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(54) A board, in particular a writing board.

(57) This invention relates to a board, in particular a writing board comprising a base layer (6), a cover layer (7) provided for erasably writing thereon and a photo-luminescent layer (8) comprising photo-luminescent particles embedded in a polymeric layer and disposed between said base layer (6) and said cover layer (7), the latter being made of a transparent material so that texts or drawings applied on this board are even in the dark clearly visible.

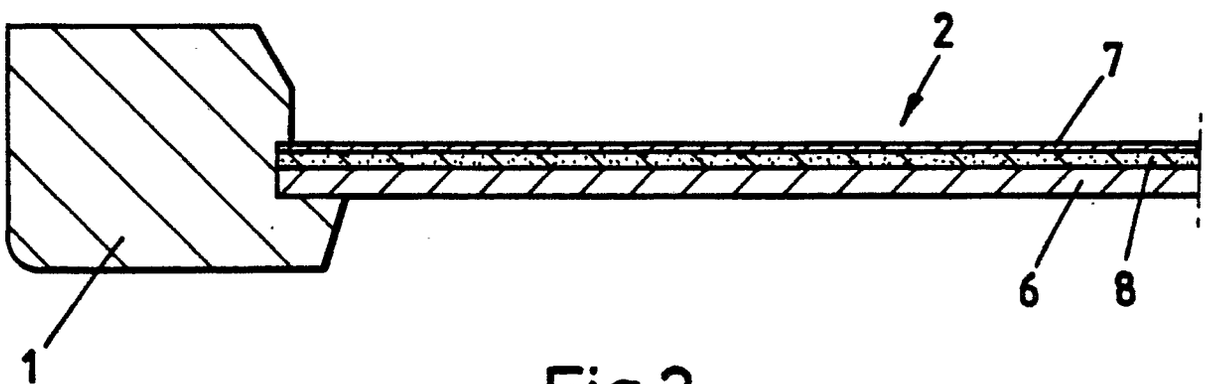

Fig.2.

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This invention relates to a board, in particular a writing board comprising a base layer and a cover layer provided for erasably writing thereon.

Such boards are generally known. There are for example known white boards on which erasable texts or drawings can be written or drawn by means of filt-tip pens even of different colours.

These known boards are not suited for being used in the dark or if the surrounding lighting is too weak, since in these circumstances the texts or drawings applied thereon are not clearly visible any more.

An object of the present invention is to provide a board on which the texts or drawings present thereon are still visible in the dusk or even in the dark.

To this end, a board according to the invention is characterized in that a photo-luminescent layer is disposed between said base layer and said cover layer made of a transparent material, which photo-luminescent layer comprises photo-luminescent particles embedded in a polymeric layer. A text or drawings applied on this board can be seen clearly in the dusk or even in the dark since said photo-luminescent layer provides a light emitting plane behind the transparent cover layer. Moreover, that photo-luminescence light is agreable to look at and thus offers an advantage from an aesthetical point of view.

In a particular embodiment of the board according to the invention, said photo-luminescent layer comprises from 30 to 95 % by weight and preferably from 40 to 60 % by weight of said photo-luminescent particles. Even if a relatively small amount of photo-luminescent particles is used, the photo-luminescent activity of said photo-luminescent layer is sufficient to make the applied texts or drawings in an agreable way visible in the dark. Moreover, a smaller amount of photo-luminescent particles improves the mechanical properties of the photo-luminescent layer.

In a preferred embodiment of the board according to the invention said photo-luminescent particles have a diameter comprised between 5 and 100 microns. Such small particles offer the advantage that they allow to obtain a homogeneous distribution of the photo-luminescent material over the photo-luminescent layer and they have a larger specific surface resulting in a higher photo-luminescent activity and a more agreable appearance.

In a further preferred embodiment of the board according to the invention, said photo-luminescent layer is an extruded layer. An advantage of an extrusion is that it allows to obtain a very homogeneous distribution of the photo-luminescent particles into the photo-luminescent layer.

Other advantages and particularities of the invention will appear from the following description of a board in particular a writing board according to the invention. This description is only given by way of example and does not limit the scope of the invention. The reference numerals relate to the annexed drawings wherein :

Figure 1 shows a perspectif view of a particular embodiment of a writing board according to the invention;

Figure 2 shows schematically a sectional view according to line II-II in Figure 1; and

Figure 3 shows a diagramatical scheme of a method for manufacturing a board according to the invention.

