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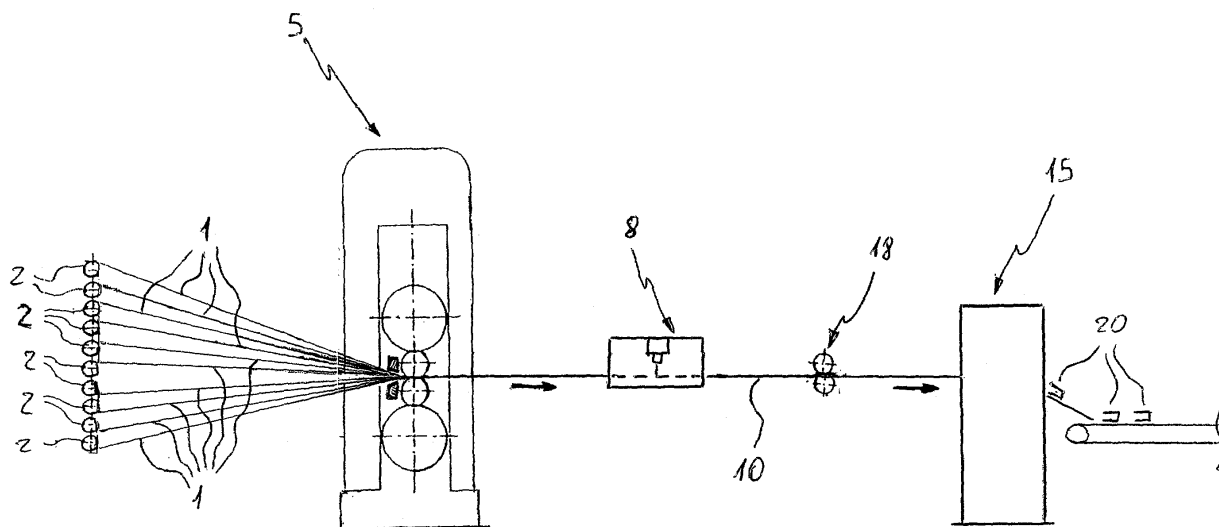
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(54) **Process and apparatus for the manufacture of stitches for staplers, band and stitches bar obtained using such process**

(57) The invention relates to a process for manufacturing metal stitch bars (20) for staplers, without use of adhesives.

For this purpose the metal wires (1) utilized to form a semi-finished band (10) from which the bars (20) are then obtained, are joined together by welding. The weld-

ing may be longitudinal or, preferably, transverse to the wires; as an alternative the semi-finished band may be manufactured starting from a band of sheet metal cut longitudinally in order to obtain the above wires. The invention also comprises the semi-finished band (10) and the stitch bars (20) obtained using the process without adhesive.

**FIG. 1****EP 1 623 774 A1**

Description

[0001] The invention relates to a new process of manufacturing stitches for staplers in particular, but not exclusively, compressed-air-driven staplers for industrial or professional applications.

[0002] In the course of such a process an intermediate band is formed which is then subsequently cut and folded to the desired dimensions, thereby obtaining the bars of stitches used in the staplers. Both the intermediate band and the bars are included in this invention.

[0003] At the present time, the industrial production of the stitches considered herein starts from metal wires (the wires may be of various materials including low carbon steel) and depending upon their number the process is referred to as "one-wire", "two-wire" or band process.

[0004] The band is an intermediate semi-finished product obtained by joining a set of wires using heat-hardening adhesive, the wires being caused to advance through the production plant in parallel, keeping them in a condition of continuity with each other. The number of parallel wires is a few tens (but may be approximately one hundred or more) and they are shaped into a typical "barrel" profile obtained by rolling them in line.

[0005] The rolling dimensions depend on the type of stitch and may be of the order of 1.5 mm per 0.5 mm.

[0006] In practice the wires are unwound from corresponding spools and all converge on a comb which arranges them into the adjacent parallel condition; downstream from the comb there is a pair of opposing rollers which squeeze them when they pass there between, imparting the "barrel" shape already mentioned upon them.

