J. F. JOHNSON.

BLADE.

APPLICATION FILED AUG. 20, 1917.

1,335,002. Patented Mar. 30, 1920.

Fig. 2.



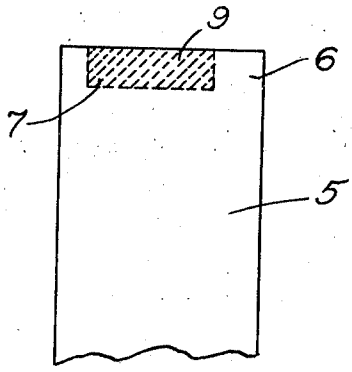


Fig 1.

Fig. 4.



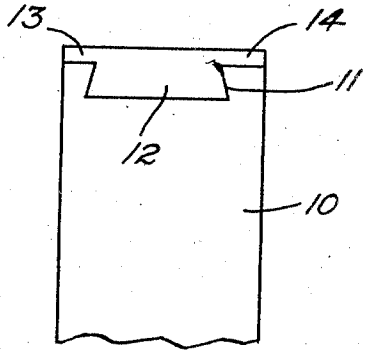


Fig. 3.

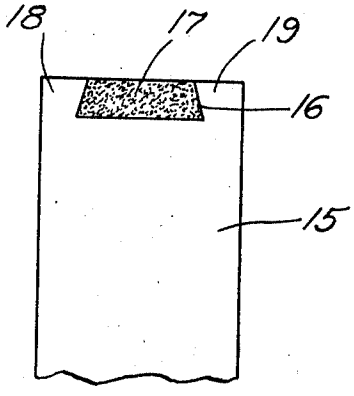


Fig. 5.

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BLADE.

1,335,002. Specification of Letters Patent. Patented Mar. 30, 1920.

Application filed August 20, 1917. Serial No. 187,246.

To all whom it may concern:

Be it known that I, JOSIAH FRANCIS JOHNSON, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Blades, of which the following is a specification.

This invention relates to blades and has for an object to produce a blade which is provided with a wearing tip which will readily yield to abrasion, and will therefore prevent damage to the blade in case of a blade rub.

A further object is to produce a blade having a tip of full cross sectional area but of greatly reduced abrasion resisting characteristics.

These and other objects are attained by means of the blades embodying the features herein described and illustrated in the drawings accompanying and forming a part hereof.

In some types of turbines it is common practice to provide small clearances between the free ends of the blades and the adjacent blade carrying element. My invention contemplates the production of a blade which is especially adapted to be employed under conditions where small clearances between the end of the blade and an adjacent element are essential. I accomplish this by providing the blade with a tip which effectually eliminates any danger of damage to the turbine due to blade rub due to the fact that the tip will readily wear away or yield when subject to a rub. An additional feature of the invention is that a blade so equipped presents an unimpaired working face from the mounting element to the free end of the blade. In addition to this, the amount of leakage through the clearance space at the end of the blade is materially reduced, below that encountered where the blade is reduced in section at the end to provide a wearing edge, due to the fact that the leakage space is bounded by surfaces having appreciable area.

In drawings: Figure 1 is a diagrammatic elevation of a blade embodying my invention.

Fig. 2 is a plan view of a blade shown in Fig. 1.

Fig. 3 is a diagrammatic view of a blade illustrating a modification of my invention.

Fig. 4 is a plan view of the blade shown in Fig. 3.

Fig. 5 is a diagrammatic view of a blade illustrating a further modification of my invention.

In Figs. 1 and 2 I have shown the outer or free end of a blade 5. In order that the outer or free end 6 may have the freely wearing characteristics required to eliminate any danger of damage due to blade rub, I have shown the blade as provided with a depression 7, which is so formed as to leave only a narrow wall 8 of the material of which the blade is formed. This depression is preferably filled with a material 9, which may be easily worn away. The thin walls 8 surrounding the wearing material are thin enough to wear away as readily as the wearing material, in case of blade rub, and consequently the danger of any damage to the turbine resulting from a blade rub is completely eliminated.

In Fig. 3, I have illustrated the outer end of a blade 10 which, as shown, is provided with a dove-tailed slot 11 cut in its tip. A soft metal blade tip 12 is inserted in the slot 11 and is formed with outer flanges 13 and 14, so as to cover the entire end of the blade 10, as shown in Fig. 4. Consequently, in case of blade rub, only the soft tip 12 comes in contact with the adjacent element and is, of course, quickly worn away without any damage to the rest of the blade or to the turbine. In Fig. 5, I have shown a blade 15 having a dove-tailed slot 16 cut in its outer end, in which an inlay 17 of soft or friable material may be placed. On each side of the slot 16, the tips 18 and 19 of the blade body 15 extend clear out to the end of the blade, but as they are of relatively small cross section they will be quickly worn away in case of blade rub along with the soft or friable material 17.

In all the embodiments of my invention shown, the blade is of full cross section clear out to its tip, consequently no portion of the working surface is lost in securing the easy wearing characteristics required. In addition to this, the wire drawing at the ends of the blades is increased with the result that the small clearance is effective in reducing leaking at the ends of the blades.

While I have illustrated and described several embodiments of my invention, it will

be apparent to those skilled in the art that various changes, modifications, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention as set forth by the appended claims.

What I claim is:

1. A turbine blade terminating in a recessed tip portion having a working surface similar to that of the body of the blade, and a wearing tip having a relatively low abrasion resisting characteristic mounted in the recess flush with the tip and held against lateral displacement by the portions of the blade overlapping the tip.

2. A turbine blade having a substantially uniform cross-section throughout its working surface, terminating in a recessed tip portion having a working surface similar to that of the body of the blade, and a wearing tip having a relatively low abrasion resisting characteristic mounted in the recess flush with the tip and held against lateral displacement by the portions of the blade overlapping the wearing tip.

3. A turbine blade terminating in a tip portion having a working surface similar to that of the body of the blade and provided with an undercut recess and a wearing tip having a relatively low abrasion resisting characteristic mounted in the recess and held against lateral displacement by the portion of the blade overlapping the tip.

In testimony whereof I have hereunto subscribed my name this 17th day of August, 1917.

JOSIAH FRANCIS JOHNSON.