

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 October 2001 (11.10.2001)

PCT

(10) International Publication Number
WO 01/75906 A1

- (51) International Patent Classification⁷: **H01B 7/288**, 3/00
- (21) International Application Number: PCT/NL01/00275
- (22) International Filing Date: 3 April 2001 (03.04.2001)
- (25) Filing Language: Dutch
- (26) Publication Language: English
- (30) Priority Data:
1014829 3 April 2000 (03.04.2000) NL
- (71) Applicant (for all designated States except US): **LANTOR B.V.** [NL/NL]; Verlaat 22, NL-3901 RG Veenendaal (NL).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **KOHN, Frederik, Emiel** [NL/NL]; Fokkeschoot 18, NL-3904 PW Veenendaal (NL). **LAMERS, Peter, Hubertus** [NL/NL]; Vrekenhorst 121, NL-3905 VS Veenendaal (NL).
- (74) Agent: **PRINS, A., W.**; Verenigde, Nieuwe Parklaan 97, NL-2587 BN The Hague (NL).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*



WO 01/75906 A1

(54) Title: CABLE TAPE AND METHOD FOR MANUFACTURING A CABLE TAPE

(57) Abstract: The invention relates to a cable tape, based on at least one fibrous web, in which fibrous web at least 0.5 % by weight, calculated on the weight of the cable tape, of thermoplastic microspheres which may or may not be partly or wholly expanded and, if desired, an effective amount of a water-swelling powder is incorporated, and to a method for the manufacture of such a tape and to cable manufactured using the tape.

Title: Cable tape and method for manufacturing a cable tape

The invention relates to a cable tape, based on a fibrous web, as well as to a method for manufacturing such a cable tape and to cables in which such a cable tape is incorporated.

When manufacturing cables, for instance telecommunication cables, industrial (flexible) cables or energy cables (medium, high and ultra high voltage), a cable tape is often provided between the core or vein and the sheath, together, or not, with one or more other layers, for instance the copper wire screen in an energy cable. The function of this tape is often twofold, on the one hand to provide longitudinal watertightness and on the other hand to fill up empty spaces in the cable, so that this tape can serve as a bedding for an overlying layer, such as the copper wire screen in an energy cable.

The longitudinal watertightness is obtained by incorporating a water-swelling material, swelling powder, into the tape, while the filling properties are often obtained with a thick tape, obtainable, inter alia, by providing a foam or foamy structure; more bedding, also called cushioning.

The current types of cable tape for these applications are nearly always manufactured by uniting two layers of basic web, a layer of swelling powder being provided between the two layers. To obtain the filling effect, often an additional, third layer of base web, or, as an alternative to the covering web, a layer of foam is often applied by lamination. Owing to this large number of operations, the cost price of the material is, as a rule, prohibitively high for these applications.

From EP-A-0 271 171, a cable tape is known consisting of a carrier material in which or on which thermally expandable microcapsules are provided. This known cable tape has a high content of microcapsules (typically more than 20% by weight) and, preferably, different types of microcapsules are used. For this reason, also, several process steps are necessary for expanding such a cable tape, which is disadvantageous.

Further, from the German Offenlegungsschrift 30 48 912, a petrolate composition for use in energy cables is known which composition comprises microcapsules. According to this publication, the cable is filled with the petrolate composition and, subsequently, the cable is subjected to conditions wherein the microcapsules expand. This method is also laborious and requires several process steps. Moreover, according to this publication, the microcapsules are used to influence the dielectric constant of the petrolate and not to improve the longitudinal watertightness.

Accordingly, it is one of the objects of the invention to provide a cable tape which is simple to produce and, in addition to filling properties, can also have swelling properties.

In a first embodiment, the invention concerns a cable tape, based on at least one fibrous web, in which fibrous web at least 0.5 % by weight, calculated on the weight of the cable tape, of thermoplastic microspheres and, if desired, an effective amount of water-swelling material is incorporated.

Surprisingly, it has appeared that such a cable tape, where the microspheres are present in the web instead of substantially only on its surface, is simple to produce in one step, while its quality is at least as good, if not better, than the current products which are manufactured in a number of separate steps from a number of discrete layers. The swelling powder that is preferably present can be present in and/or on the web, while the same advantages with respect to the simplicity of manufacture and the quality of the cable tape are obtained.

