



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

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<b>(21) International Application Number:</b> PCT/IT93/00139 <b>(22) International Filing Date:</b> 28 December 1993 (28.12.93) <b>(30) Priority Data:</b> UD93A000067 19 April 1993 (19.04.93) IT <b>(71) Applicant (for all designated States except US):</b> SERIGRAFIA PERTOLDI S.N.C. DI MARCO PERTOLDI & C. [IT/IT]; Via 1° Maggio, 93, I-33010 Reana del Rojale (IT). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> PERTOLDI, Marco [IT/IT]; Via 1° Maggio, 93, I-33010 Reana del Rojale (IT). <b>(74) Agent:</b> D'AGOSTINI, Giovanni; D'Agostini Organizzazione, Via G. Giusti, 17, I-33100 Udine (IT).		<b>(81) Designated States:</b> AU, BB, BG, BR, BY, CA, CZ, FI, HU, JP, KP, KR, KZ, LK, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SK, UA, US, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> PROCESS FOR THE REALIZATION OF SERIGRAPHED ELEMENTS IN THERMOPLASTIC MATERIAL WITH TRANSPARENT PARTS ABLE TO BE ILLUMINATED FROM BEHIND  <div> </div>		
<b>(57) Abstract</b>  Process for the realization of serigraphed elements in thermoplastic material with transparent parts able to be illuminated from behind, as for example overlay panels (9), of the type which provides: the realization of a sheet in a plastic, transparent and thermodeformable material (1), serigraphed (2), to obtain opaque and transparent parts such as small windows (25), containing designs and characters and/or indications and/or references, subsequently varnished for the protection of the said serigraphs (3); the formation by thermo-moulding of the said serigraphed and varnished sheet, and the respective die-cutting for the shape definition of the semi-finished product (5); the injection under pressure of a reinforcing plastic material which gives areas of thickness and definition on the interior surface (7) of the said semi-finished product (5), to obtain a ready to use finished overlay panel, having holes (51) and small windows (23) with respective indications and information, in which the said sheet (1) is serigraphed on its external surface (2) and the said external surface is coated with a protective layer of transparent varnish to finish the respective surface (3); the sheet so defined (10) is: shaped by thermo-moulding, and die-cut for the shape definition of the semi-finished product (5') to give the final shape of the overlay panel; to the internal surface of said die-cut semi-finished product is applied, by injection under pressure, a reinforcing plastic material (7) which gives the final thickness to said overlay panel (9) which is thus finished and ready for use, including holes (51) and small windows (25) with respective indications and information.		

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### DESCRIPTION

PROCESS FOR THE REALIZATION OF SERIGRAPHED ELEMENTS IN THERMOPLASTIC MATERIAL WITH TRANSPARENT PARTS ABLE TO BE ILLUMINATED FROM BEHIND.

### Technical Field

This invention as its subject has a process for the realization of elements in thermoplastic material printed with transparent parts able to be illuminated from behind.

The product resulting from the said process is also object of the present invention.

## Background Art

At the present stage of technology is well known the need to realize dashboards made of plastic material particularly for vehicles, electric appliances and similar, which have a shaped form of a more or less constant thickness of some millimetres, for receiving and/or covering command and visual signalling apparatuses, and therefore involving as well as a generally complex shaping, holes and small transparent windows that consent respectively, the former the insertion of control and signalling and/or command apparatuses as for example mileage recorder, tachometer, temperature indicators, knobs, switches, levers, etc., and the latter allowing underlying lighting devices for controls, signalling, etc. to be made visible.

Furthermore said elements in plastic material, hereafter briefly defined in this description as overlay panels, need to have their respective external surfaces endowed with writing, designs, etc., both on an opaque background and on a transparent background.

Hereafter for ease of definition the external side of the overlay panel will be defined as the one which the operator sees and the internal side

1 as the opposite side, or in other words the one in the direction of the  
2 electric instrumentation and respective visual signalling apparatuses  
3 and lighting.

