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EUROPEAN PATENT APPLICATION

21 Application number: 83110816.2

51 Int. Cl.³: **B 26 D 1/36**
B 26 D 1/62

22 Date of filing: 28.10.83

30 Priority: 08.11.82 US 440075

43 Date of publication of application:
16.05.84 Bulletin 84/20

84 Designated Contracting States:
DE FR GB IT

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54 **Papercutting apparatus.**

57 In rotary-type papercutting apparatus having a roller (10) carrying a cutting knife (12, 14) and a second cooperating roller (20) against which the paper is cut, the second roller has associated therewith a cutting surface (22, 24) formed of an elastomeric material.

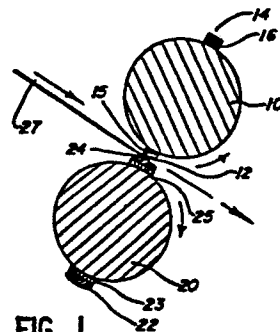


FIG. 1

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PAPERCUTTING APPARATUS

This invention relates to papercutting apparatus.

Papercutting machines are widely used in such industries as the printing industry and rotary-type papercutting machines are popular for cutting strips or webs of paper of desired size. In general, rotary papercutting machines involve two cooperating rollers, one of which carries a knife and the other being an anvil against which the paper is cut. It is desired that the paper be cut cleanly and accurately, and to this objective a number of prior art patents are directed. Yet, problems exist today in the art involving excessive noise and vibration of the machines and cost of replacement of metallic roller anvils as a result of the knife repeatedly digging into and scoring the anvils. It is, therefore, a principal object of the present invention to provide improvements in rotary papercutting machines with respect to these problems.

A major object of the invention is to provide improvements in rotary papercutting machines with respect to reduction of noise during operation of such machines.

It is another object of the invention to provide improvements in rotary papercutting machines with respect to reduction of machine vibration during operation.

It is a still further object of this invention to provide anvil surfaces for cutting knives in rotary-type papercutting machines which have increased useful lives.

Another object of the invention is to provide cutting surfaces for the cutting knives in rotary-type papercutting machines which can be readily repositioned to provide fresh surfaces for the cutting operation.

5 It is a still further object of the invention to provide cutting surfaces for the cutting knives in rotary-type papercutting machines which can be readily replaced.

 The above and other objects are accomplished in accordance with this invention by providing surfaces which
10 are struck by cutting knives during the cutting operation formed of an elastomeric material. With the anvil cutting surfaces which are struck by the cutting knives formed of an elastomeric material, the noise and vibration made by the papercutting machines during operation are significantly
15 reduced. Moreover, such elastomeric surfaces are less damaging to the edges of the cutting knives thereby prolonging their useful lives. The present invention is of general application with rotary-type papercutting machines which involve two cooperating rollers, with one roller
20 carrying a cutting knife or knives and the other roller presenting a back-up surface or anvil against which a web of paper is cut. Such rotary-type papercutting machines are well known in the art and thus will not be described in detail herein. Reference may be had to United States
25 patents Nos. 2,660,242, 2,682,306, 3,709,077, 3,857,134 and 3,893,359 for representative rotary-type papercutting machines.

 The advantages of the invention will be further appreciated by the following description taken in conjunction with the drawings wherein:
30

 Figure 1 is a transverse sectional view of cooperative cutter and anvil rollers formed in accordance with one embodiment of the present invention and which are used in a rotary-type papercutting machine.

Figure 2 is an exploded perspective view showing a cutter assembly and an array of cutting surfaces in accordance with the invention mounted on a back-up roller.

5 Figure 3 is an enlarged sectional view of a cutting surface in accordance with the invention.

Figure 4 is an end view showing the mounting of a cutting knife and a mount for an array of cutting surfaces in accordance with one embodiment of the invention.

10 Figure 5 is a transverse sectional view of co-operative cutter and anvil rollers formed in accordance with another embodiment of the present invention.

Figure 6 is an enlarged perspective view of a portion of a cylindrical anvil cutting surface formed in accordance with a further embodiment of the invention.