[0007] The wires configured in this way enter into one or more stations wherein adhesive is applied, followed by corresponding driers at the outlet thereof it is obtained an intermediate band 20-30 cm wide formed of bonded wires; in order to obtain the final packaging of the stitches into bars for staplers the band is cut and folded with a press, as if it were a normal sheet.

[0008] These operations can be performed along the production apparatus and in this case the press is arranged in line downstream of the last drying stage, or separate, and then the intermediate band is wound onto spools which are then stored and subsequently processed in an off-line press.

[0009] The manufacturing process briefly described above has been known for many years and is almost universally applied. It makes it possible to manufacture stitches for staplers according to the requirements of the existing technical specifications relating thereto, but has limitations because of the use of adhesive.

[0010] Indeed, under the point of view of utilization, the adhesive which holds the stitches in bars leaves residues on the pneumatic staplers, causing a risk of jamming or malfunctioning which requires periodical cleaning operations in order to maintain their efficiency.

[0011] On the other hand, from the manufacturing point of view, the adhesive brings about both intrinsic risks

associated with its flammability or toxicity and difficulties in carrying out the manufacturing cycle. Indeed the adhesive application and drying stations occupy at least 4-5 metres, with the consequence that the resulting apparatus as a whole has appreciable dimensions which therefore require space that is not always available.

[0012] In practice this results in the inconvenience that the press for cutting and bending the intermediate band in most cases stands off-line. The intermediate band therefore has to be wound onto spools which are then placed in a store for subsequent separate processing in the press.

[0013] Furthermore, the industrial manufacture of stitches for staplers is rendered difficult by the fact that the composition of the adhesive can change from one batch to another and environmental conditions (air temperature and humidity) can influence its behaviour, causing it to be different as climate changes (thinking of the different seasons of the year).

[0014] The technical problem underlying this invention is therefore that of providing a method of manufacturing stitches for staplers which does not require the use of adhesive. The idea for solving this problem consists of combining the filiform members of the intermediate band in a mechanical way, that is using means and/or processes which bring about material joining of the elements.

[0015] This joining may be brought about through welding or other processing of the material as will be better explained below, and acts in a wholly similar way to the conventional joining with adhesive, in the sense that the stitch bars according to the invention may be used in staplers instead of adhesively bonded bars of stitches.

[0016] In accordance with a first embodiment of the invention, mechanical joining is brought about through welding the filiform members. This arrangement is particularly suitable in the case where production takes place starting from separate metal wires, as already explained above.

[0017] In accordance with another embodiment the filiform elements are obtained by cutting a starting metal strip into thin bands longitudinally separated by intact transverse bridges which provide the joint. This alternative is suitable if the stitches are produced starting from a metal band.

[0018] Further features of the process according to the invention of the intermediate band and the stitches for staplers obtained by this process, are set forth in the claims which will follow. These features and the advantages deriving therefrom will be better understood in the light of the description provided below with reference to a preferred and non-exclusive embodiment, illustrated in the appended drawings wherein:

- Figure 1 shows diagrammatically an apparatus for carrying out the process according to the invention,
- Figure 2 shows a detail of a welding station provided in the manufacturing apparatus in Figure 1,

- Figures 3a, 3b show corresponding intermediate bands obtained by welding with the process according to the invention,
- Figure 4 shows an intermediate band obtained with a variant process according to the invention,
- Figure 5 shows a transverse cross-section of the intermediate band in Figure 3a,
- Figure 6 shows the transverse cross-section of an intermediate band obtained with another variant of the process according to the invention,
- Figure 7 shows a stitch loading bar package for staplers obtained with the process according to the invention.

[0019] With reference to the first of these figures, the production apparatus shown therein is designed to manufacture stitches packed in loading bars 20, starting from a plurality of metal wires 1.

[0020] The latter are unwound from corresponding coils 2 in a manner known per se and are delivered to a rolling stand 5, of a known type too, where the wires are squeezed in such a way as to change their initial circular cross-section into the usual "barrel" cross-section.

