(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 November 2013 (14.11.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/169128 A1

(51) International Patent Classification:
B05C 11/04 (2006.01) *D21H 25/10* (2006.01)

(21) International Application Number:
PCT/PL2013/000062

(22) International Filing Date:
8 May 2013 (08.05.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
P-399127 9 May 2012 (09.05.2012) PL

(71) Applicant: **SCHATTDECOR SP. Z.O.O.** [PL/PL]; ul. Sowia 10, PL-62-080 Tarnowo Podgórne (PL).

(72) Inventors: **KRÓL, Jan**; ul. Papiernicza 4B/2, PL-48-340 Głuchołazy (PL). **WNEK, Krzysztof**; Nowy Swietow 108 H, PL-48-330 Nowy Swietow (PL).

(74) Agent: **GÓRNICKI, Pawel**; PATENT-SERVICE Biuro Ochrony Własności Intelektualnej, ul. Rybojadzka 16, PL-60 443 Poznań (PL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: METHOD AND DEVICE FOR LEVELLING AND ESTABLISHING THE THICKNESS OF A LIQUID AGENT LAYER SPREAD ON A MATERIAL

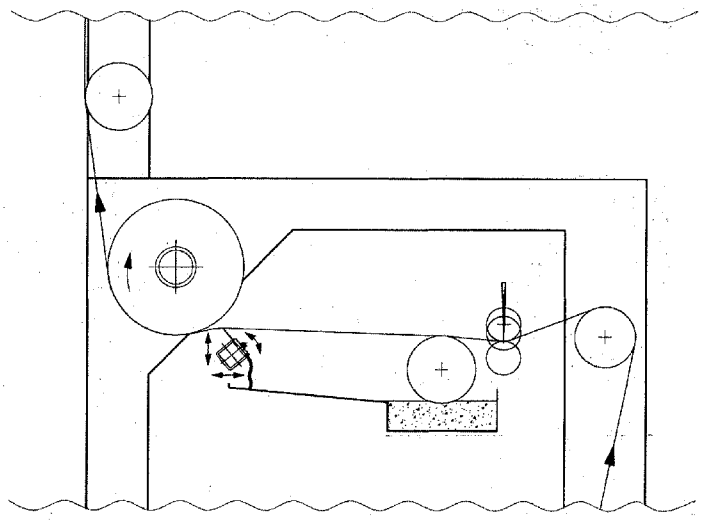


Fig.1

(57) Abstract: The subject of the invention method and device for levelling and establishing the thickness of a liquid agent layer placed on a ribbon of moving coated or lacquered material. The method characterized in that the excess of lacquer is collected with at least one blade (4) placed in the space between the applicator element (2) of the module for applying the liquid agent onto a web of material (1), and any roller of the web pulling module, outside of its wrapping space, whereas the blade (4) is knife-shaped. The device contains a blade, which is connected with a device for adjusting (7) the pressure of the working area (D) of the knife blade (4) onto the web of material (1) and the angle (a) of the placement of the knife against the web of material (1).

WO 2013/169128 A1

Method and device for levelling and establishing the thickness of a liquid agent layer spread on a material

The subject of the invention method and device for levelling and establishing the thickness of a liquid agent layer spread on a web of moving coated or lacquered material. This solution applies in particular to levelling and establishing the thickness of layer of lacquer or impregnating agent spread on a pre-impregnated decorative paper or on film base. The method and device may also be used to coat other papers, foils and materials.

The known methods implementing this goal consist of starting the movement of a web of material using a system of guide, stabilizing and supporting rollers, and then spreading the liquid agent over the moving web using a module spreading the agent on the material, and at the end, collecting the surplus of liquid agent from the web of material moved in (drawn through) the device, using a blade squeegee placed most frequently in the cylinder wrapping space, or a non-blade squeegee – round rotary – located outside of the wrapping space of the pulling cylinder. The known devices for the implementation of this goal consist of: a module for spreading a liquid agent on a web of moving material, consisting of, among others, applying elements and rollers, a module for pulling the web with the spread layer of liquid material ensuring relative movement between the material and the module for spreading the liquid material using a system of rollers and a squeegee placed behind the module for spreading the agent in direction of the movement of the material, ensuring a resistance of the flow and removing the excess of the agent from the material in such a manner as to ensure a layer with appropriate area and thickness.

