P. EMDEN & W. FRITZ.

MEANS FOR SECURING TURBINE BLADES.

APPLICATION FILED SEPT. 7, 1909.

958,239. Patented May 17, 1910.

Fig. 1.

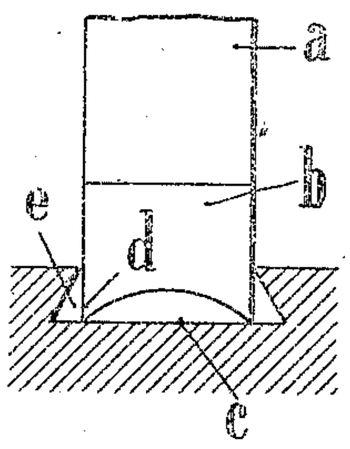


Fig. 3.

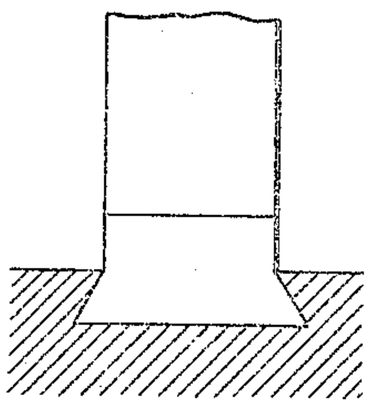


Fig. 4.

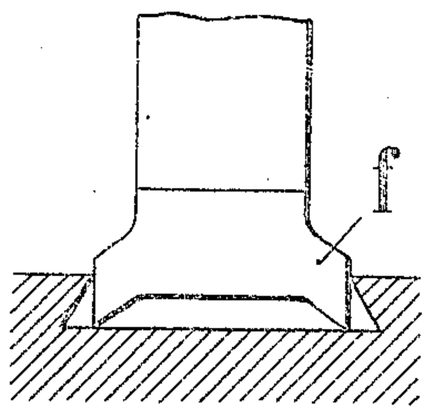


Fig. 2.

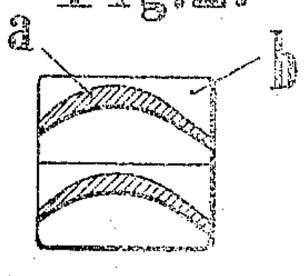


Fig. 5.

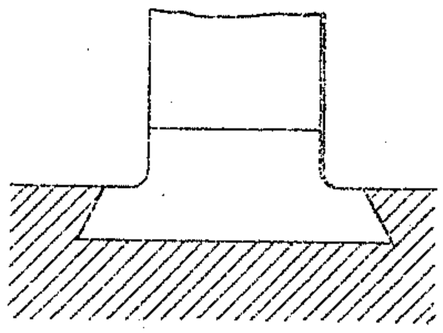


Fig. 6.

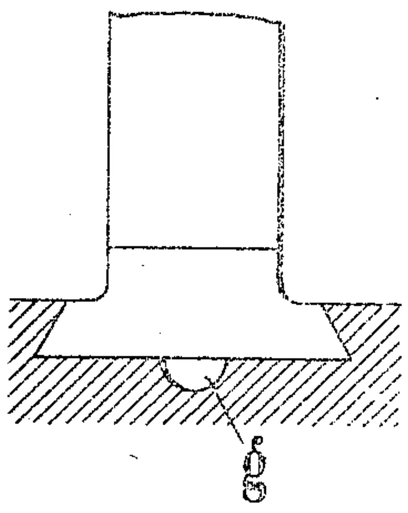


Fig. 7.

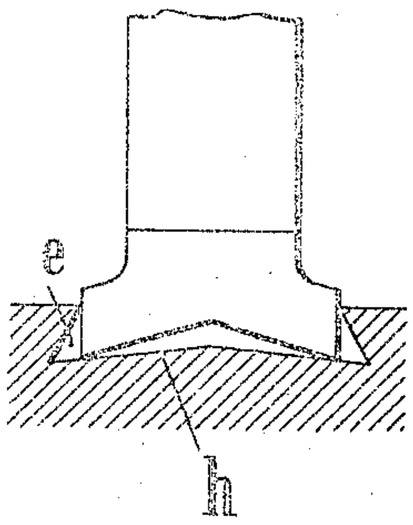
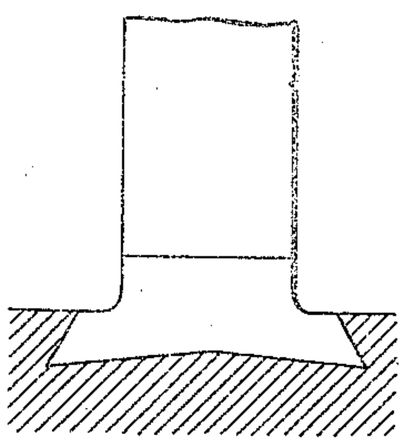


Fig. 8.



Witnesses
Fred A. Klein,
John A. Kennedy

Inventors
Paul Emden & Walter Fritz
By
Briesen & Knauth
Attorneys

UNITED STATES PATENT OFFICE.

PAUL EMDEN AND WALTER FRITZ, OF BERLIN, GERMANY.

