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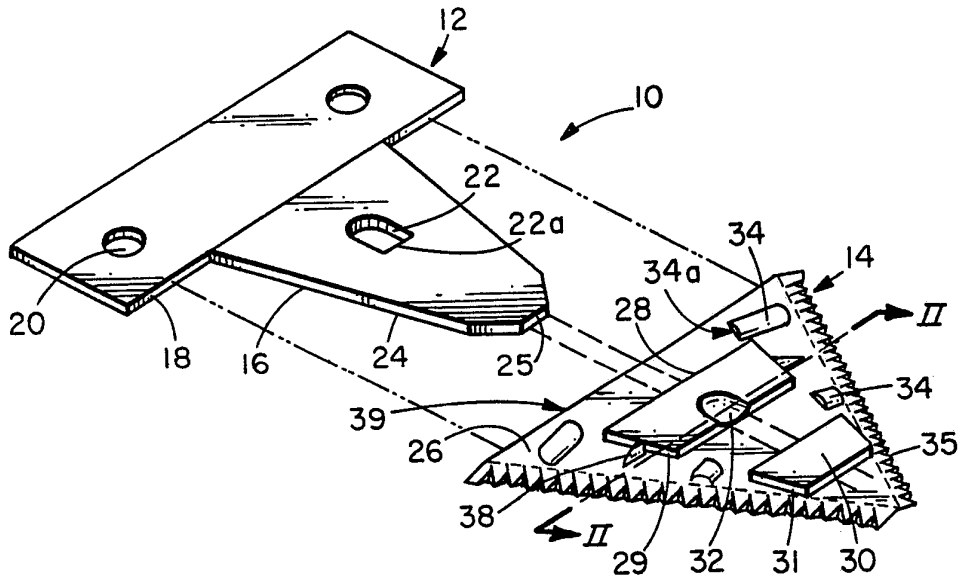
(54) Title: MOWING DEVICE



(57) Abstract

A two-piece cutter member for mounting on a sickle bar has a rigid thin support element (16) arranged for relatively permanent attachment to a sickle bar, and a flat planar pyramid-shaped spring metal blade (14). A portion of the blade provides at least one bridge or loop (28) for encircling the support element (16) and holding the blade on the support element. A section of either the blade or the support element is displaced with respect to a support face (39) to releasably hold the blade on the support when the blade is fully positioned on the support element. The spring metal blade (14) preferably is formed of two thin sheets (26a, 26b) welded together near their edges.

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MOWING DEVICE

The present invention relates to improvements in mowing devices. The invention has particular utility in connection with sickle bar cutter member for mowing machines, and more particularly to replacement cutter members for such sickle bars, and will be described in connection with such utility, although other utilities, e.g. in connection with swathers, combines and other harvesting equipments are contemplated.

Replaceable cutter members have long been a standard feature of sickle bars since the cutter members are subject to damage and breakage due to use. The art is well-developed in this area and is represented by the following U.S. patents:

Patent Number 97,062 issued November 23, 1869 in the name of G.L. Du Laney; and

Patent Number 594,747 issued November 30, 1897 in the name of H. M. Landes;

Patent Number 635,321 issued October 24, 1899 in the name of J.B. Hill;

Patent Number 915,247 issued March 16, 1909 in the name of P.E. Sundquist;

Patent Number 997,495 issued July 11, 1911 in the name of W.R. Gourley;

Patent Number 1,137,662 issued April 27, 1915 in the name of B. C. Parsons;

Patent Number 1,158,521 issued November 2, 1915 in the name of J. H. McElroy;

Patent Number 1,164,691 issued December 21, 1915 in the name of T.J. Wilson;

Patent Number 1,214,345 issued January 30, 1917 in the name of B. Melby;

Patent Number 1,274,659 issued August 6, 1918 in the name of J. W. Alexander;

Patent Number 1,315,312 issued September 9, 1919 in the name of J. H. Klenck;

Patent Number 1,537,354 issued May 12, 1925 in the name of C.F. Hover;

Patent Number 1,684,616 issued September 18, 1928 in the name of F.J. Bicek;

Patent Number 3,013,373 issue August 15, 1958 in the name of A.F. Kopaska;

Patent Number 2,427,306 issued September 9, 1947 in the name of J.F. Schafer;

Patent Number 4,223,514 issued September 23, 1980 in the name of Lawrence M. Halls and Horace G. McCarty;

Patent Number 4,646,440 issued March 3, 1987 in the name of John R. Decker;

In addition there are the following foreign patents of interest:

British Patent Number 2967 issued September 10, 1873

British Patent Number 891085 issued June 22, 1959

German Patent Number 832357 issued February 25, 1952

In all of these patents the whole blade must be replaced when there is any damage to the blade. This replacement involves various degrees of difficulty and expense.

