May 24, 1960 D. J. CLARKE 2,937,806

AXIAL FLOW COMPRESSOR CONSTRUCTION AND BLADED ROTORS THEREFOR

Filed Feb. 12, 1953 2 Sheets-Sheet 1

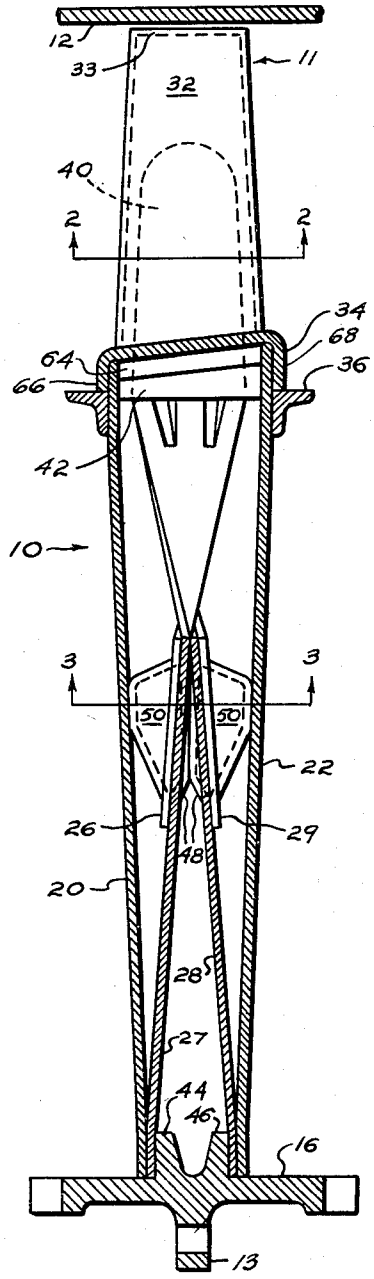


FIG. 1

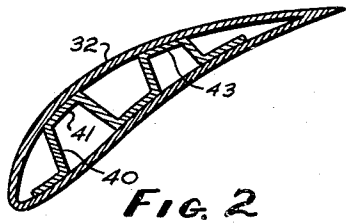


FIG. 2

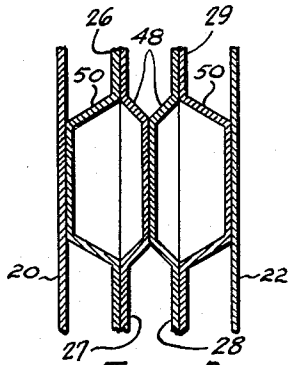


FIG. 3

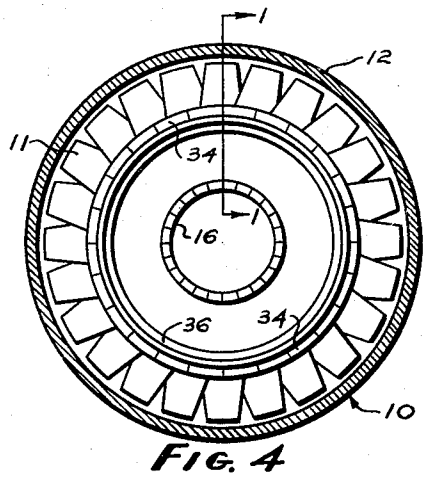


FIG. 4

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AXIAL FLOW COMPRESSOR CONSTRUCTION AND BLADED ROTORS THEREFOR

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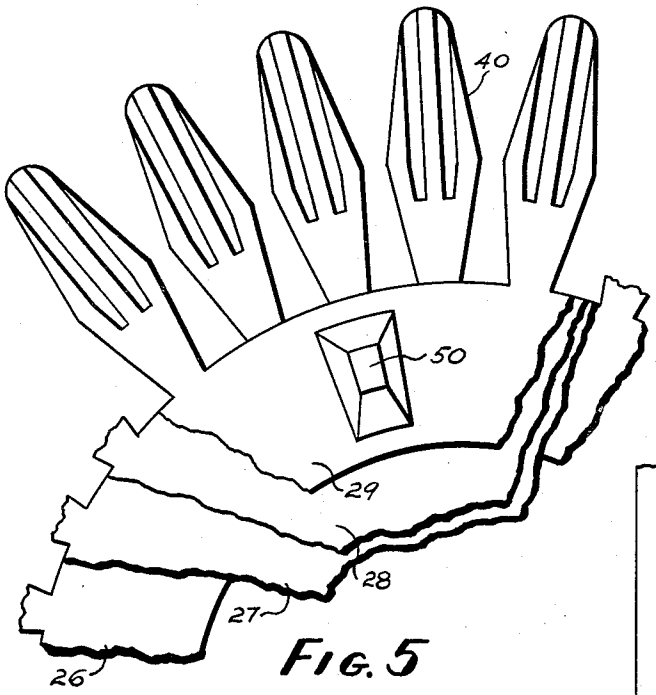


FIG. 5

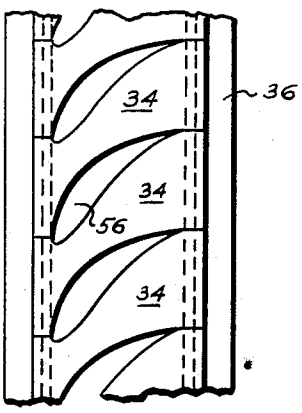


FIG. 6

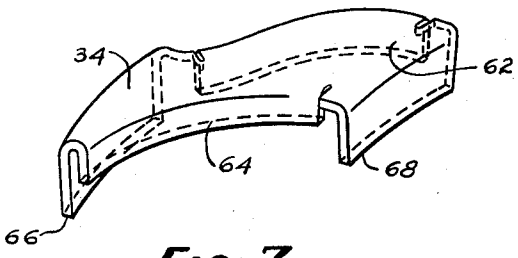


FIG. 7

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2,937,806

AXIAL FLOW COMPRESSOR CONSTRUCTION AND BLADED ROTORS THEREFOR

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3 Claims. (Cl. 230—134)

This invention relates to bladed axial flow rotors for fluid machines such as compressors, turbines and the like.

An object of the invention is to provide a rotor comprised of sheet metal stampings wherein the side plates are laterally supported from the blade supporting plates.

Another object is to provide a plurality of blade-carrying plates so that the number of blades can be a prime number.

Still another object is to provide a rotor structure adapted to sustain large axial loads from the blades.

Other objects will appear from the description, drawings and claims.

These objects are accomplished by the means illustrated in the accompanying drawings in which—

Fig. 1 is a fragmentary axial section through the rotor on line 1—1 in Fig. 4;

