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(54) **Methods and apparatus to make concentric filters composed of two or more materials.**

(57) The present invention is a modification to conventional tow processing machinery 2 and filter rod making machinery 6 which utilizes a top crimper 4 and a bottom crimper 4a alone or in combination, or a crimper and two sources of tow in combination to allow the machinery to be capable of producing different types of filters without major structural changes to the existing machinery.

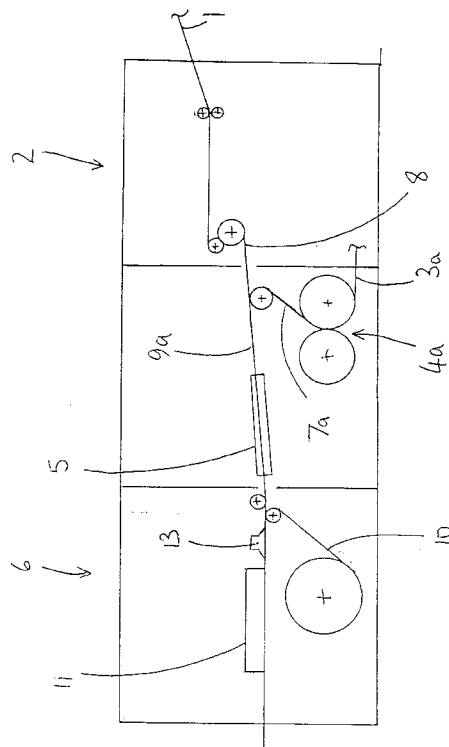


Fig. 4

This invention is a modification to standard filter making machinery. The standard machinery produces cigarette filters by taking the output of a tow processing machine to feed the input of a filter rod maker. If a spiral filter is desired, a spiral tongue may be present in the filter rod maker.

Thesing U.S. Patent No. 5,012,829 reveals a filter which also has three concentric layers, the Thesing filter differs in that the middle layer of paper is plugwrap that is used to stabilize the inner most material (Col. 5, line 19-24). The Thesing patent adds flavorants to at least one component of the filter, and only chemical plasticizers and/or wrapping can be used to stabilize the filter. (Col. 2, line 5-12) Thus, in Thesing, the purpose of the additional layer of plugwrap is as a stabilizer.

It has been desired to modify the area between the tow processing machinery and filter rod maker to allow the machinery to be capable of producing different types of filters without major structural changes.

It has also been desired to add a second tow processing line to the existing tow processing machinery so that the machinery will be capable of producing different types of filters without major structural changes.

It has also been desired to obtain filters with a higher degree of filtration than is available with other methods of filter manufacture known in the industry.

It has also been desired to modify standard filter making machinery to incorporate new elements so that a filter assembly consisting of paper and tow joined together in various arrangements is provided.

It has also been desired to provide machinery capable of producing at least six different types of filters depending upon which new elements and combinations of new elements are employed. These six filters are conventional and would be known to one of skill in the art.

It has also been desired to provide machinery capable of producing filter assemblies with a desired degree of filtration.

It has also been desired to provide machinery capable of producing different types of filters without major structural modifications and with minimal installation impact.

In accordance with the present invention modifications can be made to the area between the tow processing machinery and the filter rod maker or to the tow processing machinery. Five of the six embodiments described are modifications to the area between the tow processing machinery and the filter rod maker are provided. These five modifications incorporate three new elements: 1) a top source of paper and means to crimp it (hereafter "top crimper"); and 2) a bottom source of paper and means to crimp it (hereafter "bottom crimper"); and 3) a spiraling means of type one of ordinary skill in the art would

know. Using the above elements alone or in combination enable different filters to be formed without major structural changes in the machinery.

The use of the top crimper alone ("apparatus embodiment A") produces a first type of filter. The use of the bottom crimper alone ("apparatus embodiment B") produces a second type of filter. The use of the spiraling means in series with either the top crimper or the bottom crimper alone ("apparatus embodiments C and D") produces a third and fourth type of filter respectively. The use of the top crimper solely in conjunction with the bottom crimper ("apparatus embodiment E") produces a fifth type of filter.

The sixth embodiment of the present invention described involves modifications to the AF-1 machinery. This embodiment requires three other elements: 1) a source of paper and means to crimp it; 2) a top source of tow; and 3) a bottom source of tow. The above three elements used in combination produces a sixth type of filter. This sixth type of filter has three concentric layers, the inner most being tow surrounded by a layer of crimped paper and an outer layer of tow.

The present invention includes a filter comprising three concentric layers, in which the intermediate layer is crimped paper that is not used to stabilize, but rather as part of the filtration process.

The invention will now be further described by way of example, with reference to the accompanying drawings, in which like reference characters refer to like parts throughout and in which:

FIG. 1 shows a first embodiment of the invention which consists of a top source of paper and top crimper located between the tow processing machinery and filter rod maker;

FIG. 2 shows a second embodiment of the invention which consists of a bottom source of paper and bottom crimper located between the tow processing machinery and filter rod maker;

FIG. 3 shows a third embodiment of the invention which consists of a top source of paper and top crimper located between the tow processing machinery and filter rod maker, which contains a spiraling means;

FIG. 4 shows a fourth embodiment of the invention which consists of a bottom source of paper and bottom crimper located between the tow processing machinery and filter rod maker, contains a spiraling means;

FIG. 5 shows a fifth embodiment of the invention which consists of both a top source of paper and top crimper and bottom source of paper and bottom crimper located between the tow processing machinery and filter rod maker;

FIG. 6 shows a sixth embodiment of the invention which consists of modifying the tow processing machinery to include a source of paper and means to crimp it, a top source of tow and a bot-

tom source of tow; and

FIGS. 7 A-E are cross sectional views of filter assemblies made in accordance with the apparatuses of FIGS. 1-5.

