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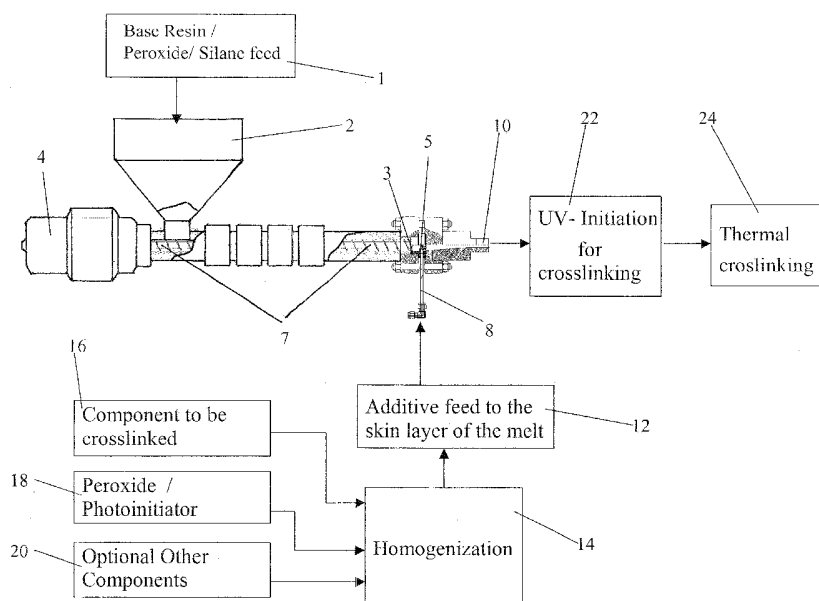
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(54) Title: EXTRUSION PROCESS



(57) Abstract: The present invention relates to preparing extruded article by flowing heat plastified stream of extrudable resinous thermoplastic material through an extrusion orifice. In the invention crosslinking additives are introduced and mixed to the surface portion of the stream of extrudable resinous thermoplastic material before the extrusion step. After the extrusion step the crosslinking of the surface portion of the extruded article provided with the crosslinking additives is initiated by special initiation means.

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EXTRUSION PROCESS

FIELD OF THE INVENTION

The present invention relates to a method according to the preamble of claim 1, which is a method in a process for preparing extruded article by flowing heat plastified stream of extrudable resinous thermoplastic crosslinking material through an extrusion orifice and to a process according to preamble of claim 10 which is an extrusion process for preparing extruded article(s) in which process heat plastified stream of extrudable resinous thermoplastic crosslinking material is arranged to flow through an extrusion orifice, the process comprising the following steps, providing a source of heat plastified extrudable synthetic resinous thermoplastic crosslinking material and advancing the material along a first flow path toward the extrusion orifice. The present invention also relates to an apparatus according to preamble of claim 15, which is an apparatus for preparing extruded article(s) by flowing heat plastified stream of extrudable resinous thermoplastic crosslinking material through an extrusion orifice.

BACKGROUND OF THE INVENTION

As known, the properties of polymer-based articles, including cables, profiles, films, tubes or the like, may be significantly enhanced by crosslinking the polymer-based material. In that case heat resistance, mechanical strength and chemical resistance are altered. There are various known crosslinking methods available in the industry, such as peroxide, silane and radiation based methods. In the above mentioned methods the material is fully crosslinking so that the degree of crosslinking and the crosslinking gradient in the produced article are difficult to control. Often it is desirable to create a surface layer on an extruded article so as to obtain an article having altered crosslinking properties on the surface layer in relation to the rest of the article for providing certain advantageous properties. According to the state of the art this crosslinked surface layer for an extruded article is produced by co-extruding it on the article.

This co-extrusion of the crosslinked surface layer makes the extrusion apparatus more complicated. Furthermore, a boundary surface is formed between the surface layer having altered crosslinking properties on the article and the extruded article itself. This kind of boundary surface between

the crosslinked surface layer and the article is undesirable and may limit the applicability of the article.

