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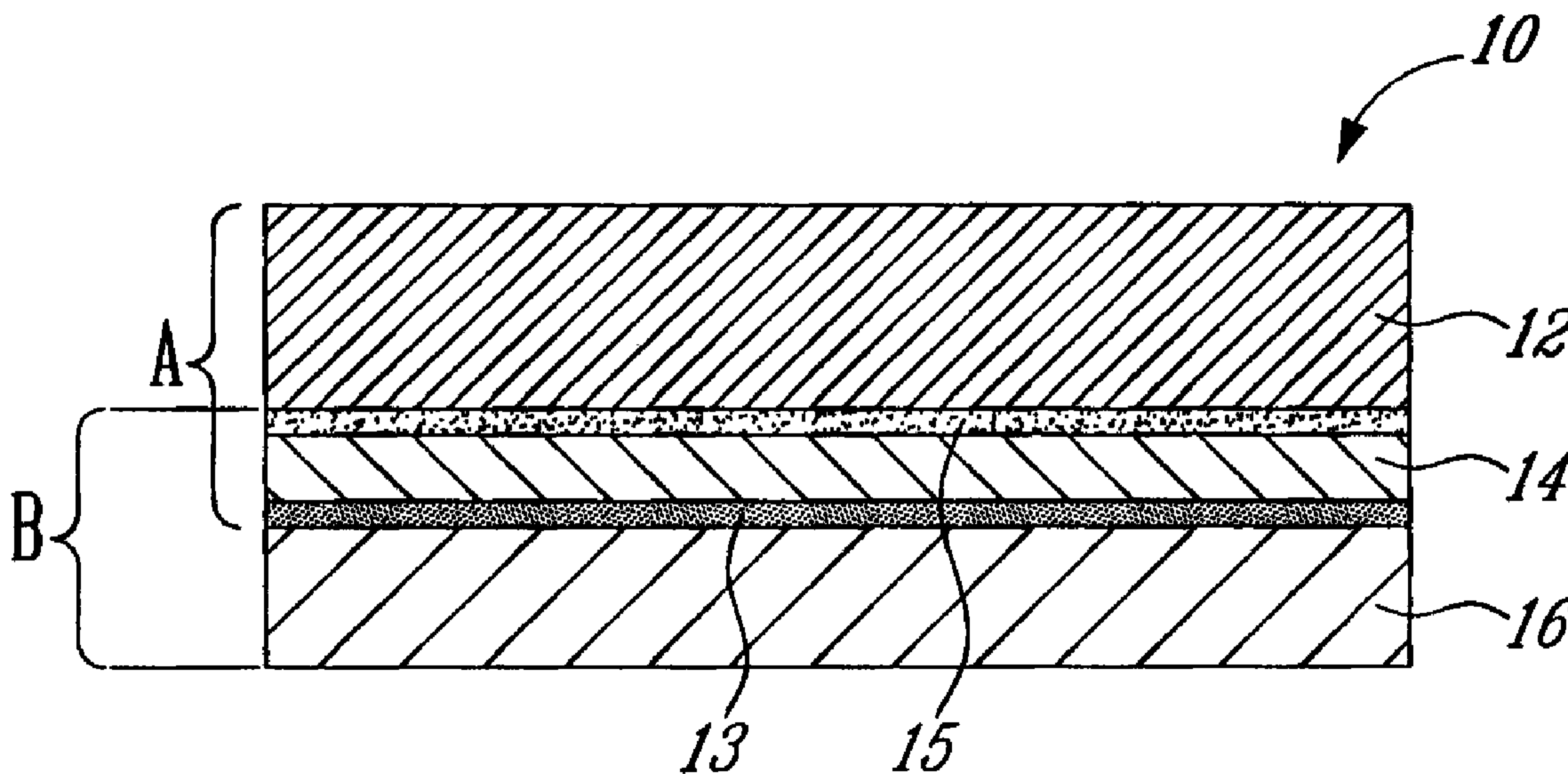
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(54) Titre : PROCESSUS DE FABRICATION D'UN MATERIAU D'EMBALLAGE  
(54) Title: PROCESS FOR MANUFACTURING A PACKAGING MATERIAL



(57) Abrégé/Abstract:

A process for manufacturing a packaging material having at least two films (12, 16) or foils (14) bonded together via at least one layer of adhesive (13,15) to give a multi-layer laminate (10), is such that the adhesive layers (13,15) are of an adhesive that cures under electron beam radiation, and the laminate (10) is radiated with electrons for the purpose of curing the adhesive. The laminate is particularly suitable for the manufacture of self-standing pouches, in particular for drinks. The production of the laminate using adhesives that cure under electron beam radiation leads to a significantly reduced throughput time and to a reduction in the emission of solvents when replacing solvent-based adhesives by electron beam curing adhesives.