The Meyer Bar method is commonly known. In a device for the implementation of this method the module for spreading a liquid agent contains, among other things, a roller spreading a liquid agent on the material, called an application cylinder and a tub with a liquid agent. Squeegees are used for removing the excess of a liquid agent and controlling its amount and thickness of the coat, in the form of steel round rotary rods made of stainless steel, covered tightly with a nickel-chrome steel with various diameter. Wet layer thickness after scraping depends on the diameter of the wire used to wrap the roller, and amounts approximately 0.1 of the wire diameter. The thickness of the dry layer of the spread agent depends on the concentration of solids in the coating agents. The module pulling the web with a spread layer of a liquid agent in the Meyer Bar method consists of multiple drive rollers for guiding, pulling and supporting and distributing the web of material to subsequent modules of the device. In the device for using this method the squeegee is mounted on a supporting cradle and placed in the space between the application cylinder of the module for spreading the liquid agent from the tub onto the material, and the pulling cylinder which is an element of the pulling module of the device located on the opposite side of the squeegee in relation to the application cylinder. The drawbacks of the Meyer Bar method include the limited evenness of spreading the agent, low speed of its application, sensitivity to the phenomenon aquaplaning with higher speeds and lack of elimination of defects of the base material.

The second known method, so-called squeegee chamber, consists of placing the lacquer on a material using an applying screen drum, to which a squeegee chamber is pressed, and to which the applied agent is fed under pressure. The applying screen drum with ink carriers placed on its surface and filled with the applied agent rotates backwards to the direction of movement of the material web. Material is placed against the screen cylinder by a press roller at a specific distance, but without pressure, and the applied agent is rubbed into the coated material. In the device for implementing this method the module for the spreading of a liquid agent is collected of: Blade chamber, screen roller and press roller (positioning roller), and the module for pulling the web with the spread layer of liquid agent consists of at least a drive roller and guide rollers. In the device for this method squeegees are blade-shaped and are the edges of the pressure roller. After pressing the screen roller they form a

hermetic dosing system. The disadvantages of this method include relatively difficult and complicated actions related to the changes, replacement and maintenance of the device, sensitivity to contamination and lack of sufficient elimination of defects of the base material.

Moreover, from the description of the American invention number US5741550 named: "Blade metering unit and method for blade-coating a material web" a method and device for applying a coat mix to a high-speed running board or paper web by accurately premetering and pre-smoothing the applied coal with an applicator device and then minimally doctoring the applied coat with an air knife. The method is based on applying a layer of coating mix of precise thickness onto the web by means of a narrow slot-orifice applicator operating with a counterflow in the reverse direction to the web travel and having precise control of the mass flow of the coat mix (liquid agent) applied to the web so as to achieve a desired coat weight. The device in this case does not have a cylinder applying a liquid agent from the tub, but an applicator module with a narrow orifice-slot extending in a cross-machine direction for facilitating high-speed laminar flow of coating mix into a gap region defined by confronting surfaces of the applicator device and the web. The applicator device has a member for directing the ejected coating mix in the gap region in a direction reverse to a travel direction of the web so that only a predetermined portion of the ejected coating mix is allowed to form an applied coat on the web. This accurate premetering of the coating mix by the applicator device permits an operator to readily optimize the subsequent process of doctoring the applied coating with an air knife. This method requires very complicated equipment and high precision of the process as well as the use of multiple control and regulation devices ensuring the maintaining of extremely high operating parameters.

The goal of the invention is the creation of a method and device enabling the maximum elimination of defects and unevenness of the created coat, related to the teleportation of defects and contamination of the rolls guiding the web and rolls cooperating with the squeegee, ensuring the self-cleaning of the squeegee, elimination of negative effects of aquaplaning and the use of this phenomenon as a method of ensuring even thickness of the applied coat.

A method of levelling and establishing the thickness of a liquid agent coat placed on a covered or lacquered material, moving inside a machine, in which the excess of

the applied liquid agent is collected using a squeegee placed behind the applicator module in the direction of movement of the web, in accordance with the invention, is characterised by the fact that excess lacquer is collected with at least one blade located in the space between the applicator element of the module for applying the liquid agent on the web, and any roller of the module for pulling the ribbon, outside of the wrapping space of this cylinder, whereas the blade is knife-shaped. Thickness of the layer placed on the material web is adjusted by the pressure of the working area of the knife blade on the material web. Thickness of the layer placed on the material web is also adjusted by the angle of the knife against the material web surface. Thickness of the layer placed on a paper web is also adjusted by the working area of the knife blade.

