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(71) Applicant: **SENSORMATIC R&D LIMITED**
Bishopstown, Cork (IE)

(72) Inventor: **Guilfoyle, Richard Patrick**
Ballincollig, County Cork (IE)

(74) Representative: **Weldon, Michael James et al**
c/o John A. O'Brien & Associates,
Third Floor,
Duncairn House,
14 Carysfort Avenue
Blackrock, Co. Dublin (IE)

(54) **Manufacture of article surveillance tags**

(57) Surveillance tags (1) are manufactured by initially producing resonator elements (14) and bias elements (12) in batches in cells (21, 22). There is in-line testing of the resonator elements (14) as they are cut, and dynamic feedback to the cutter to adjust cutting parameters. Bias elements (12) are cut by drawing two webs (41, 42) from reels in side-by-side juxtaposition.

Each web is drawn through fixed and dancing rollers for correct tensioning. The webs (41, 42) are fed by a feeder (70) comprising a pair of feed rollers (71(a), 71(b)) for each web, and a feed block (72) having a ramped loading section (74) located between the feed rollers. The feed block (72) has a groove (73) for each web, the groove having upwardly and inwardly extending side walls for web retention.

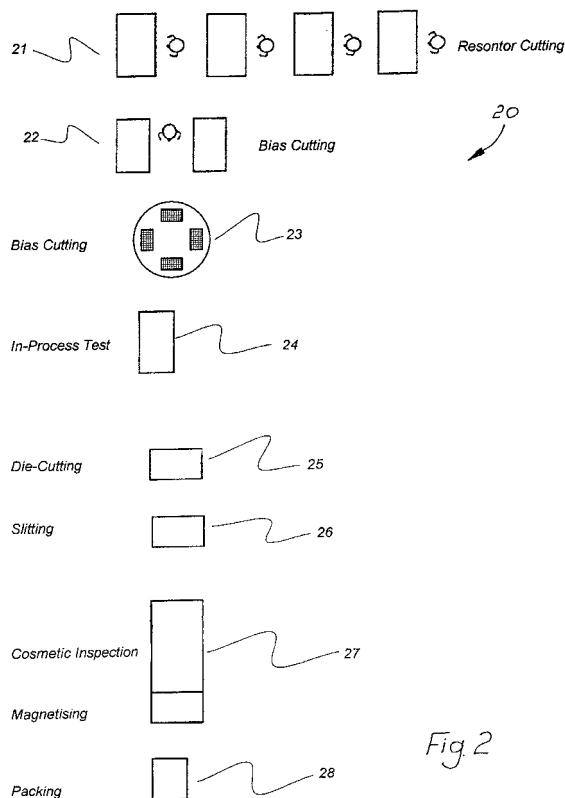


Fig. 2

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Description

Introduction

[0001] The invention relates to manufacture of article surveillance tags of the type comprising a bias strip mounted over at least one resonator strip in a sealed label package.

[0002] Such a tag has been produced by Sensormatic Corp. for use in surveillance of a wide variety of articles such as CDs, DVDs, and books. Typically, the packaging has an adhesive side for bonding of the tag to the article, and the opposed side has a code such as a bar code imprinted on it. The tag packaging encloses a bias element and one or two resonator elements. In use, if a tag is brought into the field of a security pedestal the resonators resonate according to the pedestal transmit frequency and bias of the bias element.

[0003] Such surveillance tags are a high-volume low-cost item, and typically one is placed on every article in a shop. However, they must also be produced to a very fine tolerance, particularly in terms of the sizes of the bias and resonator elements. Also, the bias and resonator elements are of expensive composite materials, and excessive scrapage can be very costly. Another aspect of tag production is that there is a requirement to manufacture tags having resonator elements of different frequency responses, and correspondingly different bias elements. For every shift in category of bias element the resonator frequency is increased or decreased by a step value of, say, 75Hz.

[0004] Thus, the invention is directed towards providing for high-volume efficient tag manufacture with strict adherence to quality criteria and with low scrapage rates. Another object is to achieve excellent versatility for efficient changing between different tag categories.

Summary of the Invention

[0005] According to the invention, there is provided a method of producing surveillance tags each comprising a bias element and a resonator element contained within a plastics housing, the method comprising:-

drawing a web of resonator material from a reel and cutting the web to provide the resonator elements;

drawing a web of bias material from a reel and cutting the web to provide the bias elements;

forming a first casing layer into a plurality of recesses in a grid pattern, and placing at least one resonator element and a bias element into each recess;

placing a second casing layer over the first casing layer and the elements, sealing around the recesses, and cutting between the recesses to provide individual tags,

wherein

the bias and resonator elements are produced at workstations which are grouped into cells, each cell producing a resonator element or a bias element of a particular type, and in which the resonator elements are individually tested for frequency response and the test results are used to dynamically change cutting parameters, and

the casing layer and element placement operations are performed by robots around a rotary workfeed table.

