



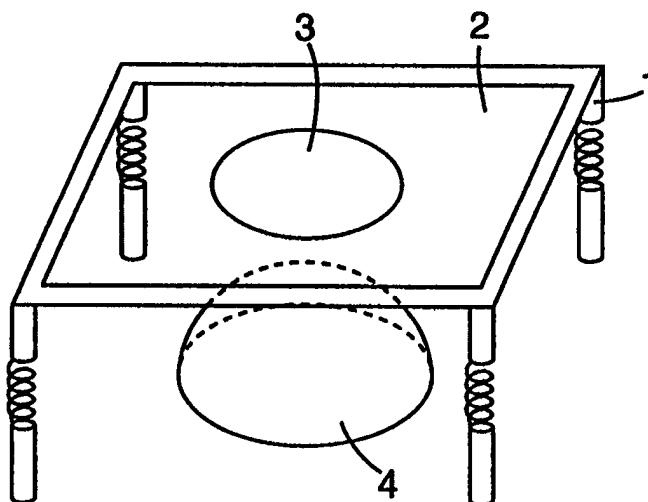
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(54) Title: METHOD AND APPARATUS FOR APPLYING A MARKING FILM WITH PRESSURE-SENSITIVE ADHESIVE

(57) Abstract

To provide a method and apparatus for the application of a marking film (3) which is simple and low in cost. A method for the application of a marking film (3) to a three-dimensional surface, comprising the steps of: disposing the three-dimensional surface of the substrate (4) inside a frame (1) having an application tape (2) attached thereon, the application tape (2) holding a marking film (3) thereon, and the marking film (3) having a pressure sensitive adhesive (3b) thereon; and pressing the application tape (2) against the substrate to apply the pressure sensitive adhesive (3b) of the marking film (3) to the three-dimensional surface of the substrate.



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Method and Apparatus for Applying a Marking Film with Pressure-Sensitive Adhesive

Technical Field of the Invention

5 The present invention relates to a method and apparatus for the application of a marking film with a pressure-sensitive adhesive to a substrate having a three-dimensional surface.

Background of the Invention

10 Marking films are used in various fields such as automobile and motor-bicycle industries. However, the application of a marking film with a pressure-sensitive adhesive to a three-dimensional surface of, for example, a fuel tank is very difficult and troublesome. The following three methods are main conventional methods for the application of a marking film to a three-dimensional substrate.

15 They have the following respective problems.

 The first conventional method is to manually apply a marking film. The marking film is usually supplied as a laminate comprised of an application tape, a pressure-sensitive adhesive, a marking film, a pressure-sensitive adhesive, and a liner provided on top of one another in that order. The application tape functions as
20 a support for transfer of a marking film to a substrate, and comprises a substrate, such as a PVC film, and laminated thereon a pressure-sensitive adhesive used in the marking film. The marking film is a urethane film having a desired shape or the like. The marking film has, laminated thereon, a pressure-sensitive adhesive for adhering the marking film to the substrate. The pressure-sensitive has thereon a liner for
25 protecting the pressure-sensitive adhesive before use against dust or the like. In this method, the liner is first removed. An application tape is applied to a substrate, and the marking film in its edge is then applied to the substrate. The application tape in its edge side remaining unapplied is lifted up by one hand, while the application tape is carefully applied using a squeegee or the like by the other hand. After the
30 application, the application tape is removed. This method suffers from a problem that, at the time of the application, the pressure-sensitive adhesive on the marking

film unintentionally comes into contact with and is adhered to the substrate, or the application to a severe three-dimensional substrate unfavorably creates wrinkles in the marking film or causes entrainment of air between the substrate and the marking film, thus requiring a great deal of skill.

5 The second conventional method is to use a device for heat application under vacuum as shown in Fig. 4. A silicone rubber sheet is disposed on the top of the vacuum device. A laminate of a marking film and an application tape is provided below the silicone rubber sheet, and a substrate is disposed in a proper position below the laminate. In this case, a heat-activatable adhesive layer is
10 provided on the surface of the marking film opposite to the surface in contact with the application tape. A port is introduced in a direction indicated by an arrow in the drawing to deaerate the interior of the vacuum device. At the same time, heating is performed by means of a heater, and the heat is diffused by the silicone rubber sheet to homogeneously heat-activate the adhesive, thereby adhering the marking film
15 onto the substrate. This method can solve the above problems. It, however, requires large-scale equipment, resulting in large cost.

 The third conventional method is to apply a vacuum-formed marking film in such a shape as will conform to the shape of the substrate as shown in Fig. 5. The marking film should be vacuum-formed by means of a male-female mold, resulting
20 in increased production cost. Further, the mold should be replaced for each substrate. This is troublesome and increases the cost. Furthermore, the thermoforming makes it very difficult to attain complete conformability of the marking film to the shape of the substrate.

