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ELASTIC FLUID TURBINE BUCKET WHEEL

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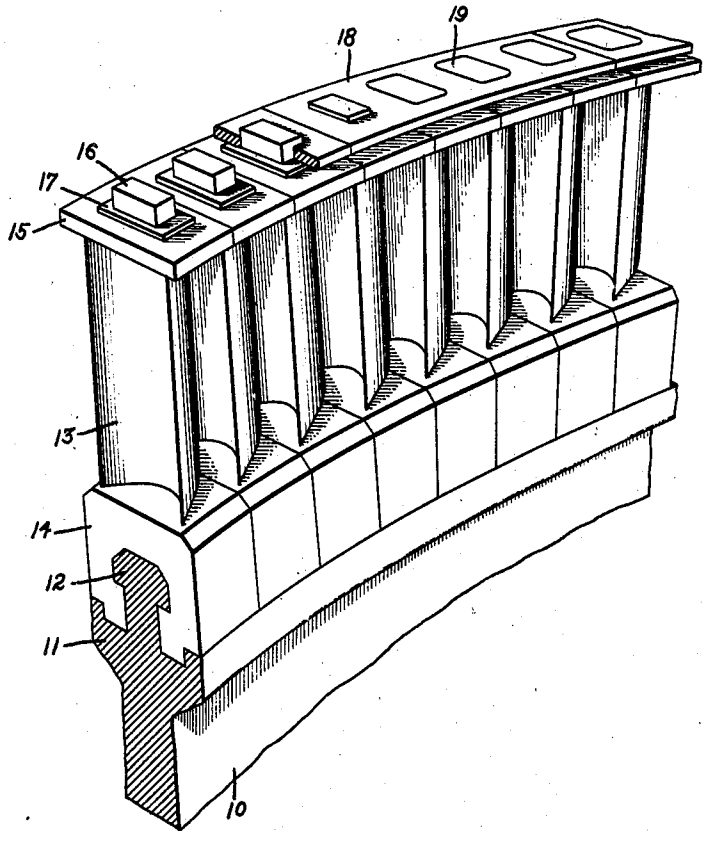

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ELASTIC FLUID TURBINE BUCKET WHEEL

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7 Claims. (Cl. 253—77)

The present invention relates to elastic fluid turbine bucket wheels and more particularly to arrangements for covering the outer ends of the buckets.

In turbine bucket wheel design it is the usual practice to connect adjacent buckets together by some form of a cover attached to the ends of the buckets to confine the operating fluid within the working passage and to prevent it from spilling outwardly past the ends. Because of the relatively great force exerted by the operating fluid acting against the buckets, particularly in the high pressure stages, a certain amount of bending of the individual buckets takes place which is accompanied by a corresponding distortion of the covers between adjacent buckets. This distortion of the covers together with the centrifugal force, due to the wheel rotation, acting outwardly on the cover, severely stresses the attaching means. In elastic fluid turbines designed not only for high speed operation but also for modern high pressures and temperatures, the stresses are greatly amplified. Because of the relatively great force exerted by the operating fluid against the cover, normal to its surface, special precautions must be taken to prevent the undue loading thereof.

It is an object of this invention to provide a new and improved turbine bucket wheel cover arrangement of great strength and capable of withstanding extreme operating conditions.

A further object is to produce a new and improved turbine bucket cover arrangement in which the interconnecting band member is protected from the force of the operating fluid by portions integral with the buckets.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto taken in connection with the accompanying drawing.

The single figure of the drawing represents a section of a turbine bucket wheel in perspective provided with covers according to my invention.

Referring to the drawing, 10 indicates the web of the wheel disk or rotor and 11 the grooved rim thereof which on opposite sides is provided with annular shoulders defining a dovetailed portion 12 for retaining the buckets 13 thereon. The bucket bases 14 are provided with a grooved slot defining an inverted dovetail for cooperatively fitting over the rim of the rotor substantially as shown.