[0021] Downstream of the rolling stand 5 wires 1 advance in mutual contact to enter a welding station 8, which will be dealt with in more detail below. In this station the wires are welded transversely along junction lines 9 illustrated in Figures 3a, 3b, thereby forming a band 10.

[0022] In other words, downstream of station 8 the wires are no longer separate from one another but form a semi-finished product consisting of the intermediate band 10 which can subsequently be bent and cut in a known manner with a press 15, thereby obtaining the final bars 20 of metal stitches.

[0023] A pair of drawing rollers 18 is provided in order to advance band 10 (and wires 1) through the apparatus in Figure 1. Obviously any other system for advancing the aforesaid wires and band may be used as an alternative. Returning now to consider station 8, the welding which it carries out is preferably of the laser type. For this purpose it comprises a laser beam emitting head 30 which can move along a guide 32, arranged transversely to the direction of advance of wires 1 entering station 8 (see Figure 2).

[0024] In this respect it should be pointed out that tests have been carried out with a CO₂ laser and a welding power of approximately 2000-2500 W in order to weld the normal wires for metal stitches. Since the welding preferably does not require the provision of material, the wires must be held close together so that they touch in order to achieve a good joint 9.

[0025] The latter is produced along a line which is oblique with respect to wires 1 as in Figure 3b when welding head 30 moves only along guide 32, or along a line perpendicular to the wires as in Figure 3a when head 30 also moves in the direction of advance of the wires.

[0026] This means that in the latter case it is effected a welding of the flying type, during which guide 32 moves

parallel to the wires with the same speed thereof while head 30 moves along it. Obviously when welding is complete guide 32 is returned back to the initial position ready to move again for the next weld.

[0027] As mentioned above, in the production apparatus in Figure 1 the wires which are joined together form an intermediate band that can then be bent and cut in a known way in order to obtain bars 20 of metal stitches for staplers. In this respect it should be added that band 10 is bent towards the same part where junction lines 9 lie, so that the latter remain within the bar of stitches 20 as shown in Figure 7.

[0028] Furthermore the separation between the joining lines 9 will depend on various parameters such as the rigidity of the wires (associated with their dimensions and their material), the length of the stitches for staplers, etc. In the tests performed the spacing between one junction line 9 and the next was approximately 10-15 mm.

[0029] From what has been explained hitherto it can be appreciated how the manufacturing process just described solves the technical problem underlying the invention.

[0030] First of all it is clear that the welded junction between the wires makes it possible to manufacture bars of stitches for staplers without the use of adhesive: therefore all the abovementioned disadvantages relating to known manufacturing processes of stitches for staplers, are automatically solved.

[0031] The elimination of adhesive also makes it possible to achieve other major advantages, such as that of being able to simplify manufacture of the final product, that is bars 20, wholly in line starting from wires unwound from corresponding coils.

[0032] This is a consequence of the fact that laser welder 8 has quite small dimensions in comparison with the usual machines for applying and drying adhesive used in the known art: therefore there is more space available for placing press 15 and any other machinery necessary for obtaining final bars 20 in line, downstream of station 8 where the wires are joined together.

[0033] Nevertheless, the process according to the invention may also be carried out not in line, differently from the example considered.

[0034] Indeed it is conceivable that the manufacturing cycle could be subdivided into two parts - the first in line as above, at the end of which intermediate band 10 is wound in coils in order to be stored separately; the second off-line, in which the coils are transported close to the press for being processed and then obtain final bars 20.

[0035] It is however obvious that the results and advantages of the invention already mentioned will not be adversely affected by the fact of having a production cycle subdivided in this way.

[0036] In this context it is worthwhile adding that transverse welding of the wires (both perpendicular and oblique) carried out as in the example considered above, is more advantageous than longitudinal welding since it

requires only one welding head 30 and is therefore quite simple to carry out.

[0037] Furthermore the welding carried out in this way is compatible with the rates of advance of the wires (10-15 m/min) normally used in existing apparatus for the manufacture of adhesive-bonded stitches. This means that such apparatuses can easily be modified by replacing the equipment for application and drying of the adhesive, with the welding station 8 in order to reconvert them for carrying out the process according to the invention.

