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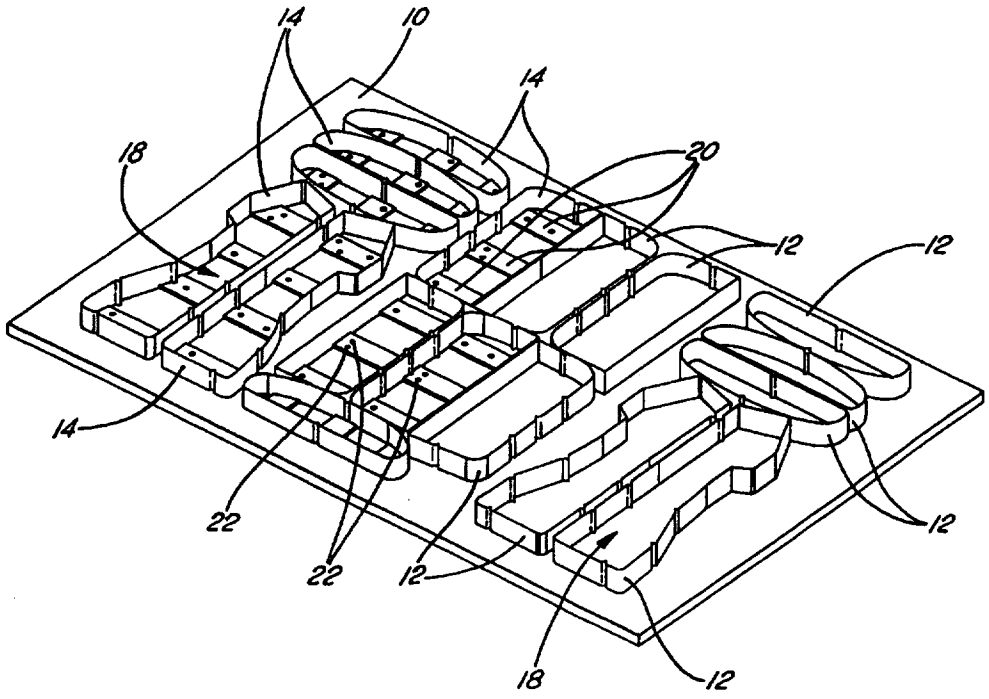
(54) Title: CUTTING KNIFE ASSEMBLY



(57) Abstract

A cutting knife assembly has a projecting cutting knife (12) detacheably connected to a baseboard (10). The cutting knife circumscribes a knife cavity (18) on the baseboard (10). An elongate cross member (20) extends across the knife cavity (18), is affixed to the cutting knife (12) and is mounted to the baseboard (10) by a removable fastener.

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CUTTING KNIFE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to cutting knives for die cutting, and more particularly, to a method and apparatus for mounting cutting knife cavities onto a baseboard.

2. Discussion of the Related Art

Cutting knives are commonly used for cutting sheet material such as cloth or vinyl. Cutting knives are also referred to in the industry as cutting dies. Typically, a cutting knife assembly has a support board with a cutting blade or knife mounted thereto shaped to cut a desired pattern. The cutting knife assembly is mounted into a press. The sheet material is fed into the press. The press forces the cutting blades or knives through the sheet material to cut the desired pattern. A common press type is a clicker die press.

The cutting knives are mounted to the support plate which is commonly wood or steel. Wood is preferred because of its low cost compared to steel. A typical method for mounting a cutting knife is by machining a channel into the support plate corresponding to the shape of the desired pattern and securing the cutting knife within the channel. The support plate is typically machined in a machine shop at a location remote from the manufacturing area and then brought to the press for assembly.

Sheet material comes in a variety of widths. It is common for the widths of a particular material to vary several inches between rolls. It is highly desirable to fully utilize the material to minimize waste. As material widths change, placement of the fixed cutting edges may not fully utilize the material unless rearranged.

Conventional cutting knife mounting methods do not allow for the easy removal and rearrangement of the cutting knife to fully utilize different material widths or improved layouts. Because the modifications to the support plate are performed off-line, substantial time and effort are required to rearrange the knives. So much effort is required that a substantial material width change is required before rearranging is cost effective.

Conventional machining methods used in the mounting of cutting knives result in permanent modification to the base plate. Subsequent changes in cavity layout require new baseplate material. New baseplate material substantially increase cost of a new arrangement.

It is therefore desirable to have the capability to quickly and cost-effectively rearrange the cutting knives to fully utilize the available material.

Summary of the Invention

It is therefore one object of the invention to provide a technique for mounting cutting knives on a baseboard that allows for the inexpensive and expeditious rearrangement of the cutting knives to optimize material usage.

A preferred embodiment of the present invention includes a non-metallic baseboard that has a generally planar surface. A cutting knife extends in a generally perpendicular direction to said baseboard and circumscribes a knife cavity. The cutting knife has an elongated cross member affixed to the cutting knife that extends across the knife cavity. The cross member provides a means for affixing the cross member to the baseboard. One method for attaching the cutting knives to the baseboard is by screwing through the cross member into the baseboard. If the cutting knives need to be removed, the cutting knife is quickly unscrewed, preferably using a power screwdriver, and remounted on the assembly line.

