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HEAT SHRINKABLE SLEEVE FOR CONNECTING A PIPE AND CABLE**BACKGROUND OF THE INVENTION**05 **Field of the Invention**

The present invention relates to a heat shrinkable sleeve for connecting a pipe and cable, and more particularly, to the heat shrinkable sleeve comprising heat shrinkable sheet materials, a woven fabric made of synthetic fibers having a crack resistance, such as polyamides, polyesters, polypropylenes etc. and interposed between the heat shrinkable sheet materials, and high molecular polymers melt-attached to both faces of the sheet materials. According to the present invention, the costs of equipment and production may be reduced owing to a simplified manufacturing process of the heat shrinkable sleeve.

Description of the Prior Art

Generally, the connecting sleeves are wrapped around the connecting portions of oil pipelines, pipes for transporting chemical materials, gas pipes or all sorts of cables so as to protect the connecting portions against mechanical abrasion and corrosion due to inflow of moisture, or breakage resulted from invasion of insects and animals, and contact with chemical materials or all kinds of oils and the like.

25 Conventional connecting sleeves are made from netlike fabrics cross-linked heat shrinkable fibers with reinforcing fibers and basic materials of polymers adhered to both faces of these fabrics.

In connection with the manufacturing processes of such sleeves, however, a number of disadvantages are included in that these

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☒ Drawing(s)	: paged <u>11</u> to paged <u>21</u>	
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processes require the use of roving and crosslinking devices and reinforcing fibers as reinforcing materials and are complicated due to forming of netlike fabrics, thereby polluting working environment and increasing the costs of equipment and production.

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SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a heat shrinkable sleeve formed by crosslinking heat shrinkable sheet materials with organoperoxides, silanes or the like, elongating cross-linked sheet materials and inserting a woven fabric of synthetic fibers, such as polyamides, polyesters, polypropylenes and the like, between sheet materials.

15 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more readily apparent from the following description of preferred embodiments thereof shown, by way of example only, in the accompanying drawings in which:

20 ~~Fig.1 is a perspective view, partly in section, illustrating the first embodiment of a heat shrinkable sleeve of the present invention.~~

Fig.2 is a sectional view illustrating the second embodiment of the heat shrinkable sleeve of the present invention.

25 Fig.3 is a sectional view illustrating the third embodiment of the heat shrinkable sleeve of the present invention.

Fig.4 is a sectional view illustrating the fourth embodiment of the heat shrinkable sleeve of the present invention.

Fig.5 is a sectional view illustrating the fifth embodiment of the heat shrinkable sleeve of the present invention.



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Fig.6 is a diagrammatic illustration of shrunk state of a heat shrinkable sheet material of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Referring now to the drawings, and particularly to Fig.1, there is shown a heat shrinkable sleeve 1 comprising heat shrinkable sheet materials 3 capable of shrinkage in a certain direction by the application of heat, a woven fabric 4 of synthetic fibers interposed
10 between the sheet materials 3, and high molecular polymers 2 melt-adhered to both faces of the sheet materials 3. In this embodiment, when the heat is applied to the sheet materials 3 which are formed by cross-linking polymers with organoperoxides and silanes etc. and elongating them, the high molecular polymers 2 melt, the
15 sheet materials 3 shrink and therefore the woven fabric 4 of synthetic fibers is shrunk closely and adhered fixedly between the sheet materials 3. The heat shrinkable sleeve 1 allows connecting portions to be sealed closely and to be protected from the outside environment with an improved break resistance thereof.

~~20~~ Referring now to Fig.2, there is illustrated a heat shrinkable sleeve 1 according to the second embodiment of the present invention, which comprises a layer of a heat shrinkable sheet material 3, a woven fabric 4 positioned only one side of the sheet material 3 and made of synthetic fibers, e.g., polyamides, polyesters, polypropylenes or the
25 like, and high molecular polymers 2 melt-adhered to both faces of the sheet material 3.

Fig.3 shows a heat shrinkable sleeve 1 constructed in accordance with the third embodiment of the invention. The heat shrinkable sleeve comprises one layer of high molecular polymer 2, a woven fabric



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4 of synthetic fibers, which is positioned at one side of the polymer 2, heat shrinkable sheet materials 3 attached to both faces of the polymer 2 and the other layers of high molecular polymers 2 attached to both of the sheet materials 3.