According to my invention, the buckets 13 are each provided with relatively rigid integral cover portions 15 substantially bridging the space between the adjacent buckets at the upper ends thereof. These cover portions prevent the operating fluid from escaping outwardly past the ends of the buckets and absorb the force which would otherwise be directed against the tie band.

A tie member is provided connecting a group of adjacent buckets together for transmitting part of the force acting against the individual buckets to those attached to it. Such a tie member may be secured in any suitable manner upon the upper surfaces of the cover portions such as by the arrangement shown. As shown in the drawing, the upper surfaces of the cover portions are provided with upwardly extending integral lugs 16 having shoulders 17 at the base thereof. The tie member sections 18, which are relatively flexible are suitably perforated for cooperatively fitting over the lugs 16 and seating upon the shoulders 17 in spaced relationship from the upper surface of the cover portions 15. The sections 18 may be secured in place as by peening over the edges of the lugs substantially as indicated at 19. In the drawing the tie band sections are shown as connecting groups of four adjacent buckets together, though it is obvious that a greater or smaller number may be secured together as desired. The size of the lugs 16 is such that the tie band sections are securely retained on the ends of the buckets against the centrifugal force acting thereon. It will be further noted that because of the height of the shoulders 17 the tie band is held in spaced relationship with respect to the cover portions 15 which will permit the band sections to flex between the fastening lugs. Because of the relative narrowness of the shoulders, there is a considerable length of band between the lugs of adjacent buckets for absorbing the distortion caused by the bending of the buckets by elastic fluid passing the nozzles. This distortion will not take place in the form of sharp bends likely to cause failure of the band or of the fastening lugs, but will be distributed over the length of the band portion spaced above the integral covers. A turbine bucket wheel provided with a bucket covering and tying arrangement in the manner described will operate at high speeds and with extremely high admission pressures of operating fluid safely and efficiently.

Having described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a fluid motor having a rotor provided with buckets, the combination including covers integral with each of said buckets substantially bridging the space between the outer ends of adjacent buckets, a relatively flexible tie band, centrally disposed means integral with the upper surface of said covers for securing and maintaining said tie band in spaced apart relationship with respect to said covers.

2. A turbine rotor comprising a disk having curved blades mounted thereon, a cover portion integral with each blade for substantially bridging the space between the outer ends of adjacent blades, a relatively flexible tie band, means for securing said tie band onto the outer ends of said blades above said cover portions, and means integral with said cover portion for spacing said tie band from said cover portion.

3. An elastic fluid turbine having a rotor with buckets provided with integral cover portions, a lug extending upwardly from the upper surface of each cover portion, a shoulder around the base of each lug, and a tie band secured by said lugs against said shoulders in spaced apart relationship with said cover portions.

4. An elastic fluid turbine having a rotor with buckets provided with integral cover portions, a centrally disposed lug extending upwardly from the surface of said cover portion of each of said buckets, a perforated tie band secured over a plurality of said buckets by said lugs extending through said perforations, and means including shoulders on said lugs for engaging and retaining said band in spaced apart relationship with said cover portions.

5. In an elastic fluid turbine, the combination with buckets having integral cover portions substantially bridging the space between the outer ends of adjacent buckets, lugs extending upwardly from the surface of said cover portions, a perforated band secured over said cover portions by means including said lugs, and means including shoulders on said lugs for retaining said tie band in spaced apart relationship with respect to said cover portions.

6. In an elastic fluid turbine having a rotor with buckets provided with individual integral cover portions, a relatively flexible tie band, means for securing said tie band to the ends of a plurality of adjacent buckets, and means provided between said tie band and said cover portions around said securing means for maintaining said tie band in a spaced apart relationship with respect to said cover portions.

7. A turbine blade provided with an integral cover portion, a tie band, a tie band securing lug integral with and extending upwardly from the upper surface of said cover portion, said lug having a relatively narrow shoulder around the base thereof for supporting and maintaining said tie band in spaced relationship from said cover portion.

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