Surprisingly, it has also appeared that in the presence of swelling powder in and/or on the web, the microspheres in the web considerably increase the swelling properties of the web in water, in particular its swelling rate. The swelling properties, especially the swelling rate, are particularly favourably influenced if at least a part of the swelling powder is present on the web.

In a further embodiment, the cable tape according to the invention is characterized in that it is obtainable by manufacturing an unbound base web, providing a binding agent in the web, and binding the web by drying and curing of the binding agent, while the non-expanded, thermoplastic microspheres and, if desired, the water-swelling powder, are incorporated in and/or on the basic web at any moment prior to the drying or prior to the drying and curing of the binding agent, and the microspheres are expanded during or after the drying or during or after the drying and curing of the binding agent.

10 The invention also relates to a method for manufacturing the cable tape, by manufacturing a base web, providing a binding agent in the web, and binding the web by drying and curing the binding agent, while the water-swelling powder and non-expanded thermoplastic microspheres, at any moment prior to the drying, or prior to the drying and curing of the binding agent, are incorporated in the base web, and, during or after drying, or during
15 of after drying and curing of the binding agent, the microspheres are expanded.

It is particularly surprising that this web can be manufactured in such a simple manner, while, to the present day, in practice, always multi-step processes were used, with their inherent problems.

The cable tape according to the invention, in its simplest form, is built up from two or three components. The base web, which is the starting point, is a standard base web, originating from a carding machine or spunbond machine for manufacturing non-woven webs. A woven can also be used.

25 The fibres of the base web are selected from natural fibres and synthetic fibres or a combination thereof. More in particular, polyester fibres, polypropene fibres, acrylic fibres, glass fibres, carbon fibres, polyamide fibres, aramid fibres and mixtures of two or more of these types of fibres are used. The weight of the base web can vary within broad limits, depending on the
30 application. Current weights are from 10 g/m² to 250 g/m², preferably from 25

to 100 g/m². During manufacture, the web is bound with a binding agent, which, after drying or after drying and curing, gives the structure to the tape. Current binding agents are polyacrylates, styrene-butadiene rubbers, vinyl acetate, homo and copolymers and polyvinyl alcohol.

5 The expanded thermoplastic microspheres form the second group and consist of a thermoplastic skin, containing a gas. These microspheres are obtained by heating non-expanded spheres, provided with a blowing agent, to the correct temperature whereupon they expand. Such microspheres are, inter alia, commercially available under the name Expancel™ of Akzo Nobel. The
10 thermoplastic polymer of which the cover consists can be based on methyl methacrylate and acrylonitrile, or on methyl methacrylate, acrylonitrile and vinylidene chloride. As a blowing agent, an organic material, such as an aliphatic hydrocarbon gas, for instance isobutane, pentane or iso-octane, is provided in the microspheres. The diameter and the amount of microspheres
15 together with the thickness determine to a large extent the filling properties (bedding properties) of the tape. The tape has a thickness of preferably 0.2 to 5 mm, more in particular 0.25 to 3 mm. The amount of microspheres is at least 0.5 % by weight and at most 40 % by weight. Preferably, this amount is
between 5 and 25% by weight, most preferably between 10 and 20% by weight.

20 The microspheres are preferably added to the standard binder formulation together with special auxiliary agents which provides for the non-expanded spheres to be and to remain homogeneously distributed in the impregnated web.

25 Upon heating of the microspheres, from the interior of the web, the fibrous structure will also deform (become thicker) and thus obtain its "cushioning" properties (thickness, volume and, most of all, resilient or bedding properties).

30 The third component is a water-swelling powder, also called "super absorber". These materials are already commonly used in cable tape, and therefore do not need further elucidation.

The swelling powder is preferably strewn on top of the web and covers the top layer; the binder on the surface will serve as an adhesive medium.

It has appeared that swelling powder in and/or on the web, together with microspheres in the web, gives considerably better swelling properties, in particular a higher swelling rate, to the web, than when there are no microspheres in the web.

Apart from these main components, the web optionally contains other auxiliary substances, such as conductive materials (for instance metal particles), shielding or low-conductive materials (for instance soot). In particular for the manufacture of conductive, shielding or low-conductive tapes, it is desired to incorporate this sort of components. This effect can also be obtained by providing conductive fibres in the web in a suitable manner.

The invention also relates to a cable, more in particular a telecommunication cable, industrial (flexible) cable and energy cable (medium high and ultra high voltage), manufactured using the cable tape according to the invention.