05 Fig.4 illustrates a heat shrinkable sleeve 1 constructed according to the fourth embodiment of this invention. The heat shrinkable sleeve 1 consists of a woven fabric 4, the first layers of high molecular polymers 2 adhered to both faces of the woven fabric 4, heat shrinkable sheet materials 3 attached to both of the first high
10 molecular polymers 2, and the second layers of high molecular polymers 2 attached to both of the sheet materials 3.

Referring now to Fig.5, there is shown a heat shrinkable sleeve 1, which comprises a layer of heat shrinkable sheet material 3, woven fabrics 4 attached to both faces of the sheet material 3 and high
15 molecular polymers 2 adhered to both of the woven fabrics 4. The woven fabric 4 may have various weave configurations, for example, woof weave including plain weaves, rubber weave and pulp weave, and warp weave including tricot and double cloth.

Preferably, the heat shrinkable sheet materials 3 consist of
20 cross-linked high molecular polymers 2, and the woven fabrics 4 are made of monofilaments, multifilaments and staple yarns and have flexibility such that they do not impede shrinkage when the sheet materials 3 are shrunk by the application of heat to them.

In addition, the materials of these woven fabrics 4 may generally
25 include polyamides, e.g., nylon 6, nylon 11, nylon 12, nylon 66, nylon 610 and nylon 612, polypropylenes, e.g., polypropylene, polypropylene impact copolymer, polypropylene random copolymer, polypropylene ethylene copolymer or the like, and polyesters, e.g., polybutylene terephthalate, polyethylene terephthalate and the like.



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On the other hand, the high molecular polymers 2 and woven fabrics 4 preferably comprise materials which do not shrink after they have been subjected to heat and do not prevent the shrinkage of the heat shrinkable sheet materials 3 during heat shrinkage.

05 In order to ensure a perfect-sealing state and an improved break resistance of the connecting portions of pipes and various types of cables, the preferred sleeve having dimensional stability may be manufactured by using the laminated heat shrinkable sheet materials 3 and woven fabrics 4 as needed, especially applying heat activated
10 adhesives, sealing materials or thermopaints and using the woven fabrics 4 which contain reinforcing materials, such as fiber glass or the like.

On the other hand, the heat shrinkable sleeve is shrunk from the shrinkage of the heat shrinkable sheet materials and such shrinkage
15 operation is shown in Fig.6.

Breaking strength, i.e., sleeve state after shrinkage, break resistance and notch test were performed on the heat shrinkable sleeve of the present invention. According to the embodiment of Fig.3, under the conditions of a temperature of 180°C, a pressure of 2kg/cm² and a
20 heating period of 5 minutes, the heat shrinkable sleeve was prepared by elongating the heat shrinkable sheet materials 3 to have elongation of about 500%, interposing the woven fabric 4 of nylon 6(20/10) between the sheet materials 3, and attaching the high molecular polymers 2 to both layers of the sheet materials 3.

25 The test results are represented in the following table.

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Table

	Test items	Unit	Test condition	result
05	Breaking strength (articles after shrinkage)	kg	Tensile speed: 200mm/min	500
10	Break resistance against damage			
	Notch test		175°C, 15 minutes	

... Likewise, as a result of testing breaking strength and break
15 resistance against damage being performed on the shrinkable sleeve of
Fig.2, Fig.4 and Fig.5, using polyesters and polypropylenes as the
materials of the woven fabrics, there were shown the breaking strength
of 300% or more and the good break resistance.

According to this invention, the manufacturing processes of the
20 sleeves may be simplified and therefore the costs of equipment and
production thereof may be reduced since it is not necessary to use
netlike fabrics cross-linked heat shrinkable fibers with reinforcing
fibers as is well known in the art, wherein the manufacturing
processes mainly consist of the following steps: interposing the woven
25 fabrics, such as polyamides, polyesters, polypropylenes or the like,
between the sheet materials to provide break resistance, and attaching
the high molecular polymers to the woven fabrics by melting.

It is to be understood that the foregoing detailed description of
the preferred embodiments of the present invention is for purposes of

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illustration only, and that many variations may be made in the invention without departing from the spirit thereof.