15 Figure 7 is a sectional view taken on the line 7-7 of Figure 6.

Figure 8 is a transverse sectional view of another embodiment of a cutting surface in accordance with the invention.

20 Figure 9 is a sectional view taken on the line 9-9 of Figure 8.

Figure 10 is a transverse sectional view of another embodiment of a cutting surface in accordance with the invention.

25 Referring more specifically to the drawings, reference numeral 10 indicates a cutting roller provided with two diametrically located, radially extending and longitudinally disposed knives 12 and 14 mounted on roller 10 through knife mounts 15 and 16, respectively. Diametri-
30 cally located on back-up roller 20 are two cutting surfaces 22 and 24 formed of an elastomeric material and secured to roller 20 by means of mounts 23 and 25, respectively. Knife 12 cuts a web of paper 27 by cutting into the elastomeric cutting surface 24 while knife 14 cuts the paper web by
35 cutting into elastomeric cutting surface 22, the speed of

rotation of the rollers 10 and 20 being synchronized to achieve cutting in this manner.

The cutting surfaces according to the invention are formed of an elastomeric resilient material which has
5 high tensile strength to withstand repeated strikes by a cutting knife and which recovers its original dimensions substantially fully after being struck by the cutting knife. A variety of such elastomeric materials can thus be used, including urethane polymers such as urethane polymers avail-
10 able commercially from Mobay Chemical Company under the name "Texin" or from B.F. Goodrich Company under the name "Estane". Other representative elastomeric materials include "Pellethane" available from CPR Division of The Upjohn Company, "Roylar" available from Uniroyal Rubber
15 Company and "Orthane" available from Ohio Rubber Company.

A particularly preferred elastomeric material for forming the cutting surfaces is "Estane" 58092 Compound which is a thermoplastic polyurethane material available from B.F. Goodrich having the following characteristics:

Typical Values

ASTM	Sample*	SI Units	in-lb Units
Shore Hardness			
D 2240	2	45 D	45 D
D 412	1	41.3 MPa	4600 psi
D 412	1	21.4 MPa	3100 psi
D 412	1	450%	450%
D 747	2	15.8 MPa	2300 psi
D 1525**	2	107° C.	225° C.
D 395			
Compression Set			
22 Hrs. at 23° C.	2	28%	28%
22 Hrs. at 70° C.	2	73%	73%
Taber Abrasion, CS17 Wheel			
1000 g Load, Loss/1000 Cycles	2	2.6 mg	
Tear Resistance	2	113.8 kN/m	650 lb/in
Specific Gravity	2	1.22	1.22
Low Temperature Stiffness			
Modulus of Rigidity at 23° C.	2	15.9 MPa	2310 psi
T ₂	2	-2° C.	28° F.
T ₅	2	-11° C.	12° F.
T ₁₀	2	-16° C.	3° F.
Freeze Point	2	-23° C.	-9° F.

* (1) 25 mil, extruded; (2) 75 mil, milled and pressed

** Method B

Figure 2 shows a plurality of arcuately arranged elastomeric cutting surfaces 30, 32, 34 and 36 of square shape mounted in longitudinally extending slots 37, 38, 39 and 40 provided in a metal mounting block 42. Mounting block 42 can be attached to back-up roller 45 by means of screws or bolts receivable in one or more of the holes 47 in the center portion of the mounting block. The extruded elastomeric strips 30, 32, 34 and 36 are preferably, but not necessarily, square in cross-section and are sized to be held within the slots 37, 38, 39 and 40 by frictional engagement and can, for example, have cross-sectional dimensions of 7/16 x 7/16 inch. After being repeatedly struck many times by a cutting knife, score lines or indentations designated by the reference numeral 50 (Fig. 3) may eventually appear on the surface of the elastomeric cutting surface. When this occurs to an undue extent after extended usage, the strips 30, 32, 34 and 36 having a square cross-sectional configuration can be removed and reinserted in reverse longitudinal orientation or can be inserted in a position 90° to that of the previous position. Thus, each strip can be positioned to present eight fresh cutting surfaces before it becomes necessary to replace the strip.