In the present invention there is provided a novel two-piece cutter member which can be semi-permanently mounted onto a sickle bar. The cutter member comprises a relatively rigid or semi-rigid support element having a base portion for rigid attachment to the sickle bar. The support element preferably extends from the sickle bar in the form of a pyramidal shape roughly representing the shape of a tooth of the cutter element. Carried by the rigid support element, there is a flat spring metal blade which is readily removable from the support element. The spring metal blade includes a cutting face and a support face. The spring metal blade preferably has at least one portion displaced from the plane thereof to provide at least one bridge or loop for surrounding the support element. This loop preferably includes a detent which is

bent toward the plane of the blade and is positioned to engage an opening in the support element to releasably lock the spring metal cutter element onto the support element. Preferably, other portions of the spring metal blade are also displaced from the plane thereof to stiffen the blade and engage the edges of the support element to provide transmittal of cutting forces from the flat spring metal blade to the support element.

In order to more fully understand the invention, reference should be had to the following detailed description taken in connection with the following drawings wherein:

Fig. 1 is an exploded schematic view of the two-piece cutter member;

Fig. 2 is a partial schematic cross-sectional view of the blade taken along the line II-II of Fig. 1.

Figure 3 is an exploded schematic view of another preferred embodiment of the invention.

Figure 3A is an enlarged section view of a portion of Figure 3 along the line 3A-3A.

Figure 4A is an enlarged plan view of another preferred embodiment of the invention.

Figure 4B is a cross-sectional view of the blade section illustrated in 4A.

Figure 5A is a plan view of a second part of the blade modification of 4A.

Figure 5B is a sectional view of the blade portion of Figure 5A.

Figure 6 shows the two blades welded together to form a single blade element.

Referring now to Figs 1 and 2, the two-piece cutter member, generally indicated at 10, comprises the relatively rigid support element 12 and the flat spring metal blade 14 carried thereby. The support element, which preferably is formed of a spring steel, comprises a rigid support member 16 which preferably is of a roughly

pyramidal shape which extends from the front edge of base member 18. The support element 12 is adapted to be secured, more or less permanently, to the sickle bar by fastening means such as bolt holes 20. An opening 22 is provided in the rigid support member portion 16. Sloping walls faces 24 terminate at an end 25 of the rigid support member.

The flat spring metal blade, generally indicated at 14, comprises a thin sheet, e.g. 0.017-0.076 cm thick spring steel shown at 26 as having offset portions 28 and 30 forming a loop therefrom. These portions are offset by at least the thickness of the rigid support member 16 to permit these offset portions to be slipped over the end 25 of the rigid support member 16.

The flat spring metal blade includes a cutting face 35, a support face 39 to receive the rigid support member, and a planar face 26. Formed on the planar face are offset portions 28 and 30 and reinforcing ribs 34 and 38.

Detent 32 formed in the lower loop 28, essentially extends across the loop opening. Reinforcing ribs 34 and 38 may be provided along the edges of the planar part of the blade inside of the area including the teeth 35. The vertical walls 29 and 31, respectively of loops 28 and 30, run parallel to edge 24 of the rigid support member 16. The same is true of the interior edges 34a of the ribs 34.

In view of the above construction, when the spring metal blade 14 is slipped over rigid support member 16, it will slide down until detent 32 enters the hole 22. At this point, all of the vertical walls 29, 31 and 34a engage the edge 24 of the rigid support member 16 and the rear edge of detent 32 will engage the transverse wall 22a of the hole 22 and lock the spring metal blade in position. The reinforcing ribs 38 adjacent to each of the walls 29 and 31 add additional rigidity to the structure. When the blade is thus rigidly mounted onto the rigid support member 16 the cutting forces are transmitted

through the relatively thin, but reinforced, spring metal sheet from the cutting edge 35 to the rigid support element 12. When the spring metal blade 14 is damaged or dulled it can be easily removed by pushing on the detent 32 to release it from the edge 22a permitting easy removal of the whole spring metal blade 14 therefrom for repair or replacement. Thus a very lightweight blade is provided which is of much less cost than a blade formed of a single rigid piece having sufficient mass to absorb the cutting forces.

In a preferred form of the invention, the support element is made of heat treated and tempered spring steel 0.152 cm thick and the steel blade is made of heat treated and tempered spring steel 0.038 cm thick. As will be noticed, the cutting edge 35 is bent downwardly away from the cutting face so that the cutting edge can be held in tight spring-like engagement with the stationary bar of the cutter, thus providing efficient cutting action.