Device for levelling and establishing the thickness of a liquid agent coat placed on a covered or lacquered material, consisting of a module applying the liquid agent to a web of material moving inside the device, a module pulling the web of material and a blade removing the surplus of the agent, in accordance with the invention, characterized in that it contains at least one blade, which has the form of a knife from the side of the coated web of material outside of the wrapping boundary of any roller of the pulling module, whereas the knife is connected with a device for adjusting the pressure of the working area of the knife blade on the web and the angle of placement of the knife against the web of material. Advantageously the knife, from the side of the liquid agent applicator module, is placed at a sharp angle between the surface of the web material and the knife axis, whereas this angle will be in the range of 5° to 80°. It is advantageous when the working area of the knife blade is within a range of 0.01 mm to 15 mm.

The subject of the invention, in a sample implementation is presented on the drawing, in which fig. 1 presents the diagram of the device and fig. 2 presents the placement of the blade against the material web, with a marked: coat of liquid agent and zone of increased hydrodynamic pressure, as well a schematic run of removing excess lacquer.

Method and device in the example solution concerns the application of lacquer in a lacquering machine. Material in the form of a preimpregnated foil web 1 is moved with a system of pulling, supporting and guiding rollers located both in the part which forms the module for pulling the web and the applicator module of the lacquering

machine. Between the application cylinder 2 of the lacquer application module and the pulling roller 3 of the module for pulling the web 1 a knife blade 4 is located. It is located directly next to the pulling roller 3, however outside of the borders of the wrapping of this roller by the web. Application cylinder 2 is placed above the lacquer tub 5 with a lacquer 6 located directly under the web of material 1. Moreover, both the pulling and the applicator module are equipped with additional guiding and supporting rollers. Blade 4 mounted on the adjustment mechanism 7 enabling the change of its position along the web of material (up-down; front-rear; and angle of inclination). The web of material with a width of 2540 mm moves with a speed of 280 m/min through the following elements of the lacquering machine: unwinding machine, pulling in station, lacquering module, guiding and pulling rollers, dryer, pulling out station and rewinding machine.

Blade is placed using the adjustment device 7 under an angle of $\alpha = 45°$ in relation to the web of material (preimpregnated). The method uses linear placement of the blade the moving, appropriately tensioned and coated material, which by creating a zone of an increased hydrodynamic pressure 8 and specific stable surface hydrodynamic overpressure of the liquid material (aquaplaning) applies the lacquer evenly over the entire surface.

Adjustment of the squeegee placement angle to the surface of the paper in connection with appropriately selected parameters: speed of web movement, tension of material web and the amount of lacquer enable obtaining self-cleaning of the squeegee blade. Devices for controlling web tension and tool pressure are widely known and used as standard in the printing and paper industry. During the process as a result of rapid movement of the material web already coated with a liquid agent, in the zone where the blade 4 is placed against the material web an increased hydrodynamic pressure zone 8 forms, in the form of a "wedge", which results in the loss of direct contact of the collecting blade 4 with the coated material web 1. As a result of the creation of the hydrodynamic pressure, a phenomenon of so called aquaplaning occurs, which causes the forming of a continuous layer of the coated material, with full control over the thickness and quality of the layer. In the sample implementation the following were used: material web movement speed – 280 m/min; material web tension for its full width – 850 N; viscosity – 16 seconds (measurement with a Ford cup DIN – 4 mm DIN 53211); squeegee placed under an

angle of α = 45° to the web of material; knife with a working area of (D) - 0.25 mm. As a result of using the invention a high-quality product is obtained with high uniformity of the coated surface, the number of weak points of the paper are reduced, self-cleaning of the knife is ensured, that is the loss of particles of hardened lacquer or lacquer contaminations.

Patent claims

1. A method of levelling and establishing the thickness of a liquid agent coat placed on a covered or lacquered material, moving inside a machine, in which the excess of the applied liquid agent is collected using a squeegee placed behind the applicator module in the direction of movement of the web, characterized in that the excess lacquer is collected with at least one blade (4) located in the space between the applicator element (2) of the module for applying the liquid agent on the web (1), and any roller of the module for pulling the ribbon, outside of the wrapping space of this cylinder, whereas the blade (4) is knife-shaped.
2. A method in accordance with claim 1, characterized in that the thickness of the layer placed on the material web (1) is adjusted by the pressure of the working area (D) of the knife blade (4) on the material web (1).
3. A method in accordance with claim 1, characterized in that the thickness of the layer placed on the material web (1) is adjusted by the angle (α) of the knife blade (4) against the material web (1) surface.
4. A method in accordance with claim 1, characterized in that the thickness of the layer placed on the material web (1) is adjusted by the working area (D) of the knife blade (4).
5. Device for levelling and establishing the thickness of a liquid agent coat placed on a covered or lacquered material, consisting of a module applying the liquid agent to a web of material moving inside the device, a module pulling the web of material and a blade removing the surplus of the agent, characterized in that it contains at least one blade, which has the form of a knife (4) from the side of the coated web of material (1) outside of the wrapping boundary of any roller (3) of the pulling module, whereas the knife (4) is connected with a device for adjusting (7) the pressure of the working area (D) of the knife blade (4) on the web (1) and the angle (α) of placement of the knife (4) against the web of material (1).