In one aspect of the invention, a method for cutting sheet material includes providing a plurality of cutting knives with an integral cross member, arranging the plurality of cutting knives in a predetermined pattern on the baseboard and securing the cutting knives to the baseboard by screwing a fastener through the cross member and into the baseboard. By using a fit-type computer program, cavity layouts may be constantly improved so that the cut material is more efficiently used.

One advantage of the present invention is that a relatively inexpensive wood baseboard may be used. The life of a wood baseboard is prolonged by the present invention since the cross members are preferably placed adjacent to the baseboard to distribute the load of the press across the surface of baseboard.

Brief Description of the Drawings

Other objects and advantages of the present invention become apparent from the following detailed description that should be read in conjunction with the drawings in which,

Figure 1 is an isometric view of a baseboard having cutting knife cavities mounted both in accordance with the present invention and in a conventional manner;

Figure 2 is a cross sectional view of Figure 1 having a wooden baseboard through a cutting knife cavity according to the present invention and mounted in a conventional manner;

Figure 3 is a similar cross section to that of Figure 2 having a non-metallic baseboard other than wood;

Figure 4 is a top view of a baseboard having knife cavities mounted according to the present invention for material having a first width; and

Figure 5 is a top view of a baseboard having knife cavities mounted according to the present invention using sheet material wider than that of Figure 4;

Figure 6 is a top view of a baseboard after several successive cutting knife rearrangements.

Detailed Description of the Preferred Embodiment

Referring now to the drawings, like reference numerals are used to identify identical components in the various figures. Although the invention will be described and illustrated in the context of a knife assembly particularly suited for use in a clicker die press, it will be appreciated that the invention may be used in conjunction with other well known types of presses.

Referring now to Figure 1, a baseboard 10 is shown having both conventional cutting knives 12 and flexible cutting knives 14 mounted thereon. Baseboard 10 is preferably made from a hard wood such as birch, beech or maple. One constructed embodiment used a baseboard constructed of 16 mm thick beech.

Flexible cutting knives 14 are flexible in the sense that they are easily removed and fastened in different locations upon baseboard 10. Each of cutting knives 12 and 14 are preferably made from a durable metallic material that is easily sharpened such as steel. Each cutting knife 14 circumscribes a knife cavity 18 that defines a desired pattern to be cut from sheet material. Each cutting knife 14 is preferably formed of a single piece of steel. Several pieces, however, may be used to form cutting knife 14.

Flexible cutting knives 14 have at least one elongated cross member 20 extending across knife cavity 18. Both ends of cross member 20 are affixed to a flexible cutting knife 14. Cross member 20 have holes 22 through which a fastener is placed to secure flexible cutting knives 14 to baseboard 10. Holes 22 are preferably preformed. Holes 22 may also be formed when affixing the flexible cutting knives to baseboard 10.

Referring now to Figure 2, flexible cutting knives 14 and conventional cutting knives 12 both have a first edge 24 that is sharpened to cut through the material.

Conventional cutting knives 12 have a second edge 26 that is used to secure conventional cutting knife 12 to baseboard 10. In conventional mounting methods, a groove 28 is cut into baseboard 10 to the shape of knife cavity 18 that extends through baseboard 10. Groove 28 must be specially machined and assembled offline in a labor and time intensive operation. Conventional machining of the baseboard does not allow for the efficient modification of the layout of the knife cavities. For example, the baseboard 10 must be removed from the press, sent to the manufacturer, retooled and then brought back to the press and reinstalled.

Flexible cutting knives 14 have a second edge 30. Second edge 30 is preferably planar in cross section. The plane is preferably parallel to the plane of baseboard 10. Cross member 20 is preferably affixed adjacent edge 30. Cross member 20 may be affixed to edge 30 by welding. Cross member 20 preferably has a substantially planar surface that lies adjacent to the surface of baseboard 10 and is preferably contiguous with second edge 30. Cross member 20 is secured to baseboard 10 by way of a screw 32 or other easily removable fasteners.

When using a flexible cutting knife configuration, baseboard 10 does not need to be removed from the press to adjust the placement of flexible cutting knives 14. A power screwdriver or a similar tool (not shown) may be used to remove screws 32 from baseboard 10. In the same manner, the flexible cutting knife 14 may be located in a different area on baseboard 10 and resecured by screwing screw 32 through holes 22 and into baseboard 10. In this manner, no offline pre-drilling or processing is required since baseboard 10 is made of a material through which a screw 32 can be easily mounted. Time for removing and resecuring is minimal compared to processing the baseboard off line.

Referring now to Figure 3, the material of baseboard 10 is shown as another non-metallic material such as a pressed fiberboard or a plastic material. The material should be resilient to the forces in a press operation but able to be screwed into so that flexible cutting knives 14 may be easily rearranged on baseboard 10.

