Oct. 20, 1942. J. A. RYDMARK 2,299,429

TURBINE BLADE SHROUDING

Filed March 8, 1941

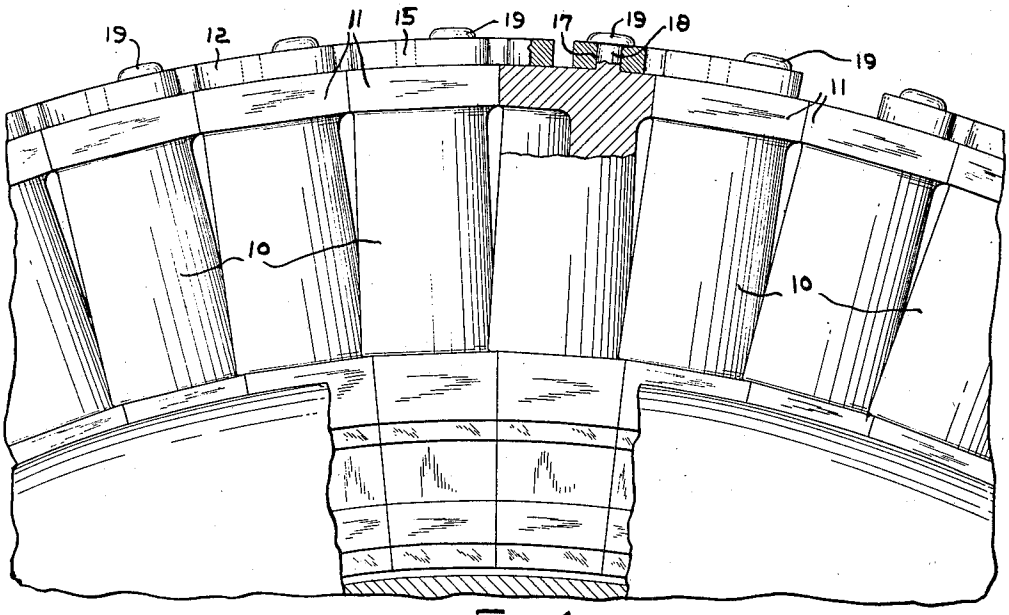


FIG. 1.

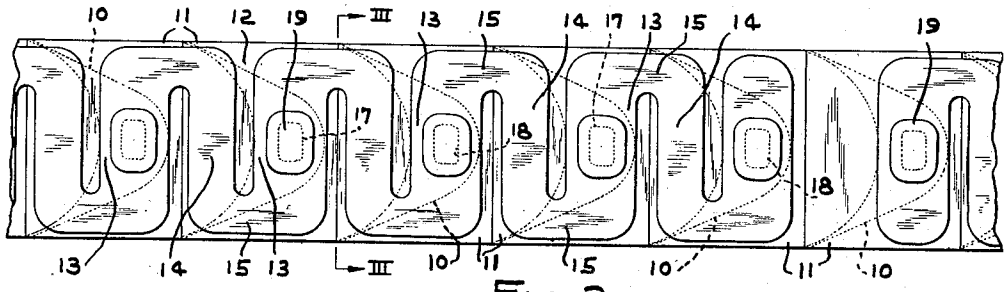


FIG. 2.

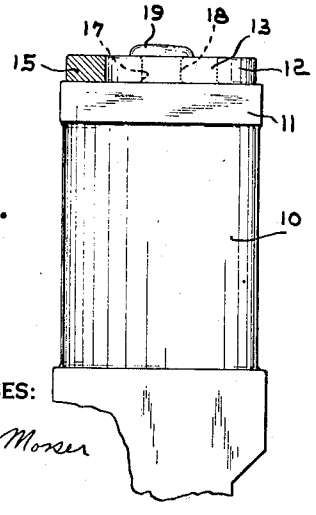


FIG. 3.

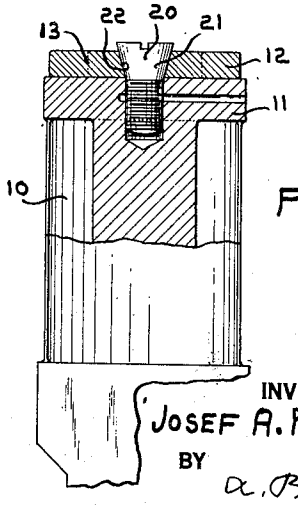


FIG. 4.

WITNESSES:

James K. Moser

E. H. Luty

INVENTOR

JOSEF A. RYDMARK.

BY

A. B. Rines

ATTORNEY

Patented Oct. 20, 1942

2,299,429

UNITED STATES PATENT OFFICE

2,299,429

TURBINE BLADE SHROUDING

Josef A. Rydmark, Lansdowne, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 8, 1941, Serial No. 382,323

5 Claims. (Cl. 253—77)

The invention relates to turbine blading, more particularly to blading of the impulse type used in the high-pressure region of a turbine and subject to rapid temperature changes, and it has for an object to provide shrouded blades connected by an elastic member.

A more particular object of the invention is to tie together blades having dependent shroud-forming elements by means of an elastic member.

