



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 685 970 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **02.08.2006 Bulletin 2006/31**
(51) Int Cl.: **B41M 5/035^(2006.01)**

(21) Application number: **06008732.7**

(22) Date of filing: **28.05.2002**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **07.06.2001 IT MI20011198**

(62) Document number(s) of the earlier application(s) in
accordance with Art. 76 EPC:
02011821.2 / 1 264 706

(71) Applicant: **Menphis S.p.A.**
22070 Casnate con Bernate (Como) (IT)

(72) Inventor: **Menin, Gilberto**
22070 Montano Lucino
Como (IT)

(74) Representative: **Sama, Daniele**
Sama Patents
Via Morgagni, 2
20129 Milano (IT)

Remarks:

This application was filed on 27 - 04 - 2006 as a
divisional application to the application mentioned
under INID code 62.

(54) **Composite sheet for a transfer printing process**

(57) Transfer printing process through colour sublimation by the bag technology, comprising the following steps:

application of vacuum;
c) heating at temperatures from 170°C to 240°C;
d) cooling and recovery of the printed article.

- a) coating of the article surface to be printed with a composite comprising a film with mated surfaces, an aluminum layer, a drawing, with the respective colours, printed on the aluminum layer in contact with the surface of the article to be printed;
- b) closing of the case formed by the composite and

EP 1 685 970 A1

Description

[0001] The present invention relates to a transfer printing process employing a particular composite which can be used in the bag technique, as described hereafter, to obtain a drawing reproduction with a very good picture definition, very good chromatic yield and substantially defect free, such as bubbles, dots, uncompactness, etc.

[0002] More specifically in the transfer printing of the invention the colour transfer is made by sublimation and a particular composite film is used comprising a mated polymer film having a metallized surface on which a drawing, preferably coloured, is printed.

[0003] More in particular said process is applied to flat surfaces and tridimensional articles and is carried out under reduced pressure, optionally by treating the composite, before the printing, with conventional techniques so that the composite results electrostatically charged.

[0004] Still more in particular the process of the present invention uses a composite comprising a basic polymer film having one or both the surfaces mated, i.e., opaque and rough, wherein a mated surface is metallized and on the metal layer a drawing, preferably coloured, is printed by sublimable inks at the temperatures of the transfer printing process.

[0005] The transfer printing is a consolidated and diffused printing technique in the industries of this field.

[0006] Compared with the conventional printing, the transfer printing shows the following advantages:

- more faithful reproduction also of high complexity drawings (four-colour process);
- lower printing costs, since less sophisticated colour transfer plants are required;
- reduced environmental impact, the total amount of colours dispersed in the environment being very low;
- as regards the printing on textiles, elimination of the vaporization, washing and finishing phases used in the conventional printing, and therefore elimination also of the respective processing recycling.

[0007] By using the transfer printing technique the drawing is first printed, for example by rotogravure printing, on a suitable support; subsequently the drawing transfer is carried out on the manufactured article, for example by calendaring for textiles or by heating in an oven for aluminum profiles or articles of various shapes, at temperatures in the range 170°C -240°C. At said temperatures the transfer step is completed in some minutes.

[0008] In European patent application EP 921,014 in the name of the Applicant, a composite for transfer printing is described, formed by a basis polymer layer on which a thin aluminum layer is deposited. On the aluminum surface the drawing is printed by sublimable colours.

[0009] The composite can be used to print flat surfaces or tridimensional articles such as aluminum profiles, doors and windows or others. In the patent application it is described that in the tridimensional article printing the

so called "membrane" technique can be used, consisting in coating the article wrapped in the composite in an external membrane. Inside the pocket formed by the membrane, hermetically sealed, vacuum is made. With this printing technique of tridimensional articles, using the above described composite, printed manufactured articles are obtained having a very good chromatic yield and definition of the transferred drawing.

[0010] Another technique to print tridimensional articles with drawings having sublimable colours is the so called "bag" technique. Said technique is industrially cheaper than the "membrane" technique, since the printing preparation steps are simpler and the whole cycle is carried out in shorter times. The external pocket, which constitutes the bag, is formed in this case by the same composite film. During the printing step the vacuum is kept by connecting the pocket to a vacuum pump.