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WHAT IS CLAIMED IS:

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1. A heat shrinkable sleeve for connecting a pipe and cable, comprising a double heat shrinkable sheet material capable of shrinkage in a certain direction by the application of heat, a woven fabric of synthetic fibers, such as polyamides, polypropylenes or polyesters, interposed between said sheet material, and high molecular polymers melt-adhered to both faces of said sheet material.
2. The heat shrinkable sleeve of claim 1, wherein the woven fabric takes the form of woof weave, such as plain weave, rubber weave or rubber weave and warp weave, such as tricot and double cloth.
3. The heat shrinkable sleeve of claim 1, wherein the woven fabric have flexibility such that it does not impede shrinkage of the heat shrinkable sheet materials during heat shrinkage.
4. The heat shrinkable sleeve of claim 1 or claim 3, wherein the woven fabric is made of monofilaments, multifilaments and staple yarns.
5. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polyamides, such as nylon 6, nylon 11, nylon 12, nylon 66, nylon 610 and nylon 612.
6. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polypropylenes, such as polypropylene, polypropylene impact copolymer, polypropylene random copolymer and polypropylene ethylene copolymer.



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7. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polyesters, such as polybutylene terephthalate and polyethylene terephthalate.

05 8. The heat shrinkable sleeve of claim 1, wherein the heat shrinkable sheet material consists of the cross-linked high molecular polymers.

9. The heat shrinkable sleeve of claim 1 or claim 3, wherein the
10 high molecular polymers and woven fabric comprise materials, which do not shrink after they have been subjected to heat and do not prevent the shrinkage of the heat shrinkable sheet material.

10. The heat shrinkable sleeve of claim 1, which sleeve is
15 applied with heat activated adhesives and sealing materials.

11. The heat shrinkable sleeve of claim 1, which sleeve is applied with thermopaints and is covered with a sheet for preventing the heat shrinkable sheet material from scratching.

20 12. The heat shrinkable sleeve of claim 1, which sleeve comprises a layer of a heat shrinkable sheet material, a woven fabric positioned one side of the sheet material, and high molecular polymers melt-adhered to both faces of the sheet material.

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13. The heat shrinkable sleeve of claim 1, which sleeve comprises a layer of high molecular polymer, a woven fabric attached to one side of the polymer, heat shrinkable sheet materials adhered to both faces of the polymer and the other layers of high molecular polymers



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attached to both of the sheet materials.



14. The heat shrinkable sleeve of claim 1, which sleeve consists of a woven fabric, the first layers of high molecular polymers adhered to both faces of the woven fabric, heat shrinkable sheet materials attached to both of the first high molecular polymers, and the second layers of high molecular polymers attached to both of the sheet materials.

15. The heat shrinkable sleeve of claim 1, which sleeve consists of a layer of heat shrinkable sheet material, woven fabrics attached to both faces of the sheet material and high molecular polymers adhered to both of the woven fabrics.

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ABSTRACT

HEAT SHRINKABLE SLEEVE FOR CONNECTING A PIPE AND CABLE

The present invention relates to a heat shrinkable sleeve for connecting a pipe and cable, which is manufactured by cross-linking heat shrinkable sheet materials with organoperoxides, silanes or the like, elongating the cross-linked sheet materials and inserting woven fabrics, or synthetic fibres e.g. polyamides, polyesters, polypropylenes and the like, between the sheet materials, thereby reducing the costs of equipment and production due to simplified manufacturing processes and providing high breaking strength and providing good break resistance.

