

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
19 April 2007 (19.04.2007)

PCT

(10) International Publication Number
WO 2007/043931 A1

(51) International Patent Classification:

B31F 5/00 (2006.01) **B65D 5/42** (2006.01)
B31F 7/00 (2006.01)

(21) International Application Number:

PCT/SE2006/001069

(22) International Filing Date:

20 September 2006 (20.09.2006)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

0502237-1 11 October 2005 (11.10.2005) SE

(71) Applicant (for all designated States except US): **TETRA LAVAL HOLDINGS & FINANCE S.A.** [CH/CH]; 70, av. Général-Guisan, CH-1009 Pully (CH).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **ANDERSSON, Håkan** [SE/SE]; Planteringsvägen 24, S-240 14 Veberöd (SE).

(74) Agent: **AHL, Camilla**; AB TETRA PAK, Patent Department, Ruben Rausing's Gata, S-221 86 Lund (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

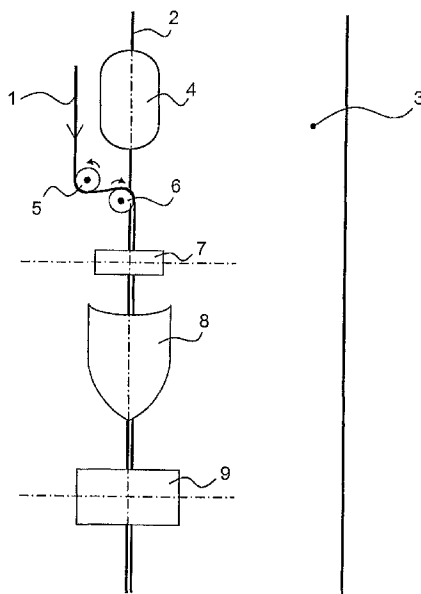
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

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.

(54) Title: A METHOD AND AN APPARATUS FOR APPLYING A STRIP



(57) Abstract: The disclosure relates to a method of applying an edge-sealing strip (1) of a first thermoplastic material to an edge (2) of a packaging laminate web (3). It comprises the steps of advancing the edge (2) of the packaging laminate web (3) through a hot air oven (4) for heating the edge (2) at least to tacking temperature, tack adhering the edge-sealing strip (1) at least adjacent the edge (2) on the product side of the web (3), feeding the edge (2) with the tack adhered edge-sealing strip (1) through an induction oven (8) where the active element of the induction oven (8) is turned to face at least towards the product side of the web (3), and positively compressing the edge (2) and the strip (1) together. The present invention further relates to an apparatus.

A METHOD AND AN APPARATUS FOR APPLYING A STRIP

TECHNICAL FIELD

The present invention relates to a method of applying an edge-sealing strip of
5 a first thermoplastic material to an edge of a packaging laminate web. The packaging
laminate web comprises at least the following layers: a first outer layer of said first
thermoplastic material, a layer of paper or paperboard, a tie layer of a thermoplastic,
a layer of an induction heatable material, and a second outer layer of the first
thermoplastic material. The first outer layer constitutes the so-called decorative
10 artwork side of the web, i.e. that side which forms the outside of the future package.
The second outer layer constitutes the so-called product side of the web, i.e. that side
which will become the inside of the package and thereby will be in contact with the
product. The tie layer of thermoplastic material may be of the same type as the first
thermoplastic material, but it may also be of a different type.

15 The induction heatable layer may consist of a metal layer, a metal oxide layer
or the like. For example, an aluminium foil may be employed.

The edge-sealing strip is intended to prevent the product, in a package
subsequently formed from the packaging laminate web, running the risk of
penetrating in between the layers included in the packaging laminate or running the
20 risk of being sucked into the paper or paperboard layer, so-called edge wicking. The
present invention also relates to an apparatus for realising the method.