[0038] Of course variants of the invention with respect to what has been described hitherto are possible.

[0039] For example, although the transverse welding in Figures 3a, 3b is generally to be preferred, it may nevertheless be replaced by longitudinal laser welding of the wires. This solution (which requires a number of laser beams equal to that of the wires, less one) could be implemented by welding the wires intermittently or joining them over their entire length.

[0040] Another major variant of the process according to the invention may be obtained by producing bars 20 starting from a band of sheet metal instead of from separate metal wires.

[0041] In this case the production apparatus is simplified and further shortened, because it is possible to eliminate the coils 2 for the wires and the rolling stand 5 in the example of Figure 1.

[0042] In this case a band having a width equal to that of intermediate band 10 already mentioned is made to advance through the apparatus and longitudinal cuts are made therein, in order to form filiform webs therein corresponding to the wires of the preceding embodiment. The longitudinal cuts are made with a predetermined pitch so as to have junction lines equivalent to the transverse welds in Figures 3a, 3b.

[0043] An example of intermediate band 10' obtained using this variant of the invention is illustrated in Figure 4, wherein it will be seen that filiform webs 1' have between them transverse junction lines 9'.

[0044] Longitudinal cutting of the band to form the filiform webs can be carried out in the most appropriate way according to various parameters, such as the width of the band to be cut, the material of the band, its thickness and its speed of advance, etc.

[0045] Also in this case it is possible to use a laser to cut the longitudinal webs 1' in the band. With this object a longitudinal cutting station which provides for a plurality of laser beams corresponding to the number of filiform webs that have to be cut, replaces welding station 8 of the production apparatus in Figure 1. Obviously the power of the laser will be dimensioned in accordance with the usual process parameters.

[0046] Filiform webs 9' may also be cut by mechanical machining, for example by milling and/or rolling of the initial band. In this way it is possible to have situations in which the filiform elements are separated from each other longitudinally and have transverse bridges between them as in the variant of Figure 4, or others in which a pre-cut

line is formed between the filiform elements.

[0047] This is the situation that may be seen in Figure 6, which shows a transverse cross-section of an intermediate band 10" wherein the dark parts indicate the material removed mechanically while the light parts are filiform elements 1".

[0048] There is a minimum thickness of material between the latter joining them in the longitudinal direction, so that in this case there are no transverse joining bridges as in Figure 4. This layer is however sufficiently thin for the stitches on the final bar obtained from intermediate band 10" to be detached by the staplers as normally occurs.

[0049] All these variants nevertheless fall within the scope of the following claims.

Claims

1. Manufacturing process of metal stitches for staplers, comprising the steps of:

- providing a plurality of filiform elements (1, 1', 1") joined in parallel to each other in order to form an intermediate band (10, 10', 10"),
- bending and cutting the intermediate band (1, 1', 1") in order to obtain bars (20) of stitches for staplers,

characterised in that these filiform elements (1, 1', 1") are mechanically joined without the use of adhesive.

2. Process according to claim 1, wherein the filiform elements (1) are joined by welding.

3. Process according to claim 2, wherein the welding comprises junction lines (9) which are substantially transverse to the filiform elements (1).

4. Process according to claims 2 or 3, wherein the welding is carried out using a laser.

5. Process according to claim 4, wherein the welding is without additional weld material.

6. Process according to the preceding claims, wherein the filiform elements are obtained from separate wires (1) unrolled from corresponding coils (2).

7. Process according to invention 1, wherein the filiform elements (1') are obtained by longitudinally cutting a metal band into thin bands with transverse bridges (9') therebetween.