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FIG. 1

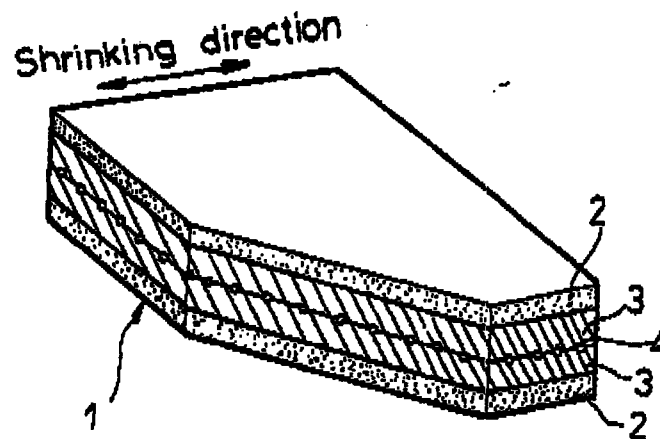


FIG. 2

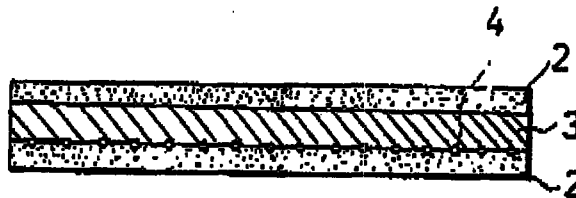


FIG. 3

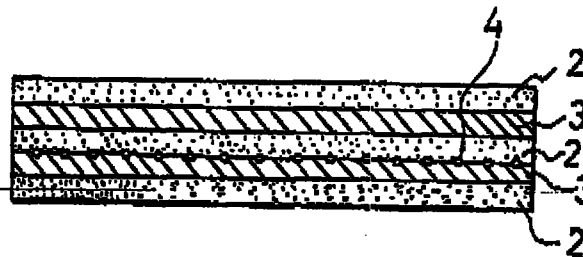
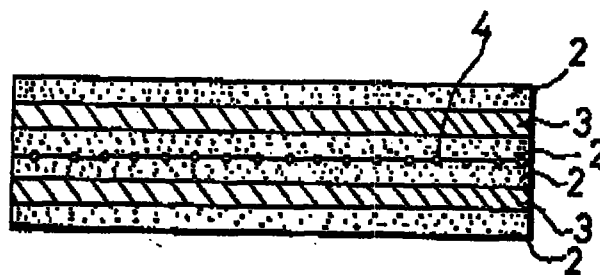


FIG. 4



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FIG. 5

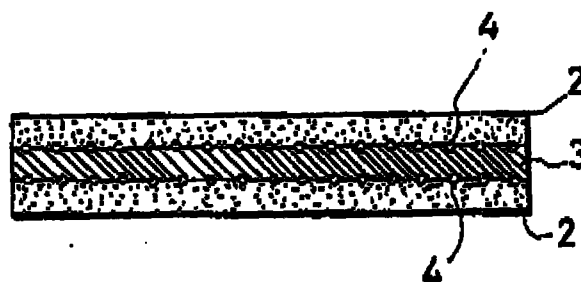
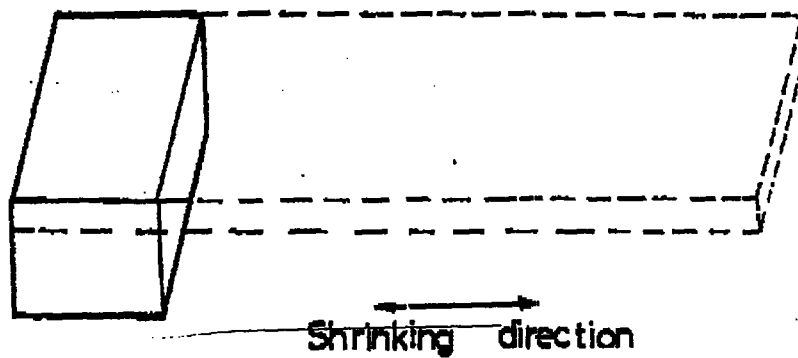
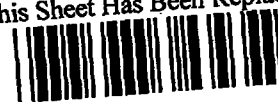


FIG. 6



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HEAT SHRINKABLE SLEEVE FOR CONNECTING A PIPE AND CABLE

BACKGROUND OF THE INVENTION

05 Field of the Invention

The present invention relates to a heat shrinkable sleeve for connecting a pipe and cable, and more particularly, to the heat shrinkable sleeve comprising heat shrinkable sheet materials, a woven fabric made of synthetic fibers having a crack resistance, such as
10 polyamides, polyesters, polypropylenes etc. and interposed between the heat shrinkable sheet materials, and high molecular polymers melt-attached to both faces of the sheet materials. According to the present invention, the costs of equipment and production may be
15 shrinkable sleeve.