25 Summary Of The Invention

 Accordingly, an object of the present invention is to solve the above problems and to provide a method for the application of a marking film which requires little or no skill and is simple and low in cost. Another object is to provide an apparatus for applying a marking film which requires little or no skill and is
30 simple and low in cost.

According to one aspect of the present invention, there is provided a method for the application of a marking film to a three-dimensional surface of a substrate, comprising the steps of: disposing the three-dimensional surface of the substrate inside a frame having an application tape attached thereon, the application
5 tape holding a marking film thereon, and the marking film having a pressure sensitive adhesive thereon; and pressing the application tape against the substrate to apply the pressure sensitive adhesive of the marking film to the three-dimensional surface of the substrate.

The disposing step can include the step of disposing the three-dimensional
10 surface of the substrate inside a frame having a larger size than the substrate. The pressing step can include the step of pressing the application tape against the substrate to apply the marking film to the three-dimensional surface of the substrate by means of a tool, such as a squeegee.

According to another aspect of the invention, an apparatus is provided for
15 applying a marking film to a three-dimensional surface of a substrate. The apparatus comprises a frame dimensioned so as to allow a three-dimensional surface of a substrate to be disposed inside the frame, an application tape, and a marking film having a pressure sensitive adhesive thereon. The application tape is attached to the frame and holds the marking film thereon so that, when the three-dimensional
20 surface is inside the frame, the application tape can be pressed against the substrate to apply the pressure sensitive adhesive of the marking film to the three-dimensional surface of the substrate.

The frame can be of a size to allow all of the substrate therein. The apparatus can further comprise a tool, such as a squeegee, suitable for pressing said
25 application tape against the substrate to apply said marking film to the three-dimensional surface of the substrate.

For either the method or the apparatus, the frame can have legs for locating the frame above the three-dimensional surface of the substrate, with each of the legs comprising an elastic body which renders the leg flexible and either stretchable,
30 compressible or both. The elastic body can be a coil spring.

Brief Description of the Drawings

Fig. 1 is a perspective view showing one embodiment of a device for practicing the method of the present invention.

Fig. 2 is a cross-sectional view showing one embodiment of the method of the present invention.

Fig. 3 is a cross-sectional view showing a laminate of application tape/marketing film with pressure-sensitive adhesive.

Fig. 4 is a cross-sectional view showing a vacuum application device used in the conventional method.

Fig. 5 is a cross-sectional view showing a laminate of application tape/marketing film with pressure-sensitive adhesive which has been vacuum-formed according to the conventional method.

Description of Reference Numerals

- 1 frame,
- 2 application tape,
- 3 marking film,
- 3a . . . substrate portion of marking film,
- 3b . . . pressure-sensitive adhesive of marking film,
- 4 substrate,
- 5 liner,
- 6 silicone rubber.

Preferred Embodiments of the Invention

In the present invention, the frame is used for fixing an application tape. The attachment of the application tape to the frame can be achieved by taking advantage of adhesive force of the pressure-sensitive adhesive laminated on the application tape per se. In this case, the frame should have a contact area large enough to attach the application tape thereto. The frame may be made of any material which can attain the above object, for example, steel. The marking film with a pressure-sensitive adhesive is applied to a substrate by bringing the pressure-

sensitive adhesive on the marking film into contact with the substrate to transfer the marking film from the application tape onto the substrate. Preferably, the frame has legs for supporting the frame, the substrate is fixed below the frame, and, upon the application of force to the application tape from the top of the frame by means of a tool, such as a squeegee, the application tape is stretched to permit the marking film to be applied onto the substrate. In the case of a severe three-dimensional substrate, the application of the marking film on the side surface of the substrate is difficult. In such a case, provision of an elastic body, for example, a spring, on the legs of the frame permits each leg to be flexed or stretched, enabling the angle of the surface of the frame, with an application tape put thereon, to the substrate to be changed. Therefore, a marking film can be easily applied also to the side face of the substrate by changing the angle of the surface of the application tape according to the three-dimensional surface of the substrate.

The application tape may be any tape commonly used in the art. The extensibility of the application tape is preferably high so that the marking film can be applied to a severe three-dimensional surface. Preferred is, for example, an application tape having an elongation at break of 150 to 400% as measured by the procedure set forth in JIS Z0237. Materials, for the application tape, usable herein include, for example, PVC, PE, PP, PE/PP, urethane rubber, and ionomer resins.

Preferably, the pressure-sensitive adhesive laminated onto the application tape has a lower adhesive force than the pressure-sensitive adhesive tape used in the marking film, and examples of such pressure-sensitive adhesives and synthetic rubber pressure-sensitive adhesives.