A further object of the invention is to provide a metallic member for connecting together a plurality of shrouded turbine blades, the member being yieldable circumferentially of the blade row and relatively rigid in a direction transverse thereof.

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

Fig. 1 is a side elevation, partly in section, showing the improved elastic member attached to the turbine blades;

Fig. 2 is a top plan view showing the improved elastic member;

Fig. 3 is a sectional view taken along line III—III of Fig. 2; and,

Fig. 4 shows a modified way of attaching the elastic member to the blades.

Referring now to the drawing, the blades 10 are of the conventional impulse type and each is provided with its individual shroud-forming element 11. With an assembly of blades, the shroud-forming elements 11 are juxtaposed to form shrouds constituting the outer boundary walls of the blade passages; and the present invention makes it unnecessary to connect the shroud-forming elements together. Instead of such a connection, there is provided an elastic band, at 12, disposed outwardly of the shroud-forming elements and attached to the respective blades.

The metallic elastic band comprises portions 13 for the respective blades and which are elongated transversely of the blade row. The elongated portions 13 are joined by connecting members 14 arranged alternately with respect thereto, each connecting member having circumferentially-extending portions 15 integral with the ends thereof and extending in oposite directions, one circumferentially-extending portion being integral with one adjacent elongated member 13 and the other circumferentially-extending portion 15 being integral with the other adjacent elongated member 13. This arrangement provides a structure which is yieldable or elastic in a circumferential direction and which is relatively stiff in a direction transverse to the blade row.

The elongated members are provided with openings to receive means by which such members may be fastened to the respective blades. Preferably, as shown in Figs. 2 and 3, the elongated members 13 have openings 17 to receive tenons 18 having heads 19 formed to overlap the outer surface of the elastic band to hold the latter assembled with respect to the blade row.

The elastic band, at 12, acts somewhat as a flat spring. Preferably, it is made of suitable sheet steel cut as illustrated. By varying the thickness of the metal material or by varying the distance between the cuts, flexibility of the band can be varied. As temperature stresses are eliminated, the improved type of shroud strip or band may be arranged to connect together a larger number of blades in a group. Furthermore, as the elastic band can be calculated for a given flexibility with a high degree of accuracy, it can be used to advantage to raise the frequency of blades a desired amount.

The shroud band also has the advantage of serving as a damping device for blades, if the heavy or transversely-elongated portions 13 are arranged to provide for angular movement relative the blade pins or tenons. Accordingly, in Fig. 4 there is shown an arrangement wherein screws 20 attach the elongated portions 13 to the blades, the screws having tapered heads 21 for engagement in tapered openings 22 formed in the elongated portions 13. Centrifugal force acting on the elastic shroud would tend to urge the latter outwardly against the taper of the screw heads with the result that friction would thereby be made available for the absorption of vibration energy.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. In a turbine, a row of blades, each blade having a shroud-forming portion and the shroud-forming portion providing outer boundaries for the blade passages between blades, said blades having tenons extending outwardly from the

shroud-forming portions, an elastic metallic band for connecting the tenons together, said elastic metallic band comprising members elongated transversely of the blade row and connected to the tenons and members arranged alternately with respect to the elongated members for connecting the latter together, said connecting members being relatively stiff in a direction transverse to the blade row and yieldable circumferentially thereof.

2. In a turbine, a row of shrouded blades, an elastic shroud band comprising elongated members for the respective blades and connecting members integral with the elongated members and arranged alternately with respect thereto, each connecting member including a portion extending between adjacent elongated members and having one end joined by a circumferentially-extending portion to one of the adjacent elongated members and having its other end joined by a circumferentially-extending portion to the other of the adjacent elongated members, and means for connecting the elongated members to the respective blades.

3. The combination as claimed in claim 2 wherein the means for connecting the elongated members to the respective blades comprises inwardly-tapered openings formed in the elongated members and pins connected to the blades and having inwardly-tapering head portions cooperating with the openings.

4. In a turbine, a row of shrouded blades, an elastic shroud band comprising members for the respective blades and elongated in a direction transverse to the blade row and connecting members integral with the elongated members and arranged alternately with respect to the latter; each connecting member including a portion extending between and parallel to adjacent elongated members and having one end joined by a circumferentially-extending portion to one of the adjacent elongated members and having its other end joined by a circumferentially-extending portion to the other of the adjacent elongated members; said elongated members having openings formed therein; and pin elements carried by the respective blades, extending through said openings and having heads arranged in overlapping relation with respect to said elongated members.

5. In a turbine, a row of shrouded blades, each blade having a shroud-forming element, an elastic shroud band disposed outwardly of the shroud-forming elements, said elastic shroud comprising members for the respective blades and elongated transversely of the blade row and connecting members integral with the elongated members and arranged alternately with respect thereto, each connecting member including a portion extending between adjacent elongated members and having one end joined by circumferentially-extending portions to one of a pair of adjacent elongated members and having its outer end joined by circumferentially-extending portions to the other adjacent elongated member, said elongated members having openings therein and engaging said shroud-forming elements of the blades, and means for connecting the elongated members to the blades and including pins arranged in the openings and attached to the blades.

JOSEF A. RYDMARK.