[0006] In one embodiment, the method comprises the further step of performing in-process testing after the rotary table.

[0007] In another embodiment, the in-process testing comprises feeding each tag through a field simulator coil and monitoring frequency and amplitude of each tag's response.

[0008] In one embodiment, the bias elements are produced by:

drawing the web of bias material from a reel and around a plurality of fixed and dancing rollers,

drive rollers on opposed sides of the web drawing the web between them and feeding it over a feed block having a ramped feeding portion extending between the drive rollers, and

cutting the web in repeated cycles of a reciprocating cutter over a cutter block downstream of the feed block.

[0009] In one embodiment, the feed block comprises a slot for the web.

[0010] In another embodiment, the slot comprises upwardly and inwardly-extending side walls for retention of the web.

[0011] In a further embodiment, a plurality of webs are drawn side-by-side from different reels, and there is a pair of drive rollers for each web.

[0012] In one embodiment, all webs are drawn over a single feed block and a single cutter block.

[0013] In another embodiment, there is a single cutter associated with each web.

[0014] In a further embodiment, the cutter is driven in a reciprocating motion by a cam follower.

[0015] In one embodiment, the cutter is a cutting edge on opposed sides, and the cutter is flipped over to use the other edge when a first edge becomes worn.

[0016] In another embodiment, the resonator elements are produced in the method as defined above for producing the bias elements.

Detailed Description of the Invention

[0017] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1(a) is a perspective view from above of a surveillance tag produced by a method of the invention, and Fig. 1(b) is a diagrammatic exploded cross-sectional view of the tag;

Fig. 2 is a flow diagram of the production method;

Fig. 3 is a side view of the bias element cutting workstation;

Fig. 4 is a perspective view from above of a cutting head of the workstation;

Fig. 5 is a side view, Fig. 6 is a cross-sectional end view in the direction of the arrows VI-VI of Fig. 5, and Fig. 7 is a perspective view from above of a web feeder of the bias cutting workstation; and

Fig. 8 is a diagrammatic front view of the cutting head.

[0018] Referring to Figs. 1(a) and 1(b) a surveillance tag 1 comprises a bar code 3 printed on a styrene casing 5. The tag 1 is of the type for adhering to articles stocked in shops. In more detail, as shown in Fig. 1(b) the tag 1 comprises:-

- 10: a transparent sticky-back placement layer,
- 11: a transparent lidstock layer,
- 12: a bias element,
- 13: a separation layer,
- 14: two resonator elements (this varies according to label type)
- 5: outer styrene layer (with imprinted bar code).

[0019] The tags 1 are produced at a rate of over two million per 24-hour production period in a method 20, shown in Fig. 2. In a step 21 four cells A, B, C, and D each having four workstations produce resonator elements. The cells are organised to produce according to expected downstream demand.

[0020] Each cell produces a particular category of resonator element. Production of each resonator element involves drawing a web of resonator material from a reel and cutting pieces to the desired length. As the elements drop down an outlet chute they are individually tested to check the frequency response. The result of the test on one piece is used to dynamically adjust cutting parameters to choose the length of the next piece.

[0021] Bias elements are produced in step 22. Again, a web of bias material is drawn from a reel and elements

are cut by descending cutters. In this case there is no need for individual frequency or other test because the bias element frequency response is not important to the end product. Step 22 is described in more detail below.

[0022] Pneumatic robots around a rotary table perform the following operations in succession:

place styrene layer 5 and press to form an array of recesses, one recess per label to be produced,

place each resonator element 14 in each recess, and in turn deposit the separation layer 13,

place a bias element 12 in each recess,

place transparent lidstock layer 11,

heat seal the lidstock layer 11 to the separation layer 13 and the styrene layer 5, and place the sticky placement layer 10.

[0023] In step 24 the sheets are cut into individual labels and are passed through a field simulator coil to check for correct frequency and amplitude.

[0024] The sheets are die-cut and slit in steps 25 and 26 to provide individual tags. In step 27 there is a cosmetic inspection and the sheets are magnetised. Finally, the sheets are packed in step 28.

[0025] Referring to Fig. 3 a workstation 40 for producing the bias elements 12 is illustrated. Webs 41 and 42 of bias material are drawn from reels. The web 41 runs in a path around:

a fixed lower roller 44,

a fixed upper roller 45(a),

a dancing roller 46(b) on an arm 47,

a fixed upper roller 45(b),

a dancing roller 46(b) on the arm 47, and

a fixed final roller 48.