BRIEF DESCRIPTION OF THE INVENTION

5 An object of the present invention is thus to provide a method, a process and an apparatus for implementing the method to overcome the above disadvantages. The objects of the invention are achieved by a method according to the characterizing portion of claim 1 which is characterized in that the method comprises the following step,

10 - introducing modified crosslinking additive(s) to the surface portion of the stream of extrudable resinous thermoplastic material before the extrusion step for altering the crosslinking properties of the surface portion of the extrudable material.

The objects of the invention are furthermore achieved by a process according to the characterizing portion of claim 10 which is characterized by the steps:

15 - introducing modified crosslinking additives to the surface portion of the material flow before the extrusion step for altering the crosslinking properties of the surface portion of the extrudable material.

20 The objects of the present invention are also achieved by an apparatus according to the characterizing portion of claim 15 which is characterized in that apparatus comprises before the extrusion orifice (10) introducing means (8) for introducing modified crosslinking additive(s) to the surface portion of the stream of extrudable resinous thermoplastic crosslinking material for altering the crosslinking properties of the surface portion of the extrudable material.

The preferred embodiments of the invention are disclosed in the dependent claims.

30 The invention is based on the idea of creating an altered crosslinking surface layer in-situ extruder a part after the melt zone by adding the modified crosslinking components/additives of the crosslinking method in question only to the surface layer of the heat plastified stream of extrudable resinous thermoplastic crosslinking material before the actual extrusion step.

35 The result is produced an extruded article having altered crosslinking properties on the surface layer in relation to the rest of the article, that is the core of the

article. This way the crosslinked surface layer may be formed as an integral part of the extruded article and no separate crosslinked surface layer, for instance by co-extruding, is needed. These modified crosslinking additives may be for example reaction promoters for boosting the crosslinking reaction or they may be reaction inhibitors for decelerating the crosslinking reaction. This integral crosslinked surface layer may be created for example by physically separating the stream of the extrudable resinous thermoplastic material into a central core stream and at least one boundary stream on the outside of the core stream before the extrusion step, while maintaining physical separation of the core and boundary stream by selectively introducing crosslinking additive(s) to the boundary streams and thereafter recombining the streams prior expelling the material in the extrusion step out of the extrusion orifice, said boundary streams being applied as a relatively thin surface layer having altered crosslinking properties between the core layer and the surfaces of the extrusion orifice. The surface layer having altered crosslinking properties is thus created as an integral surface layer during normal extrusion. Other parts of the article except the surface layer may also be crosslinked during the extrusion process, but because of the crosslinking additive supplied on the surface of the article, the crosslinking structure of the surface layer is different than the structure of the other parts of the article. Another way is to apply the modified crosslinking additives directly on the surface of the heat plastified stream of the extrudable resinous thermoplastic crosslinking material.

An advantage of the present invention is that this kind of integral surface layer having altered crosslinking properties in relation to other parts or the core of the extruded article provides a mechanically stronger surface. Additionally the invention also enables better ultraviolet radiation protection, thermal stabilization and combinations of colouring and filling agents. Also the degree of the crosslinking and the crosslinking density may be controlled more precisely and the surface and the core of the extruded article may have altered crosslinked structures while being integral parts.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following the invention will be described in greater detail by means of preferred embodiments with reference to the accompanying drawings, in which figure 1 is a schematic view of an extrusion method and apparatus according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

According to one embodiment of the invention the modified crosslinking additive or additives is applied through an extrusion orifice on the surface of the heat plastified stream of extrudable resinous thermoplastic crosslinking material before the actual extrusion step. In that case the modified crosslinking additive spreads on the resinous crosslinking material to form a surface layer having altered crosslinking properties in relation to the rest of the resinous material to be extruded. Therefore also the extruded article comprises a surface layer having altered crosslinking properties. This applying of the modified crosslinking additive is carried out using introducing means. After the actual extrusion step the crosslinking of the surface layer having altered crosslinking properties is initiated using initiation means, the crosslinking of the surface layer and the crosslinking of other parts of the extruded article being then continued using conventional crosslinking means. This way the crosslinking of the core part of the extruded article may be controlled by altering the crosslinking of the surface layer. The modified crosslinking additive may be in the form of reaction promoters for example for boosting the crosslinking reaction or they may be reaction inhibitors for decelerating the crosslinking reaction.

