Dec. 25, 1956 L. D. BARRETT, JR., ET AL 2,775,426

BLADE STRUCTURE

Filed Dec. 20, 1951

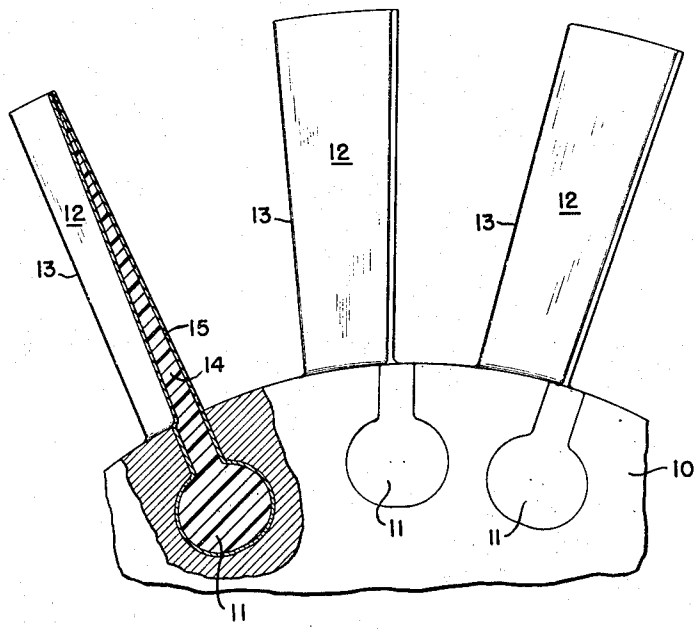

FIG. 1.

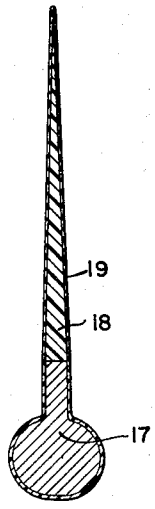

FIG. 3.

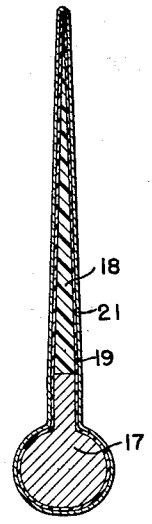

FIG. 2.

WITNESSES:

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United States Patent Office 2,775,426 Patented Dec. 25, 1956

2,775,426

BLADE STRUCTURE

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Application December 20, 1951, Serial No. 262,596

2 Claims. (Cl. 253—77)

This invention relates to a blade construction for elastic fluid turbines or gas compressors and has for an object to provide improved apparatus of this kind.

A further object of the invention is to provide an improved blade of the type set forth having relative high vibration damping properties.

A still further object of the invention is to provide an improved blade of the type set forth which is light in weight and which may be economically produced.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is an end view of a portion of an axial-flow gas compressor rotor having blades constructed in accordance with the invention secured therein, one of which blades is shown in section;

Fig. 2 is a section through a modified blade representing a second embodiment of the invention; and

Fig. 3 is a section taken through the core of the blade of Fig. 2 prior to the application of the outer shell thereto.

Referring now to Fig. 1, a portion of a rotor **10** of an axial-flow compressor is shown having suitable slots for receiving the root portions **11** of blade structures **12** constructed in accordance with the invention. The vanes of the blade structures **12** are shown at **13**.

In accordance with this invention, the blades **12** include a plastic core **14** and a metallic shell **15** enclosing and confining the core **14**. The core **14** may be formed of a suitable plastic, such as, for example, one having a phenolic base. The shell **15** is formed of high strength nickel or copper and may be applied to the plastic core **14** in any suitable manner. For example, the shell may be deposited electrolytically upon the core until a wall thickness of from .02 to .04 inch is attained. In forming the blade in this manner, the core **14** is preferably molded of plastic which is then coated with silver throughout in order to make the core electrically conductive. The core is deposited in a suitable bath and the nickel or copper is deposited electrolytically on the core until the aforementioned wall thickness is attained. The wall thickness of the vane portion **13** of the blade may be tapered from the root to the tip of the vanes by slowly withdrawing the blades from the bath with the tip of the vanes uppermost.

Hollow metallic blades formed as described have relatively high natural frequencies of vibration which is desirable to avoid resonance during operation in most present day compressors or turbines. The plastic core has

excellent vibration damping properties. Tests have shown that blades formed of a phenolic resin plastic have damping properties from four to eight times that of similarly shaped metallic blades. Accordingly, a blade constructed in accordance with this invention will operate at low amplitudes of vibration and such vibrations as are excited are effectively damped by the plastic core.

In Figs. 2 and 3, a modified form of blade structure is shown. The core of the blade includes a metallic root portion **17** and a plastic vane portion **18** which are disposed in end-to-end relation as shown. A plastic laminate **19** may be wrapped around the root **17** and the vane **18** for retaining them in position during the coating of the assembly with silver and the subsequent depositing of the metal shell **21** in the electrolytic bath as described heretofore.

From the foregoing description, it will be apparent that an improved blade structure is provided which is light in weight and low in cost when compared to conventional metal blades. In this connection, close tolerances may be held without machining the blade and a satisfactory surface finish is provided. Since the blades have a natural period of vibration which is higher than the frequency of the forces exciting vibrations in most present day turbines and compressors, resonance is avoided and such vibrations as are excited are effectively damped by the plastic core structures.

While the invention has been shown in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. As a new article of manufacture, a blade structure of the type set forth including a plastic vane core and a metallic root core disposed in end-to-end abutting relation, a plastic covering for said vane and root cores, and a metallic shell enclosing and confining the cores and the plastic covering.

2. A blade structure for the rotor of an axial-flow compressor, including a core extending substantially the entire length and width of the blade and a plastic covering of substantially uniform thickness enclosing said core, said core including a metallic root portion adapted to be received in the rotor and a plastic vane portion.

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