The number of mounting blocks 42 spaced around the periphery of the back-up roller 45 can be varied as desired to cut a paper web into strips of desired size. Likewise, the number of elastomeric cutting strips mounted within a mounting block can be varied with four being in Figure 2 as illustrative. The tangential positioning of the back-up roller 45 carrying the elastomeric cutting surfaces and the roller carrying the cutting knife 55 can be suitably adjusted so that at a given setting the knife 55 strikes any of the elastomeric cutting surfaces 30, 32, 34 or 36.

The radial positioning of the cutting blade 55 is generally such that the blade penetrates the elastomeric cutting surface to a variable depth of say, for example, from

about 0.010 to 0.080 inch thereby providing a neat, clean and accurate web cut. Because of the resilient nature of the elastomeric cutting surface as compared to a metal cutting anvil, the knife edge can be razor blade-like, with the point-
5 of the knife defining a relatively narrow angle, such as about 15 degrees to provide a straight cut as opposed to a ragged cut or a cut made by a knife having a serrated edge.

Suitable means for mounting a cutting knife and an array of cutting surfaces in accordance with the invention is illustrated in Figure 4. Thus, an L-shaped knife mount 62 is secured to cutting roller 66 by means of bolt 67 and nut 68. The cutting knife 55 can be radially adjusted at a desired position by means of bolt 70 and nut 71 with the bolt passing through holes 72 in knife clamp 58 and the
10 slots 59 in knife 55 so as to tightly secure the knife between clamp 58 and the knife mount 62. If desired, an assist finger 75 can be associated with the knife mount to assist in directing the paper web 76 into cutting position.
15

In similar manner, an anvil block 78 is secured to roller 80 by means of cap screw 81. A mounting block 42 carrying four elastomeric cutting strips 30, 32, 34 and 36 is secured to anvil block 78 by means of cap screw 83 which passes through holes 47 in the mounting block 42. Again, to assist in directing the paper web through the cutting
20 operation an assist finger 85 can be attached to roller 80 by means of cap screw 87.
25

Figure 5 illustrates an embodiment of the present invention wherein a plurality of strips or plugs 90 are geometrically spaced around the periphery of a back-up roller 92 with appropriate grooves being provided along
30 the circumference of the roller to accommodate and hold the elastomeric cutting surfaces. As shown, the cooperating roller 94 carries four cutting knives 96, although the number of knives can be varied depending upon the size to
35 which the paper is to be cut. For example, if one printing

repeat of 24 inches is to be cut into 6-inch strips, four knives can be used on the cutting roller 94. Similarly, if the 24-inch repeat is to be cut into 8-inch strips, three cutting knives would be utilized and so forth. For cutting paper into a size which is not exactly divisible into 24 inches, the circumferential spacing of the knives around the periphery of the roller is suitably adjusted with the cutting action taking place on appropriately spaced elastomeric cutting surfaces 90. Thus, for cutting paper within a certain size range, certain of the cutting surfaces 90 are utilized while for cuts of different size other cutting surfaces 90 are utilized.

According to another embodiment of the invention as illustrated in Figures 6 and 7, a back-up roller or cylinder 101 which is rotated by means of journaled drive shaft 102 has affixed over its entire outer surface a layer 104 of an elastomeric material such as "Estane" 5740X7 available from B.F. Goodrich Chemical Company.

Figures 8 and 9 of the drawings illustrate an embodiment of the invention wherein segments 110 and 112 of an elastomeric material are secured by an adhesive or other means to mounting plates 114 and 116 formed of a readily machinable metal such as aluminum. The mounting plates 114 and 116 are shaped so as to have projecting portions 117 and 119 which are clamped by means of a dovetail nut 120 which, in conjunction with cap screws 121 and 123, serves to secure the mounting plates on the back-up roller or cylinder 125. A plurality of segments 110 and 112 of an elastomeric material are preferably utilized so as to cover the entire outer surface of the cylinder 125. As illustratively shown in Figure 9, each segment defines an arc of 45 degrees so that eight segments are required to completely encircle roller 125 to produce a substantially continuous uninterrupted elastomeric cutting surface.