**Abstract**

A process for manufacturing a packaging material having at least two films (12, 16) or foils (14) bonded together via at least one layer of adhesive (13,15) to give a multi-layer laminate (10), is such that the adhesive layers (13,15) are of an adhesive that cures under electron beam radiation, and the laminate (10) is radiated with electrons for the purpose of curing the adhesive. The laminate is particularly suitable for the manufacture of self-standing pouches, in particular for drinks. The production of the laminate using adhesives that cure under electron beam radiation leads to a significantly reduced throughput time and to a reduction in the emission of solvents when replacing solvent-based adhesives by electron beam curing adhesives.

## **Process for Manufacturing a Packaging Material**

The invention relates to a process for manufacturing a packaging material having at least two films or foils bonded together into a multilayer laminate by means of at least one layer of adhesive, whereby the adhesive layer/layers is/are cure-hardened. Also within the scope of the invention is a self-standing pouch made from the laminate.

Laminates for manufacturing self-standing pouches for drinks are manufactured today in two steps using solvent-free adhesives and in one step using solvent-based adhesives.

The solvent-free process is environmentally friendly, however, requires two production steps. In a first step an aluminium foil is bonded to a printed polyethyleneterephthalate (PET) film which is coated with a solvent-free polyurethane (PUR) adhesive. After a curing time of several hours this pre-laminate can be bonded to a polyolefin-film using a solvent-based or solvent-free PUR adhesive. The final structure is: PET-film / adhesive layer / aluminium foil / adhesive layer / polyolefin film. After the final curing over a period of several days, the final laminate can be cut to size and dispatched to the customer. The throughput time from receipt of order to dispatch of the finished product depends essentially on the time required for curing the PUR-adhesive

The object of the invention is to provide a process of the kind described at the start by means of which the time required for curing the adhesive needed for the laminate – and with that the throughput time can be reduced in comparison with the adhesive curing time in conventional laminate manufacture.

That objective is achieved by way of the invention in that at least one adhesive layer is of an adhesive that can be cured using an electron beam and the laminate is radiated with electrons for the purpose of curing the adhesive.

The application of an electron beam curable adhesive results in an increase of the initial adhesion, the so called greentack, which could not be expected at once. Furthermore the application of an electron beam curable adhesive results not only in an excellent adhesion against plastic films but also against  
5 aluminium foils. In addition, an aluminium foil forms a functional barrier for electron beam curable adhesives, which is important with packaging for food, in particular beverages.

The radiation curing of plastics that can be cured with an electron beam takes  
10 place in a fraction of a second on passing through a radiation station, whereby the final bond strength has already been essentially achieved without an additional curing time when the laminate emerges from the radiation station and is coiled.

15 The advantage of manufacturing laminate using adhesives that can be cured by means of electron beam radiation is not only the much reduced throughput time, but also in the reduction of solvent emissions is solvent based adhesives can be replaced by adhesives that can be cured using an electron beam.

20 A preferred laminate exhibits three films or foils and two adhesive layers, whereby one of the adhesive layers or both adhesive layers is/are of the electron beam curing type of adhesive.

If only one of the adhesive layers is curable with an electron beam, a solvent  
25 based or solvent-free PUR-adhesive is used by way of preference for the second adhesive layer.

A preferred laminate exhibits the following structure: PET film / first adhesive  
30 layer of electron beam curable adhesive / aluminium foil / second adhesive layer of an electron beam curable adhesive / polyolefin film.

If only one of the two adhesive layers is of an electron beam curable adhesive,

a further preferred laminate exhibits the following structure: PET film / first adhesive layer of electron beam curable adhesive / aluminium foil / second adhesive layer of a solvent based or solvent-free PUR adhesive / polyolefin film or PET film / first adhesive layer of a solvent based or solvent-free PUR adhesive / aluminium foil / second adhesive layer of an electron beam curable adhesive / polyolefin film

Preferred polyolefin films are sealable films of polyethylene (PE) or polypropylene (PP). For applications involving sterilisation or high temperature cooking, PP is preferable because of its ability to withstand high thermal loads.

The PET film may exhibit printing on it. The printing is preferably provided as counterprint on the side coated with adhesive.

The electron beam curable adhesive is preferably an adhesive on an acrylate basis.

The adhesive on an acrylate basis may contain monomers, oligomers or mixtures of monomers and oligomers as the basis. Examples of monomers are mono, di- and multifunctional acrylates such as phosphoric acid ester acrylates, hydroxy-acrylates, carboxy-acrylates, amino-acrylates, acrylic acid and acrylamide. Examples of oligomers are epoxy-acrylates, urethane-acrylates, polyester-acrylates and silicon-acrylates. The monomers and oligomers mentioned are either available commercially or can be manufactured by routine methods. The term "acrylate"(or "acryl") used here also includes "methacrylate"(or "methacryl", whereby the acrylates are preferred.