Figure 1 shows a schematic view of the apparatus and method according to another embodiment of the present invention. The features described with this embodiment are also applicable with the above mentioned embodiment. The method in a process for preparing extruded article by flowing heat plastified stream of an extrudable resinous thermoplastic material through an extrusion orifice comprises separating the stream of an extrudable resinous thermoplastic material into a central core stream and at least one boundary stream on the outside of the core stream.

While maintaining the physical separation of the core and boundary streams, crosslinking additive(s) are selectively introduced to the boundary streams. These crosslinking additives comprise at least one component to be crosslinked. They may also comprise crosslinking initiators and optionally other reactive components. These components and initiators are mixed and the thus formed additive is homogenized. The crosslinking additive is then selectively introduced and mixed to the boundary stream prior to the extrusion orifice. The boundary stream and the core stream are further recombined prior to expelling the material out of the extrusion orifice so that the boundary stream forms the

outer layer of the recombined stream, the boundary stream being applied as a relatively thin surface layer having altered crosslinking properties between the core layer and the surfaces of the extrusion orifice. The resinous material of the recombined stream is then expelled through the extrusion orifice so as to
5 prepare an extruded article in which the surface layer of the recombined stream forms the outer layer of the extruded article having altered crosslinking properties.

After the extrusion step the crosslinking of the surface layer of the extruded article is initiated using initiation means, for instance ultraviolet
10 initiation means. The initiation means activate the crosslinking initiators so that crosslinking of the surface layer having these crosslinking additives begins. After the initiation of crosslinking the crosslinking may then continue as conventional thermal crosslinking. This thermal crosslinking may be carried out by thermal bath, infra red radiation or the like method. This thermal
15 crosslinking may also carry out the crosslinking of other parts than the surface layer of the extruded article. In that case the surface layer and the other parts of the extruded article have different crosslinked structures.

Properties of the surface layer of the extruded article may be modified as desired by controlling the initiation means to initiate the
20 crosslinking of the surface layer of the extruded article, by for instance ultraviolet radiation intensity of the ultraviolet initiator. These properties may also be modified controlling the duration and temperature of the thermal crosslinking. Another possibility for modifying the crosslinking properties of the surface layer of the extruded article is to vary the composition of the
25 crosslinking additive to be fed into the boundary stream. This composition of the crosslinking additive may be accomplished by selecting a suitable component to be crosslinked, a suitable crosslinking initiator and a suitable amount and proportion of components and initiators. Suitable initiators are such as peroxide, silane and photo initiators. Other optional functional
30 components may also be added to the crosslinking additive to be homogenized for altering the properties of the material for forming the surface layer of the stream of the extrudable resinous thermoplastic material and/or the surface layer of the extruded article.

The present invention also relates to an extrusion process for
35 preparing an extruded article or articles in which process an heat plastified stream of an extrudable resinous thermoplastic material is arranged to flow

through an extrusion orifice. In the process there is provided a source of heat plastified extrudable synthetic resinous thermoplastic material such as base resin, peroxide or silane material or a combination thereof. In the process this extrudable material is advanced along a first flow path toward the extrusion orifice. Before the extrusion orifice a portion of the material is diverged from the first flow path to a second flow path forming a boundary flow path outside the first flow path.

After diverging of the second flow path from the first flow path, crosslinking additives are introduced and mixed into the diverted flow, that is the second flow path. After introducing and mixing of the additives to the second flow path, the first and second flow paths are recombined so that the second flow path comprising the crosslinking additives forms the surface portion of the recombined flow in the first flow path. This way the crosslinking material is applied as a relatively thin layer to the surface of the resin flowing in the first flow path, prior to passing the material through the extrusion orifice.

This recombined flow having a surface portion comprising altered crosslinking properties is then passed through an extrusion orifice so as to perform the extrusion step. The extruded article thus has a surface layer having altered crosslinking properties because of the crosslinking additive. After the extrusion step the crosslinking of the surface portion of the extruded article provided with the crosslinking additive is initiated. This initiation of the crosslinking of the surface portion of the extruded article is may be performed for instance by ultraviolet radiation. The crosslinking is then continued by conventional thermal crosslinking so as to achieve a desired crosslinking gradient and/or degree of crosslinking of the surface portion of the article and/or the other parts of the article.

