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## STANDARD PATENT

I, Janet Lucille Werner, Acting Commissioner of Patents, grant a Standard Patent with the following particulars:

**Name and Address of Patentee:**

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**Title of Invention:** Improvements in ground engaging blades

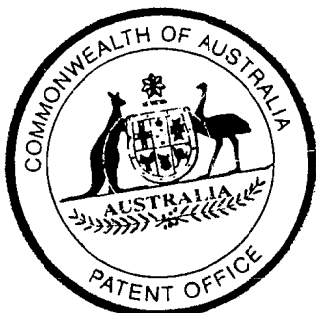
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**Improvements in ground engaging blades**

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ABSTRACT

A wear resistant blade insert adapted for releasable attachment to a leading edge insert portion of a ground engaging blade is provided, the blade insert having a front face, a rear face substantially parallel to the front face, and an upper edge face and a lower edge face, the lower edge face forming an acute angle to the front face, a lower edge face groove in the lower edge face and extending from one end of the blade insert to the other between the front and rear faces, at least part of the lower edge face groove extending across the lower edge face from the front face to the rear face, a rebate along the rear face adjacent the lower edge face, a rebate groove in the rebate extending from one end of the blade insert to the other substantially parallel to the lower edge face; and hardfacing in or on the lower edge face groove, the lower edge face, the rebate, the rebate groove, and at least some of the front face, the hardfacing in the rebate and the rebate groove being substantially level with the rear face. The edge face, the edge face groove, the rebate, the rebate groove and the hardfacing are preferably formed along both the upper and the lower side edge faces of the blade insert, and the blade insert is preferably symmetrical about a plane bisecting the front and rear faces. The edge face groove preferably extends along the edge face in a zigzag fashion from one end to the other, with the zigzag extending across from the front face to the rear face such that the individual legs extend across the edge face from the front face to the rear face.

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**COMPLETE SPECIFICATION FOR A STANDARD PATENT**

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**Invention Title:** "IMPROVEMENTS IN GROUND ENGAGING  
BLADES"

The following statement is a full description of this invention,  
including the best method of performing it known to us:

"IMPROVEMENTS IN GROUND ENGAGING BLADES"

THIS INVENTION relates to improvements in ground engaging blades.

5 The invention has particular application to improvements in replaceable blade inserts such as those typically found on the ground engaging blades of bulldozers, and for illustrative purposes, reference will be made to such application. However, the invention may also apply to the ground engaging blades of other earth moving machinery, such as graders, drag-line buckets and the like. While ground engaging blades may be straight or 10 toothed, depending on the application, the present invention is directed primarily to straight blades.

Ground engaging blades for earth moving equipment are usually provided with wear resistant hardfacing on their tips or leading edges. The hardfacing is usually provided on the blade 15 inserts which are generally removably attached to form the leading edge or tip of the blade.

Ground engaging blades have always been subject to wear of the leading edge of the blade - the edge that directly engages the ground and is generally subjected to the most amount of 20 abrasion. Attempts at overcoming this wear problem have included the application of abrasion resistant materials to the blades. However, such materials have suffered from cracking, delaminating, uneven wearing, or wearing to an inefficient leading edge angle, which results in inefficient removal of 25 foundation material from an excavation.

A primary object of the present invention is to provide a wear resistant blade insert for a ground engaging blade which has improved wear characteristics. Another object is to provide a 30 wear resistant blade which is less subject to one or more of the aforementioned problems. Other objects and advantages of the invention may become apparent from the following description.

With the foregoing in view, this invention in one aspect resides broadly in a wear resistant blade insert adapted to be 35 releasably attached to a ground engaging blade, the blade insert having:

a front face, a rear face substantially parallel to the front face, and an upper edge face and a lower edge face, the lower edge face forming an acute angle to the front face;

5 a groove (hereinafter referred to as the lower edge face groove) in the lower edge face, the lower edge face groove extending from one end of the blade insert to the other;

at least part of the lower edge face groove extending across the lower edge face from the front face to the rear face;

10 a rebate along the rear face adjacent the lower edge face;  
a groove (hereinafter referred to as the rebate groove) in the rebate extending from one end of the blade insert to the other substantially parallel to the lower edge face; and

15 hardfacing in or on the lower edge face groove, the lower edge face, the rebate, the rebate groove, and at least some of the front face, the hardfacing in the rebate being substantially level with the rear face.