BACKGROUND OF THE INVENTION

For a strip edge seal to be approved, it is required that the seal is strong and
25 tight at least on the product side of the laminate. That it is "strong" implies in
principle that the seal proper may not rupture in a tensile test. An eventual breakage
or rupture is, if it nevertheless occurs, to occur beside the seal or in some other layer
of the laminate. Moreover, the edge-sealing strip is to surround the paper edge tightly
in order not to run the risk of giving rise to edge wicking in top and bottom seals in
30 the intended package.

On application and sealing of an edge-sealing strip to a packaging laminate
web, use is normally made today of a hot air oven for initially heating the edge of the

web to a temperature at least above the melting temperature of the first thermoplastic. The strip is subsequently applied on the web and the heat in the edge melts the strip. Thereafter, the edge with the strip is rolled in order to achieve a positive fixing.

5 The edge-sealing strip is not heated up prior to the application, and so all of the energy which is required in order to realise a sufficiently strong seal must come from the packaging laminate. This implies that the packaging laminate needs to be overheated so much that the thermal energy in its product side, and in certain cases also the decorative artwork side, will be sufficient to elevate the temperature in the
10 strip above its melting point. This results in the temperature in the laminate needing to be raised to a level which lies substantially above the melting point for the first thermoplastic material. For reasons of space and because of the risk of overheating, application of the edge-sealing strip cannot be put into effect immediately adjacent the hot air oven, for which reason the laminate will moreover be cooled down on its
15 way between the hot air oven and the point of application. As a result of this situation, the laminate must be overheated further.

A symbolic temperature relation appears roughly as follows:

$$\begin{aligned} &T_{\text{sealing layer in hot air oven}} = T_{\text{melting point outer plastic layer}} + \Delta T_{\text{melting energy for strip}} \\ &+ \Delta T_{\text{cooling distance}} \end{aligned}$$

20

However, overheating may be associated with certain problems. The laminated material as a whole is subjected to thermal expansion to different degrees. This results in tension in the laminate, which runs the risk of causing delamination.
25 This results in undesirable and hardly controllable effects, not least regarding the longitudinal seal which is later to be carried out along the edge which is provided with the edge-sealing strip. Delamination, which causes the aluminium foil and adjacent plastic layers to loosen from the paper- or paperboard material will, for example, have as a consequence that severe, unacceptable folds occur in the foil
30 adjacent the strip sealing in connection with the application of the strip. If an attempt is made to remedy this situation by reducing the temperature in the hot air oven, the strength in the seal will be insufficient.

In addition, overheating becomes particularly problematical when the interjacent thermoplastic layer of the laminate consists of a thermoplastic material whose melting point lies below that of the first thermoplastic material, i.e. in the strip and the outer laminate plastic layers. For example, polypropylene (PP) is a material
5 which, int. al. for reasons of mechanical strength and aesthetic appearance, is eminently suitable as an outer material in a packaging laminate. If PP is selected as material in the outermost layers in the laminate, this implies that the edge-sealing strip as well, for reasons of adhesion, should also consist of this material. PP has a melting point which is comparatively quite high, approx. 160°C. On the other hand,
10 in many of today's packaging laminates, there are interjacent tie layers of polyethylene (PE). The melting point of PE is approx. 110°C. The combination of PP in outer layers and PE in interjacent layers will thereby become even more intractable. In order to achieve a sufficiently strong seal, the temperature in the hot air oven must lie substantially higher than that at which the PE material melts, and
15 this results in the interjacent layer running the risk of being exposed to heat to an excessively high degree, with severe delamination as a result.

SUMMARY OF THE INVENTION

It is, therefore, one object of the present invention to propose a method by
20 means of which this undesirable high thermal exposure is avoided and in which the consequential problems related thereto may thus be avoided. This object is attained according to the present invention by means of the following steps: advancing the edge of the packaging laminate web through a hot air oven for heating of the edge at least to tacking temperature, tack adhering the edge-sealing strip at least adjacent the
25 edge on the product side of the web, advancing the edge with the tack adhered edge-sealing strip through an induction oven where the active element of the induction oven is turned to face at least towards the product side of the web, and positively pressing together the edge and the strip.