[0026] The web 42 is drawn from a reel 49 around:

a lower fixed roller 43,

a first upper fixed roller 51(a),

a first dancing roller 52(a) on an arm 53,

a second fixed upper roller 51(b),

a second dancing roller 52(b) on the arm 53,

a third fixed upper roller 51(c), and

a final fixed roller 54.

[0027] The final rollers 48 and 54 deliver the webs 41 and 42 respectively side-by-side to a cutting head 55 having a feed device 70 on a base plate 56. The head 55 also comprises an outlet chute 57 for delivery of bias elements 12 to output stacks.

[0028] Referring to Figs. 4 to 8 the cutting head 55 is now described in more detail. A cam follower 60 is driven by a cam 61 so that it reciprocates up and down at a frequency of 340 Hz. The cam follower 60 supports a pair of side-by-side cutters 62 which cut the webs 41 and 42 against a cutting block 63.

[0029] Feeding of the webs 41 and 42 is very important as, previously, this function has led to considerable downtime and scrappage. It should be appreciated that the web material is very thin (46 microns) and is prone to breaking. The pressure on the arms 47 and 53 is maintained at a constant and correct level by a motor controller which uses an optical sensor indicating position of the dancer arms.

[0030] Also, it has been found that use of two dancing rollers helps to achieve the desired tension without significant risk of excessive tension causing breakage.

[0031] Further, the feed device 40 helps to ensure consistent and high speed (175.6 mm/s) delivery of web to the cutting block. The webs 41 and 42 run between a pair of rollers 71(a) and 71(b) and over a feed block 72. The feed block 72 comprises a ramp 74 shaped to fit between the rollers 71(a) and 71(b), thus minimising the chance of the web losing tension and orientation between the rollers 71(a) and 71(b) and the block 72. On the block 72 the webs 41 and 42 run through slots 73 having side walls 75 which taper inwardly to retain the webs 41 and 42.

[0032] The feed device 70 delivers the webs 41 and 42 to run on a cutter block 63 comprising a top adjustable plate 64 and a base plate 65. The top plate 64 comprises four fastening apertures 66, each of which may be used to retain the top plate 64 on the base plate 65. Thus, there are three possible top plate lateral positions as viewed in Fig. 8. Furthermore, the top plate 64 may be flipped over to utilise the lower surface as viewed in Fig. 8.

[0033] Also, the cutters 62 are double-sided and may be turned around so that the top edge as viewed in Fig. 8 is used for cutting.

[0034] The feeding and cutting features of the workstations 40 are also employed in the resonator cutting workstations as similar cutting and material parameters exist.

[0035] It will be appreciated that the bias and resonator cell arrangement, the web feeding mechanisms, and the rotary table features all contribute to efficient production with a high volume. They also help to minimise scrappage, and achieve a high quality.

[0036] The invention is not limited to the embodiments described but may be varied in construction and detail.

Claims

1. A method of producing surveillance tags (1) each comprising a bias element (12) and a resonator element (14) contained within a plastics housing, the method comprising:-

drawing a web of resonator material from a reel and cutting the web to provide the resonator elements;

drawing a web (41) of bias material from a reel and cutting the web to provide the bias elements;

forming a first casing layer (5) into a plurality of recesses in a grid pattern, and placing at least one resonator element and a bias element into each recess;

placing a second casing layer (10) over the first casing layer and the elements, sealing around the recesses, and cutting between the recesses to provide individual tags,

wherein

the bias and resonator elements are produced at workstations which are grouped into cells (21, 22), each cell producing a resonator element or a bias element of a particular type, and in which the resonator elements (14) are individually tested for frequency response and the test results are used to dynamically change cutting parameters, and

the casing layer and element placement operations are performed by robots around a rotary workfeed table (23).