Description of the Prior Art

Generally, the connecting sleeves are wrapped around the connecting portions of oil pipelines, pipes for transporting chemical
20 materials, gas pipes or all sorts of cables so as to protect the connecting portions against mechanical abrasion and corrosion due to inflow of moisture, or breakage resulted from invasion of insects and animals, and contact with chemical materials or all kinds of oils and the like.

25 Conventional connecting sleeves are made from netlike fabrics cross-linked heat shrinkable fibers with reinforcing fibers and basic materials of polymers adhered to both faces of these fabrics.

In connection with the manufacturing processes of such sleeves, however, a number of disadvantages are included in that these

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processes require the use of roving and crosslinking devices and reinforcing fibers as reinforcing materials and are complicated due to forming of netlike fabrics, thereby polluting working environment and increasing the costs of equipment and production.

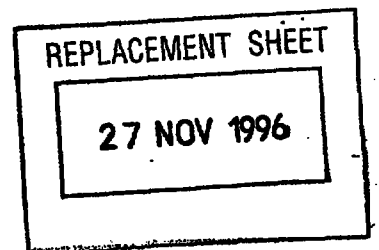
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SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a heat shrinkable sleeve formed by crosslinking heat shrinkable sheet materials with organoperoxides, silanes or the like, elongating cross-linked sheet materials and inserting a woven fabric of synthetic fibers, such as polyamides, polyesters, polypropylenes and the like, between sheet materials.

15

BRIEF DESCRIPTION OF THE DRAWINGS



The invention will become more readily apparent from the following description of preferred embodiments thereof shown, by way of example only, in the accompanying drawings in which:

20

Fig.1 is a perspective view, partly in section, illustrating the first embodiment of a heat shrinkable sleeve of the present invention.

Fig.2 is a sectional view illustrating the second embodiment of the heat shrinkable sleeve of the present invention.

25 Fig.3 is a sectional view illustrating the third embodiment of the heat shrinkable sleeve of the present invention.

Fig.4 is a sectional view illustrating the fourth embodiment of the heat shrinkable sleeve of the present invention.

Fig.5 is a sectional view illustrating the fifth embodiment of the heat shrinkable sleeve of the present invention.

Fig.6 is a diagrammatic illustration of shrunk state of a heat shrinkable sheet material of the present invention.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Referring now to the drawings, and particularly to Fig.1, there is shown a heat shrinkable sleeve 1 comprising heat shrinkable sheet materials 3 capable of shrinkage in a certain direction by the application of heat, a woven fabric 4 of synthetic fibers interposed
10 between the sheet materials 3, and high molecular polymers 2 melt-adhered to both faces of the sheet materials 3. In this embodiment, when the heat is applied to the sheet materials 3 which are formed by cross-linking polymers with organoperoxides and silanes etc. and elongating them, the high molecular polymers 2 melt, the
15 sheet materials 3 shrink and therefore the woven fabric 4 of synthetic fibers is shrunk closely and adhered fixedly between the sheet materials 3. The heat shrinkable sleeve 1 allows connecting portions to be sealed closely and to be protected from the outside environment with an improved break resistance thereof.

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Referring now to Fig.2, ~~there is illustrated~~ a heat shrinkable sleeve 1 according to the second embodiment of the present invention, which comprises a layer of a heat shrinkable sheet material 3, a woven fabric 4 positioned only one side of the sheet material 3 and made of synthetic fibers, e.g., polyamides, polyesters, polypropylenes or the
25 like, and high molecular polymers 2 melt-adhered to both faces of the sheet material 3.

Fig.3 shows a heat shrinkable sleeve 1 constructed in accordance with the third embodiment of the invention. The heat shrinkable sleeve comprises one layer of high molecular polymer 2, a woven fabric

4 of synthetic fibers, which is positioned at one side of the polymer 2, heat shrinkable sheet materials 3 attached to both faces of the polymer 2 and the other layers of high molecular polymers 2 attached to both of the sheet materials 3.

05 Fig.4 illustrates a heat shrinkable sleeve 1 constructed according to the fourth embodiment of this invention. The heat shrinkable sleeve 1 consists of a woven fabric 4, the first layers of high molecular polymers 2 adhered to both faces of the woven fabric 4, heat shrinkable sheet materials 3 attached to both of the first high
10 molecular polymers 2, and the second layers of high molecular polymers 2 attached to both of the sheet materials 3.