The cable tape is manufactured with the aid of conventional equipment, which only needs to be adapted for providing the microspheres and the swelling powder.

In the appended figures, a number of possibilities for this manufacture are given. These are examples of possible embodiments, without, however, being limited thereto.

All variants shown are based on a conventional carding machine which produces as carding webs or unbound base webs an upper web 1 and a lower web 2, which are pressed and united at 5. Each web separately, or the assembly of upper and lower web, is subsequently provided through a foam foulard 3, with binding agent, in which the not yet expanded microspheres are dispersed, after which the web is dried in a dryer (not shown) or dried and cured.

In the first method, the swelling powder is strewn on the lower web at 4.

With this method, the microspheres are incorporated in the web through the binding agent, while the swelling powder particles are bound in and on the single web with the binding agent. In or after the dryer, the microspheres expand. Depending on the desired form of delivery, the web is subsequently delivered at full machine width or cut to the desired width, which is typically between 5 mm and 200 mm. It is also possible for this cutting to take place subsequently at the cable manufacturers'.

In a second method, the lower web is first bound in the foulard with binding agent, after which the powder is strewn onto it, followed by uniting with the upper web 1 and pressing together 5. The remainder of the treatment is as described hereinabove for method 1.

According to a third method, powder is only strewn onto the web after the foulard 3, optionally followed by pressing-on and, optionally, applying a thin covering web 6.

In the fourth variant, the upper web 1 as well as the lower web 2 are separately bound with foulards 3, after which the lower web 2 is strewn with the powder, united and pressed at 5 and further processed as in the first method.

With all methods, after the drying, or after the drying and curing, optionally, calendering can take place, while for special variants, the cable tape obtained in one step can be further treated, for instance by combining two layers, combining with another web, adding a fabric inlay, a surface treatment and the like.

The invention will presently be elucidated in and by two examples.

Example 1

A fibrous web consisting of a polyester fibre with a weight of 27 g/m² was impregnated by means of a foam foulard with 20 g/m² of a polyacrylate

binder dispersion, to which non-expanded microspheres (Expancel™ 007, Akzo Nobel, with a particle size of 14 µm) had been added. For the dispersion, this gave a distribution of 15 g/m² binder and 5 g/m² microspheres.

5 Directly after impregnation, an amount of 25 g/m² swelling powder was strewn onto the still wet web. Subsequently, the web was dried at 130°C, whereby, on the one hand, the binding agent cured and, on the other hand, the microspheres expanded. The thickness of the web increased from 0.45 mm to 1.2 mm, which demonstrates that with microspheres in the web, a cable tape with a low weight (47 g/m²) still obtains a much higher thickness (270%
10 higher) and bedding, without a foam layer being necessary.

Example 2

A fibrous web consisting of a polyester fibre with a weight of 22 g/m²
15 was impregnated by means of a foam foulard with 22 g/m² of a polyacrylate binder dispersion, to which a low percentage of non-expanded microspheres, of the type Expancel™ 007 of Akzo-Nobel, had been added: 95 % by weight of binder and 5 % by weight of microspheres. Directly after impregnation, an amount of 15 g/m² swelling powder was strewn onto the wet web.
20 Subsequently, the web was dried at 130°C, whereby, on the one hand, the web was dried, or dried and cured, and, on the other hand, the microspheres expanded. Thereupon, the web was calendered with the swelling powder to a thickness of approximately 0.30 mm. In comparison to the situation without microspheres, it appeared that, by adding a low percentage thereof, the
25 swelling height in the first minute increases from less than 60% to over 80% of the maximum swelling height.