2. A method as claimed in claim 1, wherein the method comprises the further step of performing in-process testing (24) after the rotary table.
3. A method as claimed in claim 2, wherein the in-process testing (24) comprises feeding each tag through a field simulator coil and monitoring frequency and amplitude of each tag's response.
4. A method as claimed in any preceding claim, wherein the bias elements (12) are produced by:

drawing the web (41, 42) of bias material from a reel and around a plurality of fixed and dancing rollers,

drive rollers (71(a), 71(b)) on opposed sides of the web drawing the web between them and

feeding it over a feed block (72) having a ramped feeding portion (74) extending between the drive rollers (71(a), 71(b)), and

cutting the web (41, 42) in repeated cycles of a reciprocating cutter (62) over a cutter block (64, 65) downstream of the feed block. 5

5. A method as claimed in claim 4, wherein the feed block comprises a slot (73) for the web. 10

6. A method as claimed in claim 5, wherein the slot (73) comprises upwardly and inwardly-extending side walls (75) for retention of the web. 15

7. A method as claimed in any of claims 4 to 6, wherein a plurality of webs are drawn side-by-side from different reels, and there is a pair of drive rollers (71(a), 71(b)) for each web. 20

8. A method as claimed in claim 7, wherein all webs are drawn over a single feed block and a single cutter block.

9. A method as claimed in claim 8, wherein there is a single cutter associated with each web. 25

10. A method as claimed in any of claims 4 to 9, wherein the cutter (62) is driven in a reciprocating motion by a cam follower. 30

11. A method as claimed in claim 10, wherein the cutter is a cutting edge on opposed sides, and the cutter is flipped over to use the other edge when a first edge becomes worn. 35

12. A method as claimed in any of claims 4 to 11, wherein the resonator elements are produced in the method of claims 4 to 11 for producing the bias elements. 40

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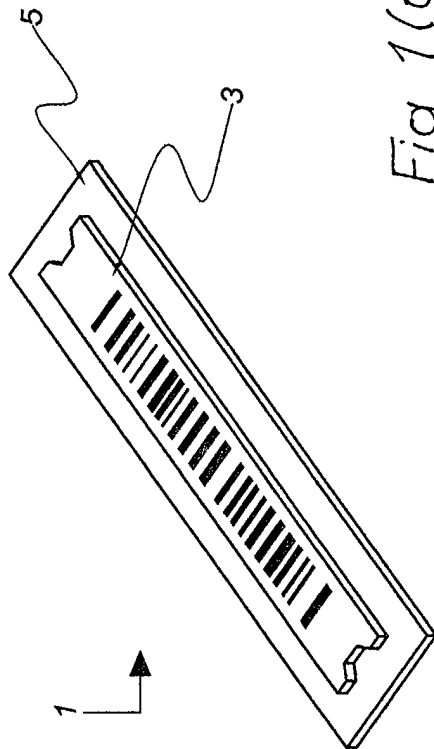


Fig. 1(a)

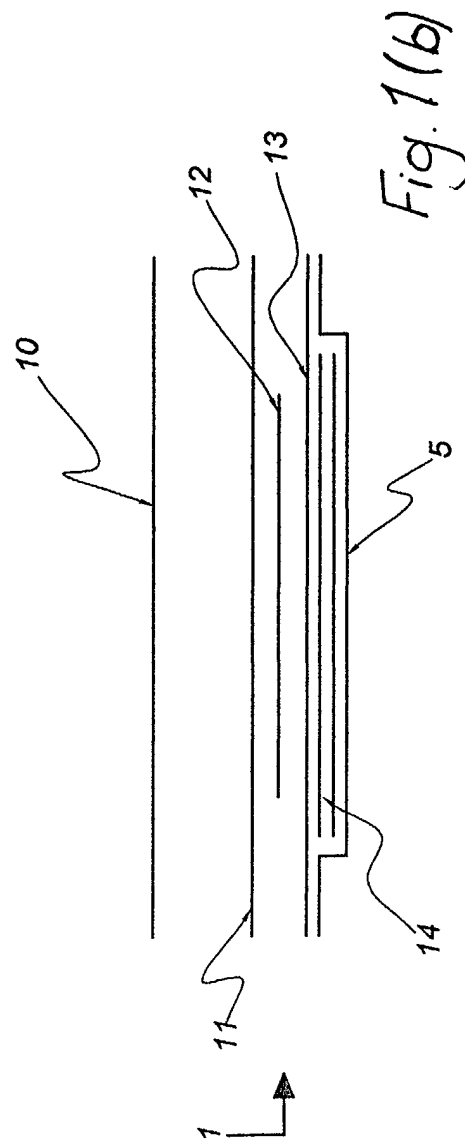


Fig. 1(b)