Fig. 2 is a section along line 2—2 in Fig. 1;

Fig. 3 is an enlarged section on line 3—3 in Fig. 1 through the cups supporting the side plates;

Fig. 4 is a rear view of the rotor of Fig. 1 shown in the compressor case;

Fig. 5 is a fragmentary axial view of the four blade-carrying plates;

Fig. 6 is a radial view of a fragment of the rotor hub rim; and

Fig. 7 is a perspective view of the flanged rim segment between blades.

Referring to the drawings and particularly Figs. 1–4 the rotor is indicated generally as **10** and the case as **12** enclosing the rotor to sustain the fluid pressure created by the rotor.

The rotor is comprised of the blades **11** supported on the hub structure which includes hub **13**, the toothed clutch rings **16**, the side plate **20** and **22**, the stem or blade supporting plates **26—29** and segments **34**, and the rings **36**. The rim segments **34** collectively form a rim means capable of sustaining the pressure rise from one side of the rotor to the other. The blade envelopes are **32**. The end surfaces are crimped at **33** to seal the ends of the respective blades.

As shown in Figs. 1–5 and particularly in Fig. 5 the stem plates each have integral stems **40** spaced peripherally. Each stem is corrugated radially, defining on one surface the splines **41** and **43**. These are shown terminating about two thirds of the way out from the roots of the blade in Fig. 1. The corrugations are omitted in Fig. 5. Each stem is twisted somewhat about the neck adjacent to the central portion of the plate.