8. Process according to claim 7, wherein longitudinal cutting of the band is carried out using a laser.

9. Process according to claim 1, wherein the filiform elements (1") are obtained by subjecting a metal band to milling, rolling or other mechanical machining, leaving a thin joining bridge between the said elements sufficient to form a pre-cut line. 5
10. Process according to any of the preceding claims, wherein said stages of providing a plurality of filiform elements (1, 1', 1") joined together to form the intermediate band (10, 10', 10") and that of bending and cutting the intermediate band (1, 1', 1") to obtain the bars (20) of stitches for staplers, are carried out in line without any break in continuity. 10
11. Apparatus for carrying out the method according to claims 1 to 6, comprising a stand (5) for rolling a plurality of separate wires (1), a press (15) to bend and cut an intermediate band (10) formed of the said wires joined in parallel with each other, obtaining the bars (20) of stitches for staplers, **characterised in that** it comprises a welding station (8) for the wires between the rolling stand and the press. 15 20
12. Apparatus according to claim 11, wherein the welding station (8) is of the laser type. 25
13. Apparatus according to claim 12, wherein the rolling station (8) comprises a laser beam emission head (30) movable in a direction transverse to that in which the wires (1) advance. 30
14. Apparatus according to claims 11 to 13, wherein the rolling stand (5), the welding station (8) and the press (15) are arranged in line. 35
15. Bar of stitches for staplers, **characterised in that** said stitches are joined mechanically to each other without adhesive. 40
16. Bar according to claim 15, wherein said stitches are joined by junction lines (9, 9') extending along the length of the bar. 45
17. Bar according to claim 16, wherein the junction lines (9) are welds located inside the bar. 50
18. Bar according to claim 15, wherein said stitches are joined together longitudinally by a metal joining layer capable of forming a pre-cut line. 55
19. Intermediate band for the manufacture of metal stitches, **characterised in that** it comprises a plurality of filiform elements (1, 1', 1") mechanically joined together. 55
20. Intermediate band according to claim 9, wherein the filiform elements (1, 1', 1") are joined by welding.
21. Intermediate band according to claim 19 or 20, wherein the weld comprises junction lines (9) which are substantially transverse to the filiform members (1).
22. Intermediate band according to claims 20 or 21, wherein the welding is carried out using a laser.

