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(54) **FILM CONNECTOR AND METHOD OF MANUFACTURING SAME.**

(57) This invention is roughly divided into two, i.e., a film in which a pattern is formed by providing one main surface of a flexible insulating film (1) with a first metallic film (2) which consists of one kind of metal chosen among copper, silver, nickel and aluminum, or an alloy thereof, a second metallic film (3) consisting of one kind of metal chosen among nickel, chromium, tungsten and silver, or an alloy thereof, a third isotropic conductive film (4) consisting of carbon powder and synthetic resin, and a fourth anisotropic conductive film (7a) consisting of carbon powder and synthetic resin; and an anisotropic conductive bonding agent. Owing to the functions of these products, a film connector capable of reliably carrying out the electrical connection of even the high-density terminal leads, and having an improved reliability can be obtained.

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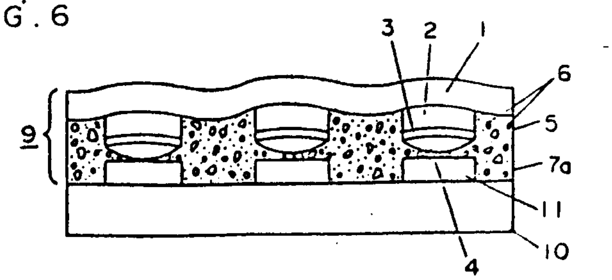

Croydon Printing Company Ltd.

SPECIFICATION

TITLE OF THE INVENTION

"Film Connector and Manufacturing Method therefor"

Field of the Invention

The present invention relates to a film connector which is capable of easily performing an electrical connection, for example, between a liquid crystal display panel and a drive module and easily connecting parts such as electric parts with high-density terminal leads, which difficulty is encounterred to effect an electrical connection by a soldering, to a circuit substrat, peripheral module or the like. The present invention further relates to a manufacturing method therefor.

Background Technique

Recently, with progress of high-density mounting of electric circuit parts, improvement is being made in terms of making patterns fine and making parts compact. Furthermore, with remarkable progress of display apparatus using liquid crystal, various methods have been studied to perform the connection to peripheral modules.

Since various methos are known to mutually connect corresponding electrodes between a plurality of circuit substrates, a description will be made with respect to these methods.

In the first method, corresponding electrodes formed in the same shape and positioned in the opposed relation to each other are electrically connected through an elastic connector pressed under pressure. In the second method, the connection is made by a member which is formed by printing thermoplastic insulating ink and conductive ink alternately in stripe-configuration on an insulating film. In the third method, the electrical connection is made using an aeolotropic conductive adhesive containing powder-like or fiber-like conductive filler.

In the conventional methods described above, the first method always requires a uniform pressing and has disadvantages in that difficulty is encounterred to effect the positioning with respect to a fine pitch electrode and a discrepancy in position occurs due to deformation. The second method has a disadvantage in that the fine pattern printing is limited owing to many printing steps and therefore the production of a narrow pitch pattern is difficult. Furthermore, the third method has a disadvantage in that a flexible printed subtrate must be used because of the drawing of a lead.

Further known is a method in which metallic conductive power such as silver paste is employed. However, this method results in the occurrence of a shot-circuit due to migration and provide a problem in reliability.

Disclosure of the Invention

An object of the present invention is therefore to provide a film connector which is capable of certainly performing the electrical connection between parts with high-density terminal leads and improving the reliability, and to provide a manufacturing method therefor.

In order to achieve this object, a film connector according to the present invention comprises an insulating film with flexibility and first to fourth films formed on a main surface of the insulating film, the first film being a metallic film constituted of one selected from copper, silver, nickel, and aluminium or by an alloy essentially consisting of them, the second film being a metallic film constituted of one selected from nickel, chromium, tungsten and silver or of an alloy consisting of them, the third film being an isotropic conductive film consisting of carbon power and synthetic resin, and the fourth film being an aeolotropic conductive film essentially consisting of carbon powder and synthetic resin. Furthermore, a manufacturing method of the film connector according to the present invention comprises the step of successively forming a second metallic film comprising one selected from copper, silver, nickel and aluminium or comprising an alloy essentially consisting of copper, silver, nickel and aluminium on the whole of one main surface of an insulating film with flexibility, the step of forming a third isotropic conductive film comprising carbon powder and synthetic resin by a printing method in an optional pattern, the step of performing etch removal with respect to the first and second metallic films, and the step of forming an aeolotropic conductive film, consisting of synthetic resin and carbon powder whose particle diameter is greater than that of the third conductive film and whose amount is less than that of the third conductive film, on the entire surface of the pattern.