[0011] The Applicant has found that the transfer printing by the bag technique on tridimensional articles and non, carried out by the composite of the above European patent application, has a lower quality in comparison with the printing obtained in the same conditions by the membrane technique. See the Examples.

[0012] The need was therefore felt to have available a transfer printing process by colour sublimation on tridimensional articles and flat surfaces, carried out by means of the bag technology as above defined, such as to allow to obtain a manufactured article having the following property combination:

- defect free (bubbles, blurrings in the printed drawing, etc.),
- very good image definition and chromatic yield comparable with that obtainable by the membrane transfer printing technique by using the composite of the above European patent application,
- easy transfer with high definition of complex drawings, such for example the drawing of the pinewood grain.

[0013] The Applicant has surprisingly and unexpectedly found a process wherein the bag transfer printing technology is used which solves said technical problem.

[0014] An object of the present invention is a transfer printing process by colour sublimation by means of the bag technology, comprising the following steps:

a) coating of the article surface to be printed with a composite comprising:

- a polymer film or sheet, which forms the composite basis and is capable to resist without decomposing and without being deformed at the temperatures used in the colour transfer phase by sublimation, said polymer film or sheet having a thickness ranging from 6 to 100 micron and having one or both the surfaces mated, therefore rough and opaque, characterized by a gloss <

60%, determined by the DIN 67530 method with measurement angle of 85°;

- an aluminum layer, having a thickness from 5 to 400 Å, preferably from 10 to 200 Å preferably having an optical density in the range 0.05-3.0, preferably 0.1-0.5, measured by TD 932 - Macbeth densitometer, the aluminum layer being deposited on a mated surface of the polymer compound film;
- a drawing, with the respective colours, printed on the aluminum layer and put into contact with the surface of the article to be printed;

b) longitudinal closing of the case formed by the composite and vacuum application or pressure reduction between the composite film and the article to be printed, using a residual pressure from 0.05 bar (5×10^3 Pa) to 0.2 bar (2×10^5 Pa), preferably 0.1 bar (10^4 Pa);

c) heating at temperatures from 170°C to 240°C, preferably from 190°C to 210°C, keeping the residual pressure within the previous limits, for a time from 1 minute to 5 minutes;

d) cooling and recovery of the printed article.

[0015] The longitudinal closing of the case formed by the composite can be carried out for example by adhesive tape, or by ultrasound welding, using known techniques.

[0016] The vacuum is applied to the two ends of the case formed by the composite by a pump.

[0017] Optionally, the composite can be treated by conventional techniques so that it results electrostatically charged when used in the process according to the present invention. In this way the adhesion of the composite to the article is easier and therefore the bag formation and the vacuum application is simpler.

[0018] To carry out the printing process, for example an oven suitable to this purpose or any other equivalent equipment can be used.

[0019] The thickness of the polymer compound film is preferably from 10 to 25 micron and the optical density of the aluminum film, determined as above, is preferably from 0.1 to 0.5.

[0020] Preferably the gloss of the rough surface of the polymer film forming the basis composite film, is > 10%, measured by the above method, but with contact angle of 60°, still more preferably it ranges from 15%, measured with angle of 60° to 55°, measured with angle of 85°, extremes included.

[0021] The polymer forming the film or sheet is selected from polyesters, fluorinated resins, polyamides, polyimides, polyethers and polyurethane resins.

[0022] Preferably a polymer film of polyester, in particular polyethylene terephthalate, polybutylene terephthalate, glycol terephthalate is used.

[0023] Also polymer films stretched in one or both the directions, longitudinal and/or transversal, can be used.

[0024] The results obtained with the composite of the present invention are surprising since tests carried out

by the Applicant have shown that by using only the basis polymer film, with the mated surface, the transferred image definition and the chromatic yield are not satisfactory.

[0025] Furthermore the use of the composite of the present invention allows a significant time reduction of the transfer printing process, contemporaneously using lower temperatures and lower times with respect to non metallized mated films.