In the different figures, the same reference numerals relate to the same or analogous elements.

Figure 1 shows a preferred embodiment of a writing board according to the invention comprising a frame 1 applied at least around the actual writing board 2.

The frame 1 can be made of any suitable material and can have any shape and dimensions according to its destination. In Figure 1 it shows for example a recess 3 provided for applying a sticker and a groove 4 for carrying a pen 5 to be used for writing on the board.

As shown in Figure 2, the board 2 is composed of different superimposed layers and comprises at least a base layer 6, a transparent cover layer 7 and a photo-luminescent layer 8 disposed between the base layer 6 and the cover layer 7.

The base layer 6 constitutes usually a support layer for the writing board 2. Preferably it is a dull layer in order to avoid that too much light would reflect on the writing board 2. The base layer 6 may be formed for example of a film, a plate, a sheet, a woven or a non wover fabric, a felt or a wadding. The base layer 6 may further comprise a more rigid layer which has not been shown in the figures and which is for example a part of the frame 1.

The photo-luminescent layer 8 comprises photo-luminescent particles embedded in a polymeric layer. These photo-luminescent particles are made of a photo-luminescent material. A large group of such materials are suitable for that purpose and they comprise for example zinc sulphide, selenide and telluride; cadmium sulphide, selenide and telluride; alkaline earth sulphide, selenide and telluride and mixtures thereof. The photo-luminescent activity of all these materials is due to the presence of a metallic activator such as for example copper, cobalt or bismuth powders and mixtures thereof. All of these photo-luminescent materials have a particular body colour in the dark. Preference is given to the following photo-luminescent materials : zink sulphide with copper activator (ZnS:Cu), zink and cadmium sulphide with copper

activator ((Zn,Cd)S;Cu), zink sulphide with copper and cobalt activator (ZnS:Cu,Co), strontium sulphide with bismuth activator (SrS:Bi), calcium sulphide with bismuth activator (CaS;Bi), strontium and calcium sulphide with bismuth activator (-(Sr,Ca)S:Bi) and strontium and calcium sulphide with bismuth activator mixed with zink sulphide with copper activator ((Sr,Ca)S:Bi) + (ZnS):Cu).

The photo-luminescent particles are embedded in the polymeric layer in the form of a fine powder, the particles of which have a diameter comprised between 2 and 200 microns and preferably between 5 and 100 microns. This can be done by means of an extrusion. The thus obtained photo-luminescent layer 8 comprises from 30 to 95 % by weight and preferably from 40 to 60 % by weight of said photo-luminescent particles and has a thickness of 400 to 1200 microns. Two or more of such photo-luminescent layers can be superimposed.

The cover layer 7 is a transparent layer and is in particular transparent for the light emitted by the photo-luminescent layer 8. The cover layer is made of a polymeric material. It may consist of one or several layers which have all to be transparent. A particular characteristic of this cover layer 7 is that text or drawings written thereon with the pen 5 can be wiped out. It's thickness is preferably comprised between 10 and 100 microns.

The polymeric material of the photo-luminescent layer 8 as well as of the cover layer 7 can be selected from the following polymers or copolymers : polyethylene, polypropylene, ethylene-propylene copolymers and other olefinic polymers and copolymers; vinyl-acetate polymers and copolymers (especially copolymers with ethylene and/or propylene); methyl-methacrylate polymers and copolymers and other resins coming from acrylic or methacrylic esters and nitriles; aromatic polycarbonates; thermoplastic polyurethanes; polyethylene terephthalate, polybutylene terephthalate and other crystalline aromatic polyesters; vinyl or vinylidene fluoride polymers and copolymers; polyvinyl-chloride; elastomeric polymers and copolymers and in particular ethylene-propylene elastomeric copolymers (EPM) or ethylene-propylene-diene elastomeric terpolymers and polybutadiene; silicon rubbers and other natural or synthetic rubbers; vinyl aromatic polymers and copolymers, like polystyrene and especially high impact polystyrene, where the high impact properties come from the presence of an elastomeric component, for instance polydienic units, EPM or EPDM rubbers and so on; styrene-acrylonitrile (SAN) and styrene-butadiene-acrylonitrile (ABS) copolymers; polyamides such as nylon 6, nylon 6,6 and so on; blends thereof.

From this series, polypropylene, polymethylacrylate, polystyrene and high impact polystyrene are especially preferred.