In the embodiment illustrated in Figure 10, an elastomeric cutting surface 130 is secured to the outer surface of a convex insert 132 which is received in appropriately sized cut-out portions 134 spaced around the periphery of a back-up roller 136. The inserts 132 are secured to the roller by means of cap screws 137. Any desired number of inserts 132 can be employed depending upon the size of cut desired. In this embodiment a cooperating cylinder or roller carries one or more cutting knives so as to make paper cuts of desired size with the cutting surfaces 130 serving as an anvil for the cutting operation.

Fabrication of the elastomeric cutting surfaces according to the invention is preferably accomplished by compacting and fluxing granules of a selected elastomeric resin material and extruding the molten material through a die opening designed to yield the desired profile. The hot extrudate is immediately passed through a cold water through where it develops sufficient strength to be pulled away from the die by a suitable take-up. After take-up the dimensioned part is cut to length.

From the foregoing it will be apparent that the invention affords numerous advantages in the papercutting art. The invention affords significant economic advantages by extending the useful life of costly cutting knives. The invention also significantly reduces down time of papercutting machines for maintenance, repair or replacement of metal back-up or anvil cylinders. These cost savings result in lower costs for the printing industry or other users of the machines. Moreover, papercutting machines utilizing the present invention are relatively quiet in operation as compared with papercutting machines in which the cutting is done against metal anvils. The substantial noise reduction is of major benefit to the health and welfare of operators. Also, the significant reduction in vibration of papercutting machines using the present invention is quite

advantageous with respect to lessened wear and strain on various elements associated with the papercutting machines.

Those modifications and equivalents which fall within the spirit of the invention are to be considered a
5 part thereof.

WHAT IS CLAIMED IS:

CLAIMS:

1. In a rotary-type papercutting apparatus having a roller carrying a cutting knife and a second cooperating roller against which the paper is cut, the improvement which consists in associating with said second roller a cutting surface formed of an elastomeric material.
2. The improvement in accordance with claim 1 wherein at least one longitudinally extending strip of an elastomeric material is provided on the surface of said second roller.
3. The improvement in accordance with claim 1 wherein at least one convex longitudinally extending mount is carried on the surface of said second roller, said mount carrying at least one longitudinally extending strip of an elastomeric material.
4. The improvement in accordance with claim 3 wherein the longitudinally extending strip of elastomeric material is square in cross-section.
5. The improvement in accordance with claim 3 wherein said mount carries a plurality of longitudinally extending strips of an elastomeric material.
6. The improvement in accordance with claim 1 wherein at least one longitudinally extending strip of an elastomeric material is carried within a cut-out portion on the outer surface of said second roller.
7. The improvement in accordance with claim 6 wherein the strip of elastomeric material is square in cross-section.

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8. The improvement in accordance with claim 6 wherein a plurality of said longitudinally extending strips of elastomeric material are carried within a plurality of cut-out portions on the outer surface of said second roller.
9. The improvement in accordance with claim 1 wherein the outer surface of said second roller is completely covered with a layer of an elastomeric material.
10. The improvement in accordance with claim 1 wherein a plurality of segments of an elastomeric material are disposed around the periphery of said second roller with the number of such segments being sufficient to form a complete circle.
11. The improvement in accordance with claim 1 wherein a convex longitudinally extending mount is carried with a cut-out portion of said second roller, said mount having on its outer surface a layer of an elastomeric material.
12. The improvement in accordance with claim 11 wherein a plurality of said mounts are spaced around the periphery of said second roller.