The laminate manufactured according to the invention is particularly suitable for manufacturing self-standing pouches, in particular such for drinks. Preferred is at least for the film of the laminate forming the outside of the pouch to be laminated using an adhesive layer that can be cured using an electron beam.

Further advantages, features and details of the invention are revealed in the following description of preferred exemplified embodiments and with the aid of the drawing which shows schematically in

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Fig. 1 cross-section through a laminated packaging film;

Fig. 2 manufacture of a pre-laminated partial film of the packaging film shown in Fig. 1;

10 Fig. 3 manufacture of the packaging film in Fig. 1 from the pre-laminated partial film in Fig. 2;

Fig. 4 manufacture of the packaging film in Fig. 1 by triple lamination;

Fig. 5 another embodiment of the manufacture of the packaging film.

15 Fig. 1 shows a packaging film 10 for manufacturing self-standing pouches for drinks featuring a printed PET film 12 representing the outer side, an aluminium foil 14 as barrier layer and a sealable PE or PP film 16 representing the inner side. The PET film 12 is permanently bonded to the aluminium foil 14 by way of a first adhesive layer 13 and the aluminium foil 14 to the sealing film 16 by way of a second adhesive layer 15. In a typical packaging film 10 the thickness of  
20 the PET film is e.g. 12  $\mu\text{m}$ , the thickness of the aluminium foil 8 – 10  $\mu\text{m}$  and the thickness of the sealing layer 90 – 100  $\mu\text{m}$ .

25 Fig. 2 shows the manufacture of a partial film A comprising PET film 12, adhesive layer 13 and aluminium foil 14. The printed PET film 12 is uncoiled from a first spool 18 in strip form and continuously coated with adhesive 13. The aluminium foil 14 is uncoiled in strip form from a second spool 20 and fed to the PET film 12 coated with adhesive 13 and laminated to this to a partial film A. The partial film A is passed through a radiation station 22 in which the adhesive layer 13 is cured by electron beam radiation within a fraction of a second. After  
30 leaving the radiation station 22, the partial film A is coiled onto a third spool 24.

In a further production step, shown in Fig. 3, the sealing film 16 is uncoiled from

a fourth spool 26 and continuously coated with adhesive 15. The partial film A is fed from the third spool in strip form and fed to the sealing film 16 coated with adhesive 15 and laminated continuously to this to yield the packaging film 10. The packaging film passes through a radiation station 28 in which the adhesive layer 15 is cured by electron beam radiation within a fraction of a second. On leaving the radiation station 22 the packaging film 10 is coiled onto a fifth spool 30.

The second adhesive layer 15 does not necessarily have to be an electron beam curing adhesive. Instead, it may e.g. be a conventional PUR adhesive. In that case the curing station 28 is omitted. The longer curing time required for the PUR adhesive has no influence on the process for producing the composite film 10 and simply requires a minimum storage time until it is processed further.

Another version of the manufacturing process – not shown in the drawing – is such that first a partial film B comprising sealing film 16, adhesive layer 15 and aluminium foil 14 is produced. The sealing film 16 is uncoiled from a first spool and continuously coated with adhesive 15. The aluminium foil is fed to the sealing film 16 which is coated with adhesive 15 and laminated to this to give a partial film B. The partial film B passes through a radiation station in which the adhesive a layer 15 is cured within a fraction of a second. After leaving the radiation station, the partial film is coiled onto a third spool.

In a further step the printed PET film 12 is uncoiled from a fourth spool and coated continuously with adhesive 13. The partial film B is fed from the third spool to the PET film 12 coated with adhesive 13 and laminated in a continuous manner to yield the packaging film 10. The packaging film 10 passes through a radiation station in which the adhesive layer 12 is cured by electron beam curing within a fraction of a second. On leaving the radiation station the packaging film 10 is coiled onto a fifth spool.

The first adhesive layer 13 does not necessarily have to be an electron beam

curing adhesive. Instead, it may e.g. be a conventional PUR adhesive. In that case of course the radiation station is omitted. The longer curing time required by the PUR adhesive has no influence on the process for manufacturing the composite film 10 and requires simply a minimum storage time to be observed  
5 until further processing.