[0026] The preparation process of the composite film used in the process of the present invention takes place in two steps.

[0027] In the first step the mated polymer film is prepared.

[0028] This step can be carried out according to known methods, for example by extrusion of the polymer containing inorganic fillers, or by chemically or mechanically treating, for example by embossing or by applying a resin layer on one or both the film surfaces, or by the "crown" treatment using well known methods to the skilled man in this field.

[0029] Mated polymer films are easily available both by the plastic compound manufacturers and on the market.

[0030] The mated films are indeed largely used for the flexible packages.

[0031] The metallization of the mated surface of the polymer film is carried out by deposition of an aluminum layer under high vacuum conditions, using the usual techniques well known to the skilled man in this field.

[0032] The film is printed with the drawing to be transferred on the side coated with aluminum, by using offset, flexo, rotogravure, serigraphy printing machines, preferably a rotogravure printing machine is used.

[0033] The used inks are those usually available on the market and that can be emulsifiable or disperseable in water or in solvent and must preferably be of the type having high resistance to light.

[0034] With the composite film according to the present invention both flat surfaces and tridimensional articles, even with irregular surfaces, can be printed.

[0035] As said, the colour transfer on the final support according to the process of the present invention is carried out by the colour sublimation technique at temperatures preferably from 190°C to 210°C.

[0036] The contact time is generally from 1 minute to 5 minutes, and varies depending on the article mass and on the thermal exchange process conditions during the transfer step.

[0037] The transferred colour amount is of the order of 90% or higher.

[0038] As said, in the printing of tridimensional articles or flat surfaces, the image definition results comparable with that obtained by using the metallized composite of the prior art in the membrane transfer printing technique under vacuum.

[0039] Generally the invention films can be used for the transfer printing by applying them to any article to be

printed formed by a compound resistant to the temperatures used in the printing process by sublimation and having surfaces capable to absorb the sublimable colours which are transferred from the metallized composite surface.

[0040] According to a preferred embodiment of the present invention process the surfaces of the support to be printed are previously coated, for example by electrostatic painting, with a layer of polymer compound, for example polyester or polyurethane thermosetting powders, formulated so to favour the sublimable ink maximum penetration.

[0041] The composite films of the present invention can be used for the transfer printing technique for the application to supports formed by different materials, for example metals (aluminum, iron, zinc, steel, cast iron), or glass, ceramic, or polymer compound manufactured articles.

[0042] The materials can have the form of both flat surfaces and tridimensional articles.

[0043] It has been found by the Applicant that by using the invention composite at the temperatures used in the transfer printing process, the drawing does not result deformed when it is printed on the manufactured article. This represents a remarkable advantage since the articles to be discarded for said printing defect are practically absent.

[0044] The process according to the present invention is much more unexpected if one considers that the use of the only mated film in the transfer printing by colour sublimation does not allow to obtain a very good image definition. See the comparative Examples.

[0045] Another object of the present invention is the composite used in the printing process which has been described above.

[0046] The following Examples have the purpose to illustrate the invention and are not to be intended as limitative of the scope of the same.

EXAMPLE 1 (comparative)

[0047] Use of the composite according to the European patent application EP 921,014 in the transfer printing by means of the bag technology

[0048] An unmated polyethyleneterephthalate film (gloss = 100%) having a thickness of 23 micron metallized on one side with aluminum having a thickness of 125 Å, corresponding to an optical density determined by densitometry of 2.1 (metallized film A) is printed with a colour drawing reproducing the pinewood grain.

[0049] The receiving support is an aluminum profile for door and windows, having sizes of about 7 meters x 10 cm x 5 cm, pretreated by electrostatic painting with polyester thermosetting powdered paint having a thickness of 75 micron.

[0050] The composite film is wrapped around the profile, so that folds do not form, and hermetically sealed on

the longest side. By a pump a vacuum of 0.1 bar (10^4 Pa) is made, taking care that folds or bubbles between the composite and the article do not form. The transfer printing is effected by transferring the wrapping wrapped on the aluminum profile in an oven at 205°C for 4 minutes, keeping the vacuum at the above indicated value by means of the pump.

