smooth, integral, outer rim which makes it unnecessary to connect a separate outer rim or shroud member to the assembled blade elements. The overlapped outer flange portions 44 of the blade elements are suitably connected together by welding, riveting, brazing or the like as indicated at 46. The step formations 44*b* in the outer flanges 44 are so located that they form seats for and space the outer edges of the blade portions 43 of the blade elements and assure an accurate assembly of the blade elements about the hub member 31. It will be noted that the circumferential width of the outer flange portions 44 is equal to twice the spacing of the blade portions at the outer edges, therefore the overlapping extends the complete distance between each blade element and a continuous rim of double blade thickness is provided around the complete outer periphery of the blades. It is obvious that the 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 base flanges then the hub structure can be accordingly modified to compensate for the increased thickness of the base flanges of the blade elements.

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 for the accurate assembly of the blade elements is assured due to the specific blade element formations. As a separate outer rim has been eliminated by the overlapped outer flange construction disclosed, both material and time consuming labor have been saved. In addition the abutting relationship of the inner and outer flanges on each blade element, with corresponding parts of an adjacent blade element, 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, blades that will create a minimum of turbulence and that will have a maximum life.

I claim:

1. A vaned rotor wheel for a hydraulic torque converter or the like comprising an annular hub portion and a plurality of prefabricated, radially extending blade elements concentrically assembled about and mounted on the peripheral surface of the hub portion, each blade element being of substantially Z-shaped cross-sectional configuration and comprising a pair of radially spaced, circumferentially extending, oppositely directed, flange portions connected by a web-like, radially extending, blade portion, at least one of the flange portions of each blade element having a transversely extending step formation formed therein substantially 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 one flange of each blade element being of a length equal to twice the blade spacing at said one flange and of a constant width equal to the width of the blade element so as to provide a continuous rim of double flange thickness about the assembled blade elements, the other flange portion of each blade element being shaped

to fit the peripheral surface of the hub portion and being mounted thereon and of a length equal to the blade spacing at the other flange of the blade elements so as to extend against and between adjacent blade elements.

2. A bladed rotor wheel comprising a stamped annular hub portion and a plurality of congruent, stamped, radially directed blade elements concentrically arranged about and mounted on the peripheral surface of the hub portion, each blade element being of substantially Z-shaped cross-sectional configuration and comprising a pair of radially spaced, circumferentially extending, oppositely directed flange portions connected by a radially extending blade portion, at least one of the flange portions 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 flange portions of adjacent blade elements extending the full circumferential distance between the blade elements and providing a full width, continuous rim of double flange thickness about said blade elements, said double flange thickness rim being adapted to rigidify the blade element mountings and to accurately space the blades about the hub portion, and the other flange portion of each blade element being shaped to fit the contour of the peripheral surface of the hub portion and having a circumferential length equal to the blade spacing at said other flange so as to extend between and against the blade portion of an adjacent blade element to accurately space and rigidify the blade elements at said other flanges.

3. A bladed rotor wheel for a hydraulic torque transmitting device comprising a stamped, annular supporting member and a plurality of stamped, radially directed blade elements concentrically arranged about and fixedly mounted on a peripheral surface of the supporting member, each blade element being of substantially Z-shaped cross-sectional configuration and comprising a pair of radially spaced, circumferentially extending, flange portions connected by a web-like, radially extending blade portion, at least one of the flange portions of each blade element being of a length equal to twice the blade spacing at said one flange and having a transversely extending step formation therein midway between the ends thereof adapted to receive in overlapped, engaged, supporting relationship a free end portion of the corresponding flange of an adjacent blade element, the overlapping portions of the blade elements extending the full distance between the adjacent blade elements and combining to provide a continuous rim of double flange thickness and full flange width about one flanged edge of the blade elements, the opposite flanged edge of the blade elements being spaced by and connected together through the other blade element flange portions which are mounted on the peripheral surface of the supporting member, said other flange portions each being of such length as to extend between and against adjacent blade elements at the other flange portions to accurately space and rigidify the blade elements.

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