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(54) Title: FOLDABLE DUCT COMPRISING LAMINATED FOIL ON INSIDE AND OUTSIDE

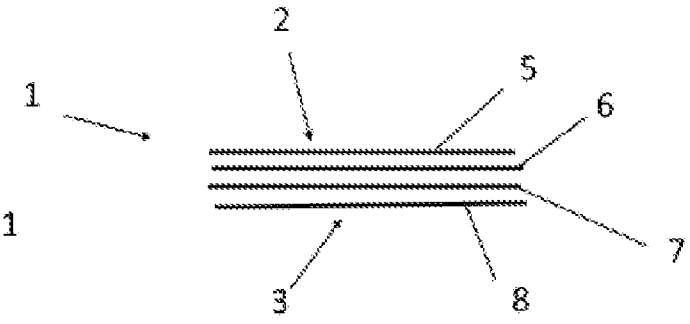


FIG. 1

(57) Abstract: The present invention concerns a foldable duct (4) made of glass or stone fibres and binder agent having a foil (1) laminated thereon, on the inside and outside of the duct, wherein the foil (1) at least comprises: -an outer layer of aluminium (5), -an intermediate layer of a thermoplastic polymer (6) having a lower melt point than polyethylene, positioned closest to the outer layer of aluminium (5), -an intermediate layer of polyethylene (7), positioned between the intermediate layer of thermoplastic polymer (6), and -an inner layer of a thermoplastic polymer (8) having a lower melt point than polyethylene.

Foldable duct comprising laminated foil on inside and outside

Technical field

The present invention concerns foldable duct having a foil laminated thereon. The foil is especially suitable for laminating ducts, preferably made up of mineral fibres, such as glass or stone fibres, and binder agent. The ducts may be suitable for use in ventilation systems.

Background art

Previous foils used for laminating ducts are made up by a metal layer, usually aluminium, and a polymer layer, usually polyethylene (PE). These kind of layers have low mechanical properties, i.e. break easily when bent or stretched or exposed to pressures, especially concentrated pressures.

Summary of the invention

An aim of the present invention is to provide a duct having a foil that has better mechanical properties than previously known foils. Another aim is to provide a fire protecting foil. Especially, an aim is to provide a foldable foil which does not rupture due to folding and stretching. Thus an aim is to provide a foil with some flexibility.

A solution according to the present invention is to add a layer of a polyethylene, such as polyethylene terephthalate (PET), to the previously known foils of an outer aluminium layer and an inner layer of polyethylene (PE). Although, this inner layer may be any thermoplastic polymer having a melting point below the polyethylene. This layer of polyethylene such as PET brings a flexibility to the foil at the same time as it does not break easily when it is exposed to mechanical forces, such as bending, stretching and pressure. Thus the foil will withstand folding and concentrated pressures. Withstanding folding is

important during transport of ducts and building of duct systems. Withstanding pressure is important not to puncture the foil. The foil needs to be intact in order to provide fire protection.

It is a special aim to provide a foil that can be folded and unfolded repeatedly without breaking. The development of a duct with clearly defined folding lines combined with zones that will not be folded put these special requirements on the foil. When folded the duct will be folded again and again in the same place. The high requirements on fire resistance, unburnability, steam resistance and air tightness all after repeated folding have pushed forward this product.

Preferably an additional layer of a thermoplastic polymer having a melting point below polyethylene such as PET is intermediate the outer aluminium layer and the layer of PET in order to adhere the aluminium layer to the PET layer. The adhesion arises when the polymer is melted. Thus the intermediate layer of a thermoplastic polymer having a melting point below PET functions as an adhesive. The inner layer of thermoplastic polymer having a melting point below PET also functions as an adhesive between the PET layer and the duct or the outer layer of aluminium, when wrapped around or inside a duct. The foil is heat sealable. The duct is preferably made up of mineral fibres, such as glass fibres, and binder agent and preferably used in ventilation systems.

According to another embodiment the foil further comprises an intermediate layer of glass fibres, which further enhances the mechanical properties, especially the withstanding of pressure. Preferably the intermediate layer of glass fibres is present in between the intermediate layer of polyethylene such as PET and the inner layer of thermoplastic polymer having a

melting point below polyethylene such as PET. Preferably the thermoplastic polymer having a melting point below polyethylene such as PET is polyethylene (PE).

An aim is to fulfil a specific fire protection classification called A2s1d0. This means that the energy content of the product may not exceed 3 MJ/kg (A2); the smoke exhaust must be low (s1); and no dripping of melted product is allowed during fire (d0). This means that the foil must fulfil these requirements. In such an embodiment the inner layer of PE has a weight of 20-30 g/m^2, preferably 22-28 g/m^2 and/or the intermediate layer of PE has a weight of 10-20 g/m^2, preferably 12-18 g/m^2. The foil may have a total weight of 75-105 g/m^2, preferably 85-95 g/m^2 and a total thickness of 40-60 µm, preferably 45-55 µm.