4 The realization of these overlay panels is presently carried out by means  
5 of the following procedures:

- 6 • applying a serigraph onto the external side of a sheet of a transparent  
7 polycarbonate plastic material as for example Makrofol Lexa, Bayfol, etc.  
8 (thickness from mm 0.50 to 0.75):
  - 9 • coating the serigraph with a transparent varnish;
  - 10 • coating, with similar transparent varnish, a transparent sheet made of  
11 a plastic material and analogous to the preceding one, and
  - 12 • union of the two sheets by means of calendering at a thermo-glueing  
13 temperature to form a single sheet including the serigraphed drawings  
14 and writing, small transparent windows and opaque surfaces;
  - 15 • thermo-moulding, generally at high temperatures and under  
16 compressed air pressure or vacuum, to obtain a permanent deformation  
17 of the sheet, according to the form desired for the dashboard:
  - 18 • cutting of the moulded sheet to obtain the defined perimetrical shape of  
19 the semi-finished product of the overlay panel;
  - 20 • application between a mould and counter-mould of the covering of the  
21 overlay panel so obtained and subsequent injection of a plastic material  
22 to give a certain thickness on the internal surface of said overlay panel,  
23 taking care not to fill said holes in said overlay panel and not to  
24 introduce thick and dull material inside in connection with said small  
25 visualization windows; for the formation of a structurally finished and  
26 self-supporting overlay panel.

27 This way of obtaining the aforementioned overlay panels is complex and  
28 costly and has particular defects which include swelling (bulging of said

1 windows) caused by surface tensions due to recovery of stratification of  
2 the sheet.

3 In particular, if subjected to environments with a high temperature of  
4 recovery (temperature resistance test), for example as may be verified  
5 by leaving these overlay panels in the summer sun, the following can be  
6 seen:

- 7 • flaking of the serigraphed sheet away from the underlying support;
- 8 • more or less obvious bulging in the portion of sheet forming said  
9 window;
- 10 • flaking (separation of the two sheets), etc..

11 To avoid said drawbacks, there is a technique that uses only a single sheet  
12 of covering, to the interior of which is applied a serigraph which is then  
13 coated on the inside with a transparent varnish that also acts as a  
14 protective coating for the serigraph, before finally proceeding to the  
15 injection of the plastic material that forms the internal structural  
16 thickening.

17 This solution has the drawback that it requires much attention in the use  
18 of materials to cover the serigraph that, because of the high  
19 temperature, can easily be damaged resulting in a high level of wastage.  
20 Furthermore it does not guarantee a perfect sticking of the sheet onto  
21 the underlying plastic material, precisely due to the need to cover the  
22 serigraph.

23 In fact, to reduce wastage as much as possible, the underlying plastic  
24 material must be injected at a very low temperature, which decreases the  
25 number of pieces discarded, but at the same time compromises its  
26 adhesion to the superficial sheet.

#### 27 Disclosure of Invention

28 The aim of the present invention is to obviate the aforementioned

1 drawbacks and obtain an overlay panel as shown, at a reduced cost, of  
2 high quality and without both present and future defects.

3 The problems mentioned above are however solved as successively  
4 described and claimed, in particular according to the characteristics of  
5 claim 1, which claims:

6 a process for the realization of serigraphed elements in thermoplastic  
7 material with transparent parts (with eventual designs and/or writing)  
8 able to be illuminated from behind, as for example an overlay panel (9),  
9 of the type which provides:

10 • the realization of a transparent sheet in a thermo-deformable plastic  
11 material, subsequently serigraphed, for obtaining opaque and  
12 transparent parts such as small windows, including designs and  
13 characters and/or indications and/or references, subsequently  
14 varnished for the protection of said serigraphy and for the finishing of  
15 the surface on the external side;

16 • the shaping by means of thermo-moulding of said serigraphed and  
17 varnished sheet, and the respective die-cutting for shaping to the design  
18 of the semi-finished product;

19 • the injection under pressure of a reinforcing plastic material which  
20 gives areas of thickness and definition on the internal surface of said  
21 serigraphed thermo-moulded and die-cut sheet, to obtain a finished  
22 overlay panel ready for use, including holes and small windows with  
23 respective indications and information, characterized by the fact that:

24 • said sheet is serigraphed on its external surface, and

25 • said external surface is coated with a layer of protective transparent  
26 varnish to finish the respective surface:

27 • the sheet so defined is:

28 - shaped by means of thermo-moulding, and

1           - die-cut for the shape definition of the semi-finished product to  
2 the form of the final shape of the overlay panel;  
3 • to the internal surface of said die-cut semi-finished product is applied,  
4 by injection under pressure, a reinforcing plastic material which gives  
5 the final thickness to said overlay panel which is thus finished and  
6 ready for use, including holes and small windows with respective  
7 indications and information.