In a first way of manufacturing the threefold lamination shown in Fig. 4, the production of the packaging film 10 takes place by bringing together the PET film 12, the aluminium foil 14 and the sealing film 16 and adhesively bonding via  
10 the two adhesive layers 13, 15 in one single pass. The printed PET film 12 is uncoiled from a first spool 32 and coated continuously with adhesive 13. The aluminium foil 14 is fed in strip form from a second spool 34 to the PET film 12 coated with adhesive 13 and laminated continuously to this to yield partial film A. The sealing film 16 is uncoiled from a third spool 36 and coated continuously  
15 with adhesive 15, fed in strip form to the partial film A and laminated to it in a continuous manner yielding the packaging film 10. The sealing film 16 is uncoiled from a third spool 36 and coated with adhesive 15, fed in strip form to the partial film A and laminated to it in a continuous manner yielding the packaging film 10. The packaging film 10 passes through a radiation station 38  
20 with adequate capacity enabling both adhesive layers 13, 15 to be cured by electron beam radiation within a fraction of a second in one single pass. On leaving the radiation station 38 the packaging film 10 is coiled onto a fourth spool 40.

25 In a second way of manufacturing the threefold lamination shown in Fig. 5, the production of the packaging film 10 takes place the same way as the production shown in Fig. 4 by bringing together the PET film 12, the aluminium foil 14 and the sealing film 16 and adhesively bonding via the two adhesive layers 13, 15 in one single pass. The aluminium foil 14 is uncoiled from a first spool 42 and  
30 coated continuously with adhesive 15 at a first adhesive application station 17. The sealing film 16 is fed in strip form from a second spool 44 to the aluminium foil 14 coated with adhesive 15 and laminated continuously to this to yield

partial film B. The partial film B passes through a first radiation station 50 with adequate capacity enabling the adhesive layer 15 to be cured by electron beam radiation within a fraction of a second. The PET film 12 is uncoiled from a third spool 46 and coated continuously with adhesive 13 at a second adhesive application station 19, fed in strip form to the partial film B on leaving the first radiation station 50 and laminated to it in a continuous manner yielding the packaging film 10. The packaging film 10 passes through a second radiation station 52 with adequate capacity enabling also the adhesive layer 13 to be cured by electron beam radiation within a fraction of a second. On leaving the radiation station 52 the packaging film 10 is coiled onto a fourth spool 48.

Immediately after coiling onto the spool 40, 48 the packaging film 10 with fully cured adhesive layers 13, 15 is divided on a slitting line into commercially required breadths ready for dispatch.

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It is self-evident that, on bonding the films or foils in the above laminating processes, the adhesive may also be deposited on the other films or foils mentioned in the examples.

**Claims**

1. Process for manufacturing a packaging material having at least two films (12, 16) or foils (14) bonded together via at least one layer of adhesive to give a multi-layer laminate (10), whereby the adhesive layer/layers (13,15) is/are cured,  
  
characterised in that,  
  
at least one adhesive layer (13) is of an electron beam curable adhesive and the laminate (10) is radiated with electrons for the purpose of curing the adhesive.
2. Process according to claim 1, characterised in that the laminate (10) exhibits three films (12,16) or foils (14) and two adhesive layers (13,15)
3. Process according to claim 2, characterised in that one of the adhesive layers (13) is an adhesive that cures under electron beam radiation.
4. Process according to claim 2, characterised in that both adhesive layers (13,15) are an adhesive that cures under electron beam radiation.
5. Process according to claim 3, characterised in that the first adhesive layer (13) is an adhesive that cures under electron beam radiation and the second adhesive layer (15) is a solvent-based or solvent-free PUR adhesive.
6. Process according to claim 4, characterised in that the laminate (10) exhibits the following structure: PET film (12) / first adhesive layer of an electron beam curing adhesive (13) / aluminium foil (14) / second adhesive layer of an electron beam curing adhesive (15) / polyolefin film (16).

7. Process according to claim 5, characterised in that the laminate (10) exhibits the following structure: PET film (12) / first adhesive layer of an electron beam curing adhesive (13) / aluminium foil (14) / second adhesive film (15) of a solvent-based or solvent-free PUR adhesive / polyolefin film (16).
8. Process according to claim 5, characterised in that the laminate exhibits the following structure: PET film (12) / first adhesive layer of a solvent-based or solvent-free PUR adhesive (13) / aluminium foil (14) / second adhesive layer of an electron beam curing adhesive (15) / polyolefin film (16).
9. Process according to one of the claims 6 to 8, characterised in that the PET film (12) exhibits printing on the side coated with adhesive.
10. Process according to one of the claims 6 to 9, characterised in that the polyolefin film is a PE or PP film.
11. Process according to one of the claims 1 to 10, characterised in that the electron beam curing adhesive is an acrylate-based adhesive.
12. Self-standing pouch manufactured from a laminate (10) using the process according to one of the claims 1 to 10.
13. Self-standing pouch manufactured from a laminate (10) using the process according to one of the claims 2 to 10, characterised in that at least film (12) of the laminate (10) forming the outside of the pouch is laminated via an adhesive layer (13) that cures under electron beam radiation.
14. Self-standing pouch according to claim 12 or 13, characterised in that the adhesive that cures under electron beam radiation is an acrylate-based adhesive.