The marking film may be a conventional one, and examples thereof include those made of PVC, urethane, acrylic, ionomer resins and the like. The pressure-sensitive adhesive laminated on the marking film may be any conventional pressure-sensitive adhesive, and examples thereof include acrylic pressure-sensitive adhesives. The pressure-sensitive adhesive may have thereon a line for protecting the pressure-sensitive adhesive before use against dust or the like.

Fig. 1 is a perspective view showing an embodiment of a device for practicing the method according to the present invention. A frame with legs is

provided. A marking film, with a pressure-sensitive adhesive, in its surface remote from the pressure-sensitive adhesive is adhered to a desired position, preferably the central position, of an application tape having a larger size than the frame by taking advantage of adhesive force of the application tape. The application tape is then
5 provided under proper tension on the frame with legs and fixed thereto with the aid of the adhesive force of the application tape. Thereafter, a substrate is placed, below the frame with legs, in a proper position relative to the marking film. A liner provided on the pressure-sensitive adhesive layer in the marking tape is separated and removed, and the application tape is pressed downward as indicated by an
10 arrow in Fig. 2 to permit the application of the marking film to the substrate to proceed from the upper part of the substrate toward the lower part of the substrate. Thus, a marking film can be easily applied to a three-dimensional surface. During the application, no wrinkle is created in the marking film because the application tape is spread under given tension. Heating the application tape and the marking
15 film will further facilitate the application of the marking film to the substrate.

Examples

An example of the present invention will be described.

A #331 PVC film, with an acrylic pressure-sensitive adhesive laminated
20 thereon, manufactured by Sumitomo 3M was used as an application tape, and a PU295T urethane film, with an acrylic pressure-sensitive adhesive laminated thereon, manufactured by Sumitomo 3M was used as a marking film. The PVC application tape had an elongation at break of 300% as measured by the procedure set forth in JIS Z0237.

25 A rectangular steel frame, with four legs, having a size of 50 cm x 75 cm was provided. The width of the frame which comes into contact with the PVC application tape was 5 cm. Thereafter, the urethane marking film, with a pressure-sensitive adhesive, in its surface not having a pressure-sensitive adhesive layer was applied to the PVC tape, and the laminate per se was then fixed onto the frame so
30 that the laminate in its surface having the urethane marking film faced downward. A tank of a motorcycle was placed below the frame, and the PVC application tape

was pressed downward to transfer the marking film, with a pressure-sensitive adhesive, to the tank of a motorcycle. The urethane marking film could be satisfactorily applied to the tank of the motorcycle without creating any wrinkle.

Claims:

1. A method for the application of a marking film to a three-dimensional surface of a substrate, comprising the steps of:
 - 5 disposing the three-dimensional surface of the substrate inside a frame (1) having an application tape (2) attached thereon, the application tape (2) holding a marking film (3) thereon, and the marking film (3) having a pressure sensitive adhesive (3b) thereon; and
 - 10 pressing the application tape (2) against the substrate to apply the pressure sensitive adhesive (3b) of the marking film (3) to the three-dimensional surface of the substrate.
2. The method according to claim 1, wherein the disposing step
15 includes disposing the three-dimensional surface of the substrate inside a frame (1) having a larger size than the substrate.
3. The method according to claim 1, wherein said pressing step
20 includes pressing the application tape (2) against the substrate to apply the marking film (3) to the three-dimensional surface of the substrate by means of a tool, such as a squeegee.
4. The method according to claim 1, wherein the frame (1) has legs for
25 locating the frame (1) above the three-dimensional surface of the substrate and each of the legs comprises an elastic body which renders the leg flexible and stretchable.
5. The method according to claim 1, wherein the frame (1) has legs for
30 locating the frame (1) above the three-dimensional surface of the substrate and each of the legs comprises an elastic body which renders the leg flexible and compressible.

6. The method according to claims 4 and 5, wherein the elastic body is a coil spring.

7. An apparatus for applying a marking film to a three-dimensional surface of a substrate, said apparatus comprising:
5 a frame (1) dimensioned so as to allow a three-dimensional surface of a substrate to be disposed inside said frame (1), an application tape (2), and a marking film (3) having a pressure sensitive adhesive (3b) thereon,
wherein said application tape (2) is attached to said frame (1) and holds said
10 marking film (3) thereon so that, when the three-dimensional surface is inside said frame (1), said application tape (2) can be pressed against the substrate to apply the pressure sensitive adhesive (3b) of said marking film (3) to the three-dimensional surface of the substrate.