Claims

1. A cable tape, based on at least one fibrous web, in which fibrous web at least 0.5% by weight, calculated on the weight of the cable tape, of non- expanded, pre-expanded or expanded thermoplastic microspheres and, if desired, an effective amount of water swelling powder are incorporated.
- 5 2. A cable tape according to claim 1, obtainable by manufacturing a base web, providing a binding agent in the web, and binding the web by drying or by drying and curing of the binding agent, wherein the non-expanded, thermoplastic microspheres and, if desired, the water-swelling powder are incorporated in the basic web at any moment prior to the drying or
10 prior to the drying and curing of the binding agent, and the microspheres are expanded during or after drying, or during or after drying and curing of the binding agent.
3. A cable tape according to claims 1 or 2, wherein the amount of water-swelling powder is between 5 and 70% by weight, calculated on the
15 weight of the cable tape.
4. A cable tape according to claims 1 - 3, which has a thickness of 0.2 to 5 mm, preferably 0.25 to 3 mm.
5. A cable tape according to claims 1 - 4, which has a width of 2 to 4000 mm, preferably of 10 to 1000 mm.
- 20 6. A cable tape according to claims 1 - 5, wherein the amount of expanded, thermoplastic microspheres is between 0.5 and 40% by weight, preferably between 1 and 25% by weight, more preferably between 5 and 20 % by weight, calculated on the weight of the cable tape.
7. A cable tape according to claims 1 - 6, wherein the average diameter
25 of the not yet expanded thermoplastic microspheres is between 10 and 100 μm .
8. A cable tape according to claims 1 - 7, wherein the fibres of the fibrous web are selected from the group consisting of natural and synthetic

fibres, more in particular polyester fibres, polypropylene fibres, acrylic fibres, glass fibres, carbon fibres, polyamide fibres, aramid fibres and mixtures of two or more of these types of fibres.

9. A cable tape according to claims 1 - 8, wherein the web has filling
5 properties and bedding properties.
10. A cable tape according to claims 1 - 9, wherein the tape is suitable for use in telecommunication cable, industrial (flexible) cable and/or energy cable (medium, high and ultrahigh voltage).
11. A cable tape according to claims 1 - 10, wherein the web is
10 insulating, low-conductive or conductive.
12. A method for manufacturing a cable tape according to claims 1- 11, comprising manufacturing a base web, providing a binding agent in the web, and binding the web by drying or by drying and curing of the binding agent, wherein the water-swelling powder and the non-expanded, thermoplastic
15 microspheres are incorporated in the basic web at any moment prior to the drying or prior to the drying and curing of the binding agent, and the microspheres are expanded during or after drying or during or after drying and curing of the binding agent.
13. A method according to claim 12, wherein the non-expanded, the
20 pre-expanded or the expanded thermoplastic microspheres are dispersed in the binding agent and are incorporated in the basic web together with the binding agent.
14. A method according to claim 12 or 13, wherein the drying, or the drying and curing takes place at a temperature of 100 to 250°C, preferably of
25 120 to 160°C, and the expansion of the microspheres takes place at a temperature of 75 to 200°C.
15. A cable comprising at least one core or vein, a cable tape and a sheath, such as an insulating sheath, wherein as cable tape, a cable tape according to claims 1 - 11 is used.

16. A cable according to claim 15, in the form of a telecommunication cable, industrial (flexible) cable and/or an energy cable (medium, high and ultra high voltage).