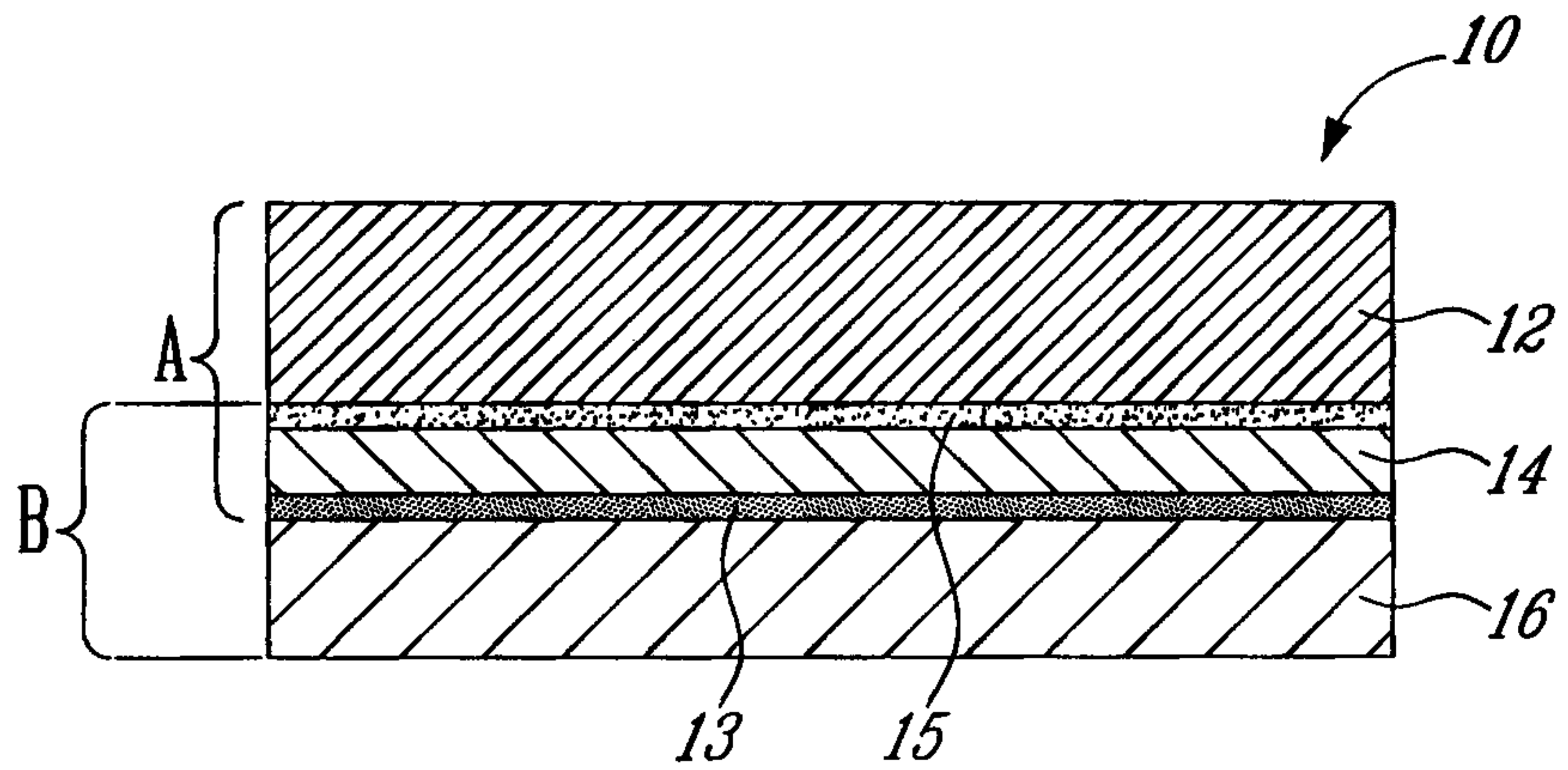


FIG. 1