20 Preferably, the upper edge face includes an upper edge face groove, rebate, rebate groove and hardfacing in a similar fashion to the lower edge face groove, the rebate, the rebate groove and the hardfacing along the lower edge face respectively. It is further preferred that each edge face, edge face groove, rebate, rebate groove and hardfacing be formed symmetrically about a plane bisecting the front and rear faces. The edge face groove preferably extends along the edge face in a zigzag fashion from  
25 one end to the other, with the zigzag extending across from the front face to the rear face such that the individual legs of the zigzag extend across the edge face from the front face to the rear face. It is also preferred that the acute angle be 55° and that the front and rear faces be separated by about 50 mm.

30 Preferably the hardfacing comprises a wear resistant material dispersed in a weld matrix. The hardfacing material used is preferably formed by welding ARM-2 weld wire as manufactured and supplied by Abrasion Resistant Materials Pty Ltd, in a metal-inert-gas atmosphere to coat the required net  
35 area required for the weld. This weld wire conforms to BS2901 Part 1 1970A18 and AWS A5.18 E70S-6. It is also preferred that tungsten carbide grit be added into the molten weld pool during

the welding process, by any suitable means, and preferably be provided to mesh size 12/35.

In another aspect, this invention resides broadly in a method of hardfacing a blade insert for a ground engaging blade, the method including:

providing a blade insert having a front face, a rear face substantially parallel to the front face, an upper edge face and a lower edge face, the lower face forming an acute angle to the front face;

forming a groove (hereinafter referred to as the lower edge face groove) along the lower edge face, the lower edge face groove extending from one end of the lower edge face to the other, and at least part of the lower edge face groove extending across the lower edge face from the front face to the rear face;

providing a rebate along the rear face adjacent the lower edge face;

providing a groove (hereinafter referred to as the rebate groove) in the rebate extending substantially parallel to the lower edge face from one end of the rebate to the other; and

applying hardfacing to substantially fill the lower edge face groove, to substantially cover the edge face, to substantially fill the rebate groove, to fill the rebate substantially to the level of the rear face, and to cover at least some of the front face.

Preferably, the location of the lower edge face groove is marked onto the edge face, preferably in the form of a zigzag as described above. The groove may then be ground into the lower edge face using a grinder to grind all of the portions of the zigzag which face one way, and then all of the remaining portions of the zigzag which face the other way, joining up the respective portions to form a zigzag pattern. The zigzag form of the lower edge face groove may be considered to be a series of slots extending from the front face to the rear face across the lower edge face. It is preferred that all of the slots intersect to form a continuous zigzag pattern. Preferably, the upper edge face is provided at an acute angle to the front face and has an upper edge face groove in the upper edge face, a rebate adjacent

the rear face and upper edge face, and rebate groove substantially parallel to the upper edge face in a similar fashion to that of the lower edge face. The rebate is preferably formed in the rear face by a milling process.

5 In another aspect, this invention resides broadly in a ground engaging blade when fitted with a blade insert as herein described. In such form, it is preferred that one of the upper and lower edge faces be aligned with the leading edge of the ground engaging blade.

10 In order that this invention may be more readily understood and put into practical effect, reference will now be made to the following drawings which illustrate a preferred embodiment of the invention, and wherein:

15 Fig. 1 is a diagrammatic partial end view of a ground engaging blade insert profiled to accept hardfacing in accordance with the invention;

20 Fig. 2 is a diagrammatic partial end view of the ground engaging blade insert of Fig. 1 with hardfacing material welded to the rebate, edge face and a portion of the front face;

25 Fig. 3 is a diagrammatic partial front view of the ground engaging blade insert of Figs. 1 and 2;

30 Fig. 4 is a diagrammatic partial end view of the ground engaging blade insert of Fig. 1 showing that the insert is substantially symmetrical;

35 Fig. 5 is a diagrammatic pictorial view of the ground engaging blade insert of Figs. 1 and 3 (that is, without the hardfacing);

40 Fig. 6 is a diagrammatic plan view of the ground engaging blade insert with further machining to provide fixing apertures (but without the hardfacing);

45 Fig. 7 is a diagrammatic end view of the ground engaging blade insert of Fig. 6;

50 Figs. 8 and 9 respectively show tap and countersink details of the ground engaging blade insert of Figs. 6 and 7.

Referring to Fig. 1, a ground engaging blade insert 10 includes a front face 11, a rear face 12, and an edge face 13



which lies in a plane at an acute angle (hereinafter referred to as the face angle) to the front face 11, the face angle being indicated by the reference numeral 17. The insert also includes a rebate 14 formed into the rear face adjacent the edge face. 5 An edge face groove 15 is formed in the edge face 13, and is described in more detail below. A rebate groove 16 is formed in the rebate in substantially parallel alignment with the edge face.