In another preferred embodiment of the invention, the means for holding the replaceable blade on the rigid support comprises a ridge 40 on the support element as illustrated in Figures 3 and 3A. This ridge 40 is formed by upsetting a portion of the upper surface 16a on the support 16 adjacent hole 22. In this embodiment of the invention, the loop 28 is not deformed at 32 as in Figure 1. When the loop 28 passes over the ridge 40 it bends outwardly and then snaps in position behind the ridge 40 to hold the blade 14 firmly on the support.

Since the ridge 40 is along side the hole 22 (see Figure 3A), a tool may be inserted into hole 22 and under the edge of loop 28 to lift this edge over the ridge 40 when the blade 14 is to be removed for sharpening or replacement. If desired, hole 22 may be replaced by a groove.

Still another preferred embodiment of the invention the replaceable blade is formed of two matching sheet

metal pieces which are welded together near their edges to form a single piece which surrounds the rigid support and is held on the rigid support in the same manner as shown in either Figure 1 or Figure 3.

Referring more detail to Figures 4A and 4B a bottom piece is illustrated as a flat metal sheet element 26a bent so that a portion 30a is displaced from the plane of the sheet 26a. Reinforcing ribs 38a serve the same function as the ribs 38 in the other figures and serve to stiffen the blade to transmit the cutting force from cutting teeth 35a to the rigid support element. As will be seen the displaced portion 30a, in Figure 4A does not have any cutout sections and it fits snuggly against the backside of the rigid support element.

The top piece is shown in Figures 5A and 5B as a flat section 26b and a displaced section 30b. The section 30b has at least two cutout sections, 22a and 22b. These correspond to the openings 22 in the other Figures. Teeth 35b are slightly displaced with respect to the teeth 35a. Similar reinforcing ribs 38b to the ribs 38a of Figure 4A and 4B are also provided.

In manufacturing the final blade, the top and bottom pieces are superimposed as shown in Figure 6 and are secured together by plurality of spotwelds 50 which make a single rigid piece, constituting a cutter blade which can be slid over the end of a rigid support piece 16 and be held in place by displacement of the portion of the top loop 30b. This provides a very strong rugged device which can be made from thin spring steel stock. It can be easily replaced and would be securely held by, for example, the raised portions 40 (see figure 3) on the rigid support element 60. It can be released by putting a tool through the hole 22b and lifting up the portion of the loop 32b between the hole 22b and the hole 22a thus clearing the ridges 40. Alternatively, a portion of the edge of hole 22a can be bent toward the rigid to support

as shown at 32 in Figures 1 and 2.

Various changes may be made in the invention without departing from the spirit and scope thereof. For example, cutting edge 35 may be serrated as shown in the drawings, or the cutting edge may take on a variety of geometries depending on the intended use. Still other changes may be made by one skilled in the art from the foregoing specification.

CLAIMS

1. A two-piece cutter member for mounting on a sickle bar characterized by a rigid thin support element 16 arranged for relatively permanent attachment to a sickle bar, a flat planar pyramid-shaped spring metal blade 14 having a cutting face 35 and a support face 39, a portion of the blade being displaced away from the support face to provide at least one loop 28, 30 for encircling said support element and holding said blade onto said support element, an opening 22 in said support element, a portion 32 of said one loop being bent toward the plane of the blade and positioned to engage said opening 22 in the support element to releasably hold said blade on said support when said blade is fully positioned on said support element, other portions 34 of said blade being displaced from the plane of the blade to engage edges of the support element to resist sideways displacement of the blade during use.

2. A two-piece cutting device for mounting on a sickle bar, characterized by a rigid, thin support element 16 arranged for relatively permanent attachment to the sickle bar; a flat, planar metal blade 14 having a cutting face 35 and a support face 39 wherein the cutting face is displaced away from the support face, said blade having at least one loop portion 28 for encircling said support element and holding said blade on said support element, said loop portion 28 being bent toward the plane of the blade and positioned to engage said support element to releasably hold said blade on said support element when said blade is fully positioned on said support element.

3. A cutter member of claim 1 or 2 characterized in that the support element 16 is of a pyramid shape.

4. A cutter member of claim 1 or 2 characterized in that at least two loops 28, 30 are formed from the blade.

5. A cutter member of claim 1 or 2 characterized in that the blade has cutting edges 35 which are bent away

from the plane of the support element to permit spring loading of said cutting edges against a stationary bar.

6. A cutter member of claim 5, characterized in that said cutting edges 35 are serrated.

7. A cutter member of claim 1 or 2 characterized in that said support element 16 comprises a base unit 18 and a rigid support member 16 extending therefrom.