Referring now to Figure 4, the sheet material typically comes in a variety of widths. It is not uncommon for manufacturers of sheet material to provide a roll of material several inches wider than the material ordered. The flexible cutting knives 14 of Figure 4 are optimized to fit a material having a width W_1.

Referring now to Figure 5, flexible cutting knives 14 have been rearranged to be optimized for a new material width W_2. Width W_2 is greater than that of width W_1. Several more patterns may be cut as compared to that of a narrower width material. A conventional best fit-type computer program may be used to help determine an optimum arrangement for flexible cutting knives 14.

Referring now to Figure 6, eventually baseboard 10 will end up with a multitude of screw holes 34 from the process of removing and resecuring flexible cutting knives 14. Baseboard 10 will eventually break down once a sufficient number of screw holes 34 are formed. Cross members 20, however, help distribute the load from the force of the press over a wide area of baseboard 10 to help prolong the life of baseboard 10.

In practice, the present invention may be used alone as shown in Figures 4 through 6 or may be used in combination with a conventional die mounting method such as that shown in Figure 1.

If sheet material has a different width from that which the cutting knives are currently set, the knives may be configured to provide for a minimum amount of waste. This can be done manually or by using a computer program to find the optimum fit for the patterns to be cut. Once this configuration is known, the flexible cutting knives 14 are secured to baseboard 10 by using a power screwdriver to drive a screw through holes 22 and into baseboard 10. Once again, there is no need for pre-drilling baseboard 10 since baseboard 10 is of a material that a power screwdriver may easily drive a screw into.

While the best mode for carrying out the present invention has been described in detail, those familiar with the art to which this invention relates, will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.

CLAIMS

What is claimed is:

1. A cutting knife assembly comprising:

a baseboard having a planar surface;

a cutting knife detachably connected on said planar surface;

said cutting knife extending in a generally perpendicular direction to said baseboard and circumscribing a knife cavity thereon; and

an elongated cross member affixed to said cutting knife and extending across said knife cavity, said cross member providing a means for attaching said cross member to said baseboard.

2. A cutting knife assembly as recited in claim 1 wherein said cutting knife has a first and second edge, said first edge sharpened to form a cutting surface and said second edge placed adjacent said baseboard.

3. A cutting knife assembly as recited in claim 2 wherein said second edge has a generally planar surface parallel to said planar surface of said baseboard.

4. A cutting knife assembly as recited in claim 3 wherein said elongated cross member is affixed to said cutting knife adjacent said second edge.

5. A cutting knife assembly as recited in claim 4 wherein said cross member has a planar surface;

said planar surface of said cross member forming a contiguous planar surface with said planar surface of said second edge.

6. A cutting knife assembly as recited in claim 1 wherein said means for attaching include holes through said elongated cross member and fastening means mounted through said holes for securing said cutting knife to said baseboard.

7. A cutting knife assembly comprising:

a non-metallic baseboard having a planar surface;

a cutting knife detachably connected on said planar surface;

said cutting knife extending in a generally perpendicular direction to said baseboard and circumscribing a knife cavity thereon; and

an elongated cross member having a first and second end affixed to said cutting knife and extending across said knife cavity, said first and second end affixed to said cutting knife, said cross member providing a means for attaching said cross member to said baseboard.

8. A cutting knife assembly as recited in claim 7 wherein said cutting knife has a first and second edge, said first edge sharpened to form a cutting surface and said second edge placed adjacent said baseboard.

9. A cutting knife assembly as recited in claim 8 wherein said second edge has a generally planar surface parallel to said planar surface of said baseboard.

10. A cutting knife assembly as recited in claim 9 wherein said elongated cross member is affixed to said cutting knife adjacent said second edge.

11. A cutting knife assembly as recited in claim 10 wherein said cross member has a planar surface;

said planar surface of said cross member forming a contiguous planar surface with said planar surface of said second edge.

12. A cutting knife assembly as recited in claim 9 wherein said means for attaching include holes through said elongated cross member and fastening means mounted through said holes for securing said cutting knife to said baseboard.

13. A cutting knife assembly as recited in claim 9 wherein said non-metallic baseboard comprises wood.

14. A cutting knife assembly as recited in claim 9 wherein said non-metallic baseboard comprises a composite material.

15. A method for assembling a cutting knife assembly, said assembly having a non-metallic baseboard comprising the steps of:

providing a plurality of cutting knives each having an integral cross member;

arranging said plurality of cutting knives in a predetermined configuration; and

securing said cutting knives on said baseboard by mounting a fastener through said cross member and into said baseboard.

16. A method as recited in claim 15 wherein said predetermined configuration substantially minimizes waste from a sheet of material.

17. A method as recited in claim 15 wherein the step of securing comprising the step of;

screwing a fastener through said cross member.

18. A method as recited in claim 15 further comprising the steps of;

removing said fastener by unscrewing said fastener;

moving said cutting knife; and

resecuring said cutting knife by screwing a fastener through said cross member directly into said baseboard.