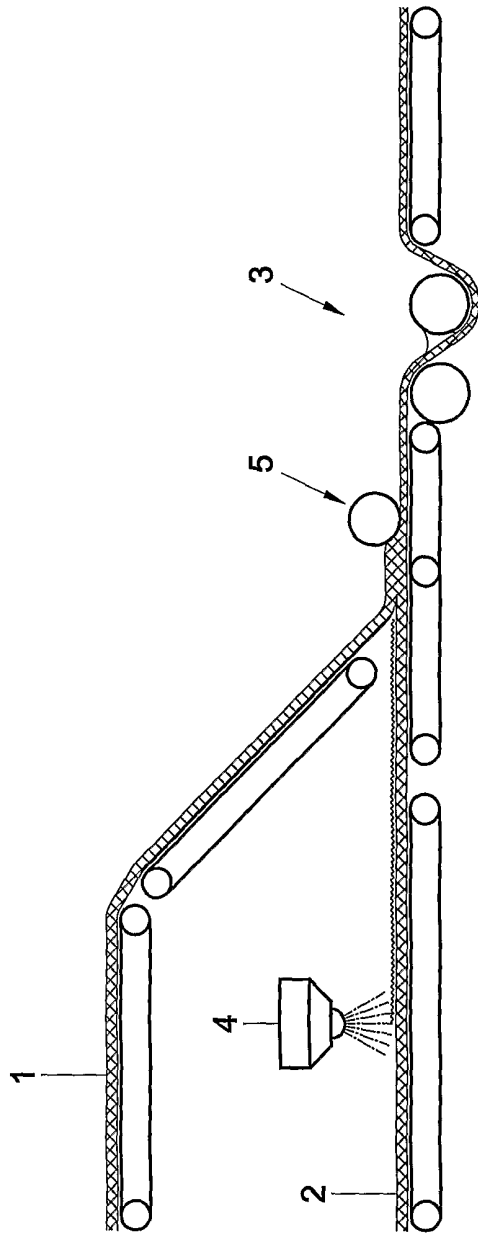


Fig. 1

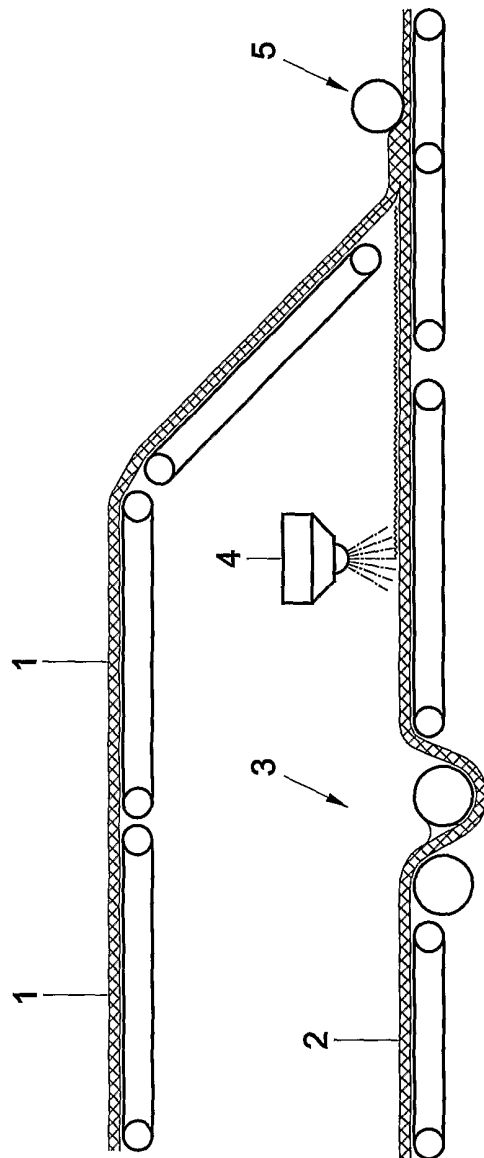


Fig. 2

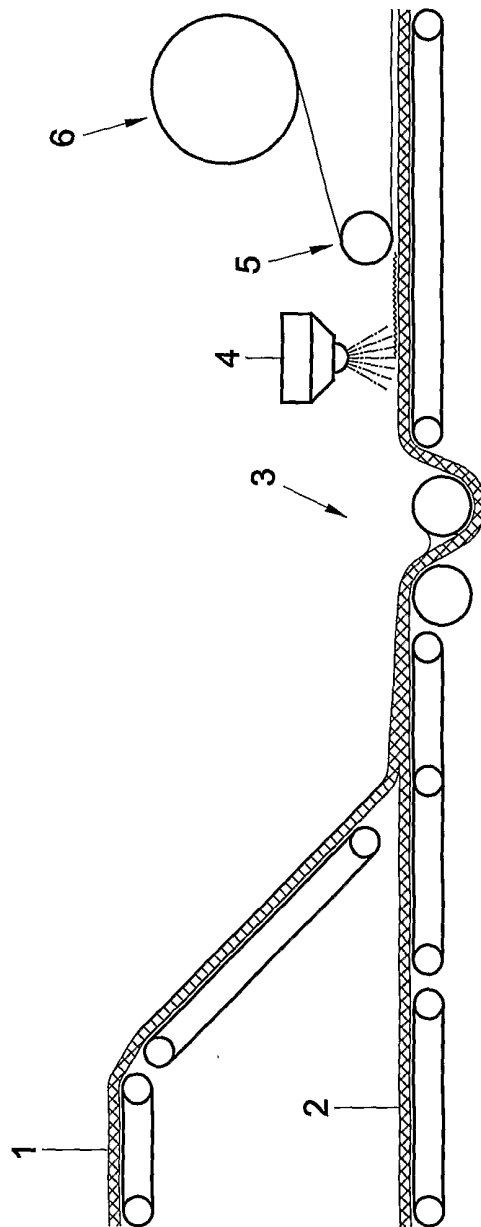


Fig. 3

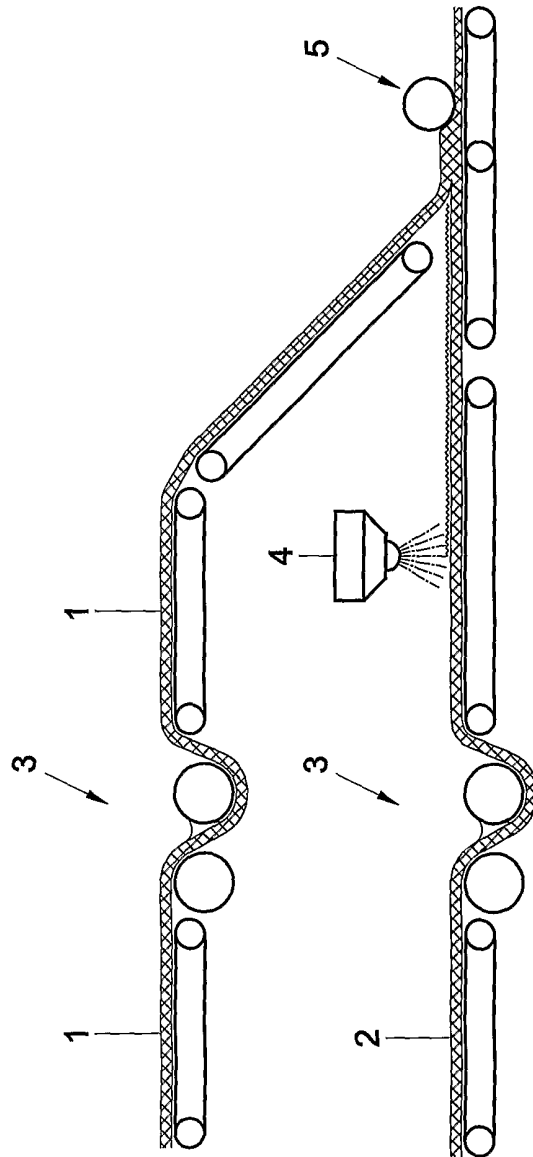


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 01/00275

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 H01B7/288 H01B3/00		
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 7 H01B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, INSPEC, IBM-TDB		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 271 171 A (LANTOR BV) 15 June 1988 (1988-06-15) the whole document ---	1-16
X	DE 30 48 912 A (SIEMENS AG) 1 July 1982 (1982-07-01) the whole document ---	1-16
A	EP 0 151 900 A (SIEMENS AG) 21 August 1985 (1985-08-21) claims 1-6 ---	1,2, 6-10, 12-16
A	DE 35 11 594 A (SIEMENS AG) 2 October 1986 (1986-10-02) claims 1-6 ---	1,2, 6-10, 12-16
	-/--	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in 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 document 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 25 July 2001		Date of mailing of the international search report 01/08/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Drouot-Onillon, M-C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 01/00275