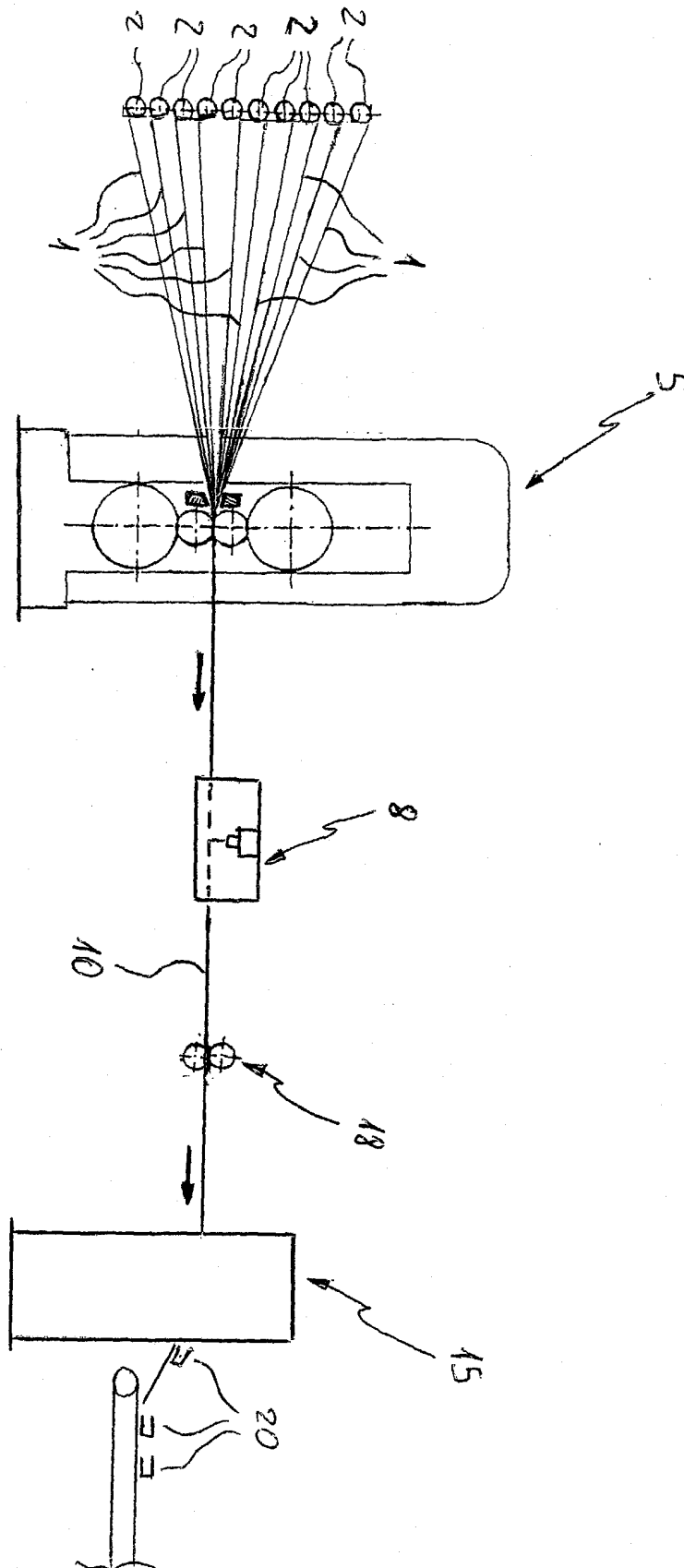


FIG. 1

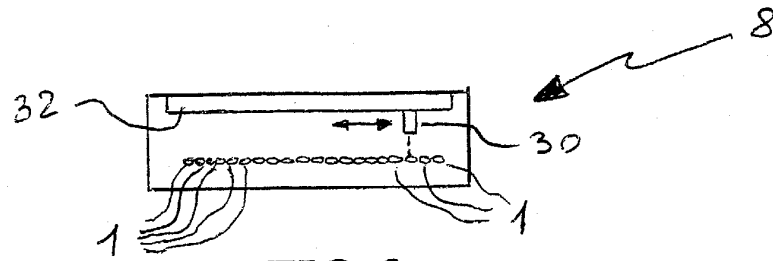


FIG. 2

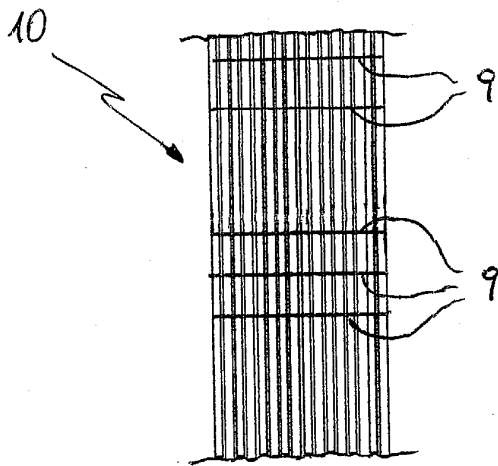


FIG. 3A

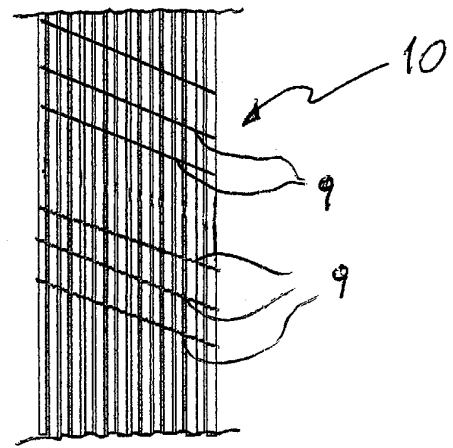


FIG. 3B

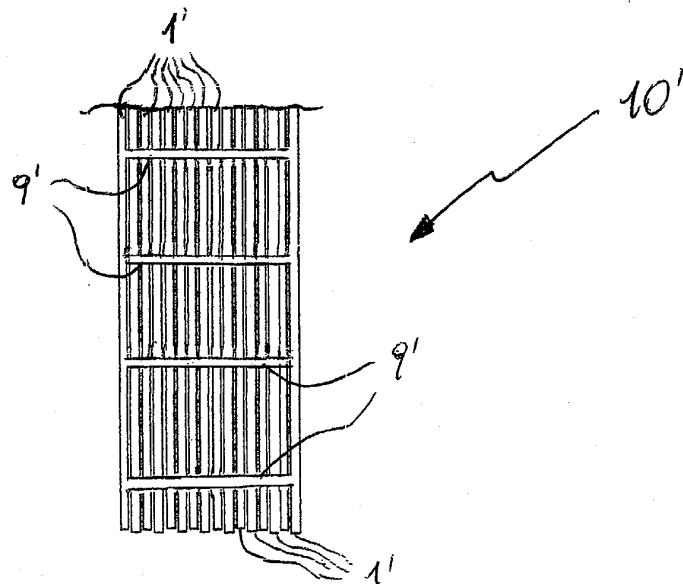


FIG. 4

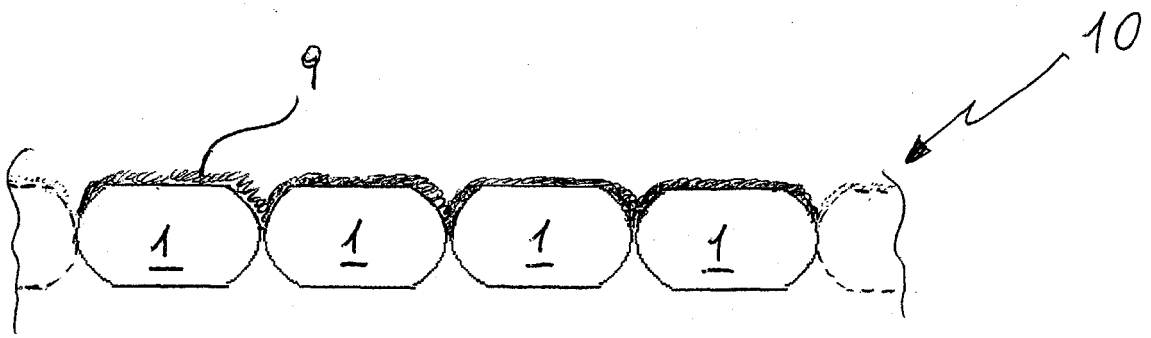


FIG. 5

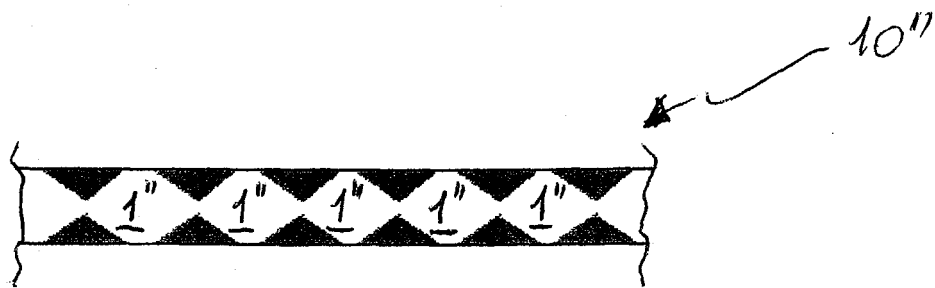


FIG. 6

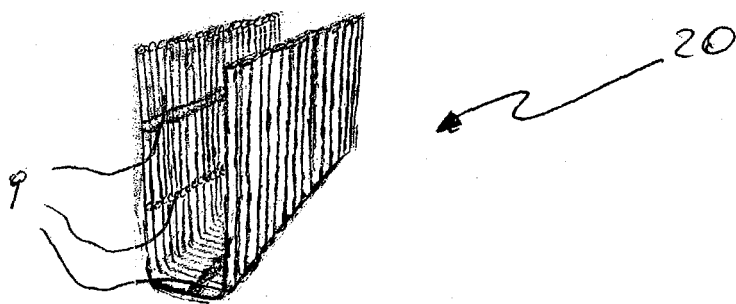


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
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Place of search The Hague		Date of completion of the search 31 January 2005	Examiner Barrow, J
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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