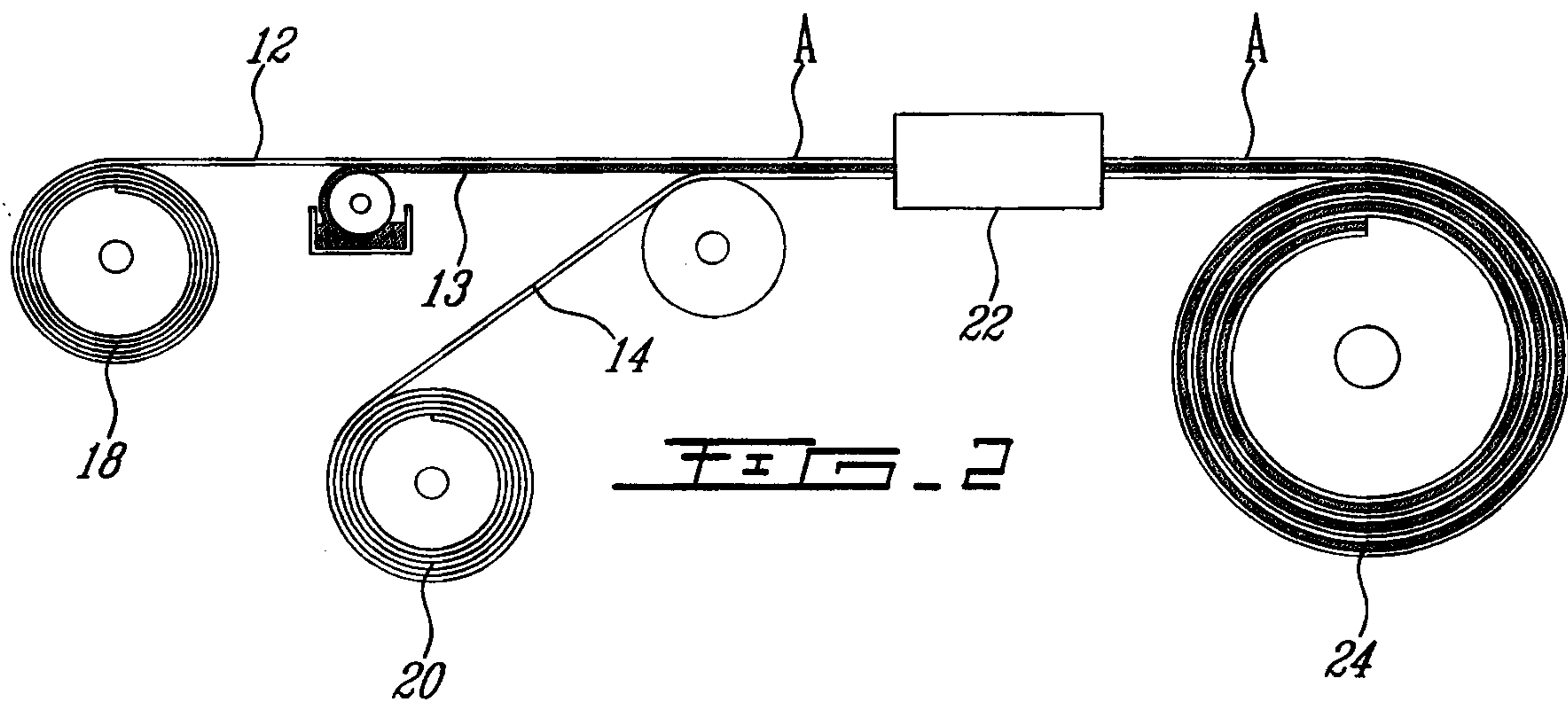


FIG. 2

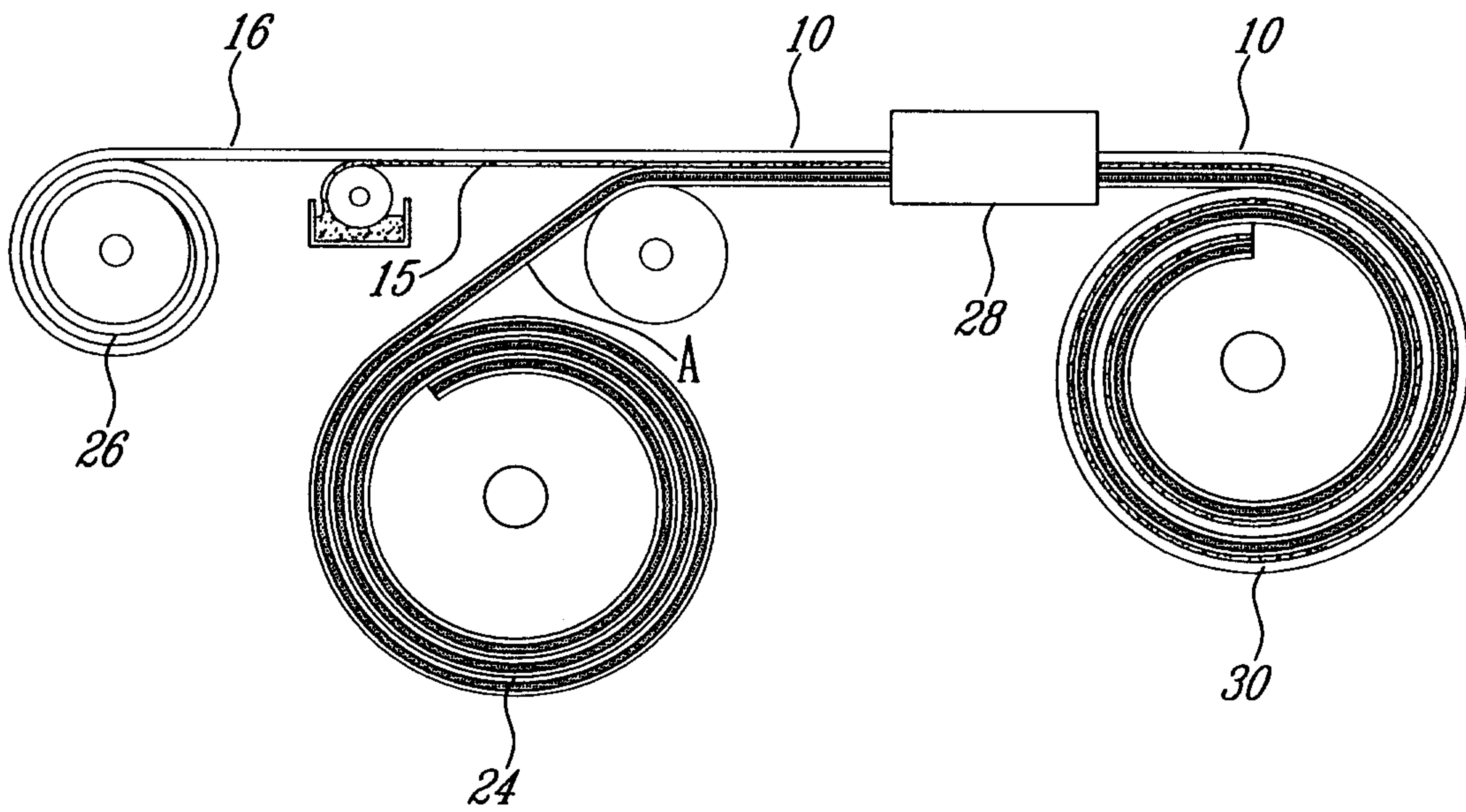