[0051] At the end it is cooled, the atmospheric pressure is restored and the composite film is taken away from the article.

[0052] The drawing printed on the aluminum bar (Fig. 1) shows printing defects attributable to air bubbles or non evacuated vapors, which have prevented the film from contacting the paint layer on the profile. Besides, some particulars of the printed grains result blurred. Therefore the reproduction of the printed drawing is not good. It is observed that on the used composite only traces of the sublimable inks remain. Therefore the colour transfer on the aluminum bar has been substantially quantitative.

EXAMPLE 2

[0053] Transfer printing by the bag technology using a composite wherein the basis polymer film surface is mated and has a gloss of 45%

[0054] Example 1 is repeated but by using a composite film in which one of the basis film surfaces is mated and then it has been metallized with aluminum.

[0055] The mated surface has a gloss of 45% determined by the DIN 67530 method, by using a measurement angle of 85°.

[0056] The drawing printed on the aluminum bar (Fig. 2) does not show defects (no air bubbles or blurrings) and it is of a very good quality. It is observed that on the used composite only traces of the sublimable inks remain. Therefore the colour transfer on the aluminum bar has been substantially quantitative.

[0057] If Figures 1 and 2 are compared, one clearly sees that the drawing reproduction in the case of Figure 2 is evidently higher than that obtained in Figure 1.

EXAMPLE 3 (comparative)

[0058] Printing with the bag technology using only the mated basis film.

[0059] Example 2 is repeated but by using only the mated basis polymer film (not metallized with the aluminum layer) on which the same colour drawing is printed.

[0060] The drawing printed on the aluminum profile (Figure 3) in this case shows a lower definition than that obtained in Example 2. At the visual observation it is noticed that the lines reproducing the grains are discontinuous, mostly formed by a sequence of points: the drawing shows the printing defect known as "uncompactness" and it is not of an acceptable quality.

[0061] It is noticed that on the polymer film recovered at the end of the process an evident amount of inks re-

mains, such that the original drawing is easily recognizable. Therefore by using only the mated polymer film in the transfer printing process with the above mentioned technique, the colours are only partially transferred to the support.

EXAMPLE 4

[0062] Transfer printing by the bag technology by using a composite in which the basis polymer film surface is mated with a gloss of 20%.

[0063] One proceeds as in Example 1 but by using a composite film wherein one of the basic film surfaces is mated and has then been metallized with aluminum.

[0064] The mated surface has a 20% gloss, determined by the DIN 67530 method, by using a measurement angle of 60°.

[0065] The drawing printed on the aluminum bar (Fig. 4) does not show defects.

[0066] The definition of the printed drawing results slightly lower than that obtained in Example 2.

[0067] On the whole the obtained print results of good quality and it is therefore acceptable.

Claims

1. A composite for use in transfer printing process by colour sublimation by the sachet technology, comprising:

- a film or a sheet of polymeric material, said film or sheet of polymeric material having a thickness ranging from 6 to 100 μm and having one or both surfaces mated, **characterized by** a gloss < 60%, determined by the DIN 67530 method at an angle of 85°;

- an aluminum layer, having a thickness from 0,5 to 40 nm, preferably from 1 to 20 nm, having an optical density in the range 0.05 and 3.0, preferably 0.1 and 0.5, the aluminum layer being deposited on a mated or rough surface of the polymeric film;

- a drawing, with the respective colours, printed on the aluminum layer which is put into contact with the surface of the object to be printed.

2. A composite according to claim 1 wherein the thickness of the film of polymeric material film ranges from 10 to 25 μm and the optical density of the aluminum film ranges from 0.1 to 0.5.

3. A composite according to claims 1-2 wherein the gloss of the mated of the polymeric film which forms the basic composite is > 10%, measured by contact angle of 60°, preferably it ranges from 15%, measured with angle of 60° to 55%, measured with angle of 85°, extremes included.

4. A composite according to claims 1-3 wherein the material of the polymeric film is selected from the following: polyesters, fluorinated resins, polyamides, polyimides, polyethers and polyurethane resins.