The stems of the several plates interdigitate and extend radially outward, each stem through an opening **56** (Fig. 6) in the rim means.

The blade envelopes **32** are bonded to the stems preferably by soldering and each extends radially inward somewhat beyond the rim means as indicated by the lower edges of the blades at **42** in Fig. 1. The envelope is also bonded to the rim segment **34** along the rim surface thereof.

The blade supporting plates **27** and **28** extend radially inward to the toothed clutch ring **16** and are bonded to the flanges **44** and **46**. These plates have the inward directed cups **48** bonded to each other for stiffening and anti-vibration purposes. Also since these plates spread apart or diverge at the clutch ring **16** they provide strength against the axial forces arising from the blade loads.

The axial extensions or cups **48** are pressed or stamped in the plates. The cup on one plate abuts the cup on the adjacent plate. The abutting or faying surfaces are preferably fused together by solder.

The plates **26** and **29** terminate about midway between the rim means and the clutch **16** of the hub structure to save weight. Each of these plates has a plurality of cups **50** which extend axially outward to support a side plate to which it is bonded as by fused metal between the faying surfaces of the cups and the side plates.

Fig. 6 shows the openings **56** in the rim means of the hub structure to accommodate the blades. These openings are formed between the adjacent rim segments **34**, that is between the flanges **62** and **64** which are bonded to the blade walls. The flanges **66** and **68** are bonded to the side plates of the hub structure.

The bonding can take the form of welding but preferably is soldering. Suitable solders are for instance, copper, copper alloys, and silver alloys or mixtures.

In compressor and turbine rotors the fluid pressure and density varies significantly between the leading and trailing edges and the rim segment surfaces serve to sustain the pressure and the variations of it.

While I have illustrated specific forms of the invention, it is to be understood that variations may be made therein and that I intend to claim my invention broadly as indicated by the appended claims.

I claim:

1. In combination in a rotor for an elastic fluid machine adapted to substantially alter the density of the fluid flowing therethrough, a hub structure having an axis of rotation and including a rim means, side plates at axially opposite sides of said rim means being fixed thereto, a plurality of stem plates between said side plates spaced therefrom, each said stem plate having a plurality of stems spaced peripherally thereabout and extending radially outward of said rim means therethrough, the stems of different plates interdigitating, a sheet metal blade envelope enclosing each said stem and being bonded thereto, each said envelope being a continuous sheet chordwise between leading and trailing edges of said blade, at least two of said stem plates diverging to space portions of each apart, each said diverging stem plate having an axial extension faying with the surface of the adjacent side plate to stiffen said hub structure.

2. In combination in a rotor for an elastic fluid machine adapted to substantially alter the density of the fluid flowing therethorugh, a hub structure having an axis of rotation and including a hollow sheet metal rim means, side plates at axially opposite sides of said rim means being fixed thereto, a plurality of sheet metal stem plates between said side plates, each said stem plate having a plurality of sheet metal stems spaced peripherally thereabout and extending radially outward of said rim means therethrough, the stems of different plates interdigitating, a sheet metal blade envelope enclosing each said stem and being bonded thereto, each said envelope being a continuous sheet chordwise between leading and trailing edges of said blade some of said stem plates having axial extensions abutting said side plates and other said stem plates having axial extensions extending from one stem plate to the other to stiffen said hub structure.

3. In combination in a rotor for an elastic fluid machine adapted to substantially alter the density of the fluid flowing therethrough, a hub structure having an

axis of rotation and including a rim means, side plates of axially opposite sides of said rim means being fixed thereto, a plurality of sheet metal stem plates between said side plates and spaced therefrom, each said stem plate having a plurality of sheet metal stems spaced peripherally thereabout and extending radially outward of said rim means therethrough, the stems of different plates interdigitating, a blade envelope enclosing each said stem and being bonded thereto, each said envelope being a continuous sheet chordwise between leading and trailing edges of said blade, some of said stem plates having axial extensions abutting said side plates and other said stem plates having axial cup-shaped extensions extending from one stem plate to the other to stiffen said hub structure.

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