10 Referring to Fig. 2, the ground engaging blade insert 10 includes all of the features described in respect of Fig. 1, and has the same reference numerals for the parts so described, but in addition includes a hardface capping 18 which covers the edge face (filling the edge face groove ) and extends to fill in the rebate to the level of the rear face (filling the rebate groove also), and also extends over a portion 19 of the front face 11 15 substantially to the same vertical distance from the acute angle as the width of the rebate.

Referring to Fig. 3, the edge face groove 15 is formed in a zigzag fashion, the legs of the zigzag shown typically at 20. Referring to Fig. 4, it can be seen that the preferred arrangement for the blade insert 10 is symmetrical so that when one edge face 13 becomes worn, the blade insert may be turned around so that the other edge face 13 may be used, the insert being roughly trapezoidal in cross-section.

25 Referring to Fig. 5, the ground engaging blade insert 10 includes all of the features described in respect of Figs. 1 and 3, and has the same reference numerals for the parts so described, and in addition shows one end face 21 of the blade insert 10. It is believed by the applicant that the zigzag form 30 of the edge face groove will decrease the likelihood of the hardface capping to fracture.

In order to show how the blade insert is attached to a ground engaging blade for a bulldozer, grader, scraper, or such like, Figs. 6 to 9 show the arrangement and the details of 35 fixing apertures and tapped apertures, but with the rebate, rebate groove, edge face groove and hardfacing not indicated for clarity. Referring to Figs. 6 and 7, the ground engaging blade

insert 10 includes nine square section fixing apertures shown typically at 25. The fixing apertures are aligned centrally astride a central plane 26 disposed halfway between the respective edge faces 13, and are spaced from the end face 21.

5 For a blade length of 1023 mm, the fixing apertures are spaced along the central plane at intervals of 55 mm, 131 mm, 207 mm, 359 mm, 512 mm, 664 mm, 816 mm, 892 mm, and 958 mm respectively. Each fixing aperture is 38 mm square, penetrating the front face and through the rear face as shown. The thickness of the insert  
10 is 50 mm, and the width of the insert is 416 mm at the rear face, the acute angle of the edge face being 55° as shown in particular in Fig. 7. Additionally, two tapped apertures 27 are provided 283 mm and 740 mm from the left hand end, opening to the rear face, but being blind, drilled to a depth of 32 mm and tapped to  
15 a depth of 25 mm, as shown in more detail in Fig. 9. The apertures are drilled to a diameter of approximately 12 mm and tapped to cut a ½ inch UNC thread.

Referring to Fig. 8, the fixing aperture is countersunk (shown at 28) to a depth which leaves a 15 mm length of the square section of the fixing aperture remaining. The diameter  
20 of the countersink 28 is 55 mm and is at an angle of 45°.

In use, one or more blade inserts are attached to the leading edge of a ground engaging blade, such as provided on a bulldozer, grader, or other earthmoving equipment. Generally,  
25 there is more than one blade insert, and each blade insert is bolted to the blade by way of several plough bolts inserted through the fixing apertures, the square section shoulder on the respective plough bolts preventing spinning of the bolts when coupled with respective nuts. The tapped apertures are for  
30 insertion of lifting bolts (or eye bolts) to assist in the safe removal of the inserts from the ground engaging blade.

During use of the blade insert, it is believed that loads are generally deflected from the leading edge, the front face and the edge face of the blade insert, reducing point impact loads  
35 and side or shear loading on the hardfacing. The wear angle of the blade insert is believed to approach 55° during use, and it has been surprisingly found that the provision of the extra

hardfacing material in the rebate on the rear face enhances the operating life of the blade inserts of the present invention.