8 In this way all the above-mentioned problems are resolved and all the  
9 above-mentioned drawbacks are obviated by using a process the cost of  
10 which is more advantageous when compared to that of the traditional  
11 technique using a double sheet, this being justified by the fact that a  
12 single stratum is used and the calendering phase is avoided.

13 These and other advantages will appear from the successive description  
14 of preferential illustrative solutions of realization in connection with  
15 the drawings attached.

16 Figure 1 is a schematic view of the form of realization of the double-  
17 layered serigraphed sheet according to most commonly used prior  
18 techniques;

19 Figure 2 is a schematic view of the passage under hot calendering of the  
20 double-layered sheet of Fig.1 to thermo-glue together the two layers to  
21 form a single sheet.

22 Figure 3 represents a sectional schematic view of a way of shaping,  
23 under pressure and heat, the serigraphed sheet into the desired shape of  
24 the semi-finished product.

25 Figure 4 the semi-finished product obtained from a single sheet after  
26 moulding and die-cutting.

27 Figure 5 represents schematically the inclusion of the semi-finished  
28 product of Fig. 4 between mould and counter-mould for the subsequent

1 injection under pressure of a plastic material for the structural  
2 thickening of its internal surface.

3 Figure 6 represents the realization form of the serigraphed sheet  
4 according to this invention.

5 Figure 7 represents the finished overlay panel obtained with the new  
6 sheet according to this invention.

7 Figure 8 represents an enlargement of the stratification of the new  
8 sheet.

9 Figure 9 represents, according to this invention, a cross-section of the  
10 completely finished overlay panel showing the underlying respective  
11 thickening structural support made of a plastic material.

12 As is disclosed by the above figures:

13 the most commonly used prior technique consists of internally  
14 serigraphing 2, a sheet 1, leaving small transparent windows 25 and then  
15 varnishing the internal surface 3.

16 In a second sheet (1'), varnishing the counter-surface (3), and hot  
17 calendering the two sheets to obtain a single thermo-glued sheet (5) Fig.  
18 1 and 2.

19 Subsequently, said sheet is shaped by means of thermo-moulding under  
20 pressure between a perimetrically sealed mould and counter-mould (6-6'  
21 Fig. 3) which provides the shaping mould 63' on one side and a counter-  
22 chamber of air pressure 63 by means of an entry nozzle 62.

23 After thermo-moulding, the sheet is cut by means of die-cutting thus  
24 obtaining the semi-finished product as indicated in Fig. 4 reference 5',  
25 with small windows 25 and holes 51.

26 Finally, said semi-finished product (5') is inserted between the mould and  
27 counter-mould (8-8' Fig. 5) and via "i" is injected under pressure an  
28 internal thickness of plastic material (for example ABS, polycarbonate,



1 polypropylene, or others) 7 with the intention of allowing light to the  
2 small windows and holes 51 pre-die-cut on said semi-finished product 5'.  
3 Instead according to this invention, only one sheet is used, Fig. 6, on  
4 which the serigraphing 2 and varnishing 3 are carried out on its  
5 external surface "ES" instead of on its internal surface "IS".  
6 Whereafter one proceeds to the thermo-moulding, die-cutting and  
7 injection under pressure (Figs. 3,4,5) as in the usual process.  
8 In this way not only is a layer of transparent polycarbonate film saved,  
9 but also a layer of transparent varnish, as well as a thermo-glueing  
10 phase, and lastly the possibility of damaging the varnish and the  
11 adjacent serigraphy when in direct contact with the material being  
12 injected under pressure is obviated, as these two are found on the  
13 opposite side in contact with the mould and therefore at a better  
14 controlled temperature.  
15 Furthermore the adherence between the two plastic materials by  
16 thermosoldering-thermofusion during injection will be done in a much  
17 more effective and safe way.  
18 Advantageously the edges in correspondence with said holes are dented  
19 towards the interior by the die-cutting process.  
20 Thus is obtained a more finished external area and the effect of flaking  
21 or detachability of the external shell (Fig.9) is eliminated.  
22 Advantageously said protective transparent varnish is a varnish based  
23 on acrylic oligomers and monomers with photo-initiators and fillers.  
24 Just as advantageously the thick material for the back-injection is a  
25 mixture of Polycarbonate and AcrylonitrilButadieneStyrene or others.  
26 With this can be obtained a perfect junction and compatibility of  
27 integration between the materials.