AMENDED CLAIMS

[received by the International Bureau on 25 September 1997 (25.09.97); original claims 1-18 replaced by amended claims 1-17 (4 pages)]

1. A cutting knife assembly comprising:

a non-metallic baseboard having a planar surface;

a cutting knife having first and second edges, said cutting knife being detachably mounted on said planar surface;

said cutting knife extending in a generally perpendicular direction to said non-metallic baseboard and circumscribing a knife cavity thereon;

said first edge forming a cutting edge which extends in a direction

away from said planar surface; and

an elongated cross member affixed to said cutting knife adjacent said second edge, extending across said knife cavity and engaging said planar surface, said cross member providing a means for rigidly attaching said cross member and said cutting knife to said baseboard;

said elongated cross member being adapted to carry the load applied to said cutting knife and to distribute the load to said non-metallic baseboard.

2. A cutting knife assembly as recited in claim 1 wherein said second edge has a generally planar surface parallel to said planar surface of said non-metallic baseboard.

3. A cutting knife assembly as recited in claim 2 wherein said cross member has a planar surface;

said planar surface of said cross member forming a contiguous planar surface with said planar surface of said second edge.

4. A cutting knife assembly as recited in claim 1 wherein said means for attaching include holes through said elongated cross member and fastening means mounted through said holes for securing said cutting knife to said baseboard.

5. The cutting knife assembly as recited in claim 1 wherein said cutting knife has a plurality of elongated cross members affixed to said cutting knife adjacent said second edge, each cross member having a planar surface forming a contiguous surface with said planar surface of said second edge and engaging the planar surface of said non-metallic baseboard.

6. The cutting knife assembly as recited in claim 1 wherein there are a plurality of cutting knives adjacent to one another detachably mounted on said planar surface of said non-metallic baseboard, said cutting knives having the same height throughout their extent.

7. The cutting knife assembly as recited in claim 6 wherein each of said cutting knives are provided with a plurality of elongated cross members affixed to their respective cutting knife adjacent said second edge, each cross member having a planar surface forming a contiguous surface with said planar surface of said second edge and engaging the planar surface of said non-metallic baseboard.

8. A cutting knife assembly comprising:

a non-metallic baseboard having a planar surface;

a cutting knife having first and second edges, said cutting knife being detachably mounted on said planar surface;

said cutting knife extending in a generally perpendicular direction to said non-metallic baseboard and circumscribing a knife cavity thereon;

said first edge forming a cutting edge which extends in a direction away from said planar surface;

said second edge having a generally planar surface parallel to and abutting said planar surface of said non-metallic baseboard; and

an elongated cross member having a first end and a second end affixed to said cutting knife adjacent said second edge, extending across said knife cavity and abutting the planar surface of said non-metallic baseboard, said first end and said second end being affixed to said cutting knife, said cross member providing a means for rigidly attaching said cross member and said cutting knife to said non-metallic baseboard;

said elongated cross member being adapted to carry the load applied to said cutting knife and to distribute the load to said non-metallic baseboard.

9. A cutting knife assembly as recited in claim 8 wherein said cross member has a planar surface;

said planar surface of said cross member forming a contiguous surface with said planar surface of said second edge.

10. A cutting knife assembly as recited in claim 8 wherein said means for attaching include holes through said elongated cross member and fastening means mounted through said holes for securing said cutting knife to said baseboard.

11. A cutting knife assembly as recited in claim 8 wherein said non-metallic baseboard comprises wood.

12. A cutting knife assembly as recited in claim 8, wherein said non-metallic baseboard comprises a composite material.

13. The cutting knife assembly as recited in claim 8 wherein said cutting knife has a plurality of elongated cross members affixed to said cutting knife adjacent said second edge, each cross member having a planar surface forming a contiguous surface with said planar surface of said second edge and engaging the planar surface of said non-metallic baseboard.

14. The cutting knife assembly as recited in claim 8 wherein there are a plurality of cutting knives adjacent to one another detachably mounted on said planar surface of said non-metallic baseboard, said cutting knives having the same height throughout their extent.

15. The cutting knife assembly as recited in claim 8 wherein each of said cutting knives are provided with a plurality of elongated cross members affixed to their respective

cutting knife adjacent said second edge, each cross member having a planar surface forming a contiguous surface with said planar surface of said second edge and engaging the planar surface of said non-metallic baseboard.

16. A method for detachably assembling a cutting knife assembly on to a non-metallic baseboard provided with a planar surface comprising the steps of:

providing on the planar surface a plurality of cutting knives, each knife circumscribing a knife cavity and having first and second edges with an integral elongate cross member having a surface coplanar with said second edge;

placing each cutting knife on said planar surface to extend in a generally perpendicular direction to said non-metallic baseboard;

arranging said plurality of cutting knives in a predetermined configuration on the planar surface, with the corresponding first edge extending in a direction away from said planar surface and the corresponding second edge of the cutting knife and the coplanar surface of said cross member abutting said planar surface; and

removably securing the cutting knives on said baseboard by screwing a fastener through each cross member directly into said baseboard thereby rigidly attaching the cross member and the corresponding cutting knife thereto.