The polymeric material of the photo-luminescent layer 8 may be different from the one of the cover layer 7. Both layers 7 and 8 can be glued to each other. If the compatibility of the layers with each other is however so that a good adhesion between the layers can be obtained, said board can be made by means of lamination, extrusion or co-extrusion or by means of a combination thereof.

According to the lamination method, two or more layers are applied to each other by leading them between the hot rollers of a rotary press (calender).

According to the extrusion method, the photo-luminescent layer 8 is extruded for example on the cover layer 7 or possibly on the base layer 6. The co-extrusion method, on the contrary, comprises the simultaneous extrusion of several layers which flow together into a single head wherein the stratified streams of the different components are superimposed to form a multilayer object.

The photo-luminescent layer 8 is preferably extruded. In order to get a product of good quality, this extrusion has to be carried out very carefully as will be explained hereunder. In particular the following successive steps are preferrably executed:

- pre-mixing the photo-luminescent particles with said polymeric material, both in the powder form, the difference between the particle size of both of these powders being smaller than 10 % of the smallest size, preferably said particle sizes are substantially equal; this pre-mixing can be carried out for example in a rotary drum or in a tumbling drum;
- feeding the obtained mixture to an extruder;
- extruding this mixture very smoothly, i.e. with a low shear stress, in order to avoid crushing and/or abrasion of the photo-luminescent particles which would thus lose their luminescence properties;
- pressing the extruding mixture in the molten state through a perforated die;
- cutting the product into pellets or granules;
- cooling them down preferably to room temperature; and
- extruding the cooled pellets or granules in the form of a photo-luminescent particles containing layer in a second extruder.

A particular example of a method for manufacturing a writing board according to the invention is given hereunder with reference to Figure 3.

Example

In this example there is started from an isotactic polypropylene powder and a powder of the

photo-luminescent material ZnS:Cu (or possibly (Zn,Cd)S:Cu) showing substantially the same particle size as the polypropylene powder. These powders are gently mixed in a tumbling drum and fed via a hopper to a mono-screw extruder kept at 180 °C. The extruding mixture is led in the molten state through a perforated die, the obtained product is cut into pellets or granules which are cooled down to room temperature.

These pellets or granules are fed via a second hopper, indicated in Figure 3 by reference 9, to a sheet co-extrusion unit 10 wherein a first extruder 11 forms the photo-luminescent layer 8.

To a second extruder 12 is fed via a third hopper 13 the same isotactic polypropylene powder as used for the photo-luminescent layer 8. The extruded sheet obtained by means of this second extruder 12 forms the transparent cover layer 7 and is led together with the extruded photo-luminescent layer 8 into a co-extrusion head 14 wherein a composite layer 15 consisting of the photo-luminescent layer 8 and the cover layer 7 is formed. This composite layer 15 is led together with an opacified polypropylene layer 6, forming the base layer 6 and coming from a first roller 16 of a calender 17, between rollers 18, 19 and 20 and is at the same time cooled down. The formed layer is then stretched by means of a train 21.

The thus obtained board 2 shows a wonderfull yellow afterglow persistent in the dark after exposure to daylight even for a time of 5 hours or more. Texts or drawings applied thereon are in clear contrast with the light-emitting photo-luminescent layer 8.

A board according to the invention can have many different shapes and can be used for various applications. It can con stitute the whole or part of differently shaped objects, for example toys, especially toys for teaching purposes; warning signals; direction signals; machine parts; dials or portions of a dials; sport equipments; switches and furnishings of rooms for example of dancing rooms.

It will be clear that the invention is not limited to the above described embodiments but that many modifications for example concerning the shape or the number of layers can be taken into consideration without leaving the scope of the present patent application.

Claims

1. A board, in particular a writing board, comprising a base layer (6) and a cover layer (7) provided for erasably writing thereon, characterized in that a photo-luminescent layer (8) is disposed between said base layer (6) and said cover layer (7) made of a transparent material, which photo-luminescent layer (8) comprises photo-luminescent particles embedded in a polymeric layer.

2. A board according to claim 1, characterized in that said photo-luminescent layer (8) comprises from 30 to 95 % by weight and preferably from 40 to 60 % by weight of said photo-luminescent particles.

3. A board according to either claim 1 or 2, characterized in that said photo-luminescent layer (8) is an extruded layer.

4. A board according to anyone of the claims 1 to 3, characterized in that said particles have a diameter comprised between 5 and 100 microns.