Employing this method, it is possible to reduce the cooling distances and this,
30 together with the heating being put into effect in two stages, does not require overheating of the materials to the same extent as was necessary according to the

prior art. The resultant negative effects are reduced and it will also be possible to employ the method according to the present invention for laminates with interjacent thermoplastic layers displaying a lower melting point than that of the outer thermoplastic layers.

5 According to one preferred embodiment of the present invention, the method includes the step of positively compressing the edge and the strip by rolling. Under the action of the heat in the material, the rolling ensures that both of the parts will be completely sealed to one another. This a relatively simple and reliable technique for achieving a strong and homogenous seal and for obviating the risk of the occurrence
10 of enclosure pockets or gap formations.

 According to yet a further preferred embodiment of the present invention, the method includes the step of folding the edge-sealing strip through approximately 180°, before the tack adhesion, for the formation of a U in order, in conjunction with the adhesion, to permit the U to be adhered to both the product side and the
15 decorative artwork side of the packaging laminate web. As a result, the edge-sealing strip may simply be united to both sides of the packaging laminate in one operation in order, in a subsequent operation, to be integrated with the laminate.

 It is also an object of the present invention to propose an apparatus for reducing the method into practice. The apparatus is characterised in that it includes a
20 hot air oven for heating the edge of the packaging laminate web to at least tacking temperature, means for moving an edge-sealing strip into contact with the edge of the packaging laminate web for tack adhesion, an induction oven for heating the edge of the packaging laminate web and the edge-sealing strip tack adhering thereto, and means for positively compressing the edge and the strip together.

25 In one preferred embodiment of the apparatus according to the present invention, the induction oven includes an active induction element turned to face at least towards the product side of the web. It will hereby be ensured that the generated heat is principally emitted to the product side of the laminate where it is most essential to ensure that no enclosure pockets or channels are to be found. Preferably,
30 use is made of an induction element comprising two coils where one is turned to face towards the product side and the other is turned to face towards the decorative artwork side, i.e. an inductor which acts on both sides of the laminate.

In yet a further preferred embodiment of the present invention, the apparatus includes means for folding the edge-sealing strip through approximately 180° for the formation of a U for refolding around the edge, such means being placed so that the folding takes place before the strip comes into contact with the edge. As a result, the edge-sealing strip will be formed so that, in connection with a subsequent light compression at the packaging laminate edge, it will surround the latter edge in a reliable, symmetric and satisfactory manner.

According to still a further preferred embodiment, the apparatus includes means for rolling the region comprising the edge of the packaging laminate web provided with the edge-sealing strip.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWING

The present invention will now be described in greater detail hereinbelow, with reference to one embodiment shown on the accompanying Drawing. In the accompanying Drawing:

Fig. 1 schematically shows a view of a web of a packaging laminate and, along its one edge, an apparatus for applying an edge-sealing strip.

DETAILED DESCRIPTION OF ONE EMBODIMENT

Fig. 1 shows the principle for application of an edge-sealing strip according to the invention. An edge-sealing strip 1 of a thermoplastic material (for example PP) is applied at one longitudinal side 2 belonging to a packaging laminate web 3. As was described by way of introduction, the laminate material has a decorative artwork side and a product side which each include an outer layer of a thermoplastic material. Said thermoplastic material is of the same type as in the edge-sealing strip 1.

In a hot air oven 4, the edge 2 of the packaging laminate web 3 is heated up to a temperature at which it can tack adhere to an edge-sealing strip at room temperature merely in that they are brought into contact with one another. This implies that the laminate edge need only be heated to a slightly higher temperature than that at which tacking is possible. The reason why the temperature must, however, be slightly higher than the tacking temperature is that a part of the energy

in the edge 2 will, in connection with the adhesion, be transferred into the edge-sealing strip 1.