8. A cutter member of claim 7, characterized in that said support member 16 is of a pyramid shape.

9. A cutter member of claim 7, characterized in that said base unit includes a plurality of holes 20 to fasten the sickle bar.

10. A cutter member of claim 1 or 2 characterized by comprising reinforcing means 38 for said loops, said reinforcing means being placed adjacent to said loops, adding additional rigidity to the cutter member.

11. A cutter member of claim 9, characterized in that said reinforcing means 38 are aligned parallel with the edges of said support element.

12. A cutter member of claim 9, characterized in that cutting forces are transmitted from the cutting edges 35 to said support element.

13. A two-piece cutting device for mounting on a sickle bar, characterized by a rigid, thin support element 16 arranged for relatively permanent attachment to the sickle bar; a flat, generally planar metal blade 14 having a support face 39 for engaging the support element and an opposite face 35 (the cutting face), and wherein the cutting face 35 is displaced away from the support face 39, said blade having at least one loop portion 28 for encircling said support element and holding said blade on said support element, a section of either said loop portion or said support element being displaced with respect to the support face to releasably hold said blade on said support element when said blade is fully positioned on said support element.

14. The cutting device of claim 13 characterized in that element 16 includes a ridge 40 for engaging a front edge of said loop portion.

15. The cutting device of claim 14 characterized in that element 16 includes a groove 22 adjacent said ridge.

16. The cutting device of claim 14 wherein said groove 22 extends through the support element 16.

17. A triangular shaped blade element 14 for mounting on a relatively rigid flat triangular support element 16 attached to a sickle bar, said blade element being formed of a spring metal sheet and having at least one loop portion 28 for encircling said support element, said loop portion being flexible so as to move away from contact with said support element as it is slid on said support element and reaches a point where a section of either said loop portion or said support element is displaced with respect to the area of contact between the loop portion and the support element, said flexible loop portion 28 returning to its original shape when the blade is fully seated and the displaced portion acts to releasably hold the blade on the support element.

18. The blade element of claim 17 characterized in that said loop portion 28 is bent towards the plane of the blade and is positioned to engage a hole 22 in the support element.

19. The blade element of claim 18 characterized in that the loop portion 28 is sufficiently flexible to pass over a ridge 40 having a rear shoulder for engaging a front edge of the loop portion.

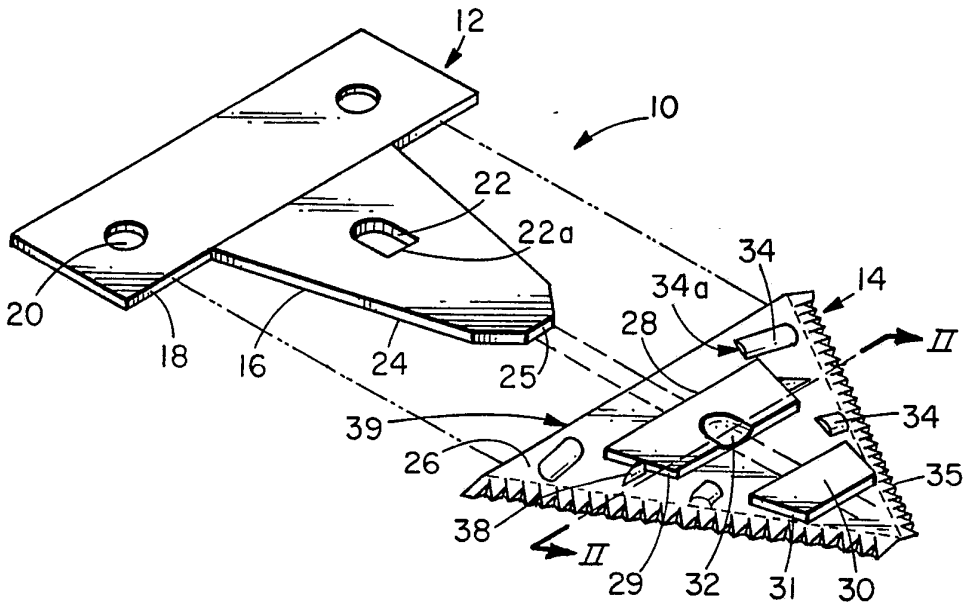
20. A triangular shaped blade element for mounting on a relatively rigid flat triangular support element attached to a sickle bar, said blade element being formed of two spring metal triangular sheets 26a, 26b welded together near their edges, at least one of the sheets having its edges serrated to provide a cutting edge 35a, at least one of said sheets constituting a loop portion

30b for encircling said support element 16, said loop portion being flexible so as to move away from contact with said support element as it is slid on said support element and reaches a point where a section of either said loop portion or said support element is displaced with respect to the area of contact between the loop portion and the support element, said flexible loop portion returning to its original shape when the blade is fully seated and the displaced portion acts to releasably hold the blade on the support element 16.