The present invention particularly refers to the area between the tow processing machinery and filter rod maker.

FIG. 1 shows a first embodiment of the invention ("apparatus embodiment A"). A source of tow 1 is processed by conventional tow processing machinery 2. Preferably this is AF-1 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. At the exit end of the tow processing machinery 2, between the filter rod maker 6 and tow processing machinery 2, is located a source of paper 3, crimping means 4 and guiding device 5. The paper 3 is fed through a crimping means 4. Preferably the paper 3 is crimped by crimping wheels. As the paper 3 passes through the crimping means 4 it becomes crimped paper 7. The crimping means 4 is located above the exit port 12 of the tow processing machinery 2. As the crimped paper 7 passes through the crimping means 4, it is laid on top of the processed tow 8 as the processed tow 8 leaves the tow processing machinery 2 through the exit port 12. This creates a combined tow/crimped paper material 9. A guiding device 5 directs the combined tow/crimped paper material 9 into a filter rod maker 6. The filter rod maker 6 is preferably KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6, the tow/crimped paper material 9 is processed into a filter by conventional methods known in the art.

One option, in the filter rod maker 6, is to surround the combined tow/crimped paper material 9 with overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 1. The resulting filter, shown in cross section in FIG. 7A, has a central core of paper 3 surrounded by a layer of tow 1 and optional overwrap 10.

FIG. 2 ("apparatus embodiment B") shows a second embodiment of the invention. A source of tow 1 is processed by conventional tow processing machinery 2. Preferably this is AF-1 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. At the exit end of the tow processing machinery 2, between the filter rod maker 6 and tow processing machinery 2, is located a source of paper 3a, crimping means 4a and guiding device 5. The paper 3a is fed through crimping means 4a. Preferably the paper 3a is crimped by crimping wheels. As the paper 3a passes through the crimping means 4a it becomes crimped paper 7a. The crimping means 4a is located below the exit port 12 of the tow processing machinery 2. As the crimped paper 7a passes through the crimping means 4a, it is laid underneath the processed tow 8 as the tow 8 exits the tow processing machinery 2 through exit port 12. This creates

a combined tow/crimped paper material 9a. A guiding device 5 directs the combined tow/crimped paper material 9a to a filter rod maker 6. The filter rod maker 6 is preferably KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6, the processed tow/crimped paper material 9a is processed into a filter by conventional methods known in the art.

One option in the filter rod maker 6, is to surround the combined tow/crimped paper material 9a by overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 2. The resulting filter, shown in cross section in FIG. 7B, has a central core of tow 1 surrounded by a layer of paper 3a and optional overwrap 10.

FIG. 3 ("apparatus embodiment C") shows a third embodiment of the invention. A source of tow 1 is processed by conventional tow processing machinery 2. Preferably this is AF-1 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. At the exit end of the tow processing machinery 2, between the filter rod maker 6 and tow processing machinery 2, is located a source of paper 3, crimping means 4 and guiding device 5. The paper 3 is fed through crimping means 4. Preferably the paper 3 is crimped by crimping wheels. As the paper 3 passes through the crimping means 4 it becomes crimped paper 7. The crimping means 4 is located above the exit port 12 of the tow processing machinery 2. As the crimped paper 7 passes through the crimping means 4, it is laid on top of the processed tow 8 as the processed tow 8 leaves the tow processing machinery 2 through exit port 12. This creates a combined tow/crimped paper material 9. A guiding device 5 directs the combined tow/crimped paper material 9 into a filter rod maker 6. The filter rod maker 6 is preferably KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6 the combined tow/crimped paper material 9 is processed into a filter by conventional methods known in the art.

The filter rod maker 6, contains a spiraling means 13 to spiral the combined tow/crimped paper material 9. The spiraling means can be one of those known in the industry. The tow/crimped paper material 9 is spiraled such that the resulting filter, shown in cross section in FIG. 7C, has tow 1 on the outside of the spiral. After the filter is spiraled, one option is to surround the filter by overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 3.

FIG. 4 ("apparatus embodiment D") shows a fourth embodiment of the invention. A source of tow 1 is processed by conventional tow processing machinery 2. Preferably this is AF-1 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. At the exit end of the tow processing machinery 2, between the filter rod maker 6 and tow processing machinery 2, is located a source of paper

3a, crimping means 4a and guiding device 5. The paper 3a is fed through crimping means 4a. Preferably the paper 3a is crimped by crimping wheels. As the paper 3a passes through the crimping means 4a it becomes crimped paper 7a. The crimping means 4a is located below the exit port 12 of the tow processing machinery 2. As the crimped paper 7a passes through the crimping means 4a, it is laid underneath the processed tow 8 as the tow 8 exits the tow processing machinery 2 through the exit port 12. This creates a combined tow/crimped paper material 9a. A guiding device 5 directs the combined tow/crimped paper material 9a to a filter rod maker 6. The filter rod maker 6 is preferably KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6 the processed tow and crimped paper are processed into a filter by conventional methods known in the art.

The filter rod maker 6, contains a spiraling means 13 to spiral the combined tow/crimped paper material 9a. The spiraling means 13 can be one of those known in the industry. The tow/crimped paper material 9a is spiraled such that the resulting filter, shown in cross section in FIG. 7D, has paper 3a on the outside of the spiral. After the filter is spiraled, one option is to surround the filter by overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 4.