From a feeding device (not shown) running parallel with the packaging laminate web 3, the edge-sealing strip 1 is set in motion at a speed which
5 corresponds to the speed of the packaging laminate web 3. This motion is put into effect by the intermediary of rotary bending rollers 5, 6 which are driven by the movement of the laminate web. The first bending roller 5 is of such a type that the strip 1 centres itself on its running surface. The second bending roller 6 displays a configuration which permits the strip 1 to have, prior to the tack adhering, a U-
10 shaped form which closely approaches the edge of the laminate web 3. Immediately after the bending roller 6, single clamping rollers 7 are provided. These act on the sides of the packaging laminate web 3 and the strip 1. The clamping rollers 7 act to ensure that the tack adhesion of the edge-sealing strip takes place at as large a surface of the edge 2 of the packaging laminate web 3 as possible.

15 Thereafter, the laminate web 3 runs together with the edge-sealing strip 1 adhering thereto into an induction heating oven 8. Induction sealing is a known technique and will not be described in greater detail here. However, the induction oven includes an induction element (not shown). In this preferred embodiment, the induction element consists of two interconnected coils, where the one acts on the
20 decorative artwork side and the other acts on the product side. It is most crucial that the sealing on the product side is strong, so in principle it would be sufficient to have a coil on the product side, but is preferable to have a coil from each side in order to achieve a uniform distribution of heat.

In the oven 8, the laminate web 3 with the edge-sealing strip 1 is heated up to
25 a temperature at which the strip is fused together with the outer layer of the packaging laminate. In order to completely ensure that no gap or enclosure pocket runs the risk of occurring between the edge-sealing strip 1 and the packaging laminate, the integrated material is fed into a further, final station 9 in which it is rolled together in order, at the prevailing elevated temperature, moreover to be
30 positively compressed together a last time.

The material is thereby ready for future process steps in the form of, for example, reforming into packaging sleeves. During these coming stages, it is highly

likely that the material will be subjected to an overlapping longitudinal seal where the edge provided with the strip overlaps the opposing longitudinal edge of the material in a seal. This overlap is made so that the edge with the strip is disposed on the inside of the contemplated package. The product side of the edge provided with the strip will thus be in contact with the product, while its decorative artwork side will be sealed to the product side at the opposing edge. If, the strip portion which is located on the decorative artwork side will thereby not to have adhered as well as the strip portion on the product side on strip sealing, that part of the strip will be given another opportunity to be sealed in connection with the overlapping longitudinal sealing.

In one alternative embodiment of the present invention, it is possible that the edge-sealing strip 1 is initially only applied adjacent the edge on the one side of the packaging laminate web 3, the product side. This application of the present invention is best suited for packaging laminate webs which, in a subsequent working phase, are to be formed into a tube (not shown) for continuous filling and transverse sealing. In this case, the laminate web 3 will, once the edge-sealing strip has been applied, display a strip portion projecting out from the edge of the laminate web 3. However, this is of no major importance, since a tube forming of the packaging laminate web 3 takes place shortly after the application of the edge-sealing strip 1. However, in order to make possible an application of the edge-sealing strip 1 only at one side of the packaging laminate web 3, it is necessary that the arrangement of the rotary bending rollers 5, 6 according to the above-described embodiment be modified. Without going into greater detail as to how this is appropriately to be put into effect, in principle it is a matter of ensuring that the edge-sealing strip is fed transversely to the surface of the web 3 and that, in association with the region where it is to be applied, it is passed over a bending/compression roller (not shown) which angles the edge-sealing strip 1 through 90° so that the packaging laminate web 3 and the edge-sealing strip 1 are brought together for the formation of a tack adhesion of the same type as described above. In all other respects, the method according to this embodiment corresponds to that previously described.

The present invention should not be considered as restricted by the foregoing description, but only by the scope of the appended Claims.