5. A board according to anyone of the claims 1 to 4, characterized in that said photo-luminescent layer (8) has a thickness of 400 to 1200 microns.

6. A board according to claim 5, characterized in that said photo-luminescent layer (8) and said cover layer (7) are co-extruded layers.

7. A board according to anyone of the claims 1 to 6, characterized in that said photo-luminescent layer (8) comprises a polymeric material of the group of polypropylene, polymethylmethacrylate, polystyrene and high impact polystyrene.

8. A board according to anyone of the claims 1 to 7, characterized in that said cover layer (7) comprises a polymeric material of the group of polypropylene, polymethylmethacrylate, polystyrene and high impact polystyrene.

9. A board according to anyone of the claims 1 to 8, characterized in that said photo-luminescent particles comprise a photo-luminescent material of the group of zink sulphide with copper activator (ZnS:Cu), zink and cadmium sulphide with copper activator ((Zn,Cd)S:Cu), zink sulphide with copper and cobalt activator (ZnS:Cu,Co), stontium sulphide with bismuth activator (SrS:Bi), calcium sulphide with bismuth activator (CaS:Bi), strontium and calcium sulphide with bismuth activator ((Sr,Ca)S:Bi), and strontium and calcium sulphide with bismuth activator mixed with zink sulphide with copper activator ((Sr,Ca)S:Bi) + (ZnS):Cu).

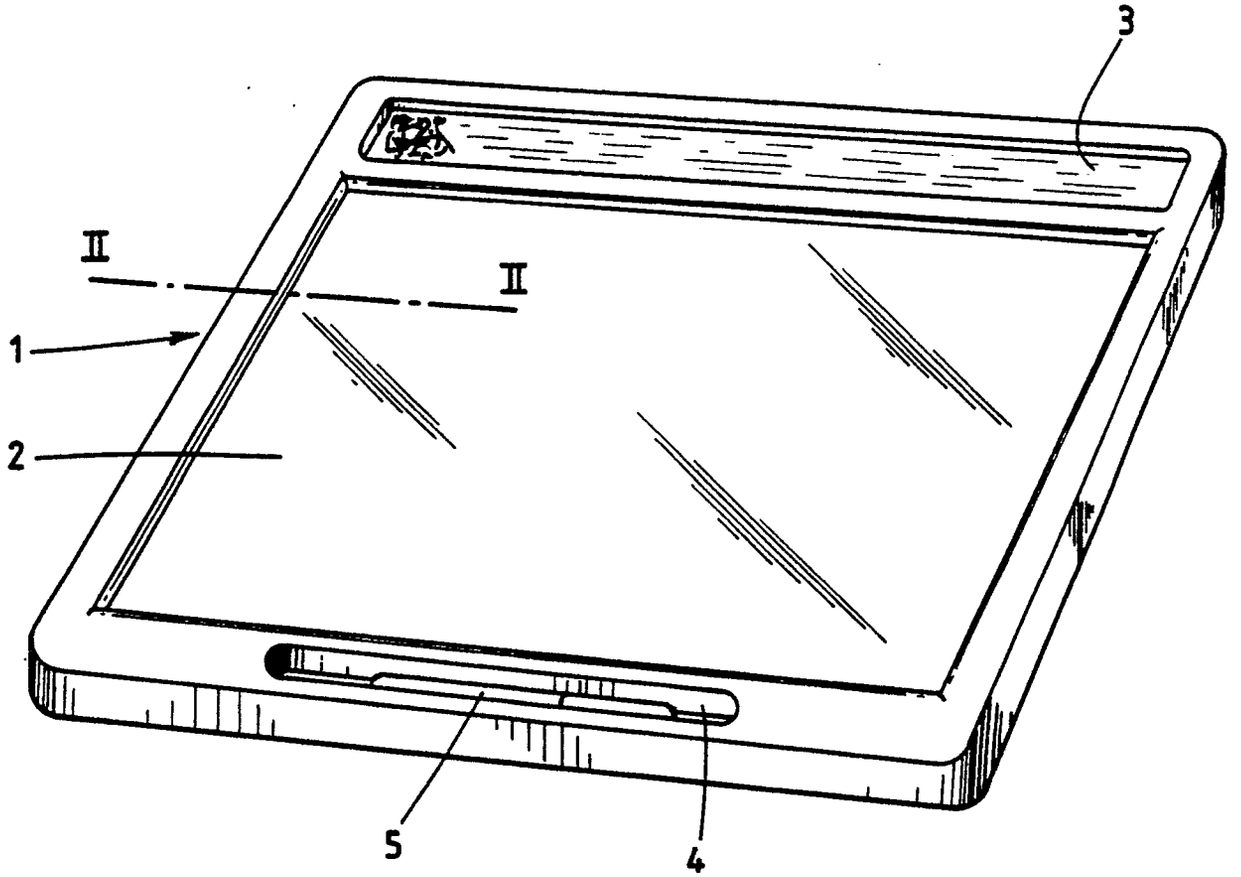

Fig.1.