According to a further aspect of the present invention the foil is used on the inside and/or on the outside of a duct, which is foldable. Preferably the foil is present at least on the inside. The foil is laminated by heat sealing. The duct is preferably made up by glass or stone fibres and binder agent.

The foil may have additional layers although it should at least have the layers according to the claims. For example it is possible to add a coating of lacquer on top of the aluminium layer.

Short description of the drawings

The present invention will now be described in detail under reference to the accompanying drawings, in which

Fig. 1 shows a schematic cross sectional view of layers of a first embodiment of the present inventive foil.

Fig. 2 shows a schematic cross sectional view of layers of a second embodiment of the present inventive foil.

Fig. 3 shows a cross sectional view of a duct with a foil having an overlapping edge.

Detailed description of embodiments of the invention

In Fig. 1 a first embodiment of a foil 1 according to the present invention is shown. The layers forming the foil will be described from the outside 2, from the top in the figure, to the inside 3 facing a duct 4, for example.

An outer layer 5 is made of aluminium. Underneath an intermediate layer 6 of a thermoplastic polymer having a melting point below polyethylene for example polyethylene terephthalate (PET), such as polyethylene (PE), is provided, which unite the outer layer 5 with an intermediate layer 7 of polyethylene such as polyethylene terephthalate (PET). This is made by means of heating the foil 1 up to the melting point of polyethylene PE, which normally is between 80-100°C. The melting point of aluminium and polyethylene such as PET is higher than PE.

Underneath the intermediate layer 7 of polyethylene such as PET is an inner layer 8 provided made of a thermoplastic polymer having a melting point below polyethylene for example PET, such as PE. The inner layer 8 of PE is also meltable in order to adhere to for example a duct, preferably a duct made of glass fibres and binder agent, or the outer layer 5 of aluminium when an overlapping edge 10 is to be fastened when applied to a duct. See Fig. 3.

According to a second embodiment of the foil according to the present invention a layer 9 of glass fibres is provided between the intermediate layer 6 of a thermoplastic polymer having a melting point below polyethylene for example PET, such as PE, and the intermediate layer 7 of polyethylene such as PET, or between the intermediate layer 7 of polyethylene such as PET

and the inner layer 8 of a thermoplastic polymer having a melting point below PET, such as PE, which is shown in Fig. 2.

Preferably the layer 9 of glass fibres is arranged like a net. According to a suggested embodiment the net is a 5x10 glass fibre scrim. The layer 9 of glass fibres are adhered to the layer 7 of polyethylene such as PET by means of the inner layer 8 of for example PE when it is melted.

It is also possible to add an outer layer of lacquer to the aluminium layer to avoid oxidation on the aluminium surface.

The foil may have a total weight of 75-105 g/m^2, preferably 85-95 g/m^2 and a total thickness of 40-60 µm, preferably 45-55 µm.

CLAIMS

1. A foldable duct (4) made of glass or stone fibres and binder agent having a foil (1) laminated thereon, on the inside and outside of the duct, wherein the foil (1) at least comprises:
   - an outer layer of aluminium (5),
   - an intermediate layer of a thermoplastic polymer (6) having a lower melt point than polyethylene, positioned closest to the outer layer of aluminium (5),
   - an intermediate layer of polyethylene (7), positioned between the intermediate layer of thermoplastic polymer (6), and
   - an inner layer of a thermoplastic polymer (8) having a lower melt point than polyethylene.
2. The foldable duct according to claim 1, wherein the foil further comprises an intermediate layer of glass fibres.
3. The foldable duct according to claim 2, wherein the intermediate layer of glass fibres is present in between the intermediate layer of polyethylene and the inner layer of a thermoplastic polymer having a lower melt point than polyethylene.
4. The foldable duct according to claim 2 or 3, wherein the intermediate layer of glass fibres is in the form of a net.
5. The foldable duct according to any of the previous claims, wherein the polyethylene is polyethylene terephthalate (PET).
6. The foldable duct according to any of the previous claims, wherein the thermoplastic polymer having a lower melt point than polyethylene is polyethylene (PE).

7. The foldable duct according to claim 6, wherein the inner layer of PE has a weight of 20-30 g/m^2, preferably 22-28 g/m^2.

8. The foldable duct according to claim 6, wherein the intermediate layer of PE has a weight of 10-20 g/m^2, preferably 12-18 g/m^2.

9. The foldable duct according to any one of the previous claims, wherein the total weight is 75-105 g/m^2, preferably 85-95 g/m^2.