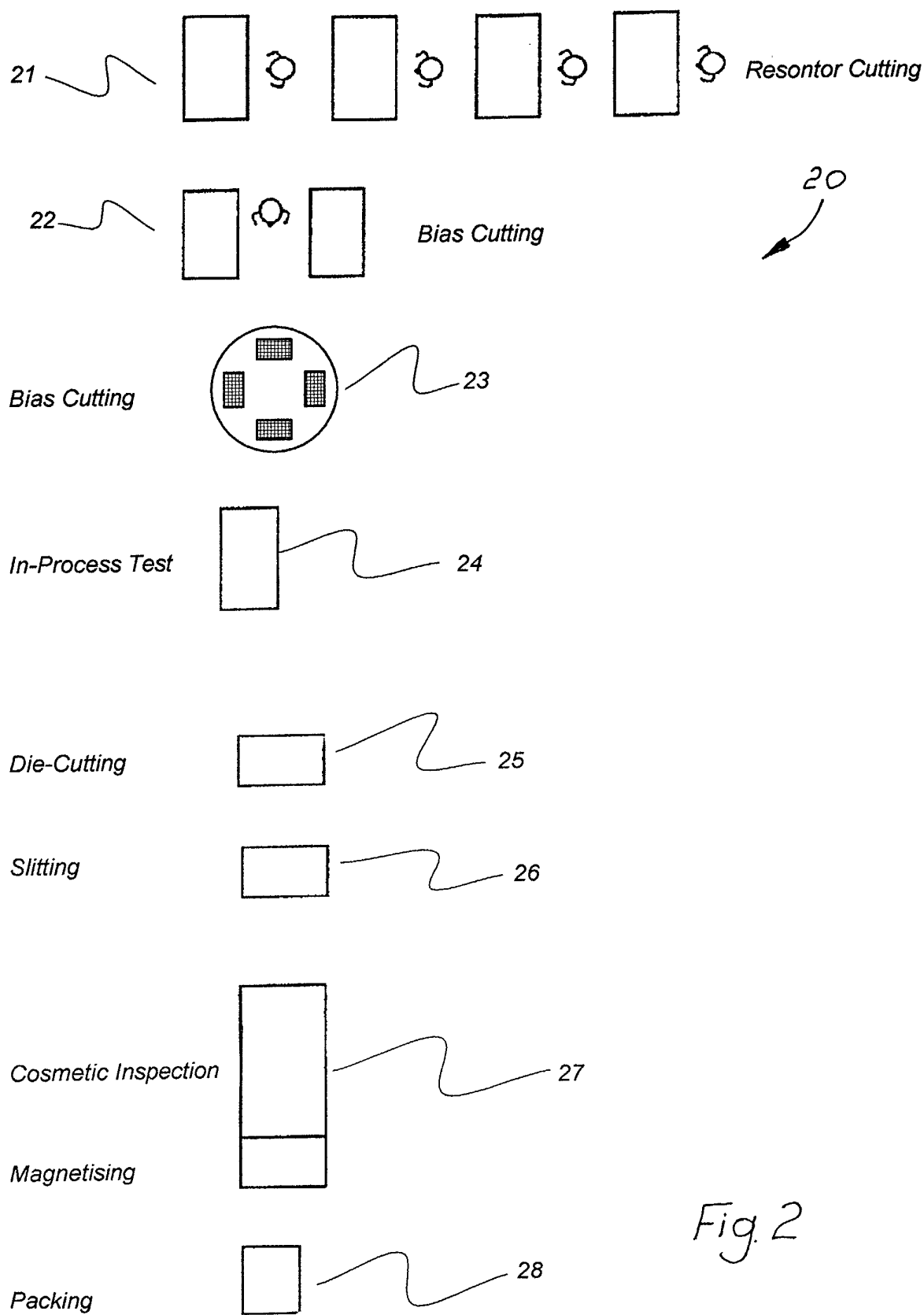


Fig. 2

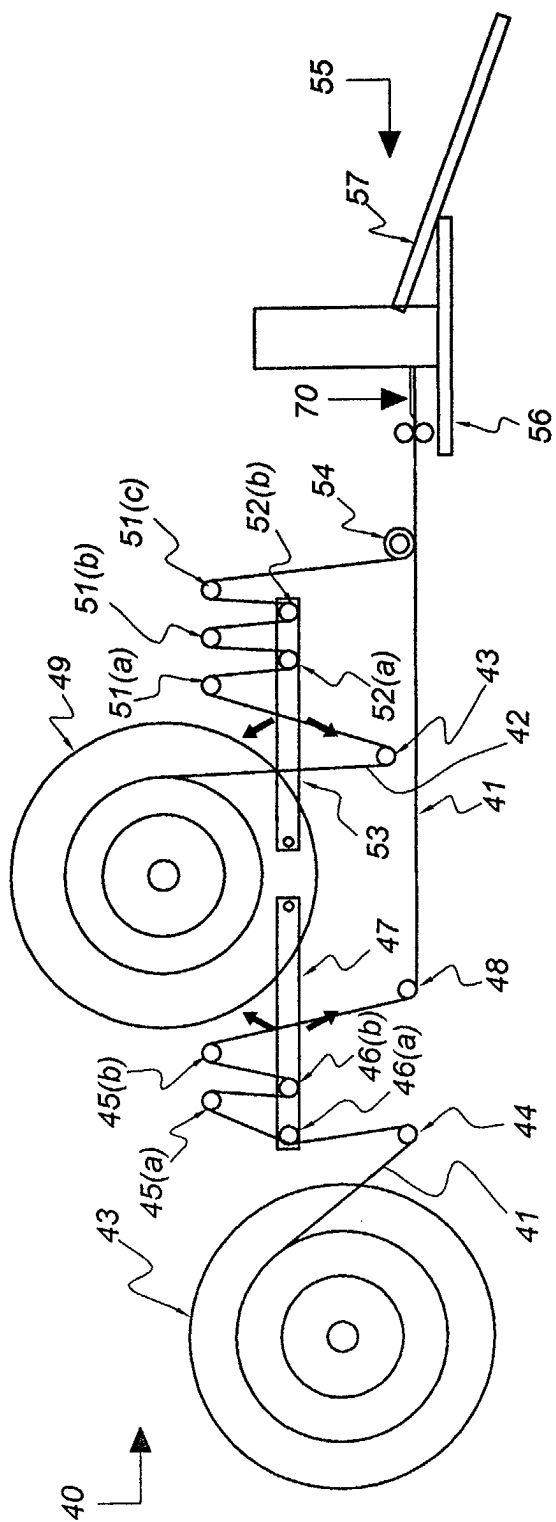