5. A composite according to claim 4 wherein the material of the polymeric film is selected from polyester, preferably polyethylene terephthalate, polybutylene terephthalate, glycol terephthalate.

6. A composite according to claims 4-5 wherein the polymeric film is stretched in one or both the directions, longitudinal and/or transversal.

7. An object to be printed coated with the composite of claims 1-6.

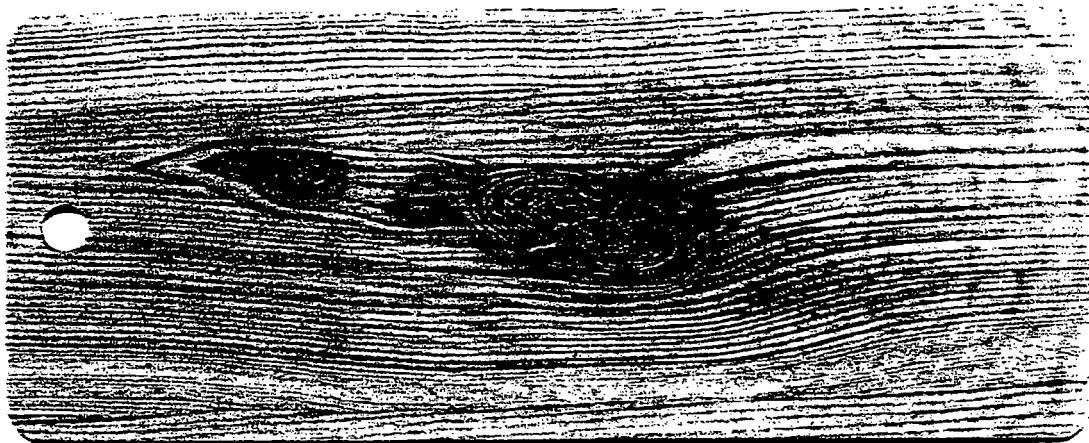


Figura 1

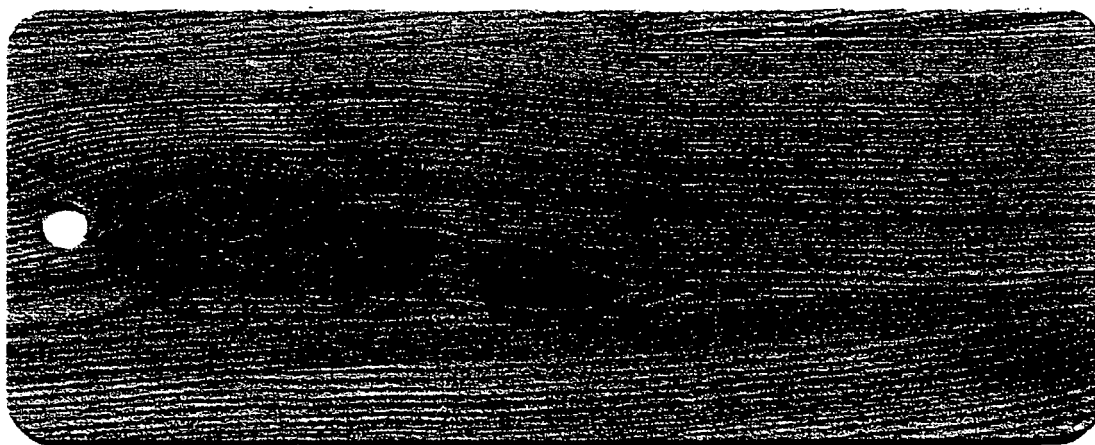


Figura 2

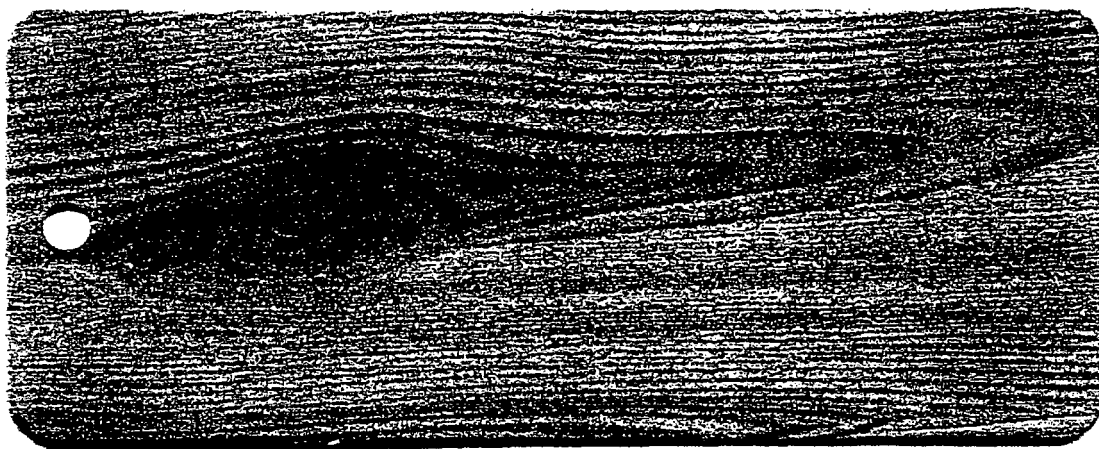


Figura 3

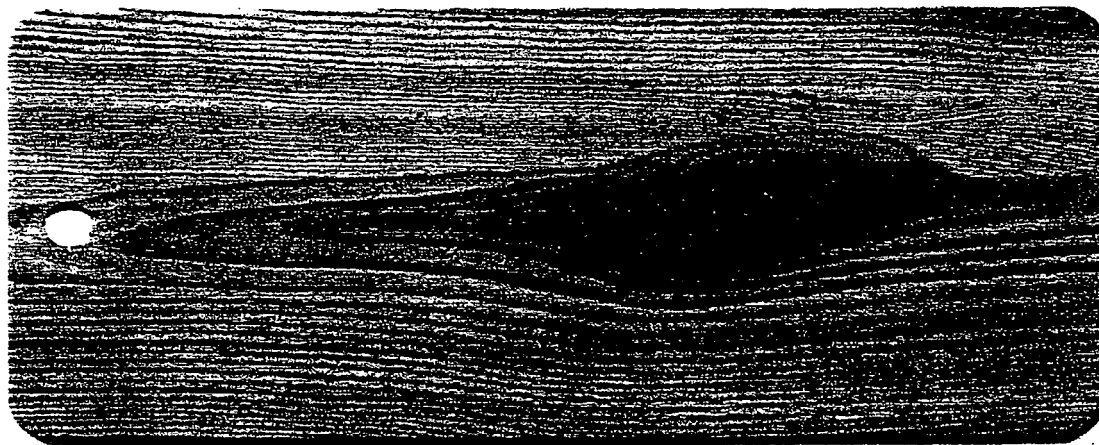


Figura 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 00 8732

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 0 921 014 A (MENPHIS S R L) 9 June 1999 (1999-06-09) * the whole document *	1-7	INV. B41M5/035
A	EP 1 092 550 A (MENPHIS S R L) 18 April 2001 (2001-04-18) * claims *	1-7	
A	EP 0 953 457 A (BORTOLATO GIOVANNI) 3 November 1999 (1999-11-03) * claims * * figures *	1-7	
			TECHNICAL FIELDS SEARCHED (IPC)
			B41M
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		20 June 2006	Martins Lopes, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

3
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 00 8732

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-06-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0921014	A	09-06-1999	AT 221464 T	15-08-2002
			CA 2254598 A1	02-06-1999
			DE 69806889 D1	05-09-2002
			ES 2180112 T3	01-02-2003
			IT MI972664 A1	02-06-1999
			US 6458743 B1	01-10-2002

EP 1092550	A	18-04-2001	IT MI992141 A1	16-04-2001

EP 0953457	A	03-11-1999	AT 259720 T	15-03-2004
			DE 69914822 D1	25-03-2004
			ES 2213941 T3	01-09-2004
			IT MI980935 A1	02-11-1999