It will of course be realised that while the above is illustrative of one or more examples of the invention, all such  
5 modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as claimed in the following claims.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A wear resistant blade insert adapted to be releasably attached to a ground engaging blade, the blade insert having:

a front face, a rear face substantially parallel to the front face, and an upper edge face and a lower edge face, the lower edge face forming an acute angle to the front face;

a groove (hereinafter referred to as the lower edge face groove) in the lower edge face; the lower edge face groove extending from one end of the blade insert to the other;

at least part of the lower edge face groove extending across the lower edge face from the front face to the rear face;

a rebate along the rear face adjacent the lower edge face;

a groove (hereinafter referred to as the rebate groove) in the rebate extending from one end of the blade insert to the other substantially parallel to the lower edge face; and

hardfacing in or on the lower edge face groove, the lower edge face, the rebate, the rebate groove, and at least some of the front face, the hardfacing in the rebate being substantially level with the rear face.

2. A blade insert according to Claim 1, wherein the upper edge face includes an upper edge face groove, rebate, rebate groove and hardfacing in a similar fashion to the lower edge face groove, the rebate, the rebate groove and the hardfacing along the lower edge face.

3. A blade insert according to Claim 2, wherein each edge face, edge face groove, rebate, rebate groove and hardfacing are formed symmetrically about a plane bisecting the front and rear faces.

4. A blade insert according to any one or the preceding claims, wherein the edge face groove extends along the edge face in a zigzag fashion from one end to the other, such that the individual legs of the zig-zag extend across the lower edge face from the front face to the rear face.

5. A method of hardfacing a blade insert for a ground engaging blade, the method including:

providing a blade insert having a front face, a rear face substantially parallel to the front face, an upper edge face and a lower edge face, the lower face forming an acute angle to the front face;

forming a groove (hereinafter referred to as the lower edge face groove) along the lower edge face, the lower edge face groove extending from one end of the lower edge face to the other, and at least part of the lower edge face groove extending across the lower edge face from the front face to the rear face;

providing a rebate along the rear face adjacent the lower edge face;

providing a groove (hereinafter referred to as the rebate groove) in the rebate extending substantially parallel to the lower edge face from one end of the rebate to the other; and

applying hardfacing to substantially fill the lower edge face groove, to substantially cover the edge face, to substantially fill the rebate groove, to fill the rebate substantially to the level of the rear face, and to cover at least some of the front face.

6. A method according to Claim 5, wherein the location of the edge face groove is marked onto the edge face in the form of a zigzag and the groove is then ground into the edge face using a grinder to grind all of the portions of the zigzag which face one way, and then all of the remaining portions of the zigzag which face the other way, joining up the respective portions to form a zigzag pattern.

7. A ground engaging blade when fitted with a blade insert according to any one of Claims 1 to 4.

8. A ground engaging blade according to Claim 7, wherein one of the upper and lower edge faces is aligned with the leading edge of the ground engaging blade.

9. A blade insert substantially as hereinbefore described with reference to Figs. 1 to 7.

Dated this 12<sup>th</sup> day of November, 1999

The Track Shop Pty Ltd  
By Their Patent Attorneys  
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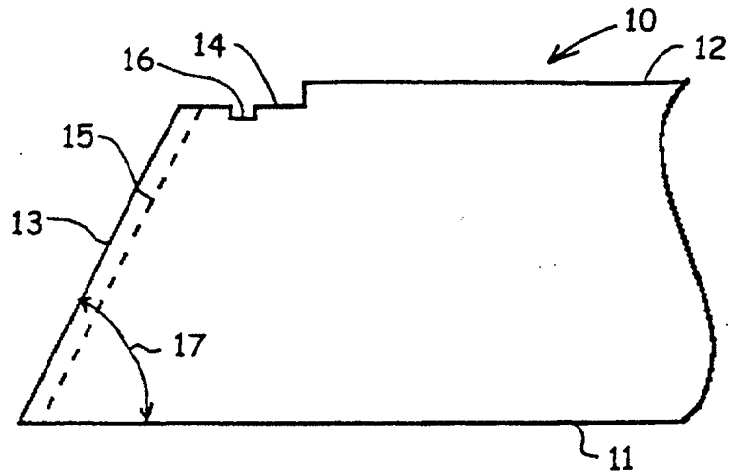