17. The method for assembling a cutting knife assembly as recited in claim 16 further comprising the steps of:

removing each fastener from the corresponding cutting knife by unscrewing the fastener;

adjusting said cutting knife on the planar surface; and

resecuring each cutting knife by screwing a fastener through each cross member directly into said baseboard thereby rigidly attaching the cross member and the corresponding cutting knife to the base board.

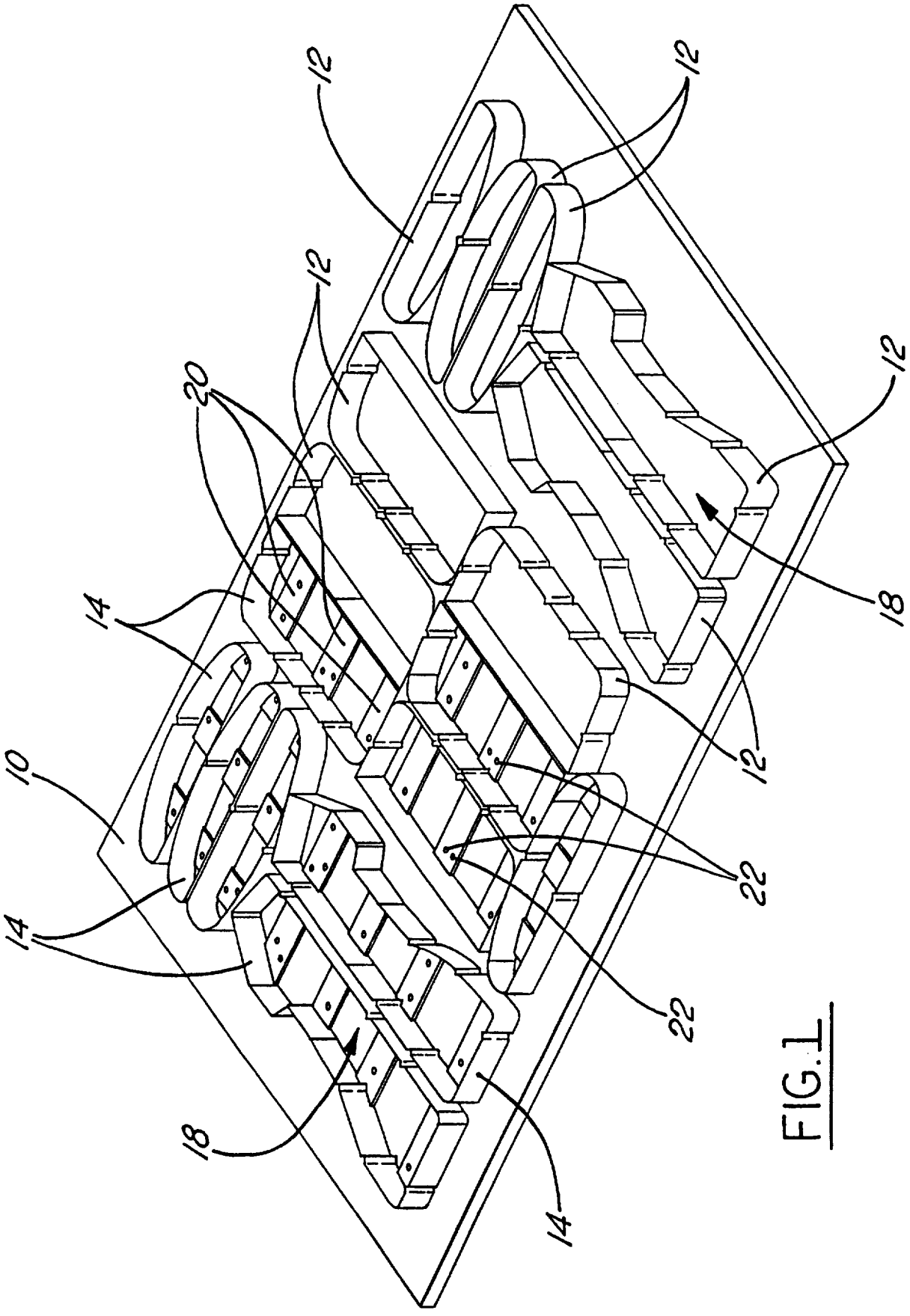

FIG.1

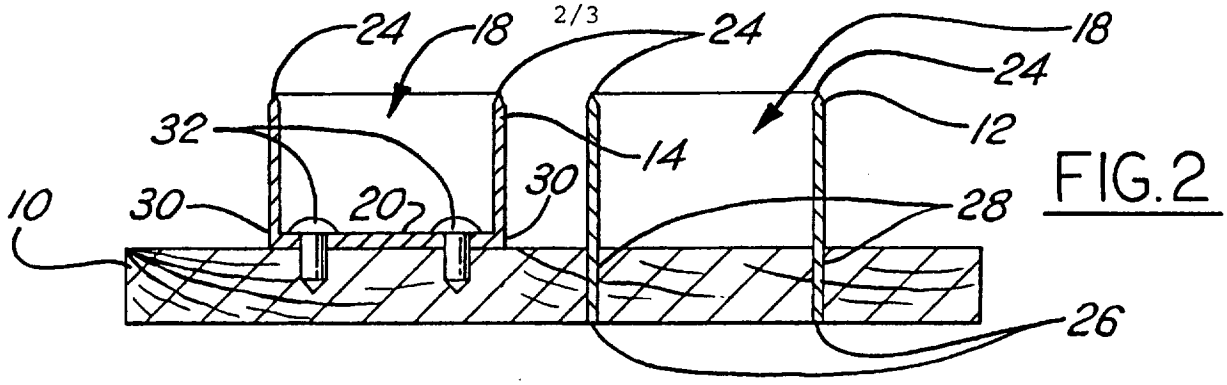

FIG.2

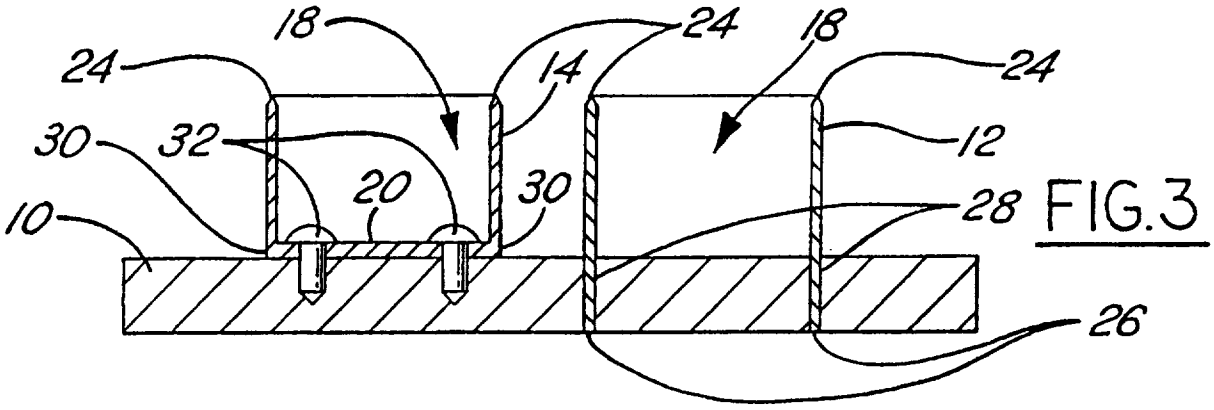

FIG.3

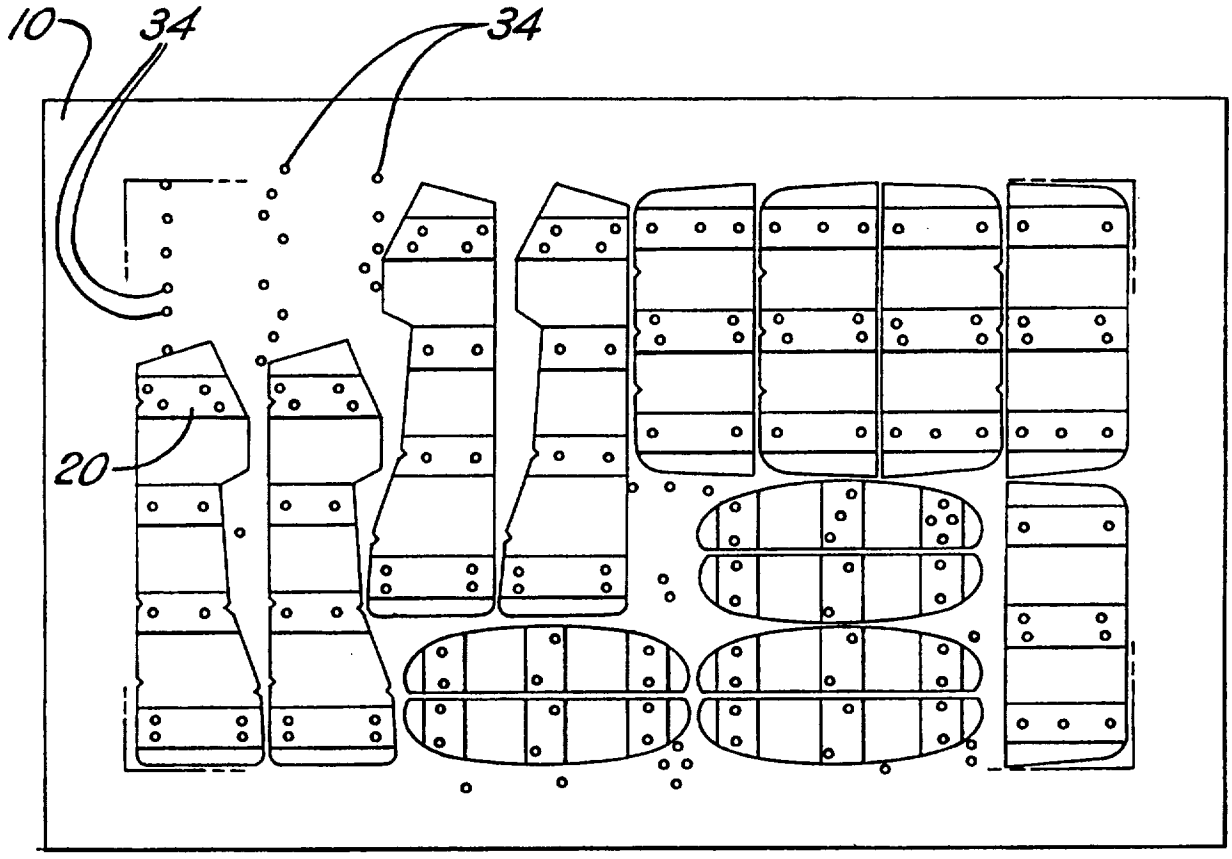

FIG.6

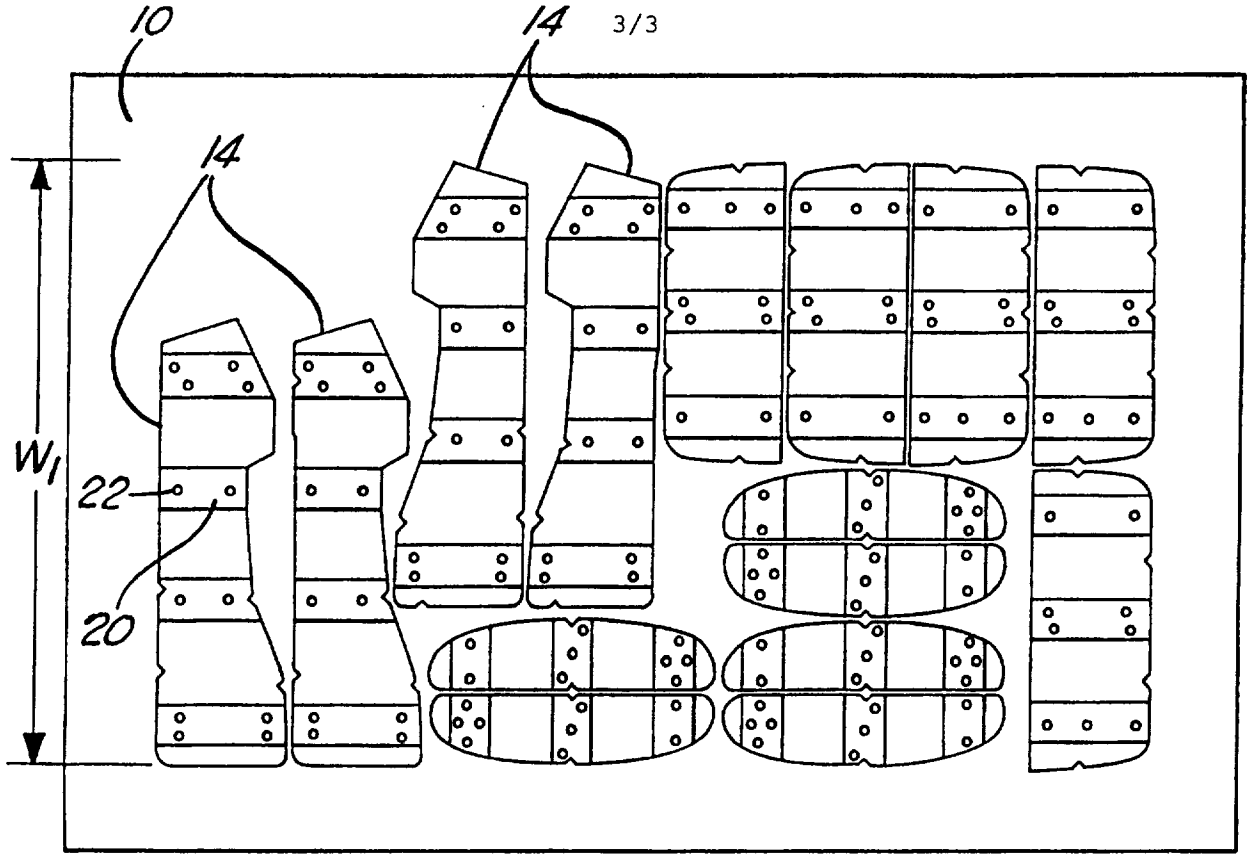

FIG. 4

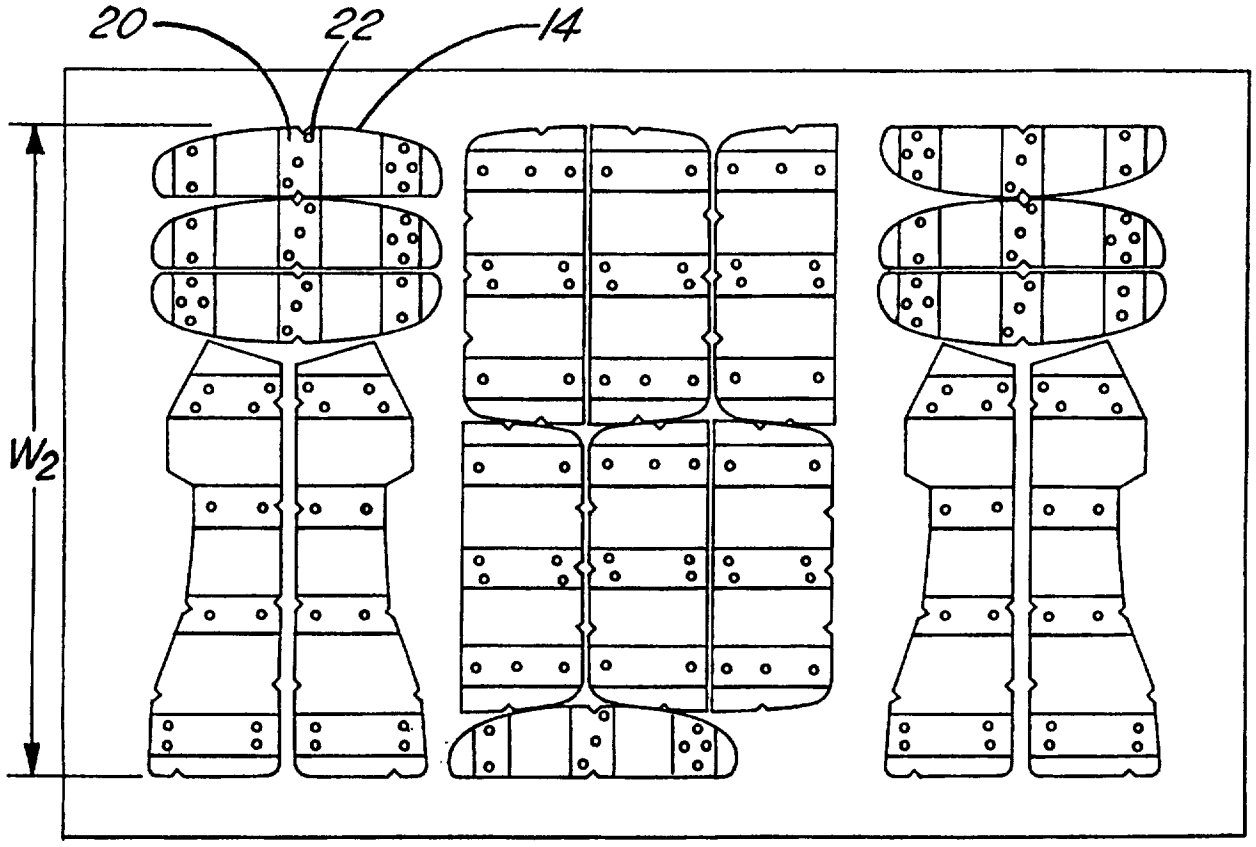