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 34 09 364 A (SIEMENS AG) 19 September 1985 (1985-09-19) claims 1-8 ---	1,2, 6-10, 12-16
A	DE 34 04 487 A (SIEMENS AG) 8 August 1985 (1985-08-08) claims 1-4 -----	1,2, 6-10, 12-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 01/00275

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0271171	A	15-06-1988	NL 8603154 A	01-07-1988
			NL 8701570 A	01-02-1989
			AU 598327 B	21-06-1990
			AU 8244387 A	16-06-1988
			BR 8706674 A	19-07-1988
			CA 1312933 A	19-01-1993
			CN 87108306 A,B	24-08-1988
			DE 3785556 A	27-05-1993
			DE 3785556 T	29-07-1993
			ES 2039428 T	01-10-1993
			FI 875407 A,B,	12-06-1988
			IN 171830 A	23-01-1993
			IN 169926 A	11-01-1992
			JP 63181208 A	26-07-1988
			NO 875127 A,B,	13-06-1988
			TR 24408 A	08-10-1991
			US 5089329 A	18-02-1992
DE 3048912	A	01-07-1982	DE 3127963 A	27-01-1983
EP 0151900	A	21-08-1985	DE 3404488 A	08-08-1985
			AT 28530 T	15-08-1987
			DE 3464979 D	27-08-1987
DE 3511594	A	02-10-1986	NONE	
DE 3409364	A	19-09-1985	NONE	
DE 3404487	A	08-08-1985	EP 0155430 A	25-09-1985