10. The foldable according to any one of the previous claims, wherein the total thickness is 40-60 µm, preferably 45-55 µm.

- - -

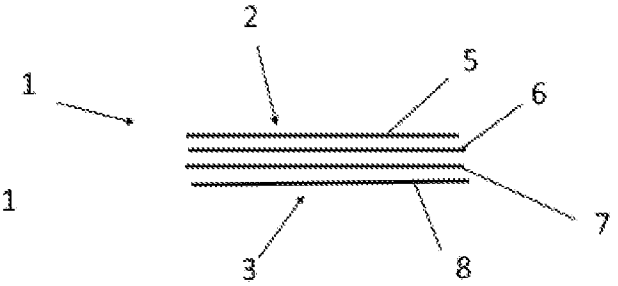


FIG. 1

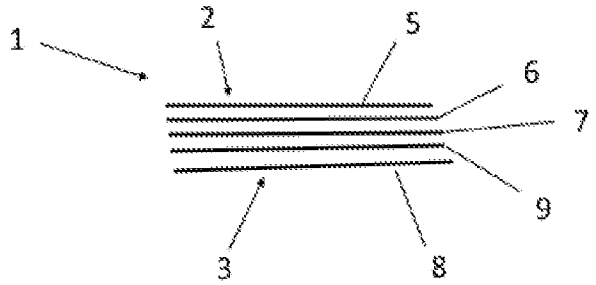


FIG. 2

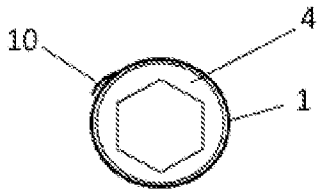


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050172

A. CLASSIFICATION OF SUBJECT MATTER

IPC: 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)

IPC: B32B, F16L, F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20070178283 A1 (TIGERFELDT STAFFAN), 2 August 2007 (2007-08-02); paragraphs [0039]-[0047]; figure 1 --	1-10
A	US 20100319839 A1 (SHUMATE MONROE WILLIAM), 23 December 2010 (2010-12-23); paragraphs [0039], [0044] --	1-10
A	US 20110155275 A1 (WALLIN PETER ET AL), 30 June 2011 (2011-06-30); paragraphs [0019], [0044], [0050]-[0053]; claim 1 --	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"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	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

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PCT/SE2016/050172

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2015004503 A (TAKENAKA KOMUTEN CO ET AL), 8 January 2015 (2015-01-08); figures 1,7; Machine translation: claim 1; [0014]-[0016]	1-10
	--	
A	JP 2013113454 A (KURIMOTO LTD), 10 June 2013 (2013-06-10); figures 1a-1b; Machine translation: claim 1; [0018]-[0020]	1-10
	--	
A	US 3212529 A (ULLMAN WILLIAM L ET AL), 19 October 1965 (1965-10-19); column 2, line 45 - line 56; figures 1-3; claim 1	1-10
	--	
A	US 20140290785 A1 (WALLIN PETER ET AL), 2 October 2014 (2014-10-02); paragraphs [0004]-[0006], [0052]-[0060]; figures 6-7; claim 1	1-10
	--	
A	US 20140227468 A1 (WALLIN PETER ET AL), 14 August 2014 (2014-08-14); paragraph [0027]; figures 3-4; claim 1	1-10
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F24F 13/02 (2006.01)

US	20070178283	A1	02/08/2007	EP	1744875	A2	24/01/2007
				SE	527024	C2	06/12/2005
				SE	0401043	L	24/10/2005
				US	9023444	B2	05/05/2015
				WO	2005105430	A3	02/03/2006
US	20100319839	A1	23/12/2010	DE	102009004970	A1	15/07/2010
				EP	2208614	B1	12/03/2014
				US	20100178822	A1	15/07/2010
US	20110155275	A1	30/06/2011	EP	2307814	A1	13/04/2011
				WO	2009145698	A1	03/12/2009
JP	2015004503	A	08/01/2015	NONE			
JP	2013113454	A	10/06/2013	JP	5674204	B2	25/02/2015
US	3212529	A	19/10/1965	GB	978139	A	16/12/1964
				LU	42833	A1	08/02/1963
				SE	307707	B	13/01/1969
US	20140290785	A1	02/10/2014	EP	2758722	A4	15/04/2015
				SE	1100695	A1	23/03/2013
				SE	536113	C2	14/05/2013
				WO	2013043100	A1	28/03/2013
US	20140227468	A1	14/08/2014	EP	2773910	A4	22/04/2015
				SE	1100696	A1	23/03/2013
				SE	536305	C2	13/08/2013
				WO	2013043101	A1	28/03/2013