Before applying the crosslinking additive to the diverted flow it is homogenized since it may contain several components including components to be crosslinked, crosslinking initiators and/or other optional reactive components.

An embodiment of an apparatus for performing the method and procedure of the present invention is shown schematically in figure 1. The apparatus according to the present invention for preparing an extruded article by arranging a heat plastified stream of extrudable resinous thermoplastic material to flow through an extrusion orifice 10 comprises a source of extrudable material 1, such as a base resin, peroxide or silane, a feed hopper

2, driving means 4 and screw means 7 for conveying the extrudable material towards the extrusion orifice 10. Before the extrusion orifice 10 there is provided first means 3 for physically separating the stream into a central core stream and at least one boundary stream outside of the core stream and third means 5 for recombining the streams prior to expelling the material out of the extrusion orifice 10. Between the first means 3 and third means 5 there is arranged introducing means 8 for selectively introducing crosslinking additives to the surface portion of the stream of the stream of extrudable resinous thermoplastic material, that is to the boundary stream. The said boundary streams are applied as a relatively thin surface layer having altered crosslinking properties between the core layer and the surfaces of the extrusion orifice.

By the third means 5 the recombined streams are then passed through the extrusion orifice 10. After extrusion of the article through the extrusion orifice 10 the crosslinking of the surface layer of the extruded article is initiated by initiation means 22. These initiation means 22 may be for example an ultra-violet radiation source. After the initiation of the crosslinking of the surface layer comprising a crosslinking additive, the crosslinking may be continued by thermal crosslinking means 24.

The apparatus according to the embodiment of the invention further comprises a source of a component to be crosslinked 16, a source of crosslinking initiator 18 and a source of other optional components 20 which together form the crosslinking additive. These components and initiators are then supplied to homogenizing means 14 for homogenizing the crosslinking additive before introducing it to the surface portion of the stream of extrudable resinous thermoplastic material. The homogenizing means 14 may be a mixer or the like apparatus for homogenizing the additive consisting of component to be crosslinked and crosslinking initiator and/or other optional reactive components. In addition there is provided a source of additive 12 for supplying the homogenized additive to the introducing means 8 and further to the surface portion of the stream of the stream of the stream of extrudable resinous thermoplastic material.

The apparatus may also comprise a source of an extrudable material, such as a base resin, peroxide or silane, a feed hopper, driving means and screw means for conveying the extrudable material towards the extrusion orifice. Before the extrusion orifice there is arranged introducing

means for selectively introducing crosslinking additives to the surface portion of the stream of the stream of extrudable resinous thermoplastic material. After extrusion of the article through the extrusion orifice the crosslinking of the surface layer of the extruded article is initiated by initiation means. These initiation means may be for example an ultra-violet radiation source. After the initiation of crosslinking of the surface layer comprising crosslinking additive, the crosslinking may be continued by thermal crosslinking means. In addition this embodiment of the apparatus may also comprise homogenizing means 14 for homogenizing the crosslinking additive before introducing it to the surface portion of the stream of the stream of extrudable resinous thermoplastic material.

It will be obvious to a person skilled in the art that, as technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims. For example the initiation means 22 may be selected according to the initiator supplied to the crosslinking additive. When using photo initiator the initiation means 22 may be a ultra violet radiation source for initiating the crosslinking of the surface layer provided with photo initiators.