Referring now to Fig.5, there is shown a heat shrinkable sleeve 1, which comprises a layer of heat shrinkable sheet material 3, woven fabrics 4 attached to both faces of the sheet material 3 and high
15 molecular polymers 2 adhered to both of the woven fabrics 4. The woven fabric 4 may have various weave configurations, for example, woof weave including plain weaves, rubber weave and pulp weave, and warp weave including tricot and double cloth.

Preferably, the heat shrinkable sheet materials 3 consist of
~~20 cross-linked high molecular polymers 2, and the woven fabrics 4 are~~
made of monofilaments, multifilaments and staple yarns and have flexibility such that they do not impede shrinkage when the sheet materials 3 are shrunk by the application of heat to them.

In addition, the materials of these woven fabrics 4 may generally
25 include polyamides, e.g., nylon 6, nylon 11, nylon 12, nylon 66, nylon 610 and nylon 612, polypropylenes, e.g., polypropylene, polypropylene impact copolymer, polypropylene random copolymer, polypropylene ethylene copolymer or the like, and polyesters, e.g., polybutylene terephthalate, polystyrene terephthalate and the like.

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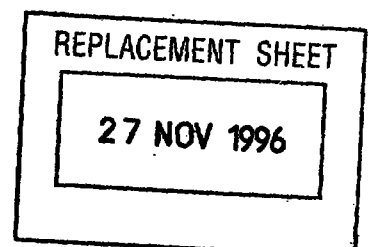
On the other hand, the high molecular polymers 2 and woven fabrics 4 preferably comprise materials which do not shrink after they have been subjected to heat and do not prevent the shrinkage of the heat shrinkable sheet materials 3 during heat shrinkage.

05 In order to ensure a perfect-sealing state and an improved break resistance of the connecting portions of pipes and various types of cables, the preferred sleeve having dimensional stability may be manufactured by using the laminated heat shrinkable sheet materials 3 and woven fabrics 4 as needed, especially applying heat activated
10 adhesives, sealing materials or thermopaints and using the woven fabrics 4 which contain reinforcing materials, such as fiber glass or the like.

On the other hand, the heat shrinkable sleeve is shrunk from the shrinkage of the heat shrinkable sheet materials and such shrinkage
15 operation is shown in Fig.6.

Breaking strength. i.e., sleeve state after shrinkage, break resistance and notch test were performed on the heat shrinkable sleeve of the present invention. According to the embodiment of Fig.3, under the conditions of a temperature of 180°C, a pressure of 2kg/cm² and a
20 heating period ~~of 5 minutes~~, the heat shrinkable sleeve ~~was prepared~~ by elongating the heat shrinkable sheet materials 3 to have elongation of about 500%, interposing the woven fabric 4 of nylon 6(20/10) between the sheet materials 3, and attaching the high molecular polymers 2 to both layers of the sheet materials 3.

25 The test results are represented in the following table.



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Table

	Test items	Unit	Test condition	result
05	Breaking strength (articles after shrinkage)	kg	Tensile speed: 200mm/min	500
10	Break resistance against damage			
	Notch test		175°C, 15 minutes	

Likewise, as a result of testing breaking strength and break
 15 resistance against damage being performed on the shrinkable sleeve of
 Fig.2, Fig.4 and Fig.5, using polyesters and polypropylenes as the
 materials of the woven fabrics, there were shown the breaking strength
 of 300% or more and the good break resistance.

According to this invention, the manufacturing processes of the
 20 ~~sleeves may be simplified and therefore the costs of equipment and~~
 production thereof may be reduced since it is not necessary to use
 netlike fabrics cross-linked heat shrinkable fibers with reinforcing
 fibers as is well known in the art, wherein the manufacturing
 processes mainly consist of the following steps: interposing the woven
 25 fabrics, such as polyamides, polyesters, polypropylenes or the like,
 between the sheet materials to provide break resistance, and attaching
 the high molecular polymers to the woven fabrics by melting.

It is to be understood that the foregoing detailed description of
 the preferred embodiments of the present invention is for purposes of

illustration only, and that many variations may be made in the invention without departing from the spirit thereof.