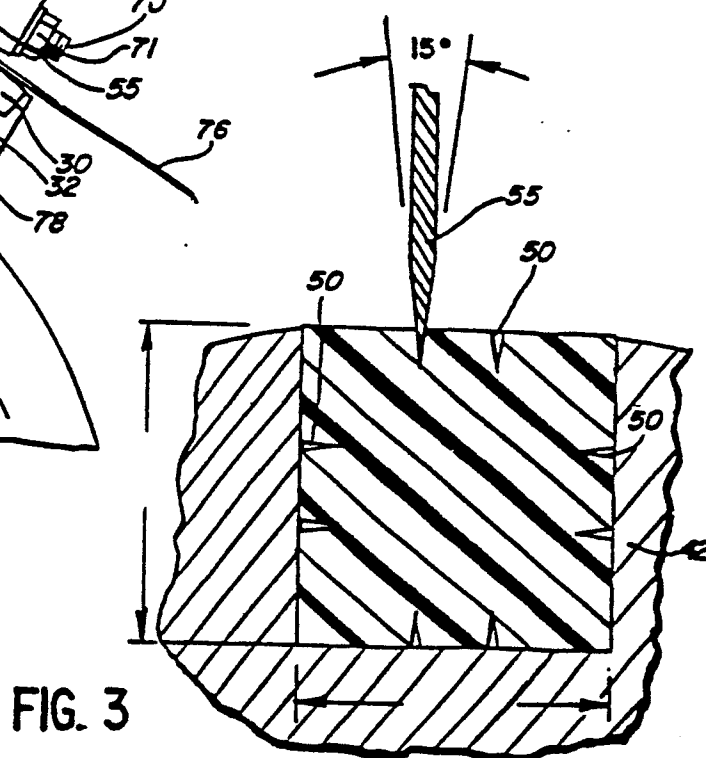
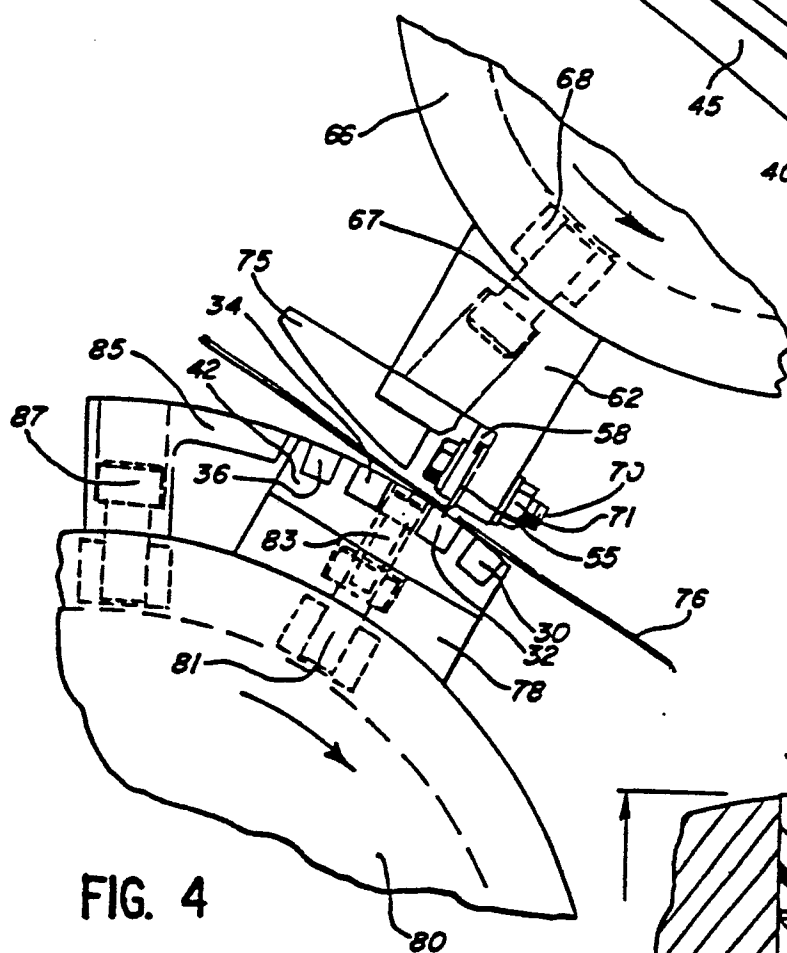
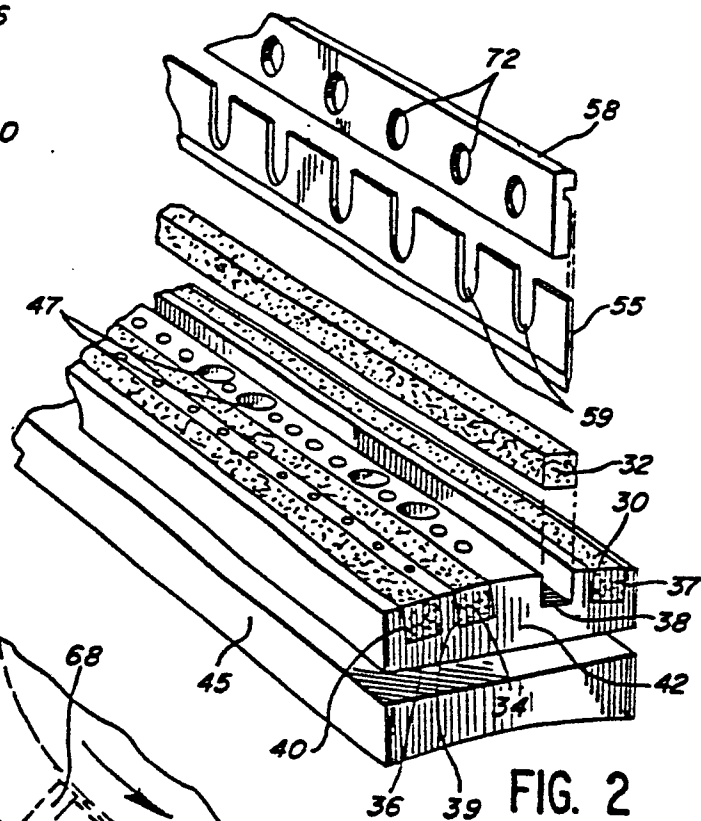
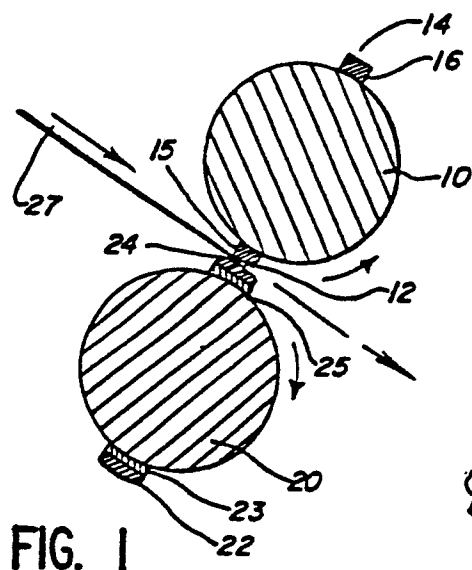


