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METHOD OF MARKING, PUNCHING, AND ASSEMBLING SHROUD BANDS FOR TURBINE BLADES.

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Method of Marking, Punching, and Assembling Shroud-Bands for Turbine-Blades.

To all whom it may concern:

Be it known that I, Joseph Briggs Weaver, a citizen of the United States, residing at Newport News, county of Warwick, State of Virginia, have invented a new and useful Method of Marking, Punching, and Assembling Shroud-Bands for Turbine-Blades, of which the following is a specification.

In methods and devices heretofore employed for marking, punching and assembling shroud bands for turbine blades, considerable difficulty has arisen owing to the unevenness and the varying thicknesses of the blades and of the spacing blocks or distance pieces, and also the necessity of spacing the last blades of a row so that they will come out even at a point. As many rotors are of great weight and difficult to handle or manipulate, since some of them exceed seventy tons in weight, it is vary advantageous that some means be employed which will eliminate the necessity of moving or shifting the rotors or any part thereof during the process of assembling the shroud bands with respect to the blades and, in my present invention, I have wholly eliminated all necessity of moving the rotors during the period of their construction hereinafter referred to. Owing to the varying dimensions of the blades, it is not practical to accurately figure or compute the center of the distances and then punch the blades from the figures thus obtained, and in such methods unnecessary and improper strain is placed upon the blades owing to their being out of alinement with the holes in the shroud band.

In my present invention, the ends of the blades are preferably formed in such a manner as to provide means for indicating or marking on the templet the exact position of the hole to be punched in the shroud band which will take care of all irregularities in a radial direction due to the varying thicknesses of the blades and distance pieces and the resultant irregularities due to cabling.

My present invention therefore in its broad and generic scope consists of a novel method of marking, punching and assembling shroud bands with respect to turbine blades of rotors whereby any and all irregularities of the blades are taken care of and the turbine blades of the rotors or casings can be readily laid off without rendering it necessary to move the rotors or casings.

It further consists of a novel method of marking, punching and assembling shroud bands with respect to the turbine blades, wherein the ends of the turbine blades are first formed in a novel manner and the blades having been assembled in the rotor or casing, an impression is next taken from the outer ends of said blades, upon a suitable templet and then this templet is next positioned in proximity to the shroud band so as to indicate the exact points at which the holes in the shroud band are to be punched, which receive the ends of the turbine blade, the shroud band being next assembled with respect to the turbine blades and secured thereto in a suitable manner preferably by swaging or heading the ends of the blades.

My invention further consists of a novel turbine blade and of a novel formation on the end thereof.

Other novel features of my invention will more clearly hereinafter appear in the detail description.

For the purpose of illustrating my invention, I have shown in the accompanying drawing one form thereof which is at present preferred by me, and which will give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described other than as defined in the appended claims.

Figure 1 represents a side elevation of a portion of a rotor and the turbine blades thereon showing the strip forming the templet contiguous to said blades. Fig. 2 represents a plan view of a portion of a rotor showing the tops of the turbine blades thereon, the templet strip having been removed therefrom. Fig. 3 represents, in side elevation, one end of a turbine blade. Fig. 4 represents a side elevation of one end of a turbine blade assembled with respect to a shroud band, said shroud band being shown in transverse section. Fig. 5 represents a plan view of a carrier and certain of its ad-
juncts. Fig. 6 represents a side elevation of Fig. 5 showing in addition a portion of a punching element, which may be operated by any suitable means. Fig. 7 represents a top plan view of a portion of a shroud band, after being punched. Fig. 8 represents a perspective view showing certain of the blades in assembled condition with respect to a shroud band.

The similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a portion of a rotor adapted to receive the lower ends of the turbine blades 2, which are maintained a desired distance from each other by means of the spacing blocks or distance pieces 3. The outer ends of the turbine blades are formed in a novel manner and, in the present instance, each blade has opposite sides thereof at its outer end cut away, as indicated at 4 and 5. By the recess 4 are formed the angularly inclined walls 6 and 7 respectively, while the recess 5 forms the angularly inclined walls 8 and 9 respectively.

By this means, a tenon or projection 10 is formed at the outer end of each turbine blade. The tenon or projection 10 has at its outer face, in the present instance, angularly inclined recesses 11 and 12 respectively, thereby forming a centrally located V-shaped marking spur 13. After the turbine blades have been assembled with respect to the rotor, as seen in Fig. 1, a strip or templet 14 of any desired material and preferably of some soft material, such as for example, paper or soft copper, is superimposed on the top of the V or other shaped lugs or spurs 13, as seen in Fig. 1, and said strip or templet is tapped with a hammer or the like over the terminal of each blade so that the markings attained in this manner on the strip are representative of the irregularities of the ends of the blades of the rotor, or, in other words, indicative of the proper positioning of the punched holes.