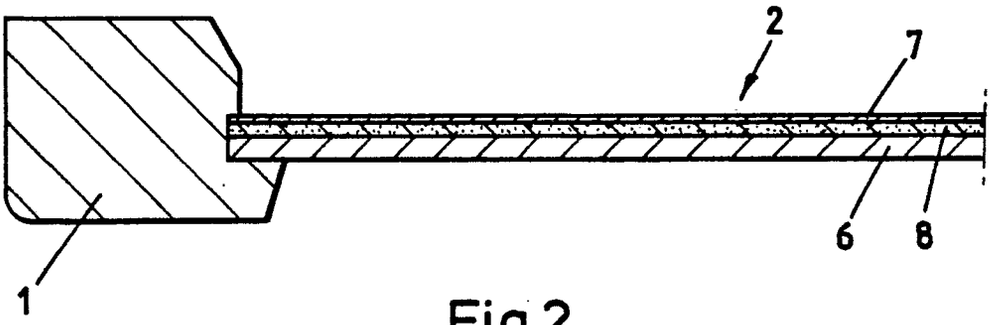

Fig.2.

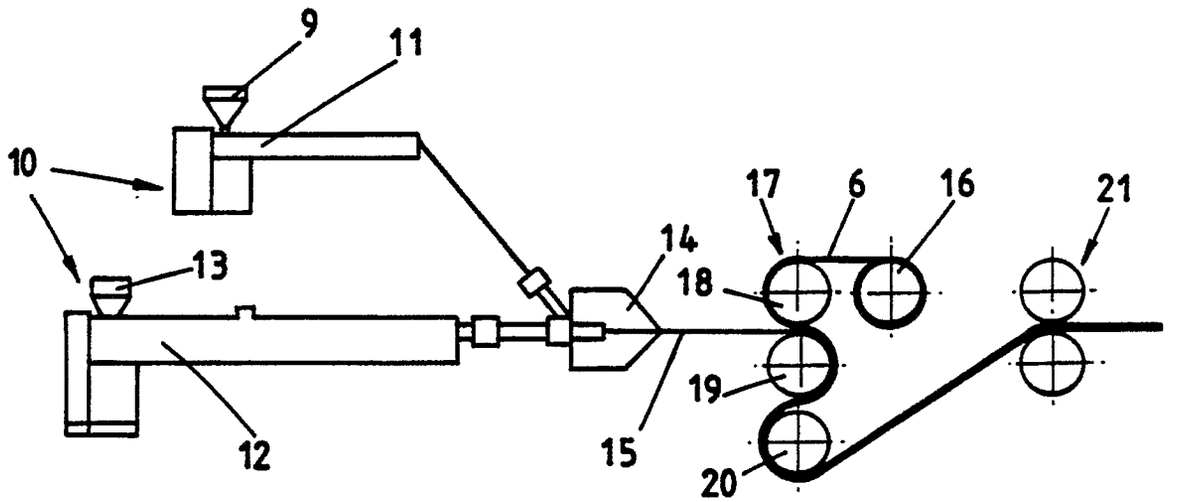

Fig.3.

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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 0689

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2427211 (SCERAB) * claims 1-10 *	1	B43L1/00
Y		4, 7	
A		9	
X	GB-A-559124 (REWALD) * page 1, line 81 - page 2, line 66 *	1	
Y	PATENT ABSTRACTS OF JAPAN vol. 6, no. 239 (C-137)(1117) 26 November 82, & JP-A-57 139171 (NIPPON DENSHIN DENWA KOSHA) 27 August 82, * the whole document *	4	
A		9	
Y	FR-A-2308155 (AEROSPATIALE) * page 1, lines 30 - 37 *	7	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B43L
G09F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 JULY 1990	PERNEY Y.

CATEGORY OF CITED DOCUMENTS

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