8. The apparatus according to claim 7, wherein said frame (1) is of a size to allow all of the substrate therein.

9. The apparatus according to claim 7, further comprising a tool, such as a squeegee, suitable for pressing said application tape (2) against the substrate to
20 apply said marking film (3) to the three-dimensional surface of the substrate.

10. The apparatus according to claim 7, wherein said frame (1) has legs for locating said frame (1) above the three-dimensional surface of the substrate and each of said legs comprises an elastic body which renders the leg flexible and
25 stretchable.

11. The apparatus according to claim 7, wherein said frame (1) has legs for locating said frame (1) above the three-dimensional surface of the substrate and each of said legs comprises an elastic body which renders the leg flexible and
30 compressible.

12. The apparatus according to claims 10 and 11, wherein said elastic body is a coil spring.

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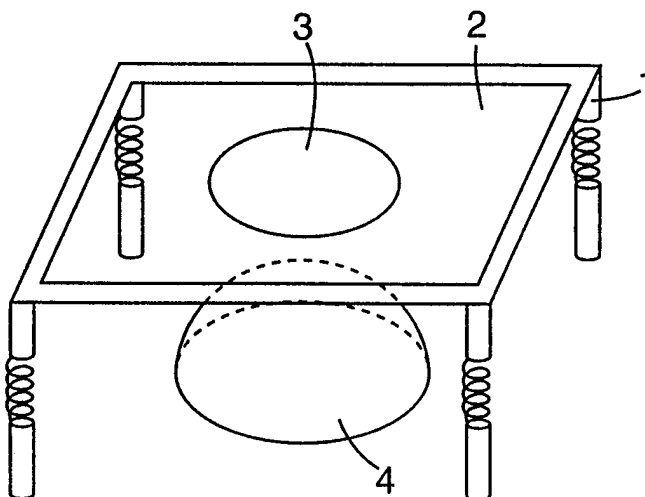


Fig. 1

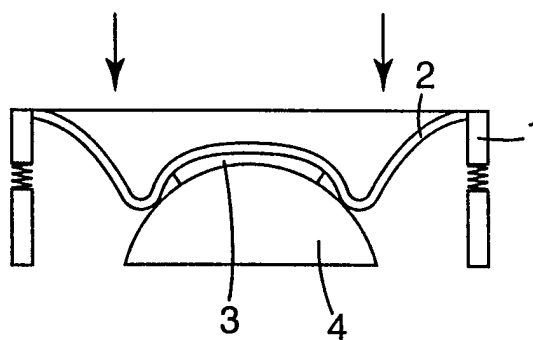


Fig. 2

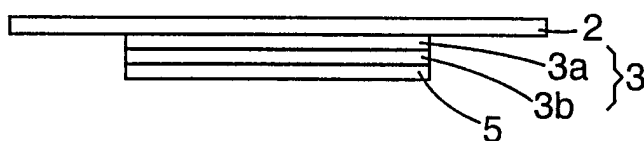


Fig. 3

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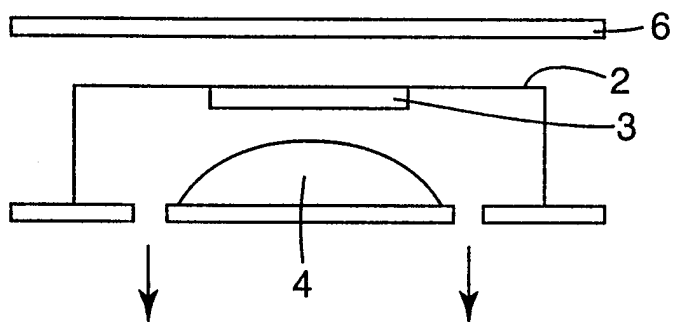


Fig. 4

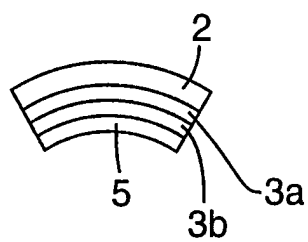


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/08362

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B44C1/17

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 6 B44C B62D

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 529 806 A (FORD MOTOR COMPANY LIMITED ET AL) 3 March 1993 see column 1, line 38 - column 4, line 13 ---	1,3-5,7, 9-11
X	GB 1 191 348 A (INDUSTRIAS SALVER S.A.) 13 May 1970 see page 1, line 29 - page 3, line 84 ---	1-3,7-9
X	EP 0 623 503 A (MINNESOTA MINING AND MANUFACTURING COMPANY) 9 November 1994 see column 2, line 45 - column 4, line 26 see column 5, line 1 - column 12, line 37 ---	1,3,7,9
X	FR 2 540 441 A (REGIE NATIONALE DES USINES RENAULT) 10 August 1984 see page 1, line 1 - page 4, line 25 --- -/--	1,3,7,9

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☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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