MEANS FOR SECURING TURBINE-BLADES.

958,239. Specification of Letters Patent. Patented May 17, 1910.

Application filed September 7, 1909. Serial No. 516,538.

To all whom it may concern:

Be it known that we, PAUL EMDEN, a citizen of the Swiss Republic, and WALTER FRITZ, a subject of the German Emperor, both residents of Berlin, Germany, have jointly invented certain new and useful Improvements in Means for Securing Turbine-Blades, of which the following is a specification.

The securing of turbine blades, whether they form part of the rotary member or of the stationary member is generally accomplished by fitting the blade ends either directly or by means of interposed spacing members in undercut grooves of the casing or of the rotor. Turbine blades are inserted either by introducing them through a widened portion of the groove or through a lateral cut and then sliding them lengthwise to the desired position, or in some cases the blades and spacing members are introduced into the groove at a right angle to its length at the desired point and the spacing members are pressed by deformation into the undercut part of the groove, the ends of the blades being at the same time held in position by mating projections and recesses. The first of these expedients is objectionable for the reason that it is impossible to remove individual blades, but it is necessary to remove a number of blades in order that the new blades may be brought to the proper position. In each of the two cases above referred to the securing of the blade is difficult and requires considerable time. Furthermore, the strength of the joint to resist centrifugal strains and bending strains is relatively low because the secured portion of the blade is generally of smaller cross section than its body, or is at least weakened by recesses, grooves and the like.

According to our present invention, the drawbacks set forth above have been avoided by giving the foot, that is the secured portion of the blade, a novel formation which not only facilitates the insertion and removal of the individual blades, but gives the connection an unusual amount of strength. The blade, according to our invention, is provided with a wide foot, which also enables us to dispense with the spacing members as a separate element. The blade is so constructed that it can be introduced from the outside into the narrowest part of the groove. Then by pressure or other suitable operation the foot is spread or widened laterally into the undercut parts of the groove.

Reference is to be had to the accompanying drawings in which—

Figures 1, 2 and 3 illustrate one form of our invention, Fig. 1 showing the blade inserted into the groove and Fig. 3 showing the same parts after expansion, while Fig. 2 is a cross section on the line 2—2 of Fig. 1. Figs. 4 and 5 show a second form of our invention and correspond to Figs. 1 and 3. Fig. 6 is a view similar to Fig. 5 showing the addition of a central groove for the purpose of facilitating the removal of the blade. Figs. 7 and 8 which correspond to Figs. 1 and 3 represent still another form of our invention.

According to Figs. 1, 2 and 3 the blade has a body *a* suitably shaped to guide the steam and a foot or attached portion *b*, the width of which does not exceed that of the narrowest portion of the undercut groove *c* provided in the stationary or rotary member to which the blade is to be secured. Preferably the lateral edges *d* of the attaching portion *b* are beveled or sharpened as shown in Fig. 1. The blade having been introduced into the groove *c* at the desired point as shown in Fig. 1 pressure is exerted in any suitable manner, as by means of a hammer or hydraulic press toward the attaching portion *b*, so that it will be expanded laterally into the undercut portions *e* of the groove *c* assuming finally the dovetailed shape shown in Fig. 3 in which the originally concave inner surface of the attaching portion *d* has become plane or flat and closely fits the bottom surface of the groove.

In order to facilitate the expansion of the foot or attached portion within the undercut groove, it may be desirable to provide the said attached portion with lateral extensions or lugs *f*, in which case the pressure may be applied directly to said lugs instead of to the outer end of the body *a*. Fig. 4 shows such a structure before expansion and Fig. 5 the same structure after expansion. In order to facilitate the removal of defective or broken blades, particularly when it is desired to remove several adjacent blades, it may be advisable to provide an additional groove or depression *g*, preferably at the central portion of the main groove as indicated in Fig. 6. The attaching member does not extend into this additional groove or

depression which therefore remains free for the insertion of a pin, bolt or other tool, which may be inserted to facilitate the removal of the blades. While we have shown such an additional groove only in connection with the form of our invention illustrated by Figs. 4 and 5 it will be understood that this feature may be applied to other forms of our invention as well.

A further expedient for facilitating the expansion of the attached portion is shown in Figs. 7 and 8. Here the bottom surface of the groove *c* instead of being flat is made with two bevels sloping outwardly toward the undercut portions *e* so that when pressure is exerted on the attaching portion *b* a wedge action will occur, its edges tending to slide outwardly on the sloping surfaces *h* so that finally the attaching portion takes the shape shown in Fig. 8.

We claim as our invention:

1. In a turbine, the combination of a carrier having a groove, and a blade having a foot which fits said groove, a secondary groove being provided between the transverse face of the carrier and the adjacent face of said foot.

2. In a turbine, the combination of a carrier having a groove provided with a depression in its transverse wall, and a blade provided with a foot which fits said groove while leaving the depression free.

3. In a turbine, a carrier provided with a circumferential groove, blades provided with feet which fit said grooves, and a secondary circumferential groove between the transverse face of the carrier and the adjacent faces of said feet.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

PAUL EMDEN.
WALTER FRITZ.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.