1 Claims

2 1. Process for the realization of serigraphed elements in thermoplastic  
3 material with transparent parts able to be illuminated from behind, as  
4 for example overlay panels (9), of the type which provides:

- 5 • the realization of a sheet in a thermo-mouldable transparent plastic  
6 material (1), serigraphed (2), to obtain opaque and transparent parts  
7 such as windows (25), including designs and characters and/or  
8 indications and/or references, subsequently varnished for the  
9 protection of the said serigraph (3);
- 10 • the shaping by thermo-moulding of the said serigraphed and  
11 varnished sheet (1,2,3), and the respective die-cutting for the shape  
12 definition of a semi-finished product (5');  
13 • the injection under pressure of a reinforcing plastic material which  
14 gives areas of thickness and definition on the internal surface (7) of said  
15 semi-finished product (5'), to obtain a finished overlay panel ready for  
16 use, including holes (51) and/or transparent small windows (23) with  
17 respective indications and information, characterized by the fact that:
- 18 • the said sheet (1) is serigraphed on its external surface (2) and  
19 • the said external surface is coated with a layer of transparent  
20 protective varnish to finish the respective surface (3);  
21 • the sheet so defined (10) is:
- 22 - shaped by thermo-moulding, and  
23 - die-cut for the shape definition of the semi-finished product (5')  
24 to give the final shape of the overlay panel:
- 25 • to the internal surface of said die-cut semi-finished product is applied,  
26 by injection under pressure, a reinforcing plastic material (7) which  
27 gives the final thickness to said overlay panel (9) which is thus finished  
28 and ready for use, including holes (51) and small windows (25) with

1    respective indications and information.

2    2. Overlay panel in plastic material of the type with holes and  
3    transparent small windows, having a serigraphed covering sheet  
4    thickened internally at least in part by injections of another plastic  
5    material, obtained according to a process which is in claim 1,  
6    characterised in that:

7    - said transparent covering sheet is single (1);

8    - said serigraph is applied externally (2-SE);

9    - said serigraph is covered with transparent varnish to finish it  
10   externally (3-SE);

11   - said internal injection of plastic material (7) is thermo-glued directly  
12   onto said transparent plastic sheet (1) by thermo-fusion.

13   3. Overlay panel according to claim 2, characterized by the fact that the  
14   edge in correspondence with the holes is dented towards the interior by  
15   thermo-moulding and die-cutting.

16   4. Overlay panel according to claim 2, characterized by the fact that said  
17   protective transparent varnish (3) is a filling varnish based on acrylic  
18   oligomers and monomers having photo-initiators.

19   5. Overlay panel according to claim 2, characterized by the fact that the  
20   thickening material for internal injection (7) is a mixture of  
21   polycarbonate and acrylonitrilbutadienestyrene.

22   6. Overlay panel according to claim 2, characterized by the fact that the  
23   material constituting the said transparent covering sheet (1) is a plastic  
24   material based on polycarbonate.