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WHAT IS CLAIMED IS:

1. A heat shrinkable sleeve for connecting a pipe and cable, comprising a double heat shrinkable sheet material capable of shrinkage in a certain direction by the application of heat, a woven fabric of synthetic fibers, such as polyamides, polypropylenes or polyesters, interposed between said sheet material, and high molecular polymers melt-adhered to both faces of said sheet material.
2. The heat shrinkable sleeve of claim 1, wherein the woven fabric takes the form of woof weave, such as plain weave, rubber weave or rubber weave and warp weave, such as tricot and double cloth.
3. The heat shrinkable sleeve of claim 1, wherein the woven fabric have flexibility such that it does not impede shrinkage of the heat shrinkable sheet materials during heat shrinkage.
4. The heat shrinkable sleeve of claim 1 or claim 3, wherein the woven fabric is made of monofilaments, multifilaments and staple yarns.
5. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polyamides, such as nylon 6, nylon 11, nylon 12, nylon 66, nylon 610 and nylon 612.
6. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polypropylenes, such as polypropylene, polypropylene impact copolymer, polypropylene random copolymer and polypropylene ethylene copolymer.



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7. The heat shrinkable sleeve of claim 1 or claim 3, wherein the materials of the woven fabric are polyesters, such as polybutylene terephthalate and polyethylene terephthalate.

05 8. The heat shrinkable sleeve of claim 1, wherein the heat shrinkable sheet material consists of the cross-linked high molecular polymers.

9. The heat shrinkable sleeve of claim 1 or claim 3, wherein the
10 high molecular polymers and woven fabric comprise materials, which do not shrink after they have been subjected to heat and do not prevent the shrinkage of the heat shrinkable sheet material.

10. The heat shrinkable sleeve of claim 1, which sleeve is
15 applied with heat activated adhesives and sealing materials.

11. The heat shrinkable sleeve of claim 1, which sleeve is applied with thermopaints and is covered with a sheet for preventing the heat shrinkable sheet material from scratching.

20 12. The heat shrinkable sleeve of claim 1, which sleeve comprises a layer of a heat shrinkable sheet material, a woven fabric positioned one side of the sheet material, and high molecular polymers melt-adhered to both faces of the sheet material.

25 13. The heat shrinkable sleeve of claim 1, which sleeve comprises a layer of high molecular polymer, a woven fabric attached to one side of the polymer. heat shrinkable sheet materials adhered to both faces of the polymer and the other layers of high molecular polymers

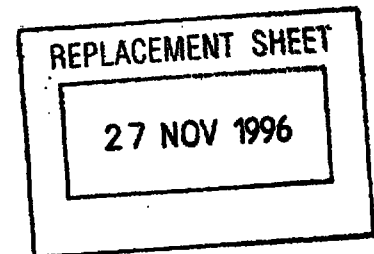


attached to both of the sheet materials.

14. The heat shrinkable sleeve of claim 1, which sleeve consists of a woven fabric, the first layers of high molecular polymers adhered to both faces of the woven fabric, heat shrinkable sheet materials attached to both of the first high molecular polymers, and the second layers of high molecular polymers attached to both of the sheet materials.

15. The heat shrinkable sleeve of claim 1, which sleeve consists of a layer of heat shrinkable sheet material, woven fabrics attached to both faces of the sheet material and high molecular polymers adhered to both of the woven fabrics.

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ABSTRACT**HEAT SHRINKABLE SLEEVE FOR CONNECTING A PIPE AND CABLE**

The present invention relates to a heat shrinkable sleeve for connecting a pipe and cable, which is manufactured by cross-linking heat shrinkable sheet materials with organoperoxides, silanes or the like, elongating the cross-linked sheet materials and inserting woven fabrics, or synthetic fibres e.g. polyamides, polyesters, polypropylenes and the like, between the sheet materials, thereby reducing the costs of equipment and production due to simplified manufacturing processes and providing high breaking strength and providing good break resistance.