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Claims

1. A method in a process for preparing extruded article(s) by arranging a heat plastified stream of extrudable resinous thermoplastic crosslinking material to flow through an extrusion orifice, characterized in that the method comprises the following step,
- 5 - introducing modified crosslinking additive(s) to the surface portion of the stream of extrudable resinous thermoplastic crosslinking material before the extrusion step for altering the crosslinking properties of the surface portion of the extrudable material.
- 10 2. A method according to claim 1, characterized in that the method further comprises initiating after the extrusion step the crosslinking of the surface portion of the extruded article(s) provided with the modified crosslinking additive(s).
3. A method according to claim 1 or 2, characterized in that
- 15 it further comprises the following step carried out before introducing modified crosslinking additive(s) to the surface portion of the stream of extrudable resinous thermoplastic crosslinking material:
- homogenizing the modified crosslinking additive(s) comprising at least component(s) to be crosslinked and/or crosslinking initiator(s).
- 20 4. A method according to claim 3, characterized in that crosslinking initiator is selected from a group consisting peroxide(s), silane(s) and photo initiator(s).
5. A method according to claim 3 or 4, characterized in that also other functional components are added to the modified crosslinking additive to be homogenized for altering the properties of the material forming
- 25 the surface layer of stream of extrudable resinous thermoplastic crosslinking material.
6. A method according to any one of claims 1 - 5, characterized in that it further comprises a step of selecting the additive
- 30 and the amount of additive.
7. A method according to any one of claims 1 - 6, characterized in that when photo initiators are used the initiation of the crosslinking of the surface portion of the extruded article is performed by ultra-violet radiation.
- 35 8. A method according to any one of claims 1 - 7, characterized in that it further comprises the following step carried out

after the initiation of the crosslinking of the surface layer of the extruded article:

- continuing the crosslinking of the surface layer of the extruded article or the whole article by thermal crosslinking by using predetermined temperature and for a predetermined time for forming a desired crosslinked structure for the surface layer of the extruded article and/or the whole article.

9. A method according to claim 1, characterized in that step of introducing modified crosslinking additive(s) to the surface portion of the stream of extrudable resinous thermoplastic crosslinking material before the extrusion step comprises the steps:

- physically separating the stream of extrudable resinous thermoplastic crosslinking material into a central core stream and at least one boundary stream on the outside of the core stream;
- while maintaining physical separation of the core and boundary stream, selectively introducing modified crosslinking additive(s) to the boundary streams; and thereafter
- recombining the streams prior to expelling the material out of the extrusion orifice, said boundary streams being applied as a relatively thin surface layer having altered crosslinking properties between the core layer and the surfaces of the extrusion orifice.

10. An extrusion process for preparing extruded article(s) in which process heat plastified stream of extrudable resinous thermoplastic crosslinking material is arranged to flow through an extrusion orifice, the process comprising the following steps;

- providing a source of heat plastified extrudable synthetic resinous thermoplastic crosslinking material;
- advancing the material along a first flow path toward the extrusion orifice,

characterized by the steps:

- introducing modified crosslinking additive(s) to the surface portion of the material flow before the extrusion step for altering the crosslinking properties of the surface portion of the extrudable material.

11. An extrusion process according to claim 10, characterized by the further step of initiating after the extrusion step the crosslinking of the surface portion of the extruded article(s) provided with the modified crosslinking additive(s).

12. An extrusion process according to claim 10 or 11,

characterized by the further steps:

- diverting a portion of material from the first flow path to a second flow path and introducing modified crosslinking additive(s) to the diverted flow; and

5 - applying the modified crosslinking material as a relatively thin layer to the surface of the resin flowing in the first flow path prior to passing the material through the extrusion orifice.

13. An extrusion process according to any one of claims 11 - 12, characterized by the further step:

10 - homogenizing the modified crosslinking additive(s) comprising at least a component(s) to be crosslinked and/or crosslinking initiator(s) before introducing it to the surface portion of the material flow.

14. An extrusion process according to any one of claims 11 - 13, characterized by the further step:

15 - continuing the crosslinking of the surface portion of the extruded article or the whole article with a thermal crosslinking.

15. An apparatus for preparing extruded article(s) by flowing a heat plastified stream of extrudable resinous thermoplastic crosslinking material through an extrusion orifice, characterized in that apparatus comprises before the extrusion orifice (10) introducing means (8) for introducing modified crosslinking additive(s) to the surface portion of the stream of the stream of extrudable resinous thermoplastic crosslinking material for altering the crosslinking properties of the surface portion of the extrudable material.

25 16. An apparatus according to claim 15, characterized in that it further comprises initiation means (22) for initiating the crosslinking of the surface layer of the extruded article(s) after the extrusion orifice (10).

17. An apparatus according to claim 15 or 16, characterized in that initiation means (22) is ultraviolet radiation source.