6. A device in accordance with the claim 5, characterized in that the knife **(4)**, from the side of the liquid agent applicator module, is placed at a sharp angle **(α)** between the surface of the web material **(1)** and the knife **(4)** axis, whereas this angle **(α)** will be in the range of 5° to 80°.
7. A device in accordance with claim 5, characterized in that the working area **(D)** of the knife blade **(4)** is within a range of 0.01 mm to 15 mm.

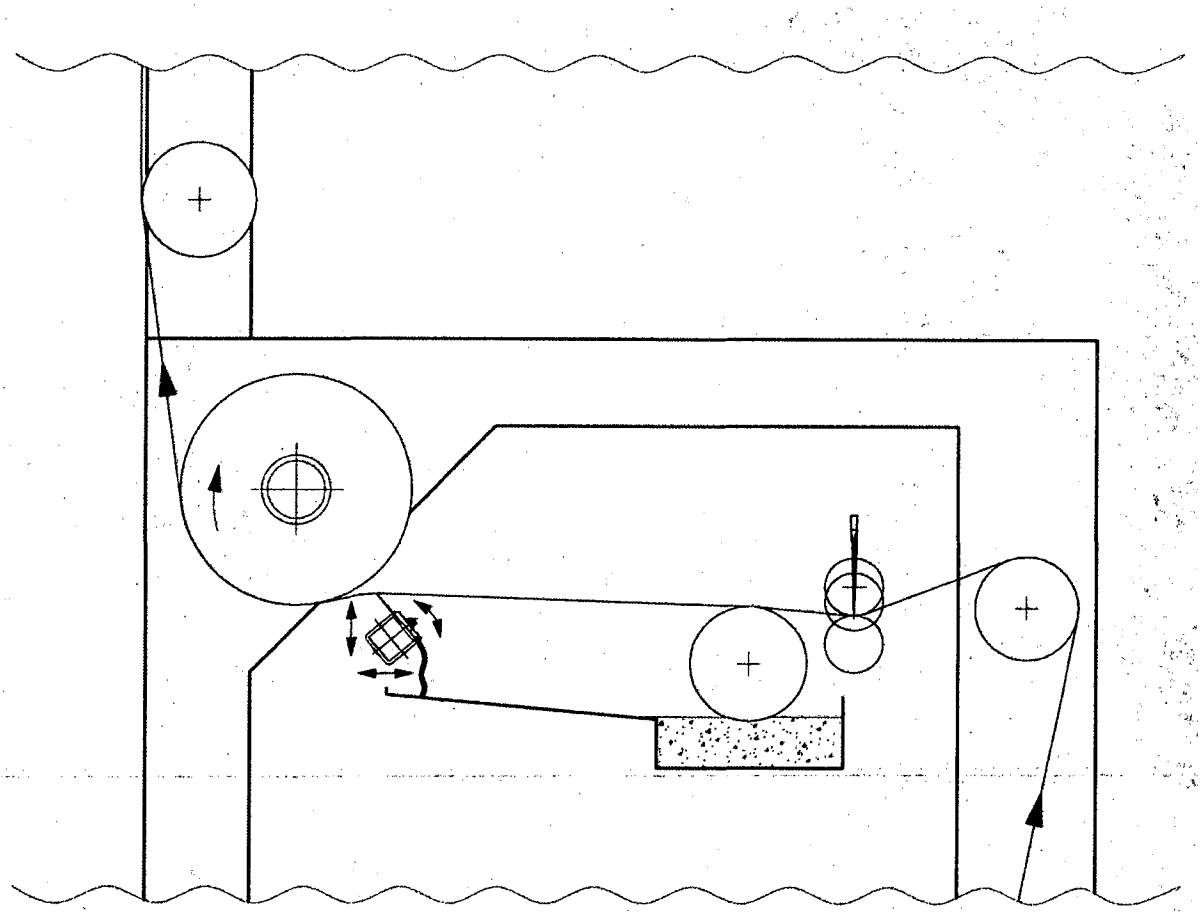


Fig.1

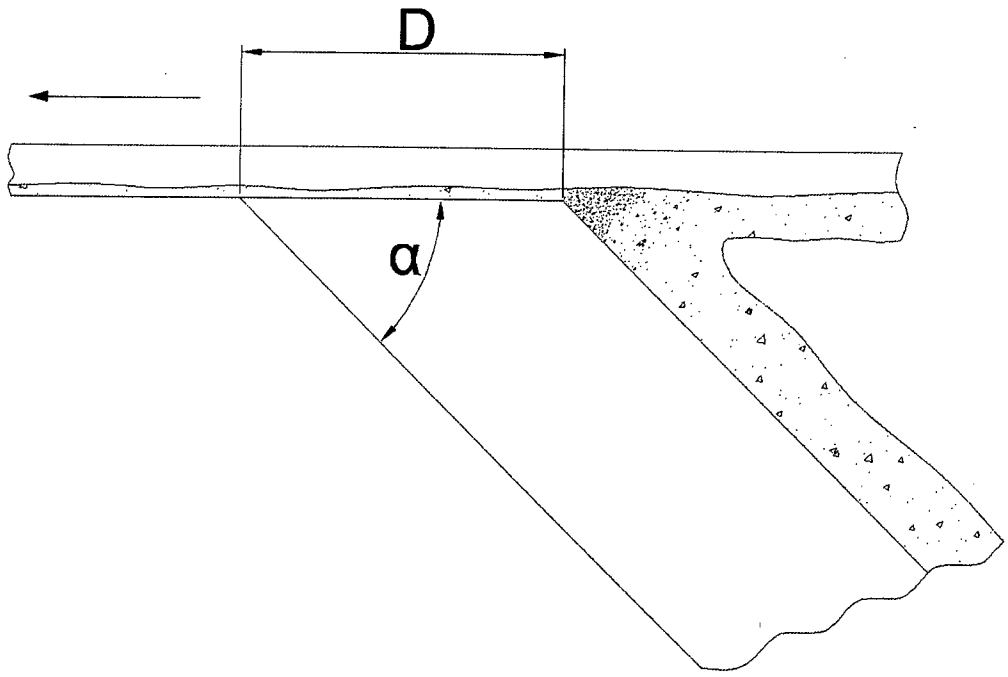


Fig.2

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2013/000062

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05C11/04 D21H25/10
ADD.

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)
B05C D21H

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 076 864 A (WALLSTEN HANS IVAR) 28 February 1978 (1978-02-28) column 2, line 24 - column 8, line 34; figures; tables 1-3	1-4
A	US 5 609 686 A (JERRY GLEN A [US] ET AL) 11 March 1997 (1997-03-11) column 3, line 46 - column 4, line 29; figures 1-4	1-7