CLAIMS:

1. A method of applying an edge-sealing strip (1) of a first thermoplastic material to an edge (2) of a packaging laminate web (3), said laminate web
5 comprising at least the following layers: a first outer layer of said first thermoplastic material, a layer of paper or paperboard, a tie layer of a thermoplastic, a layer of an induction heatable material, as well as a second outer layer of the first thermoplastic material, **characterised by** the steps of:
advancing the edge (2) of the packaging laminate web (3) through a hot air oven (4)
10 for heating the edge (2) at least to tacking temperature,
tack adhering the edge-sealing strip (1) at least adjacent the edge (2) on the product side of the web (3),
feeding the edge (2) with the tack adhered edge-sealing strip (1) through an induction oven (8) where the active element of the induction oven (8) is turned to face at least
15 towards the product side of the web (3), and
positively compressing the edge (2) and the strip (1) together.
2. The method as claimed in Claim 1, **characterised by** the step of positively compressing the edge (2) and the strip (1) together by rolling.
20
3. The method as claimed in Claim 2, **characterised by** the step of folding the edge-sealing strip (1) approx. 180°, prior to the tack adhering, for the formation of a U in order, in connection with the adhering, to permit adhering thereof to both the product side and the decorative artwork side of the packaging laminate web (3).
25
4. An apparatus for applying an edge-sealing strip (1) of a first thermoplastic material to an edge of a packaging laminate web (3), said laminate web comprising at least the following layers: a first outer layer of said first thermoplastic material, a layer of paper or paperboard, a tie layer of a thermoplastic, a layer of an induction
30 heatable material, as well as a second outer layer of the first thermoplastic material, **characterised in that** the apparatus comprises:

a hot air oven for heating the edge of the packaging laminate web (3) to at least tacking temperature,

means for moving an edge-sealing strip (1) into contact with the edge (2) of the packaging laminate web (3) for tack adhering,

- 5 an induction oven (8) for heating the edge (2) of the packaging laminate web (3) and the edge-sealing strip (1) tack adhered thereto, and

means for positively compressing the edge (2) and the strip (1) together.

5. The apparatus as claimed in Claim 4, **characterised in that** the induction
10 oven includes an active induction element facing at least towards the product side of the web.

6. The apparatus as claimed in Claim 4, **characterised in that** it includes means
(6) for folding the edge-sealing strip approximately 180° for the formation of a U for
15 folding around the edge (2), and that said means is placed so that the folding takes place before the strip comes into contact with the edge (2).

7. The apparatus as claimed in Claim 6, **characterised in that** it includes means
for rolling the region comprising the edge (2) of the packaging laminate web (3)
20 provided with the edge-sealing strip (1).