FIG. 5 ("apparatus embodiment E") shows a fifth embodiment of the invention. A source of tow 1 is processed in conventional tow processing machinery 2. Preferably this is AF-1 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. At the exit of the tow processing machinery 2, between the tow processing machinery 2 and filter rod maker 6 is located a top source of paper 3, a bottom source of paper 3a, a top crimping means 4, a bottom crimping means 4a and a guiding device 5. The top source of paper 3 is fed through the top crimping means 4. As the paper 3 passes through the top crimping means 4 it becomes first crimped paper 7. The bottom source of paper 3a is fed through the bottom crimping means 4a. As the paper 3a passes through the bottom crimping means 4a it becomes second crimped paper 7a. Preferably the top and bottom crimping means are crimping wheels. The top crimping means 4 is located above the exit port 12 of the tow processing machinery 2. The bottom crimping means 4a is located below the exit port 12 of the tow processing machinery 2. As the first crimped paper 7 passes through the top crimping means 4, it is laid on top of the processed tow 8 as the tow 8 exits the tow processing machinery 2 through the exit port 12. As second crimped paper 7a passes through the bottom crimping means 4a, it is laid underneath the processed tow 8 as the tow 8 exits the tow processing machinery 2 through the exit port. This creates a combined crimped paper/tow/crimped paper material 9b. A guid-

ing device 5 guides the combined crimped paper/tow/crimped paper material 9b into a filter rod maker 6. Preferably the filter rod maker 6 is KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6 the crimped paper/tow/crimped paper material 9b is processed into a filter by conventional methods known in the art.

One option, in the filter rod maker 6, is to surround the crimped paper/tow/crimped paper material 9b by overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 5. The resulting filter, shown in cross section shown in FIG. 7E, consists of three concentric layers, the innermost being crimped paper 3 surrounded by a layer of tow 1 and an outer layer of crimped paper 3a surrounded by optional overwrap 10.

FIG. 6 ("apparatus embodiment F") shows a sixth embodiment of the present invention. One source of tow 1 is processed by first conventional tow processing machinery 2. A second source of tow 1a is processed by second conventional tow processing machinery 2a. The first tow processing machinery 2 is located above the second tow processing machinery 2a. Located between the two tow processing machines is a source of paper 3b and crimping means 4. The paper 3b is fed through the crimping means 4. Preferably the paper 3b is crimped by crimping wheels. Because the crimping means 4 is located between the first and second tow processing machines 2 and 2a, as the paper exits the crimping means 4, it is placed between the first processed tow 1b and the second processed tow 1c. This creates a combined tow/crimped paper/tow material 9c which is guided by a guiding means 5 to a filter rod maker 6. The filter rod maker 6 is preferable KDF-2 machinery manufactured by Hauni-Werke Korber & Co., KG, Hamburg, Germany. In the filter rod maker 6, the combined tow/crimped paper/tow material 9c is processed into a filter by conventional methods known in the art.

One option, in the filter rod maker 6, is to surround the combined tow/crimped paper/tow material 9c with overwrap 10 and pass it through a curing chamber 11. This option is represented by FIG. 6. The resulting filter, shown in cross section in FIG. 7F, consists of three concentric layers, the inner most being tow 1 surrounded by a layer of crimped paper 3b and an outer layer of tow 1a and optional overwrap 10.

Claims

1. A concentric cigarette filter making apparatus including means for processing a combination of processed tow and paper into a filter, further comprising:

a crimper (4) (4a) for crimping the paper (3) (3a) (3b); and

means for combining the crimped paper (7) (7a) (7b) and processed tow (8) (1b) (1c) to form the combination.

2. Apparatus according to claim 1 in which the means for combining the crimped paper (7a) and the processed tow (8) is such that the crimped paper forms the inner layer of the combination. 5
3. Apparatus according to claim 1 in which the means for combining the crimped paper and the processed tow (8) is such that the crimped paper forms the outer layer of the combination. 10
4. Apparatus according to claim 1 comprising a first crimper (4) for crimping a first paper (3); a second crimper (4a) for crimping a second paper (3a); and means for combining the first crimped paper (7), the second crimped paper (7a) and the processed tow (8) to form the combination. 15 20
5. Apparatus according to claim 4 in which the means for combining the first crimped paper (7), the second crimped paper (7a) and the processed tow (8) is such that the first crimped paper forms the inner layer of the combination, the tow forms the intermediate layer of the combination and the second crimped paper forms the outer layer of the combination. 25 30
6. Apparatus according to claim 1 comprising means for combining a first processed tow (1b), a second processed tow (1c) and the crimped paper (7b) to form the combination. 35
7. Apparatus according to claim 6 in which the means for combining the first processed tow (1b), the second processed tow (1c) and the crimped paper (7b) is such that the first processed tow forms the inner layer of the combination, the crimped paper forms the intermediate layer of the combination and the second processed tow forms the outer layer of the combination. 40 45
8. Apparatus according to any preceding claim wherein the crimper (4) (4a) comprises a plurality of crimping wheels.
9. Apparatus according to any preceding claim further comprising a means (13) for spiralling the combination of the processed tow (8) (1b) (1c) and the crimped paper (7) (7a) (7b). 50
10. Apparatus according to any preceding claim further comprising a tow processor (2) (2a) for preparing processed tow (8) (1b) (1c) from tow (1) (1a). 55

11. Apparatus according to any preceding claim further comprising means to form the combined paper and tow into a generally cylindrical concentric filer.

12. A method for making cigarette filters in which a combination of processed tow and paper is processed into a filter comprising:
crimping the paper; and
combining the crimped paper and processed tow.

13. A method according to claim 12 in which the crimped paper and the processed tow are combined such that the crimped paper forms the inner layer of the combination.

14. A method according to claim 12 in which the crimped paper and the processed tow are combined such that the crimped paper forms the outer layer of the combination.

15. A method according to claim 12 comprising:
crimping a first paper;
crimping a second paper; and
combining the first crimped paper, the second crimped paper and processed tow to form the combination.