FIG. 5

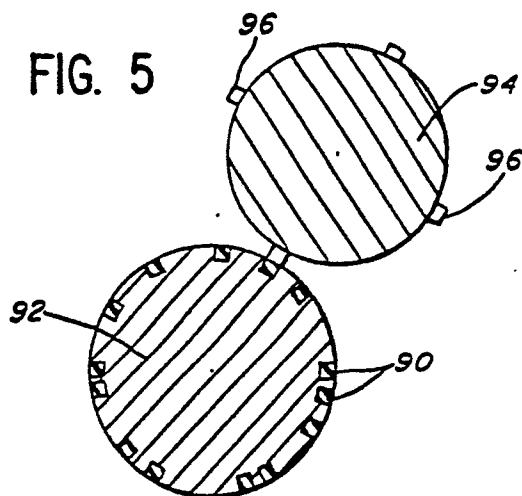
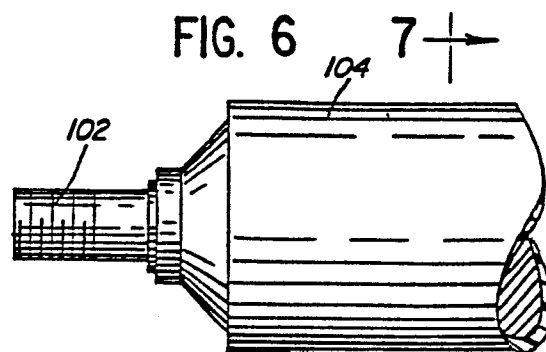


FIG. 6



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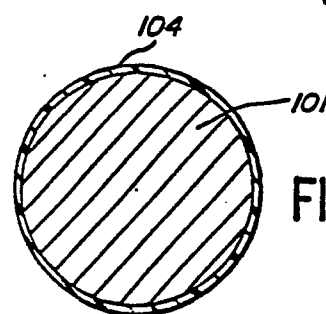


