

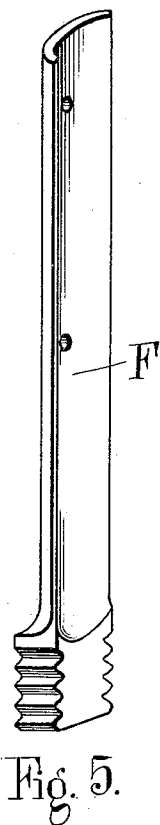
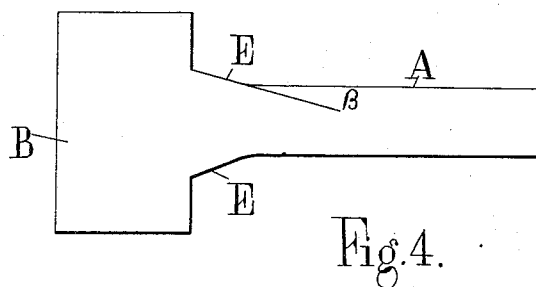
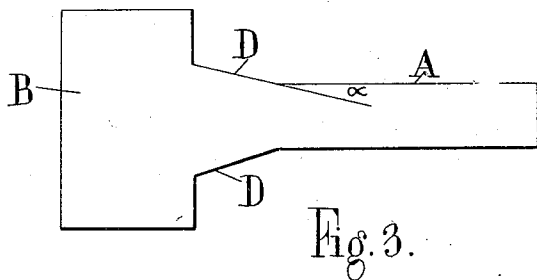
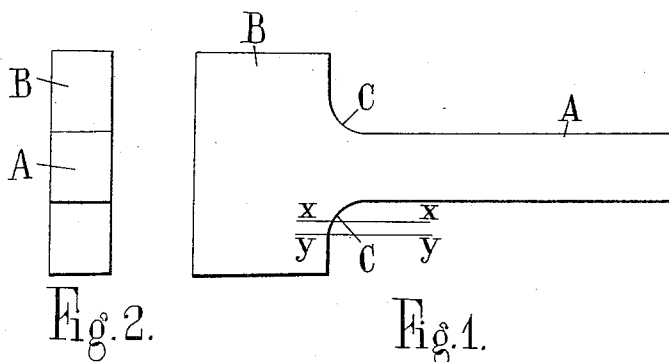
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BILLET OR BLANK SUITABLE FOR THE PRODUCTION OF TURBINE BLADES

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BILLET OR BLANK SUITABLE FOR THE PRODUCTION OF TURBINE BLADES

Application filed August 14, 1928, Serial No. 299,555, and in Great Britain November 17, 1927.

The invention relates to billets or blanks having root and stem portions and is particularly applicable to turbine-blade billets having an integral root-forming portion.

5 In the specific application indicated, such a billet may take, for example, the form of a T of uniform thickness, the cross of the T in general approximating to the final form of blade root desired while the stem, which may
10 be of considerable length in comparison with the cross, is extended and shaped as by rolling to form the blade proper.

In order to avoid too abrupt a change in cross-section between the finished blade and
15 its integral root, it is desirable that the thickness of the blade proper shall gradually increase towards the root and consequently at this point less deformation is required in the rolling or shaping operation than at other
20 points of the blade length and extra material is required at the point of junction to allow for the thicker section. Such additional material has usually been provided in the form of fillets where the blade-forming portion of
25 the billet joins the root-forming portion.

It is found by experience, however, that when such billets are rolled, folds are formed, particularly where the thin edge of the blade section joins the root, and it becomes necessary
30 to remove these folds between successive rolling operations, thus adding to the cost of and time taken in manufacturing the blades.

35 The main object of the present invention is to avoid the formation of such folds.

With such an object:—

The invention consists in a billet or blank as indicated having root and stem portions, the stem portion diverging or widening towards and adjacent to the root portion in
40 such a manner that the contour of the widening portion makes only a comparatively small angle with the length of the stem.

45 The invention also consists in the improved billets or blanks hereinafter described and turbine blades manufactured therefrom.

Referring to the accompanying diagrammatic drawings:—

50 Figure 1 shows a plan view of a turbine-

blade blank as hitherto used with quadrantal fillets,

Figure 2 being a corresponding end view; while

Figures 3 and 4 show plan views of different forms of the improved turbine-blade
55 blank according to the present invention.

Figure 5 is a perspective view of one form of finished blade with the root portion machined down to the final size and form to suit
60 the turbine groove.

Where desirable the same reference letters are used in the different figures to denote corresponding parts.

The filleted turbine-blade billet or blank
65 shown in Figures 1 and 2 as an example of common practice heretofore, comprises a blade-forming stem, A, and a root-forming base, B, forming a T of uniform thickness with fillets, C, C, having the form of circular
70 arcs of 90° or thereabouts tangential to the relative parts of the root and stem. Experiments have shown that with such a blank, the formation of the folds is caused by that
75 part of the fillet which makes the largest angle with the direction of rolling, i. e., the part between the lines X X, Y Y, more directly associated with the root of the blank, and by eliminating this part of the fillet in
80 accordance with the present invention, the difficulties set forth above are overcome.

In carrying the invention into effect according to the form shown in Figure 3 as applied to the manufacture of turbine blades, the blank as before is of uniform thickness
85 throughout and has the form of a T with a comparatively short root-forming transverse portion, B, and a comparatively long blade-forming stem, A, at right angles thereto. At its free end, the sides of the stem are parallel as shown but where the stem approaches
90 the root, the sides diverge slightly, the contour of the "fillet" being formed by straight lines, D, D, making only the small angle, α , with the length of the stem or in other words
95 with the direction of rolling. One form of finished blade F produced by rolling the blank and machining is shown in Figure 5.

According to a modified form, (see Figure 4) the contour, E, E, of the diverging "fillet" 100

may be slightly concaved, the maximum angle, β , in this case that the curved portion makes with the length of the stem corresponding to the small angle, α , between the straight lines, D, of the "fillet" and the stem in the previous form of the invention.

Further, the stem of the billet or blank, if desired, may be of other form than that shown.

Other variations may be made in the precise form of billet or blank without exceeding the scope of the invention so long as the angle or the maximum angle that the "fillet" contour makes with the length of the stem is below that at which folds begin to form.

In addition to reducing the cost and time required in manufacturing the blades, the invention results in an improved turbine blade which is strengthened at the point where it joins onto the root, which is the point where the stresses are usually highest and additional strength is most required.

We claim—

1. A billet or blank having root and stem portions suitable for the production of a turbine blade, the stem portion diverging or widening towards and adjacent to the root portion in such a manner that the contour of the widening portion makes only a comparatively small angle with the length of the stem, substantially as and for the purpose described.

2. A billet or blank as claimed in claim 1, in which the widening portion or "fillet" has a straight-line contour, substantially as described.

In testimony whereof we have signed our names to this specification.

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EDWARD GARRETT BROWNLOW.