16. A method according to claim 15 in which the first crimped paper, the second crimped paper and processed tow are combined such that the first crimped paper forms the inner layer of the combination, the processed tow forms the intermediate layer of the combination and the second crimped paper forms the outer layer of the combination.

17. A method according to claim 12 comprising combining a first processed tow, a second processed tow and crimped paper to form the combination.

18. A method according to claim 17 in which the first processed tow, the second processed tow and crimped paper are combined such that the first processed tow forms the inner layer of the combination, the crimped paper forms the intermediate layer of the combination and the second processed tow forms the outer layer of the combination.

19. A method according to any of claims 12 to 18 further comprising spiralling the combination of processed tow and crimped paper.

20. A method according to any of claims 12 to 19 further comprising a preliminary step of processing tow to form processed tow.

- 21.** A method according to any of claims 11 to 19 further comprising forming the combined paper and tow into a generally cylindrical concentric filter.

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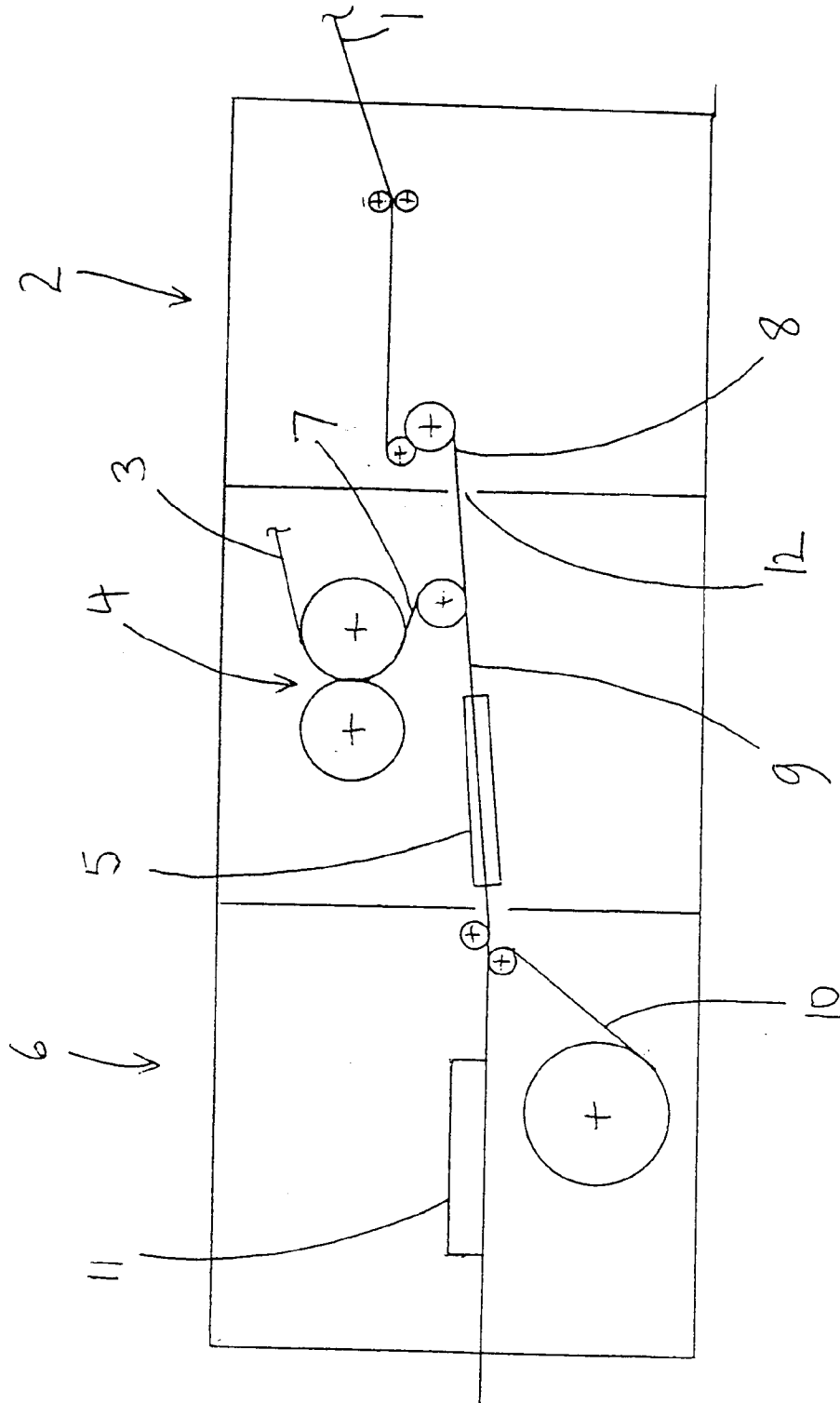