Fig. 1

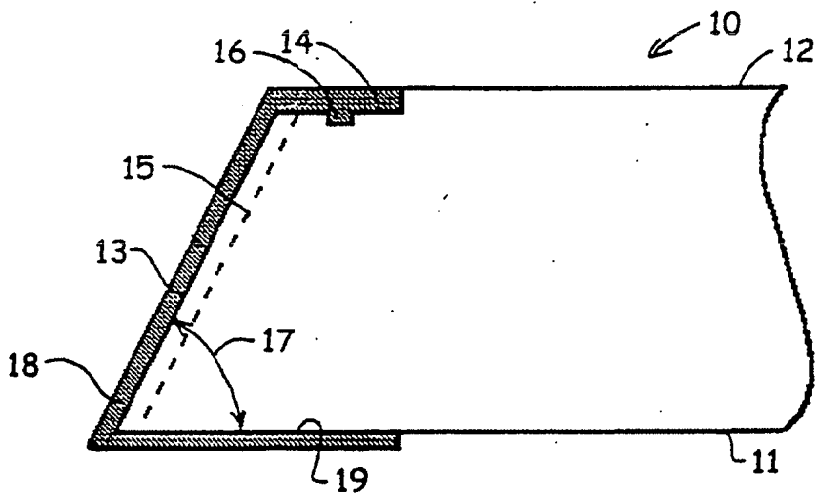


Fig. 2

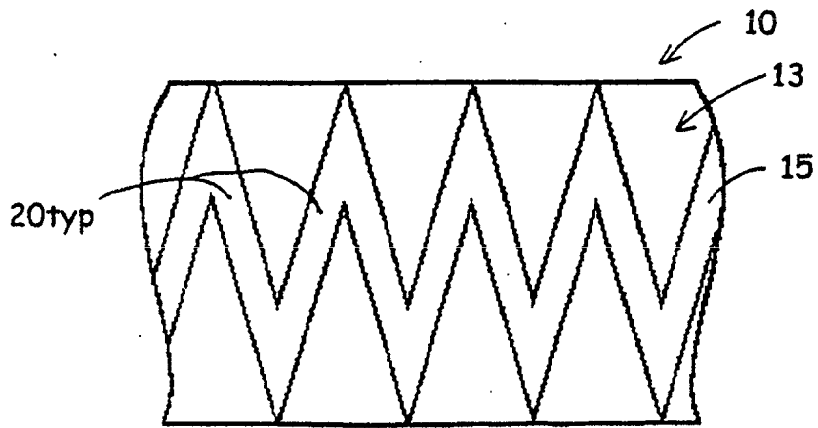


Fig. 3



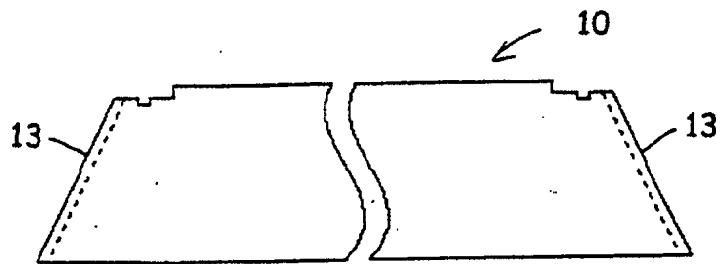


Fig. 4

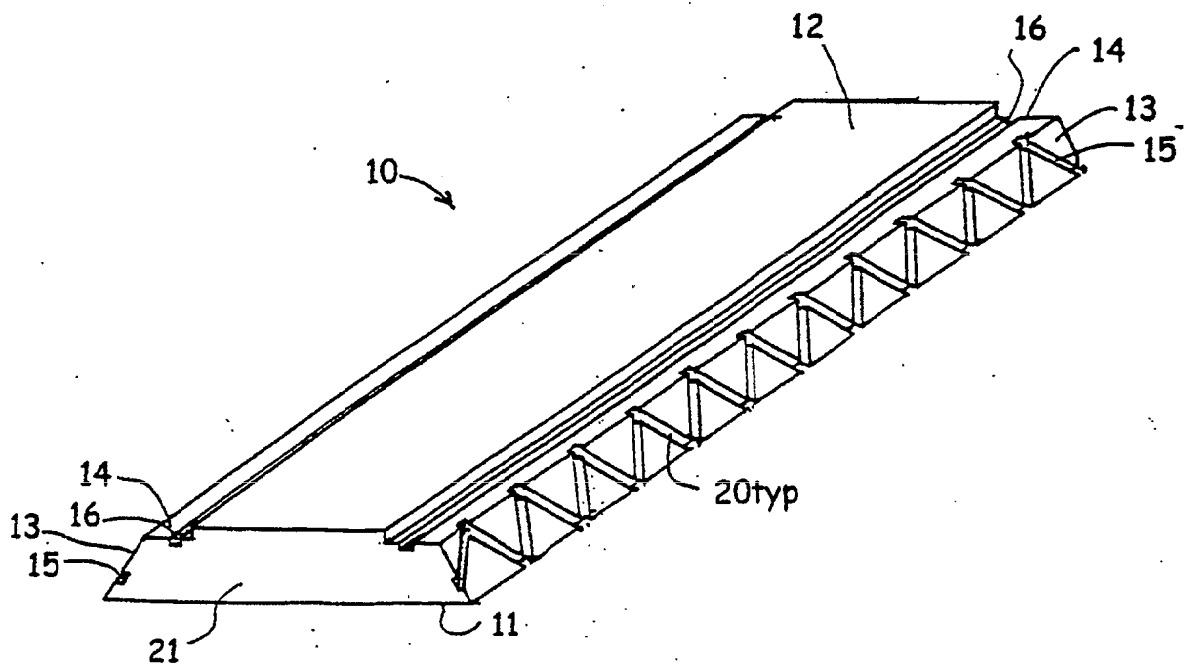