Fig.3

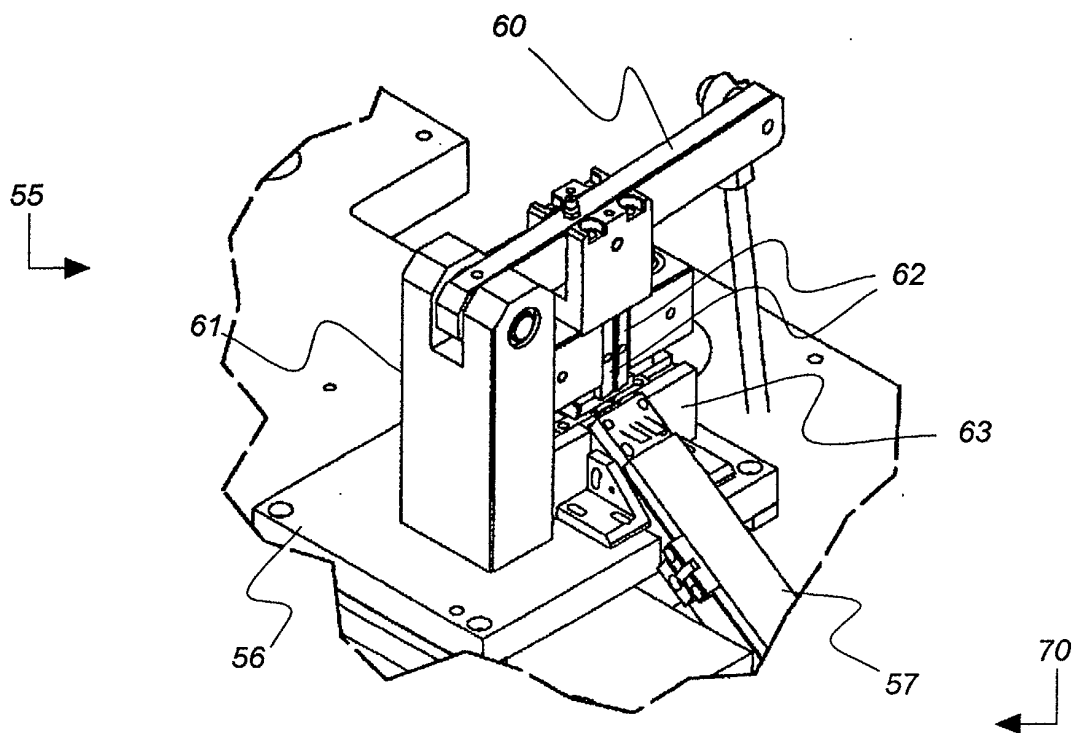


Fig. 4

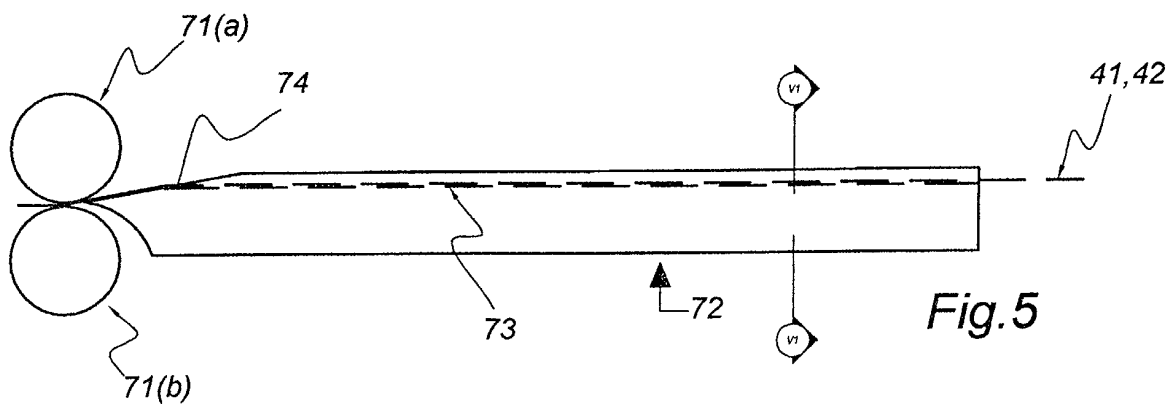