Fig. 1

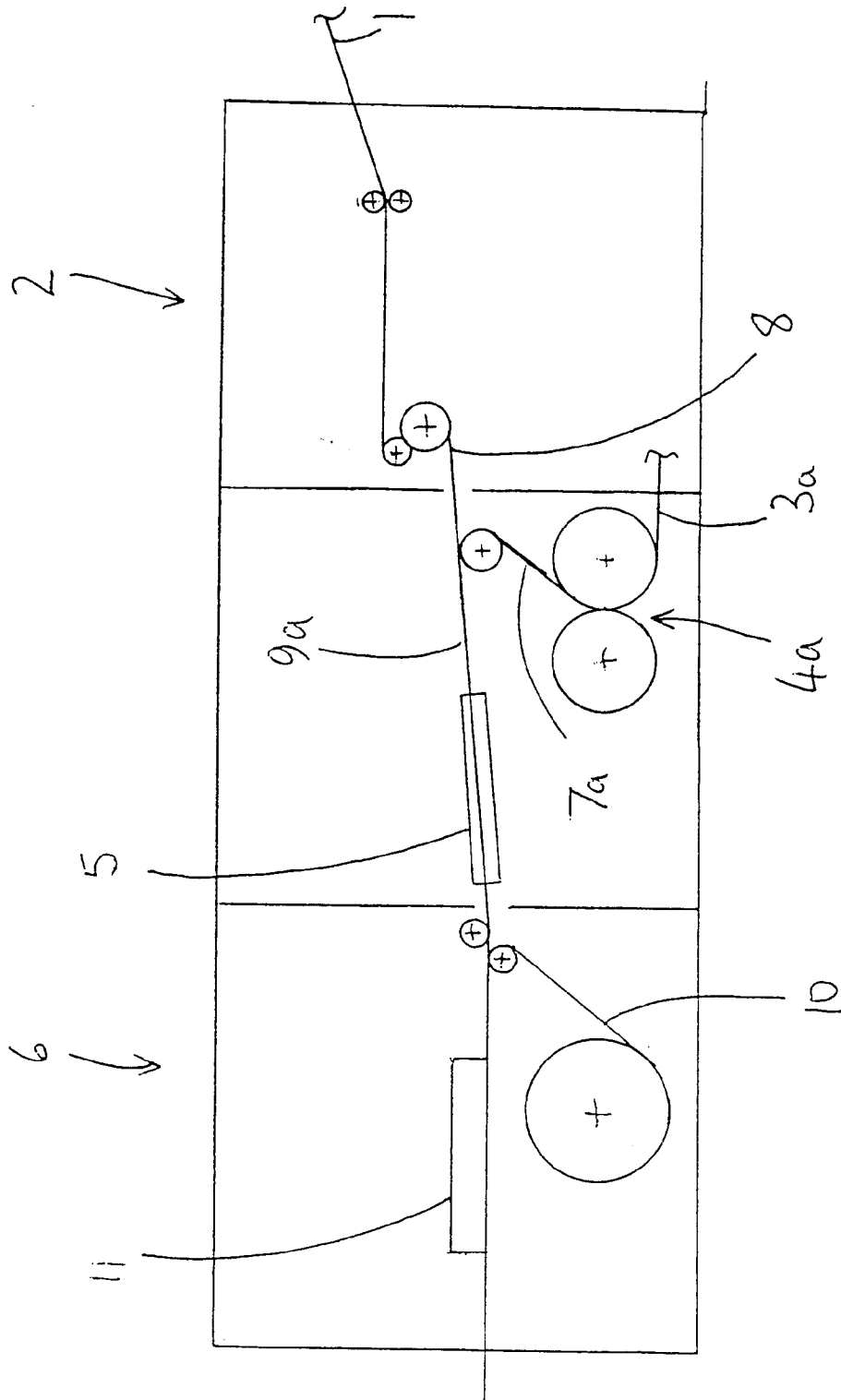


Fig. 2

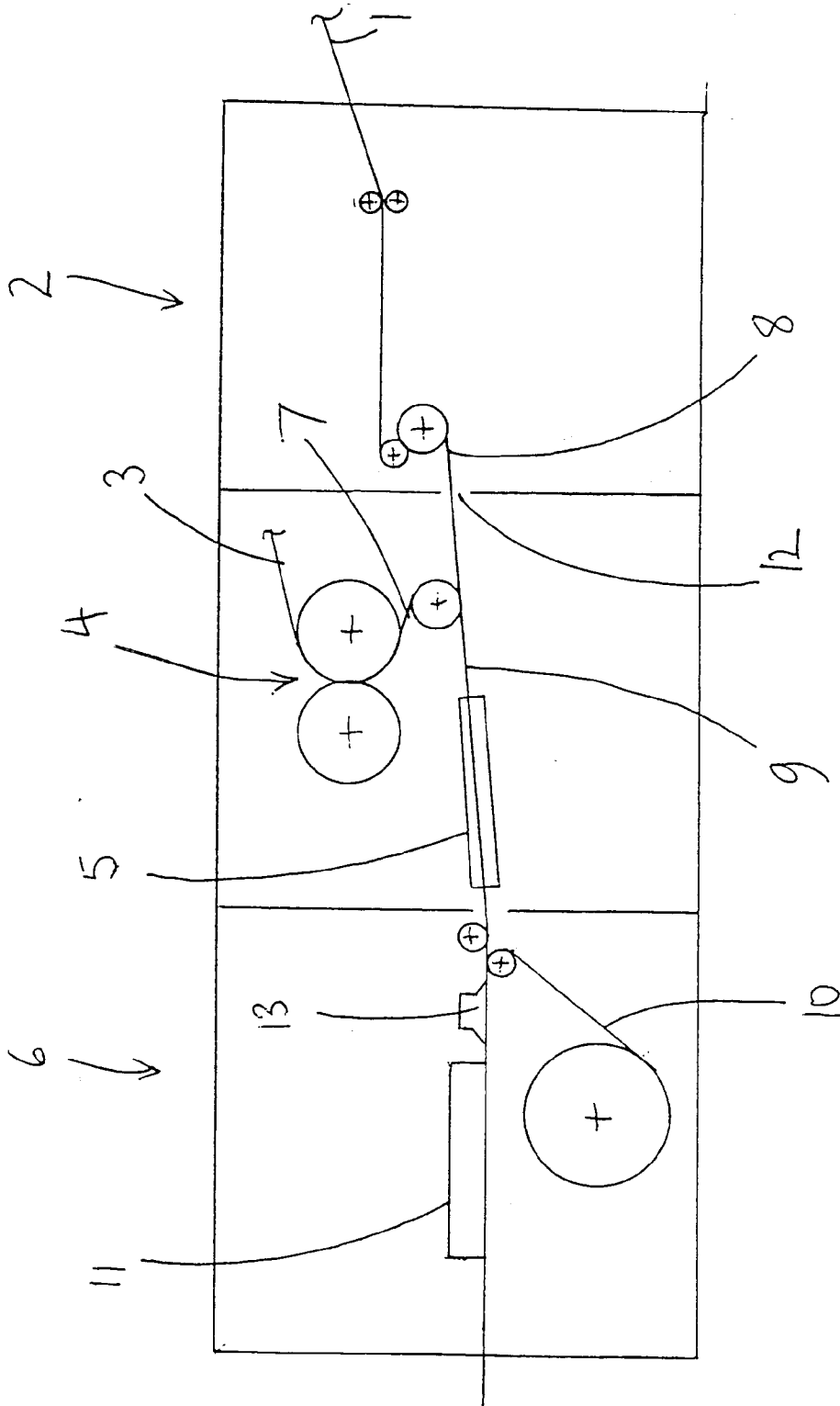


Fig. 3

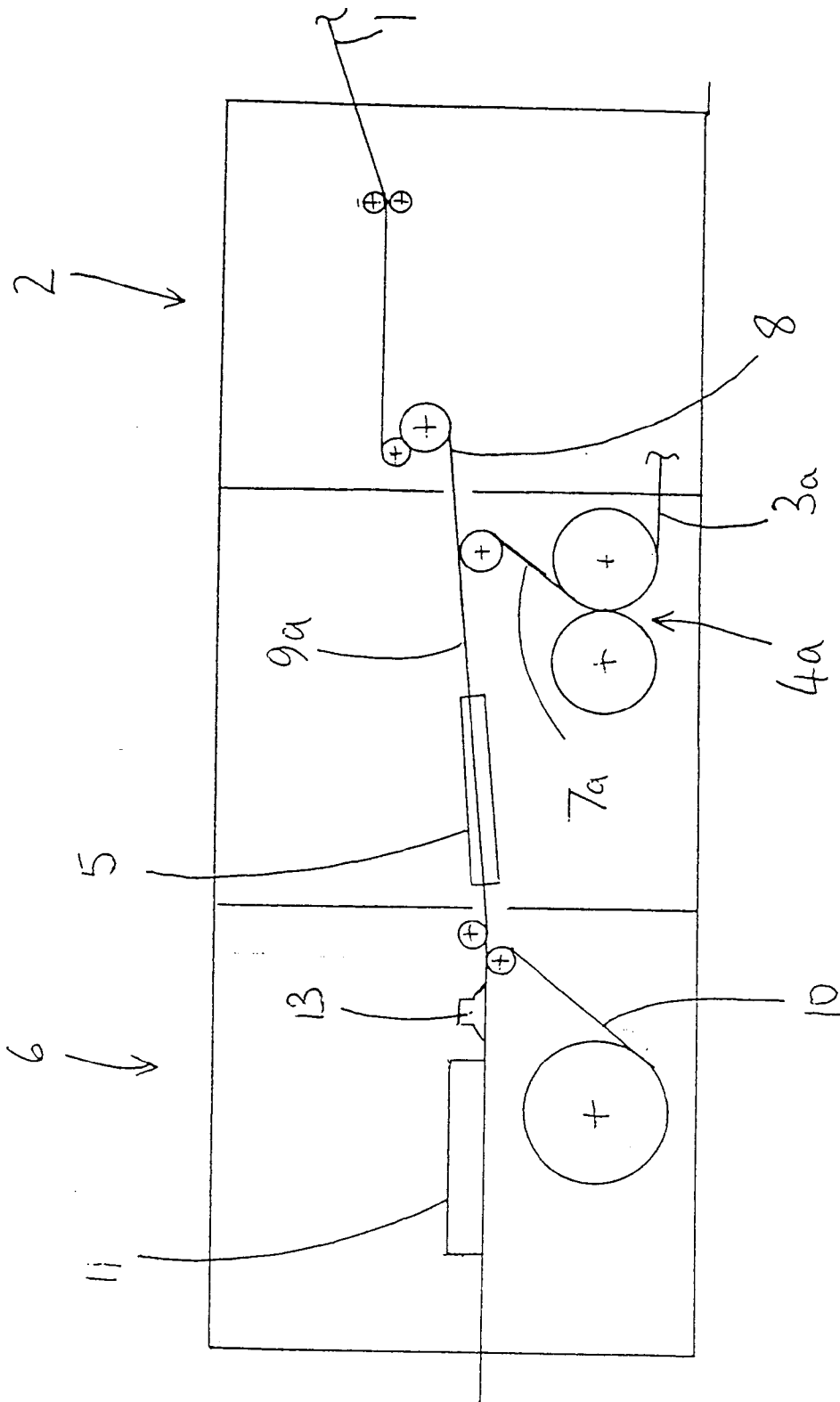


Fig. 4

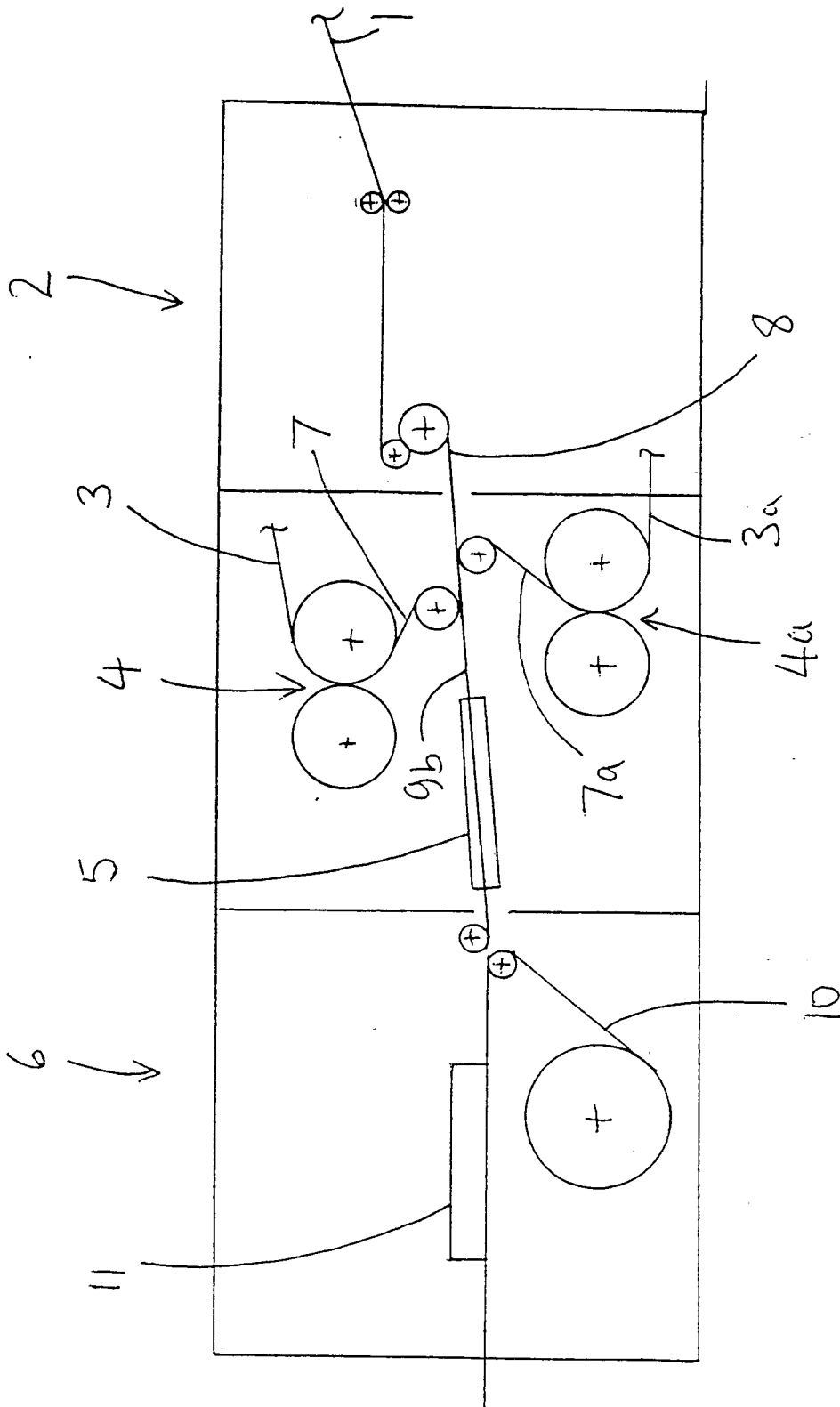


Fig. 5

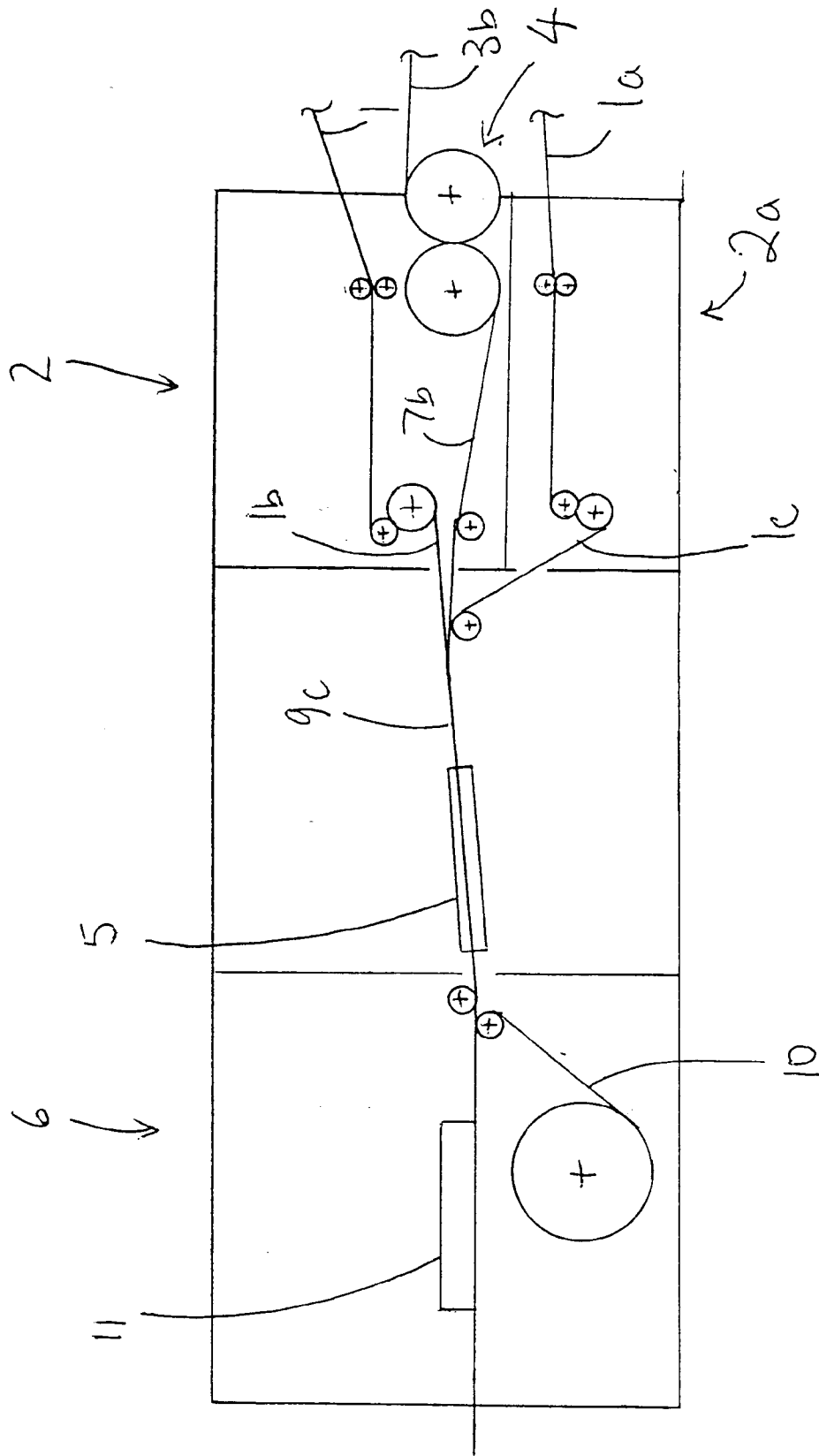