21. The blade element of claim 20 characterized in that said loop portion 30b is bent towards the plane of the blade and is positioned to engage a hole in the support element 16.

22. The blade element of claim 20 characterized in that the loop portion 30b is sufficiently flexible to pass over a ridge having a rear shoulder for engaging a front edge of the loop portion.

23. A two-piece cutting device for mounting on a sickle bar, characterized by a rigid, thin support element 16 arranged for relatively permanent attachment to the sickle bar; and a blade 14 releasably mounted on the support element said blade element being formed of two spring metal triangular sheets 26a, 26b welded together near their edges, at least one of the sheets having its edges serrated to provide a cutting edge 35a, at least one of said sheets constituting a loop portion 30b for encircling said support element 16, said loop portion being flexible so as to move away from contact with said support element as it is slid on said support element and reaches a point where a section of either said loop portion or said support element is displaced with respect to the area of contact between the loop portion and the support element, said flexible loop portion returning to its original shape when the blade is fully seated and the displaced portion acts to releasably hold the blade on the support element.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22a
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34a
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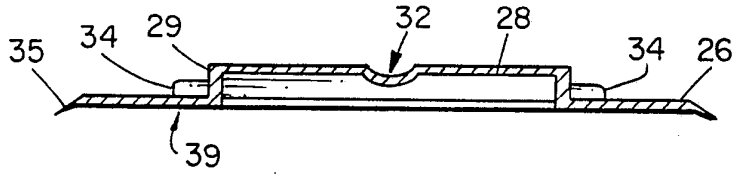
FIG. 1