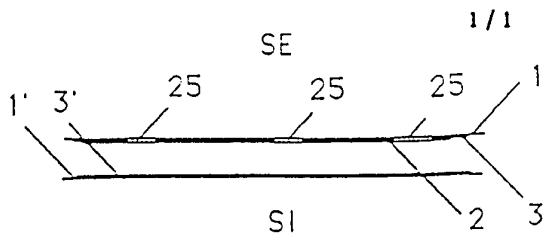


Fig.1

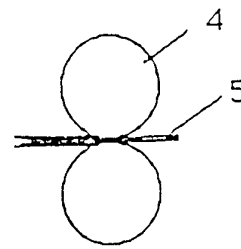


Fig.2

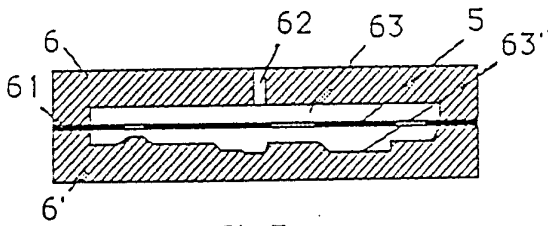


Fig.3

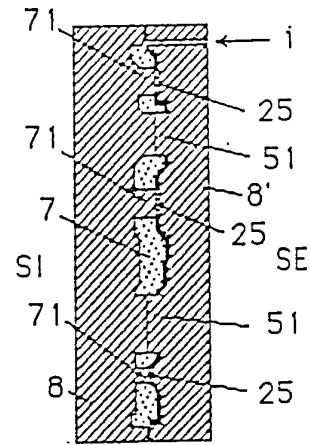


Fig.5

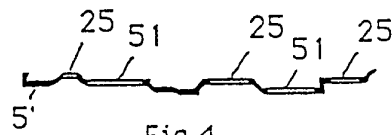


Fig.4

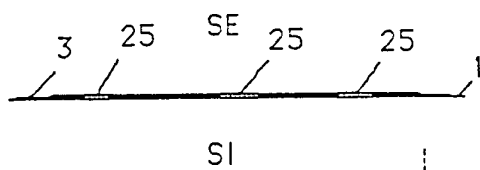


FIG.6

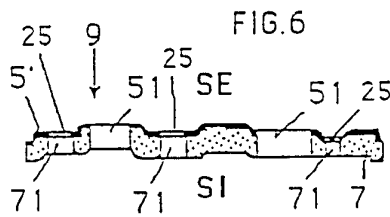


Fig.7

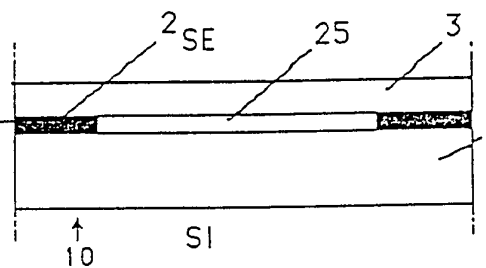


FIG.8

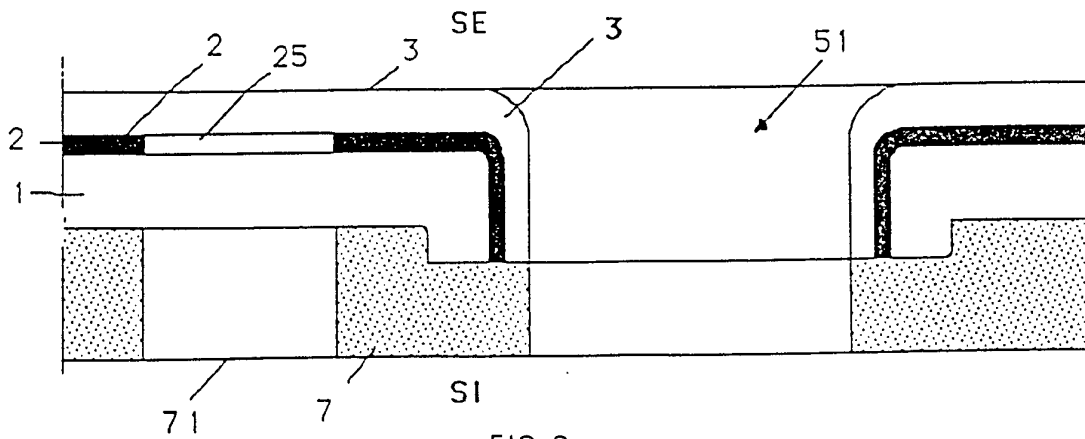


FIG.9

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IT 93/00139

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 5 B29C45/14 B29C51/08 B60K37/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

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IPC 5 B29C B60K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 448 249 (ILLINOIS TOOL WORKS) 25 September 1991 see column 1, line 28 - line 40 see column 2, line 24 - line 35 see column 4, line 28 - line 57; figures 1,2,6-9 ---	1,2,4-6
A	DE,A,40 15 125 (LEOPOLD KOSTAL) 14 November 1991 see column 1, line 64 - column 3, line 44; figures ---	1-6
A	DE,U,88 16 011 (NIEBLING) 3 May 1989 see page 22, paragraph 2 ---	1-6
A	GB,A,2 003 490 (UCB) 14 March 1979 see page 1, line 4 - line 25 -----	4

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GB-A-2003490	14-03-79	NONE		
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