Figure 1

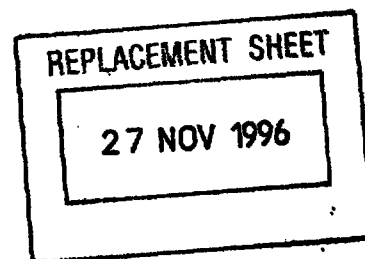


FIG. 1

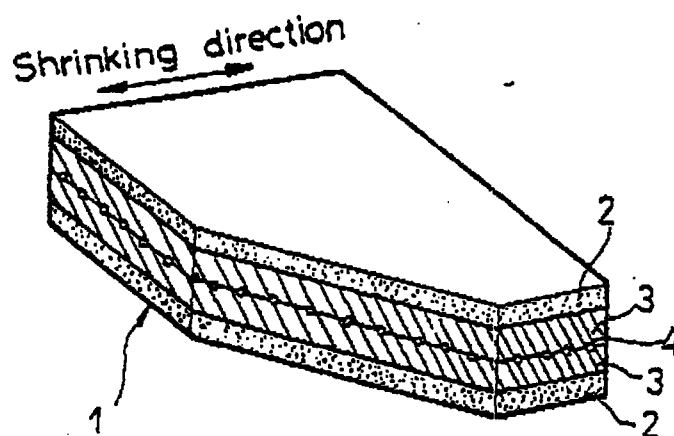


FIG. 2

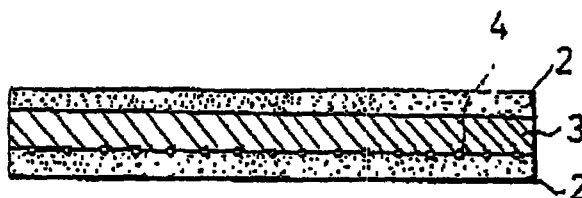


FIG. 3

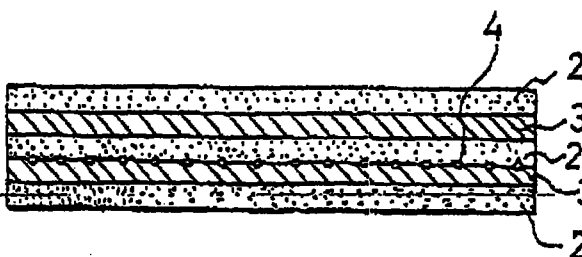
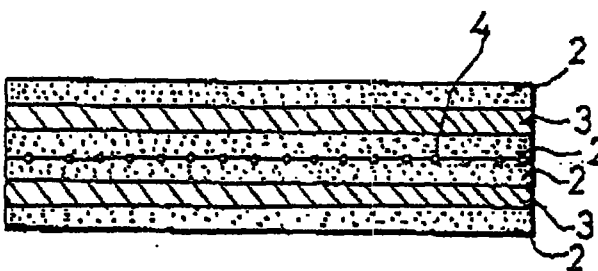


FIG. 4



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FIG. 5

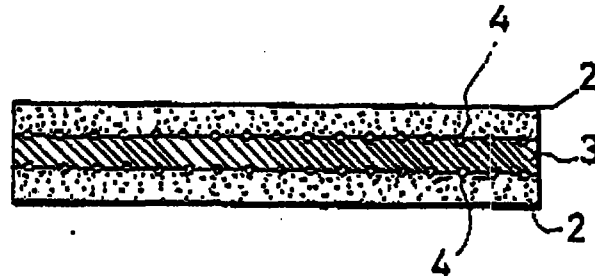
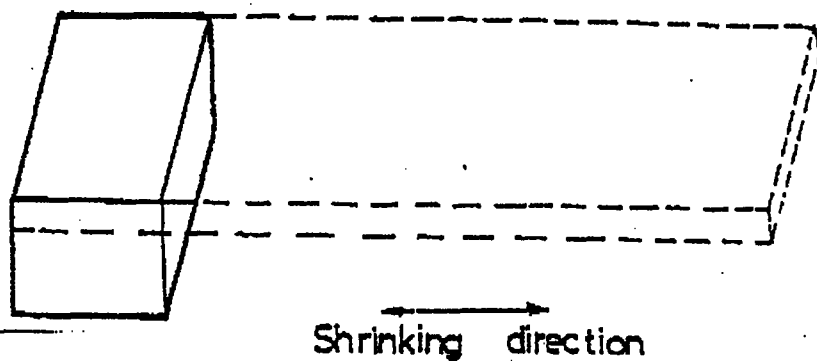


FIG. 6



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