35
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34
26
39

FIG. 2

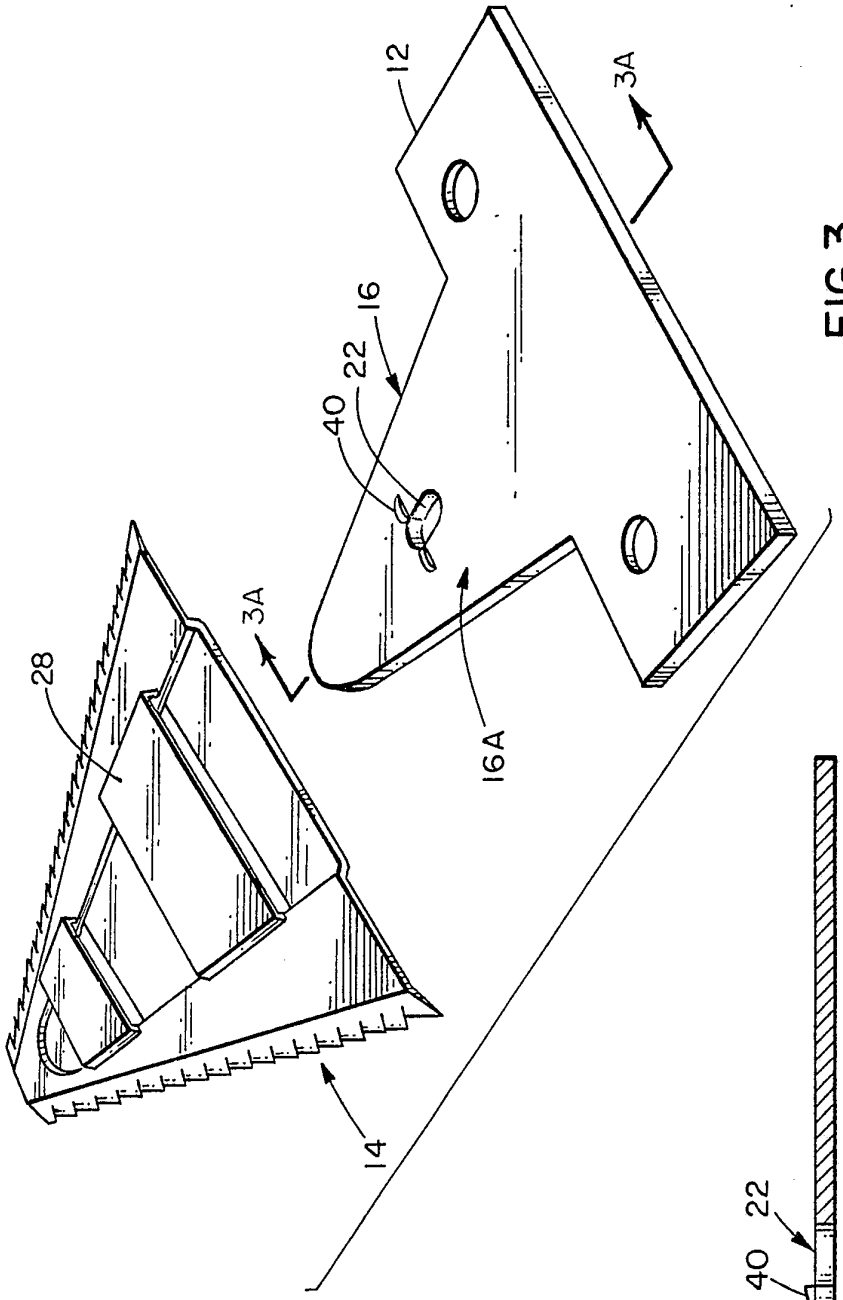

FIG.3

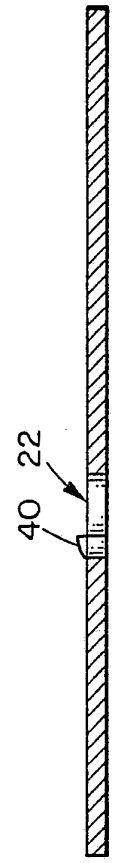

FIG.3A

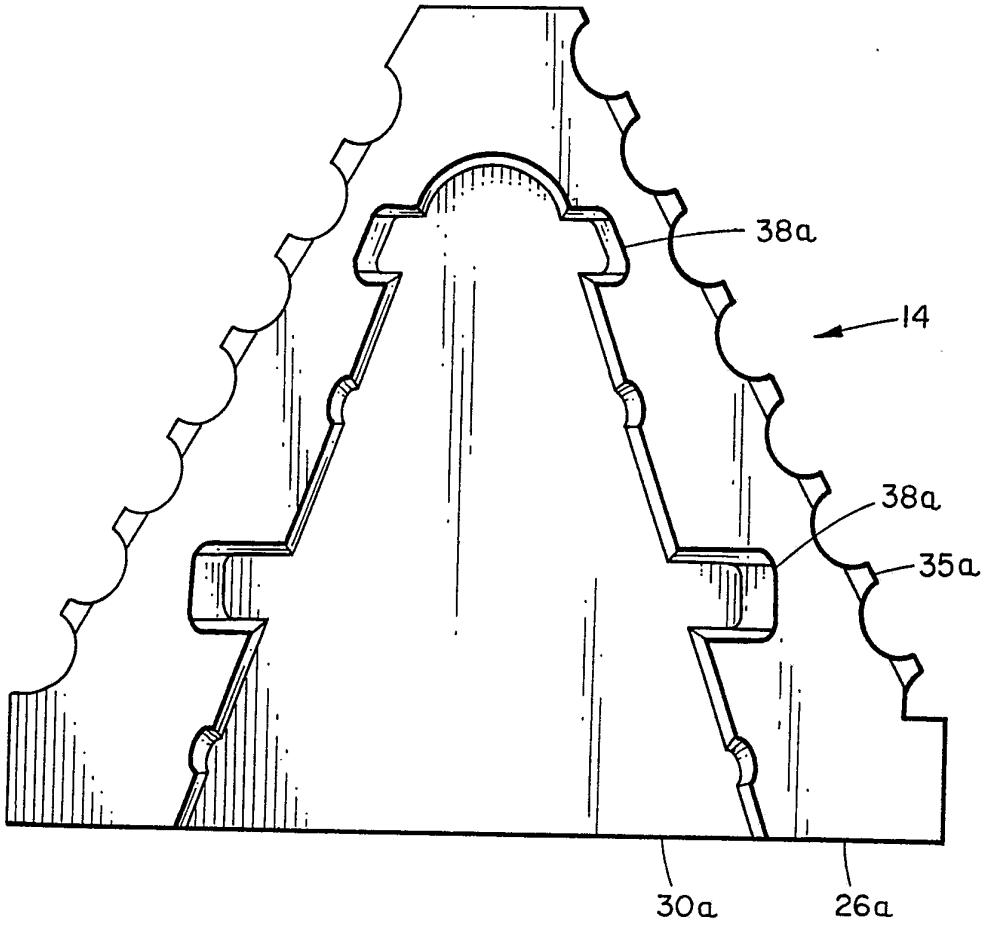

FIG.4A

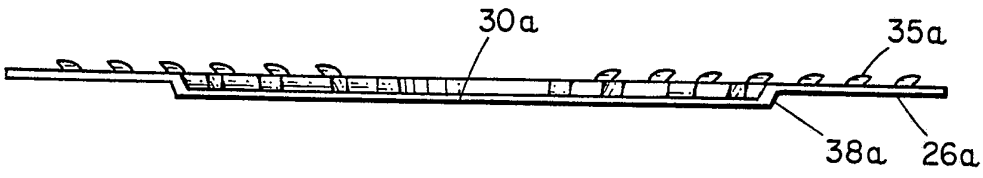

FIG.4B

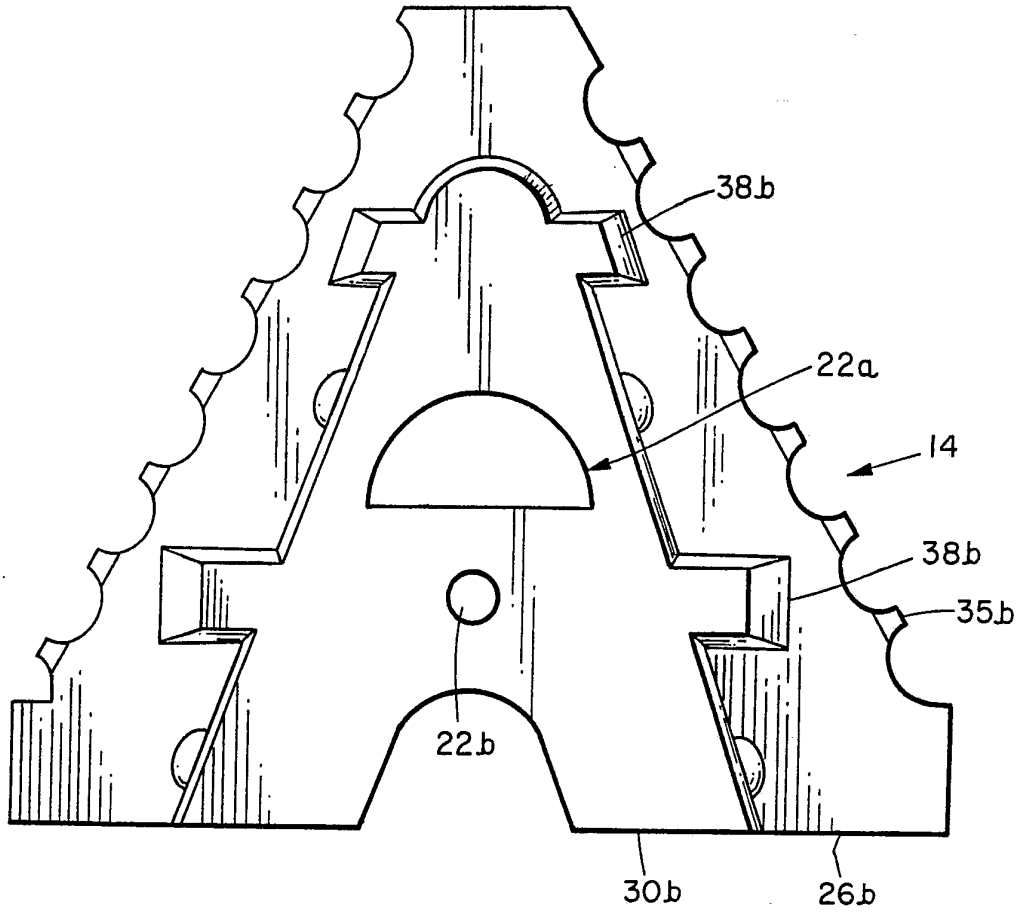

FIG. 5A

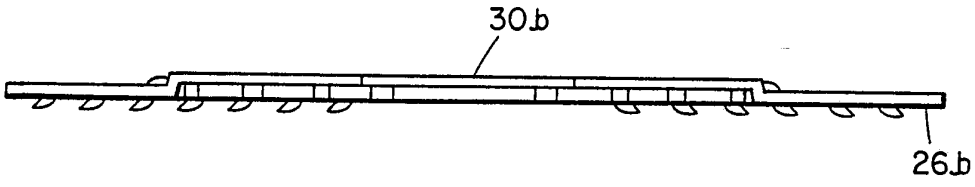

FIG. 5B

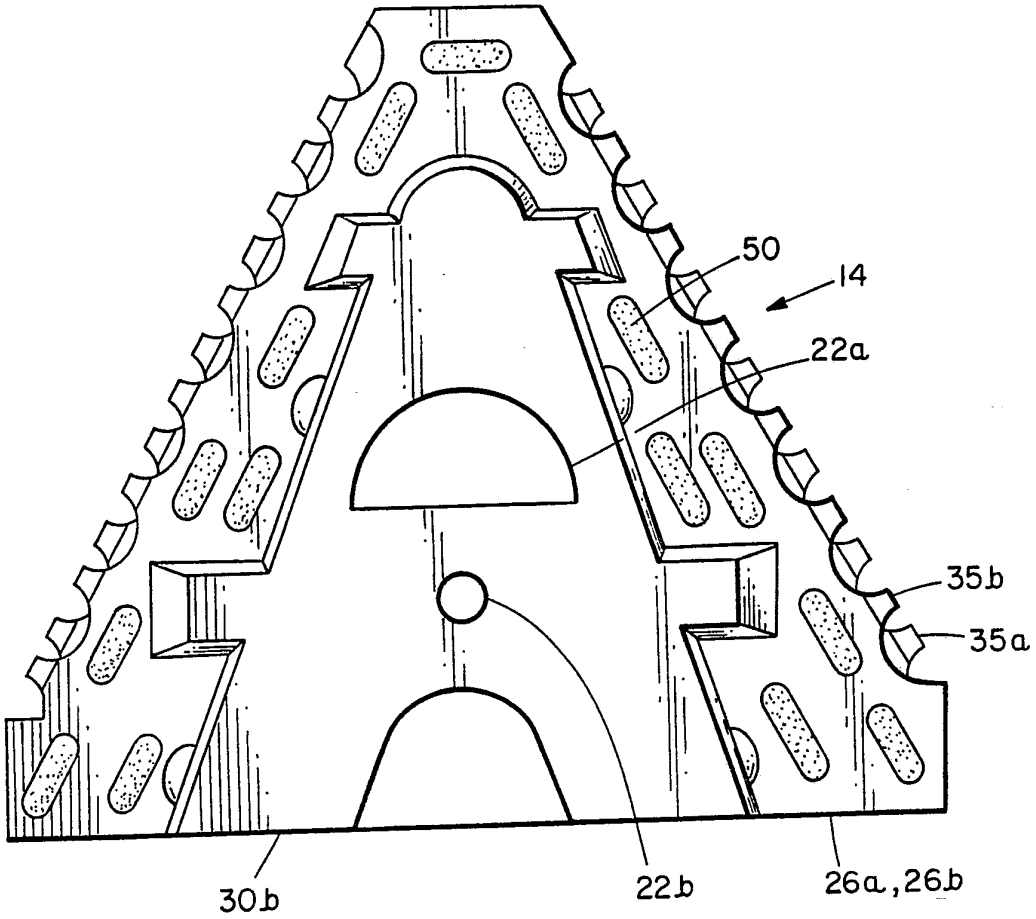

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No. PCT/US 92/03051

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A01D34/14

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A01D ; A01F ; A01B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	GB,A,20 795 a.d.1910 (THE BROCKTON MOWING MACHINE CUTTER BAR COMPANY) 18 May 1911 see page 1, line 27 - page 2, line 45; figures 1-7	1,2, 13-17