FIG. 3

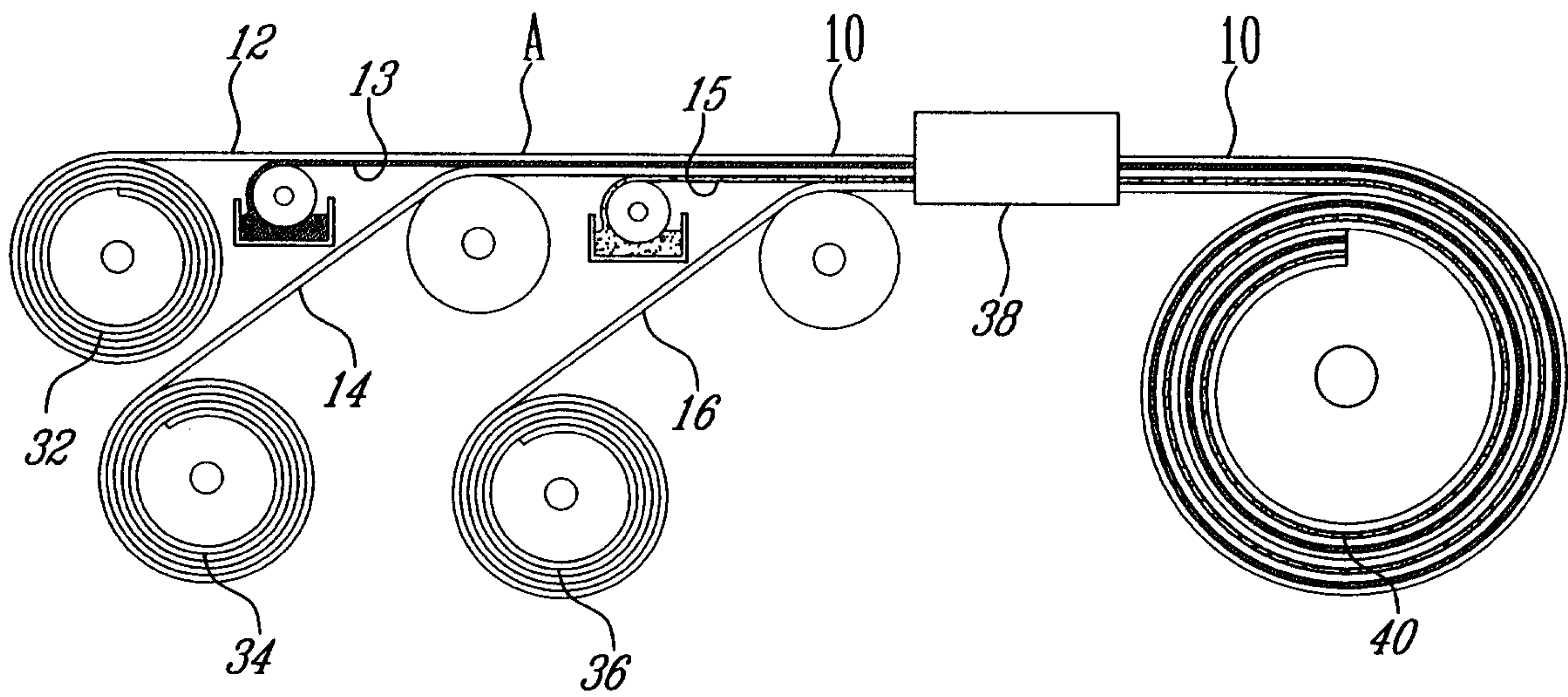