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/02925

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B26D 7/26
US CL : 83/652, 698.71
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 83/652, 653, 698.71

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ------ Y	US 3,373,643 A (SPENGLER et al) 19 March 1969, see figure 4.	1-4,7-10 ---------- 5,11
Y	US 1,471,653 A (FITZGERALD) 23 October 1923, see figures 3-6.	5,11
A	US 1,505,774 A (FITZGERALD) 19 August 1924, see figure 1.	1-5,7-11
A	US 3,217,579 A (RUBICO et al) 16 November 1965, see figure 1.	1-5,7-11
A	US 950,003 A (MACFARLAND et al) 22 February 1910, see figure 1.	1-5,7-11

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
06 JUNE 1997	08 JUL 1997

Name and mailing address of the ISA/US	Authorized officer
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Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 1,359,307 A (D'OUTILLAGES) 16 March 1964, see figure 4.	1-5,7-11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/02925

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group 1, claims 1-5,7-11, drawn to the special technical feature of the configuration of the cutting edges.
Group 2, claims 1,6,7,12, drawn to the special technical feature of the attaching means.
Group 3, claims 1,7,13,14, drawn to the special technical feature of the material of the baseboard.
Group 4, claims 15-18, drawn to the special technical feature of the method of assembling.

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

Species A - the wood baseboard

Species B - the composite baseboard

The claims are deemed to correspond to the species listed above in the following manner:

Species A - claims 1,7,13

Species B - claims 1,7,14

The following claims are generic: 1,7

The inventions listed as Groups 1-4 do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features. For example, the invention of group 1 need not be mounted to the baseboard by a fastener but could be welded instead, and conversely, the invention of group 2 could use a different configuration of cutting edges than that of group 1.

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: Species A and B are made of different materials.