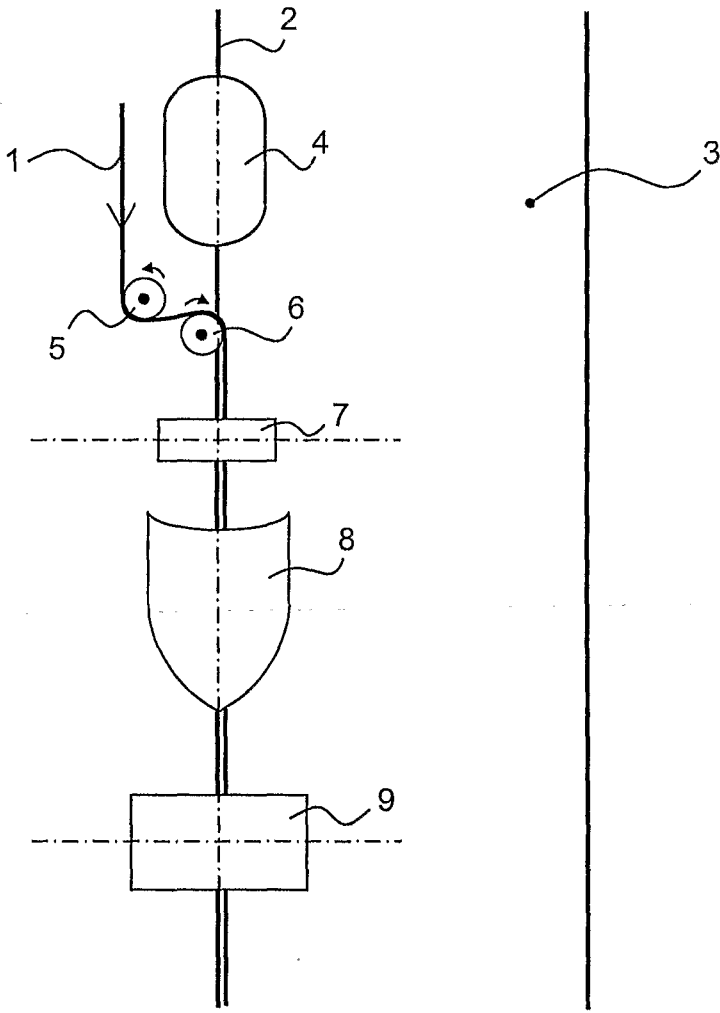


Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/001069

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: B31F, B65D

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, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4721242 A1 (WILHELM REIL), 26 January 1988 (26.01.1988), figure 6, abstract --	1-7
A	US 3456863 A (JAMES W MOLLISON ET AL), 22 July 1969 (22.07.1969), figure 4, abstract --	1-7
A	US 3081213 A1 (HARRY G CHINN ET AL), 12 March 1963 (12.03.1963) --	1-7
A	DE 4409255 A (ROVEMA-VERPACKUNGSMASCHINEN GMBH), 21 Sept 1995 (21.09.1995) --	1-7

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

4 January 2007

Date of mailing of the international search report

08-01-2007

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Kristina Berggren/EK

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/001069

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5620135 A1 (WERNER STAHLER ET AL), 15 April 1997 (15.04.1997) --	1-7
A	EP 0763472 A1 (TETRA LAVAL HOLDINGS & FINANCE SA), 19 March 1997 (19.03.1997) -- -----	1-7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2006/001069

International patent classification (IPC)

B31F 5/00 (2006.01)

B31F 7/00 (2006.01)

B65D 5/42 (2006.01)

Download your patent documents at www.prv.se

The cited patent documents can be downloaded at www.prv.se by following the links:

- In English/Searches and advisory services/Cited documents (service in English) or
- e-tjänster/anförda dokument (service in Swedish).

Use the application number as username.

The password is **HVZZXHLMB**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/11/2006

International application No.

PCT/SE2006/001069

US	4721242	A1	26/01/1988	AT	70798	T	15/01/1992
				CA	1279300	A,C	22/01/1991
				CN	1007146	B	14/03/1990
				CN	86104359	A	22/04/1987
				DE	3519955	A,C	04/12/1986
				DE	3683084	A	06/02/1992
				EP	0204137	A,B	10/12/1986
				SE	0204137	T3	
				JP	2045466	C	09/04/1996
				JP	7064364	B	12/07/1995
				JP	61287566	A	17/12/1986
				KR	9509535	B	24/08/1995
				KR	950009535	B	24/08/1995

US	3456863	A	22/07/1969	NONE			

US	3081213	A1	12/03/1963	NONE			

DE	4409255	A	21/09/1995	NONE			

US	5620135	A1	15/04/1997	DE	4411924	A	12/10/1995
				DK	676335	T	13/12/1999
				EP	0676335	A,B	11/10/1995
				JP	8080931	A	26/03/1996

EP	0763472	A1	19/03/1997	AT	186266	T	15/11/1999
				AT	209144	T	15/12/2001
				AU	685252	B	15/01/1998
				AU	711229	B	07/10/1999
				AU	2019495	A	30/11/1995
				AU	3922897	A	18/12/1997
				CA	2149690	A,C	24/11/1995
				CN	1052947	B,C	31/05/2000
				CN	1080683	B,C	13/03/2002
				CN	1088675	B,C	07/08/2002
				CN	1112892	A	06/12/1995
				CN	1244484	A	16/02/2000
				CN	1244485	A	16/02/2000
				DE	69513081	D,T	17/02/2000
				DE	69524090	D,T	18/04/2002
				EP	0684184	A,B	29/11/1995
				JP	3394596	B	07/04/2003
				JP	7315363	A	05/12/1995
				RU	2139824	C	20/10/1999
				TW	383737	Y	01/03/2000
				US	5598927	A	04/02/1997
				US	5722539	A	03/03/1998
				US	5732825	A	31/03/1998