Fig. 5

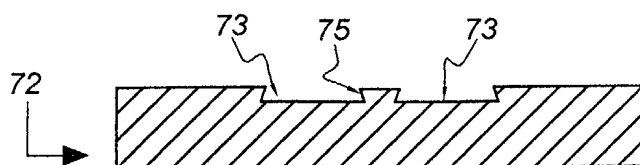
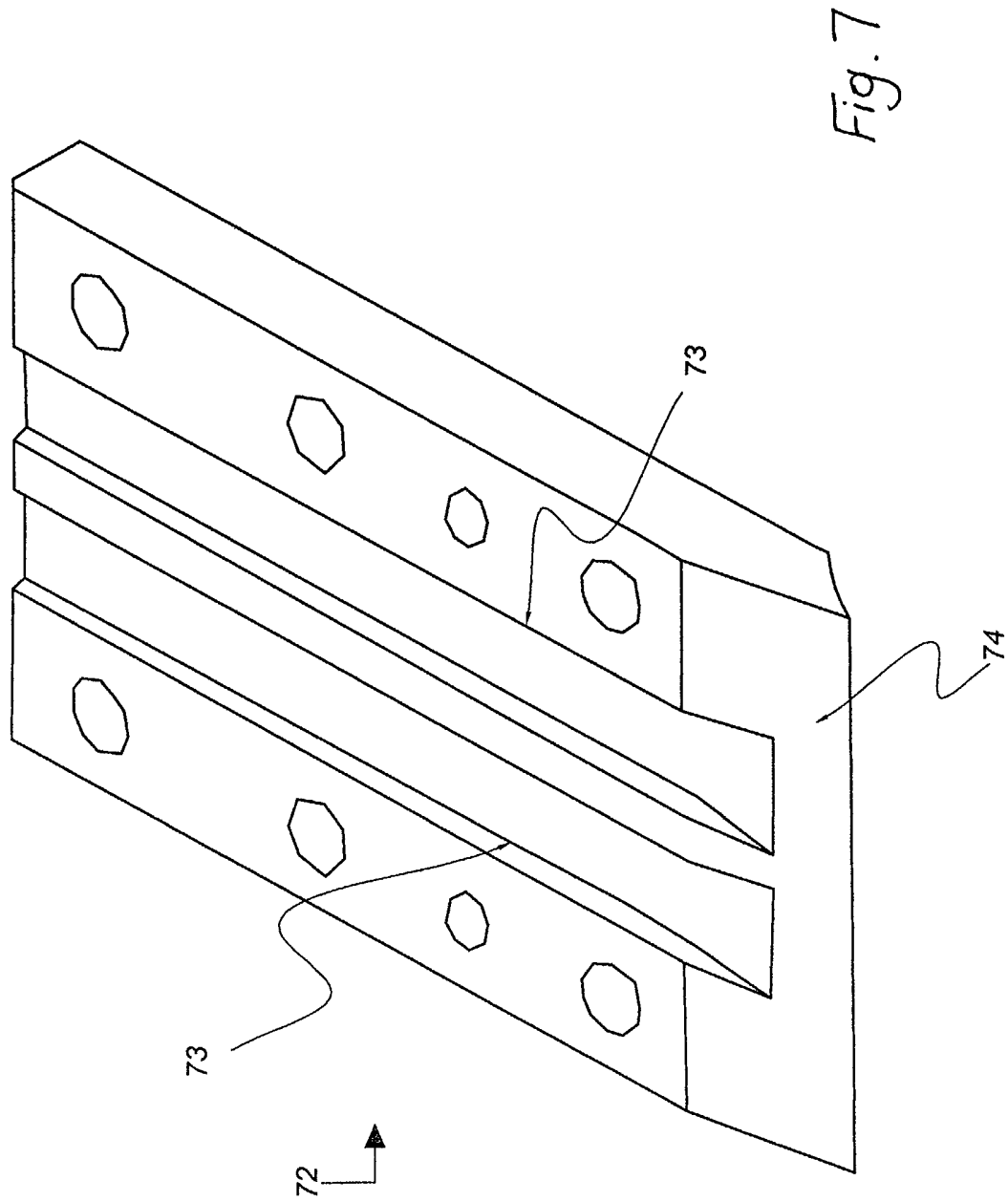