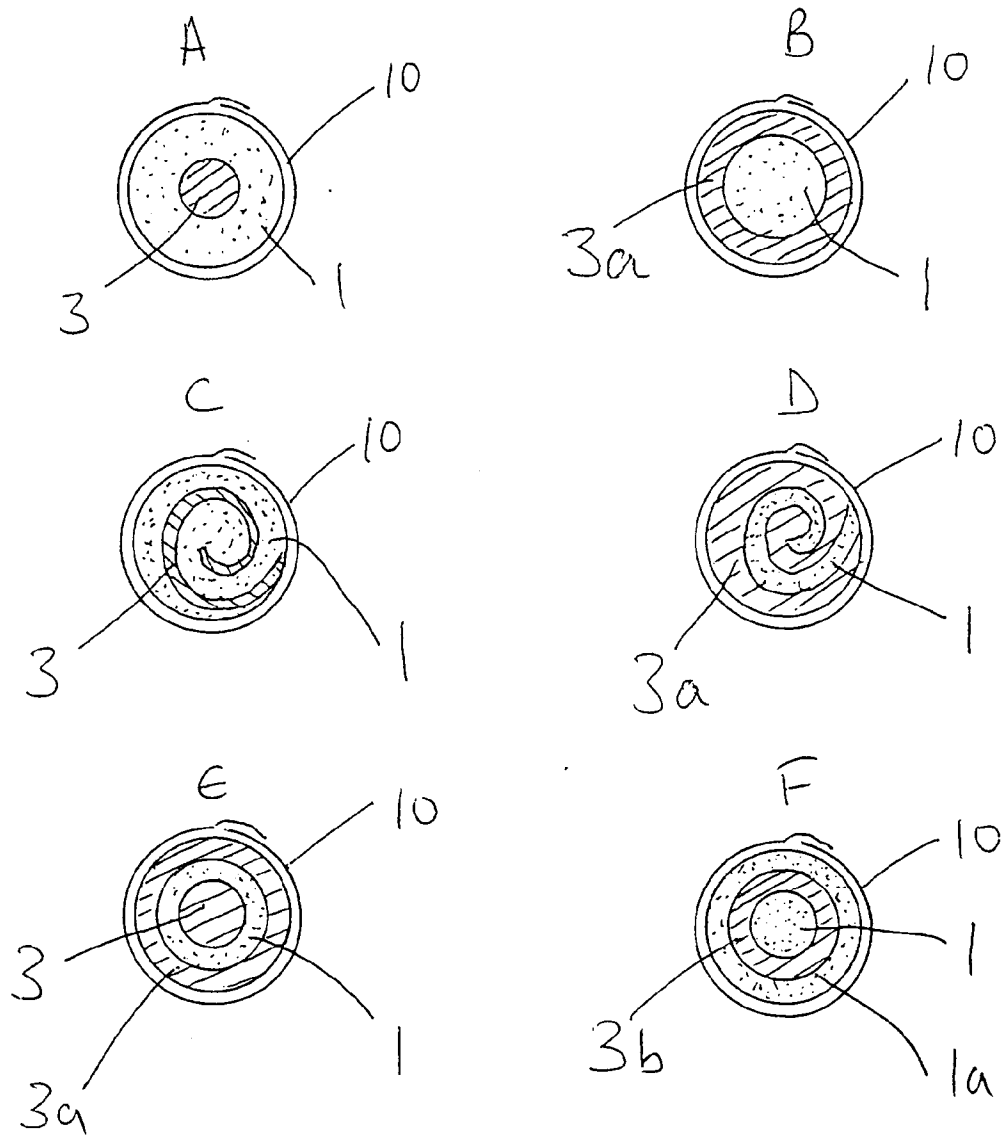


Fig. 6

Fig. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 5683

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-3 396 061 (BROWNE) * the whole document * ---	1-3, 11-14, 21	A24D3/02 A24D3/04
X	EP-A-0 474 940 (PHILIP MORRIS PRODUCTS INC.) * the whole document * ---	1-3, 11-14, 21	
A	US-A-4 355 995 (BERGER) * the whole document * ---	1-3, 8, 11-14, 21	
A	GB-A-793 114 (BYK) * the whole document * ---	1, 12	
A	GB-A-476 746 (ALLEY) * the whole document * ---	9, 19	
A	CH-A-142 428 (AIVAZ) -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) A24D
Place of search THE HAGUE		Date of completion of the search 30 November 1994	Examiner Riegel, R
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