FIG. 7

FIG. 8

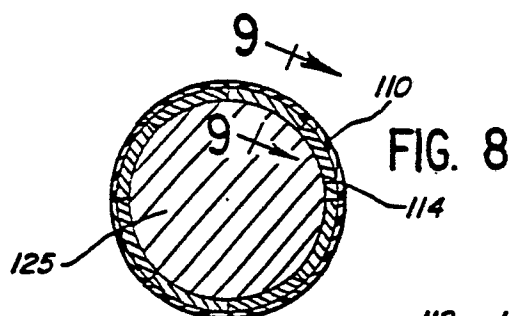


FIG. 9

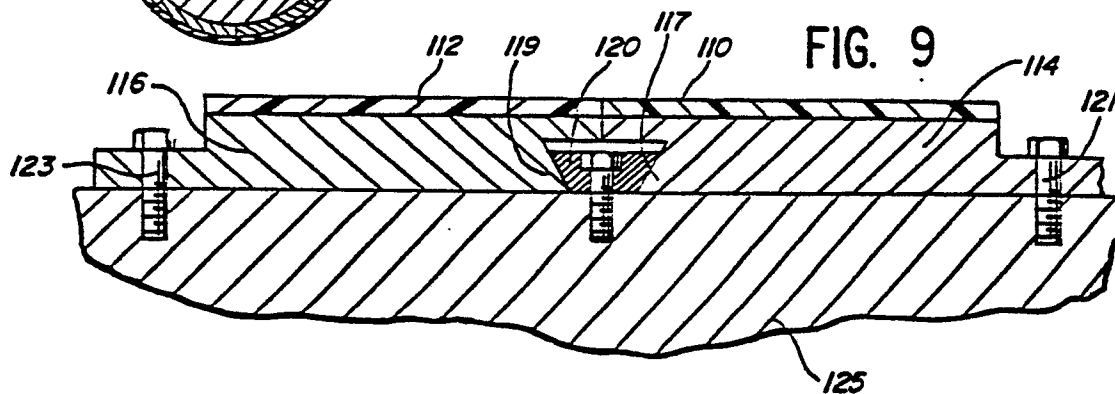
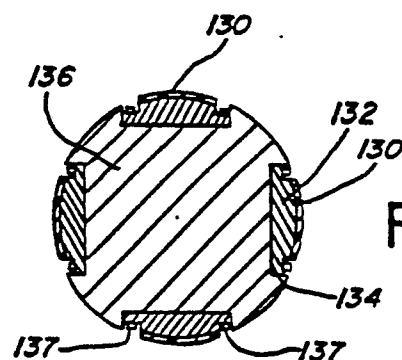


FIG. 10





European Patent
Office

EUROPEAN SEARCH REPORT

0108356

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 83110816.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
X	FR - A1 - 2 481 985 (VETROTEX SAINT-GOBAIN) * Page 13, lines 22-23; fig. 4a, 4b *	1, 9	B 26 D 1/36 B 26 D 1/62
X	US - A - 3 288 007 (MASUMI EDA) * Column 1, lines 50-60; fig. 1 *	1, 2, 6	
X	DE - A - 2 151 928 (VEB POLYGRAPH LEIBZIG) * Page 5, lines 2-12 *	1, 2, 6	
X	CH - A5 - 586 097 (MASCHINEN-FABRIK WIFAG) * Fig. 3-5 *	1, 2, 6	
X	US - A - 1 678 896 (WOOD) * Page 1, lines 33-37; fig. 1 *	1, 2, 3, 4	B 26 D 1/00 B 26 D 7/00
X	DE - B - 1 233 246 (SAUER) * Column 1, lines 1-3; fig. 1 *	1, 9, 10	
A	GB - A - 2 076 723 (ALBANY INTERNATIONAL CORP.) * Page 2, lines 73-84; fig. 3 *	1, 9	
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 30-12-1983	Examiner MANLIK
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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EUROPEAN SEARCH REPORT

0108356

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 628 466 (HOUGHTLIN)</u> * Page 1, lines 80-84; page 2, lines 22-24; fig. 1,2 * -----	2,6,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.)