FIG. 4

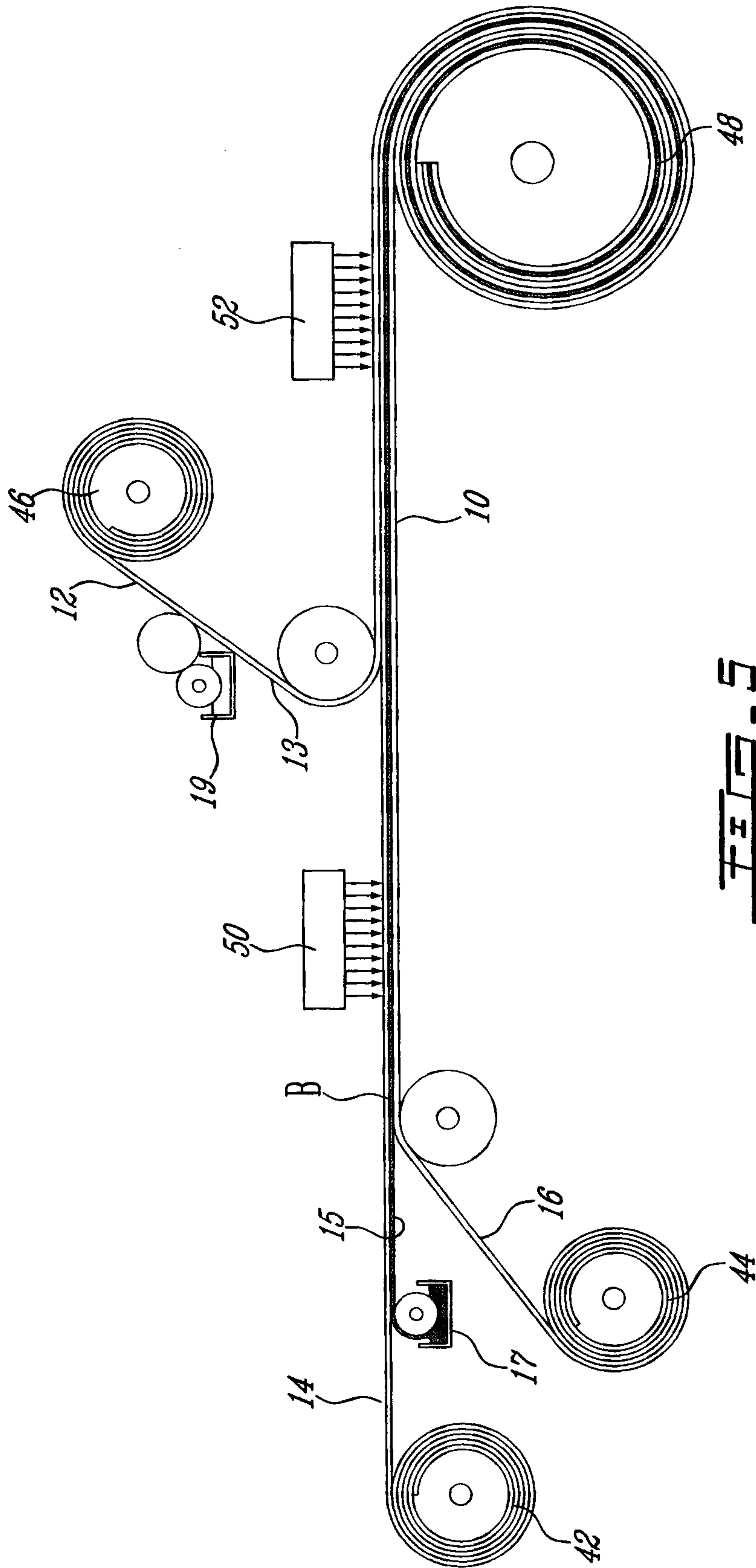


FIG. 5