Fig. 6 (V1 - V1)



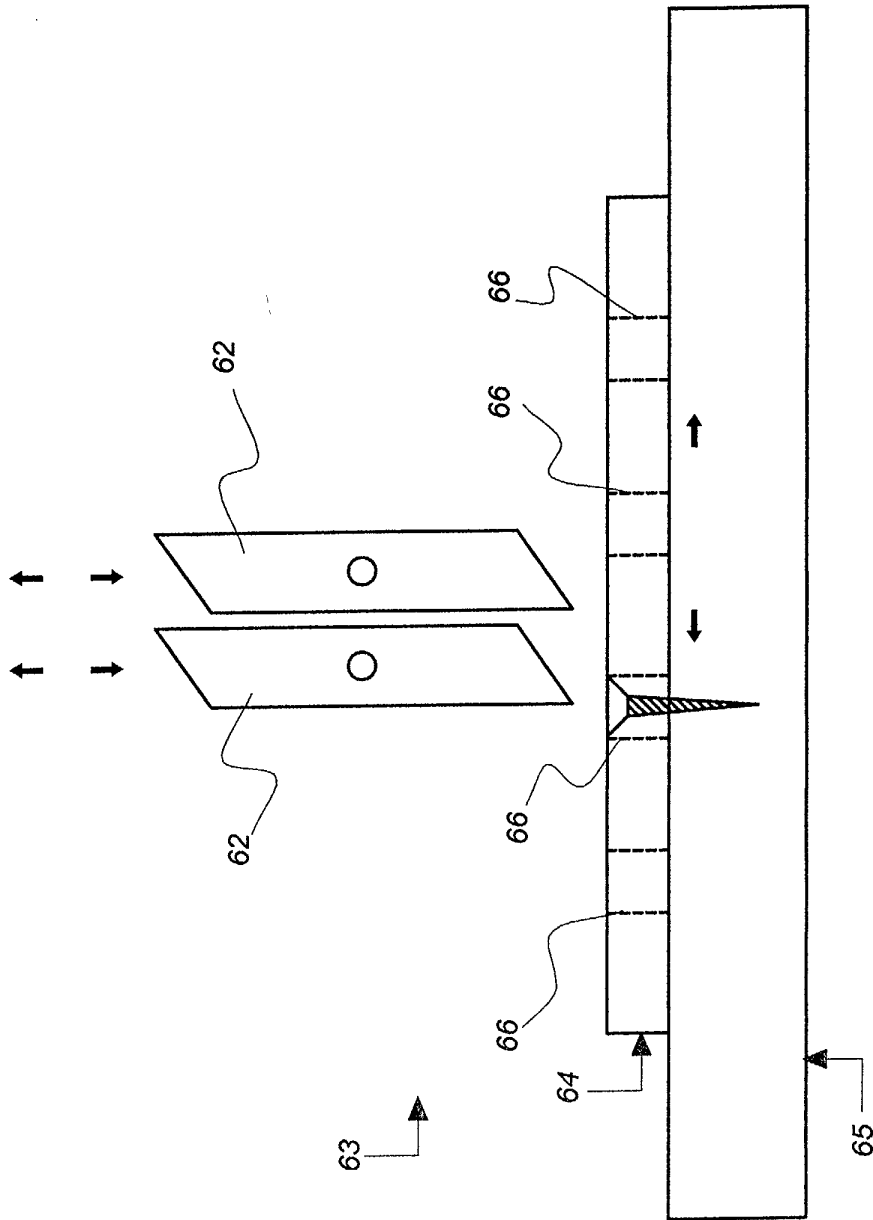


Fig. 8



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Application Number
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 September 2002	Examiner De la Cruz Valera, D
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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