30 18. An apparatus according to any one of claims 15 - 17, characterized in that it further comprises homogenizing means (14) for homogenizing the modified crosslinking additive(s) before introducing it to the surface portion of the stream of the stream of extrudable resinous thermoplastic material.

35 19. An apparatus according to any one of claims 16 - 18, characterized in that it further comprises thermal crosslinking means

(24) continuing the crosslinking of the surface layer of the extruded article or the whole article after the initiation of the crosslinking with the initiation means (22).

20. An apparatus according to any one of claims 16 - 19,
5 c h a r a c t e r i z e d in that the apparatus further comprises first means (3) for physically separating the stream into a central core stream and at least one boundary stream on the outside of the core stream, that the introducing means (8) is arranged to introduce modified crosslinking additive(s) to the boundary streams while the physical separation of the core and boundary streams is
10 maintained and that the apparatus further comprises third means (5) for recombining the streams prior expelling the material out of the extrusion orifice, said boundary streams being applied as a relatively thin surface layer having altered crosslinking properties between the core layer and the surfaces of the extrusion orifice.

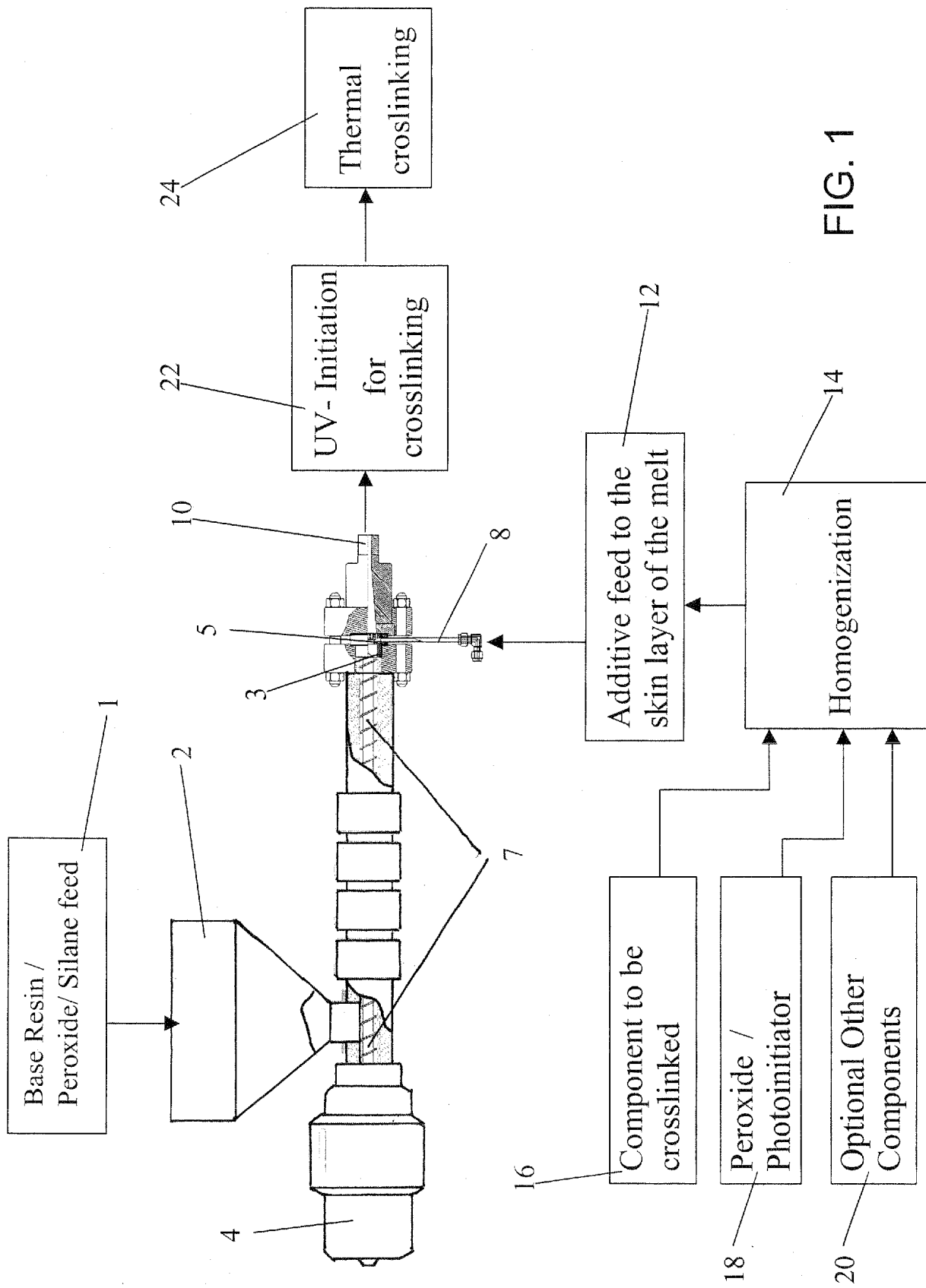


FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER See extra sheet According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC8: B29C Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched FI, SE, DK, NO Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0482257 A1 (BICC PLC) 29 April 1992 (29.04.1992) abstract; column 1, lines 40 - 55	1, 2, 4, 5, 9, 10, 11, 12, 15, 16, 20
Y		1, 7, 10, 15, 17
X	DE 2719905 A1 (BASF AG) 16 November 1978 (16.11.1978) claim 1, characterizing part; page 4, paragraph 2	1, 10, 15
Y		1, 7, 10, 15, 17