A	US,A,1 684 616 (BICEK) 18 September 1928 cited in the application see page 1, line 17 - line 60; figures 1-4	1,2,12, 13,17
A	US,A,1 537 354 (HOVER) 12 May 1925 cited in the application see page 1, line 52 - page 2, line 44; figures 1-4	1,2,13, 14,17
A	AU,B,585 175 (EUCHUCA NOMINEES PTY. LTD.) 8 June 1989 see page 3, line 24 - page 5, line 16; figures 1-4	1-3,13, 17,18

-/--

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28 AUGUST 1992	24. 09. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	WILLIAMS M.J. M.J. Williams

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,2 427 306 (SCHAFER) 9 September 1947 cited in the application see column 2, line 5 - column 3, line 26; figures 1-6	1-3,13, 17
A	US,A,3 013 373 (KOPASKA) 19 December 1961 cited in the application see column 2, line 54 - line 70; figure 6	6
A	US,A,4 223 514 (HALLS ET AL.) 23 September 1980 cited in the application	
A	US,A,1 390 753 (BERGMAN) 13 September 1921	
A	US,A,5 007 484 (JOHANSON) 16 April 1991	
A	US,A,997 495 (GOURLEY ET AL.) 11 July 1911 cited in the application	
A	US,A,1 164 691 (WILSON) 21 December 1915 cited in the application	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9203051 SA 59097

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 28/08/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-20795		None	
US-A-1684616		None	
US-A-1537354		None	
AU-B-585175	08-06-89	AU-A- 7891487	19-05-88
US-A-2427306		None	
US-A-3013373		None	
US-A-4223514	23-09-80	None	
US-A-1390753		None	
US-A-5007484	16-04-91	None	
US-A-997495		None	
US-A-1164691		None	