A	US 4 133 917 A (WALLSTEN HANS I) 9 January 1979 (1979-01-09) column 4, line 23 - column 6, line 5; figures 1-3; table 1	1-7
A	US 5 520 731 A (ESSER REINHARD [DE] ET AL) 28 May 1996 (1996-05-28) figures	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	Date of mailing of the international search report
4 September 2013	12/09/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Daintith, Edward

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/PL2013/000062

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4076864 A	28-02-1978	AT 354248 B	27-12-1979
		CA 1070574 A1	29-01-1980
		DE 2637840 A1	17-03-1977
		FI 762436 A	27-02-1977
		FR 2321950 A1	25-03-1977
		GB 1546451 A	23-05-1979
		IT 1064969 B	25-02-1985
		JP S5228537 A	03-03-1977
		SE 424510 B	26-07-1982
		SE 7509461 A	27-02-1977
		US 4076864 A	28-02-1978
US 5609686 A	11-03-1997	CN 1193929 A	23-09-1998
		EP 0847579 A2	17-06-1998
		JP H11511585 A	05-10-1999
		US 5609686 A	11-03-1997
		WO 9708690 A2	06-03-1997
US 4133917 A	09-01-1979	DE 2637828 A1	10-03-1977
		FR 2321951 A1	25-03-1977
		GB 1546500 A	23-05-1979
		SE 424511 B	26-07-1982
		SE 7509462 A	27-02-1977
		US 4133917 A	09-01-1979
US 5520731 A	28-05-1996	NONE	