The templet 14 having the markings 15 thereon, indicative of the exact location of the outer ends of the turbine blades, is then secured with respect to a carrier 16 of any desired type, one form of which is shown in Fig. 5, and preferably arranged parallel to a shroud band 17 also secured to said carrier in any desired manner. The carrier is then advanced in any desired manner by the operator so that the markings on the templet 14 will register with an indicator or pointer 18 at which time a punch 19 is caused to descend and form a hole at the proper points indicated in the shroud band 17, as indicated at 20, in Fig. 5, it being understood that the carrier preferably travels over the bed 21 of the punch. The shroud band is then assembled with respect to the ends of the turbine blade, the lugs or tenons 10 passing through said punched openings 20 in the shroud band, so that the lower face of the shroud band is seated on the surfaces or walls 6 and 9 respectively, and the outer or projecting portions of the lugs 10 are then swaged or headed, as seen at 22 in Figs. 4, 70 and 8. The grooved shroud band is formed, in the present instance, with the outwardly directed side flanges 23, the outer walls of which are in substantial alignment with the side edges 24 of the turbine blades while the inner faces of said side flanges are, in the present instance, angularly inclined with respect to the outer faces thereof, as will be understood from Figs. 4 and 7.

It will be understood from the foregoing that in carrying out my novel method the ends of the blades are formed with novel marking lugs or projections, which are preferably V-shaped, as seen in Fig. 5, but may have any other desired configuration. The blades are then assembled with respect to the rotor with the spacing blocks or distance pieces therebetween. The templet 14 is then placed along the outer ends of the blades and pressed against the same so that an exact representation of the ends of the blades is indicated on this strip. This templet strip is then assembled with respect to the shroud band and utilized to indicate the proper position on the shroud band at which the different holes are to be punched or formed to receive the ends of the blades. The holes being formed in the shroud band, the latter is then placed on the ends of the blades, and the lugs 10 will then readily pass through the openings 20 in the shroud band, and thereafter the ends of the lugs 10 are swaged.

It will be apparent that the construction and arrangement of the carrier or device for holding the marked templet and shroud band in position for the punching operation may vary widely in practice and I do not therefore claim to be limited to the special type of construction for such purpose.

It will be apparent that the templet 14 which I employ may be made of paper or other material like soft copper, and it will also be apparent that the carrier, shown in Fig. 5, which I have shown as being constructed of the end pieces suitably joined together, said end pieces also carrying the shroud band and the templet, may be constructed and assembled differently from the manner shown, it being only essential that the templet be assembled or retained in proper proximity to the shroud band upon the carrier in some suitable manner.

It has heretofore been attempted to compute the centers of the distances between the ends of the turbine blades and then to punch the shroud bands from figures thus drawn, and it has also been heretofore attempted to rotate the rotor so that the ends of the blades will pass a pointer and as each end reaches the pointer the rotor is stopped and
the shroud band is then punched. These methods are, however, not accurate and are open to serious objections in practice.

My present invention comprises a great improvement over these prior devices, since I am enabled to accurately punch the shroud bands, as hereinbefore explained, so that all irregularities of blading are provided for, and the proper positioning of the holes in the shroud bands for the blades of the rotors or casings can be laid off without moving them, which is a very important feature, since these rotors weigh, in some instances, seventy tons or more and are difficult to handle or manipulate.

It will be apparent that the punching mechanism seen in Fig. 6 can be operated manually or mechanically by any suitable means and I deem it unnecessary to show or describe in detail the mechanism whereby the punch 19 is actuated or reciprocated, as this will be apparent to those skilled in the art.

It will be apparent that by my invention I am enabled to space off and indicate, with great accuracy and exactness, the exact points or indicia at which the shroud bands are to be punched and that by my method a very much better character of work can be obtained than by the methods heretofore employed.

It will now be apparent that I have devised a new and useful method and apparatus for marking, punching and assembling shroud bands for turbine blades which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which will give in practice satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars within the scope of the appended claims without departing from the spirit or scope of the invention or sacrificing any of its advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The herein described method of marking and punching shroud bands for turbine blades, which consists in assembling said blades in a rotor, applying a templet to the ends of said blades, next impressing upon said templet the positions of the ends of said turbine blades, next assembling said templet and shroud band in a suitable carrier, and lastly punching said shroud band at points alining with the indicia on said templet.

2. The herein described method of marking, punching and assembling shroud bands for turbine blades, which consists in assembling said blades in a rotor, applying a templet to the ends of said blades, next impressing upon said templet the positions of the ends of said turbine blades, next assembling said templet and shroud band in a suitable carrier, and lastly punching said shroud band at points alining with the indicia on said templet.
sions, and lastly assembling the shroud band with respect to said blades.

8. As an improved article of manufacture, a turbine blade having a tenon formed on the end thereof and a central spur or marking point formed on said tenon.

9. As an improved article of manufacture, a turbine blade having a tenon at the end thereof provided with a marking device.

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Witnesses:
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