Y	US 4198363 A (NOEL GERARD) 15 April 1980 (15.04.1980), column 2, lines 8 - 18; column 3, lines 14 - 21; column 6, lines 7 - 15	1, 10, 15
Y	EP 0490854 A2 (INST POLYMERUTVECKLING AB) 17 June 1992 (17.06.1992), abstract; claim 1	7, 17
Y	GB 907501 A (WESTERN PLASTICS CORP) 03 October 1962 (03.10.1962), whole document	7, 17
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 16 January 2006 (16.01.2006)		Date of mailing of the international search report 17 February 2006 (17.02.2006)
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2005/050408

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
EP 0482257 A1	29/04/1992	US 5075061 A	24/12/1991
		AU 6568290 A	04/06/1992
		AU 642172B B2	14/10/1993
		GB 2235458 A	06/03/1991
		CA 2018878 A1	15/12/1990
.....			
DE 2719905 A1	16/11/1978	None	
.....			
US 4198363 A	15/04/1980	ES 451511 A1	01/10/1977
		CH 593787 A5	15/12/1977
		PL 111100B B1	30/08/1980
		NZ 180094 A	20/06/1978
		ES 445490 A1	01/06/1977
		YU 43576 A1	27/04/1983
		NL 7601815 A	27/08/1976
		LU 74409 A1	13/08/1976
		DD 123578 A5	05/01/1977
		BR 7601117 A	14/09/1976
		DK 73476 A	26/08/1976
		CS 203152 B2	27/02/1981
		NO 760555 A	26/08/1976
		FI 760413 A	26/08/1976
		AU 1125576 A	25/08/1977
		SE 7601843 A	26/08/1976
		SE 421885 B	08/02/1982
		CA 1067662 A1	11/12/1979
		US 4087222 A	02/05/1978
		FR 2302189 A1	24/09/1976
		ZA 7600910 A	26/01/1977
		JP 51107364 A	22/09/1976
		IL 49042 A	29/09/1978
		BE 838628 A1	16/06/1976
AT 109576 A	15/03/1980		
AT 359272B B	27/10/1980		
GB 1531817 A	08/11/1978		
IT 1055036 B	21/12/1981		
DE 2507979 A1	29/07/1976		
.....			

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2005/050408

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
EP 0490854 A2	17/06/1992	CN 1062149 A	24/06/1992
		DK 490854T T3	17/03/1997
		DE 69122362T T2	15/05/1997
		DE 69122362D D1	31/10/1996
		SE 9003919 A	08/06/1992
		SE 500503 C2	04/07/1994
.....			
GB 907501 A	03/10/1962	None	
.....			

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

B29C 47/00 (2006.01)**B29C 47/20** (2006.01)**B29C 47/70** (2006.01)**B29C 35/02** (2006.01)**C08J 3/24** (2006.01)