Fig. 5





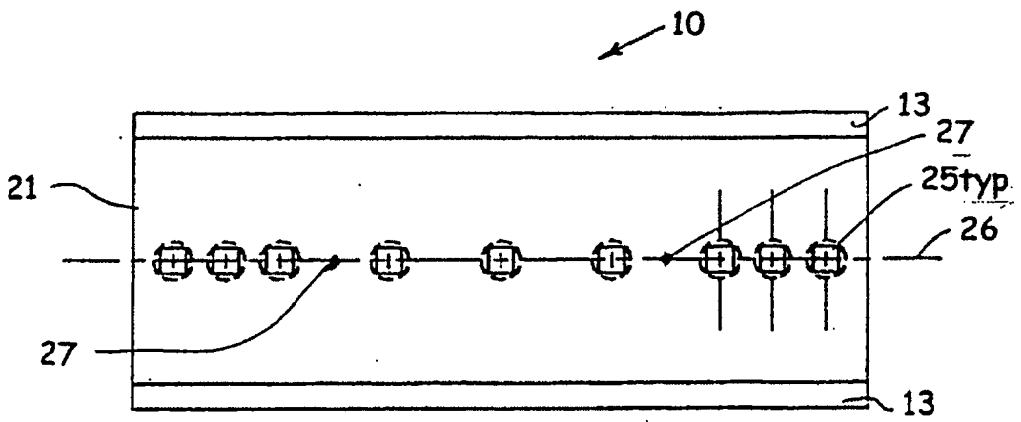


Fig. 6

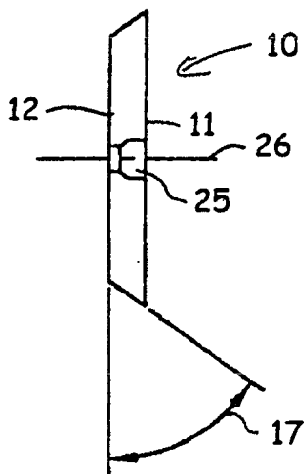


Fig. 7

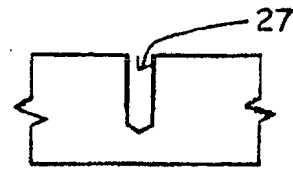


Fig. 8

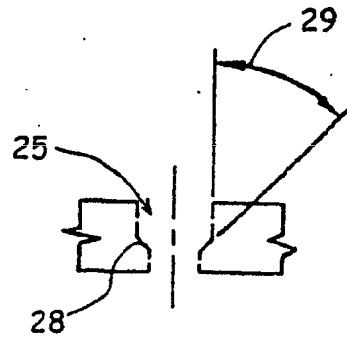


Fig. 9