Here, a metal with good conductivity is used for the first metallic film. For example, while showing a good result, nickel is worse in conductivity than copper. However, it has advanteous in view of oxidation-resistance. The first metallic film allows using silver or aluminium, and using an alloy further containing the above copper and nickel. An alloy consisting of copper and nickel, as well as nickel, has an advantage in view of oxidation-resistance. Furthermore, when the first metallic film is arranged to have two-layer construction and the lower layer formed on the film is constituted of a material such as nickel having an advantage in view of oxidation-resistance and the upper layer is consituted of a material such as copper having an advantage in view of conductivity, the upper metallic film is sandwiched between the second metallic film, which will be described hereinafter, and the lower metallic film, resulting in fine oxidation-resistance of the opper metallic film. A main object of the second metallic film is prevention of oxidation for the first metallic film having high conductivity. The second metallic film can be composed of one selected from nickel, chromium, tungsten, and silver or constituted of an alloy consisting of them. Where the first metallic film has two-layer construction as described above and the lower layer required to have oxidation-resistance is constituted of a material which is identical to the material of the second metallic film, the structure of an evaporation used when these metallic films are formed by a spatter or the like becomes simple, resulting in the reduction in manufacturing cost. Furthermore, it is appropriate that when the first metallic film comprises silver, the second metallic film is constituted of one of above-described materials other than silver to prevent the silver migration. The third isotropic conductive film can be used as an etch resist, and its object is to form an optional pattern and to improve the certainty of connection as a connector and therefore the third isotropic conductive film is formed as an auxiliary conductive film. The third conductive film, as described above, protects the metallic film positioned therebelow. The isotropic conductive film is required for ensuring conductivity when a crack occurs in the metallic film. Furthermore, the fourth aeolotropic conductive film is required to perform the adhesion to an adhered member and to have conductivity in the thickness direction and insulation in the lateral direction. Therefore, it is preferred that the amount of the carbon powder is less than that of the third conductive film. In addition, the particle diameter is greater than that of the third conductive film to effectively achieve the conductivity in the thickness direction. This reason is that the smaller diameter particles are carried in accordance with the flow of the synthetic resin when pressed and therefore may lose the conductibility.

With this construction, a film connector according to the present invention is roughly divided into pattern-formed film and aeolotropic conductive adhesive, and the functions thereof enable a certainly electrical connection between parts with high-density terminal lead and improving the reliability of the film connector.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view showing the state that first and second metallic films are formed on an insulating film, Fig. 1 being useful for describing a manufacturing method of a film connector according to the present invention;

Fig. 2 is a cross-sectional view showing the state that a conductive paste is printed on the metallic films of Fig. 1;

Fig. 3 is a cross-sectional view showing the state that an etch pattern is formed with respect to the films of Fig. 2;

Fig. 4 is a cross-sectional view showing an aeolotropic conductive adhesive coated on release paper;

Fig. 5 is a cross-sectional view showing a film connector according to an embodiment of the present invention; and

Figs. 6 to 8 are respectively a cross-sectional view showing the connection state between a film connector of this invention and a connected member after pressed under pressure.

MOST PREFERRED EMBODIMENT OF THE INVENTION

Hereinbelow, an embodiment of the present invention will be described with reference to the drawings.

First, Fig. 1 shows a cross-sectional view of a two-layer film formed by metallic films which are the basis of a pattern. In Fig. 1, reference numeral 1 represents an insulating film with flexibility. Here, a 38 μm polyethylene terephthalate (PET) film is used. It is appropriate to use a polyether sulfone (PES) film, a polyimide (PI) film or the like. First and second metallic films 2 and 3 have been successively formed on a main surface of the insulating film 1 by means of a spatter, the first metallic film 2 essentially consisting of copper to have conductivity and having a thickness of 2000 Å, and the second metallic film 3 essentially consiting of nickel to have an oxidation prevention function and having a thickness of 350 Å. It is possible that the first and second metallic films 2 and 3 are formed by means of EB (electron beam irradiation or metallizing plating, in place of the spatter. Secondly, a conductive paste is formed on the second metallic film 3 by the silk screen printing to have a desired pattern and is heated at a temperature of 130°C for 30 minutes. With respect to the conductive paste (produced by Three-Bond Co. Lid), a phenol resin (100 part by weight), which is a thermosetting resin, is used as a base and carbon powder {carbon black (acetylene black) 60 part by weight, average particle diameter 0.05 μm, graphite 40 part by weight (Nippon Kokuen Co., Ltd, CSP 40 part by weight, average particle diameter 5 μm)} is used a conductive filler. Fig. 2 shows the cross-sectional view of the formed and heated film. In Fig. 2, numeral 4 represents a third isotropic conductive film constituted of the conductive paste. The thickness of the isotropic conductive film 4 is about 10 μm and the cross-section thereof has a semicylindrical configuration as shown in Fig. 2. Next, the isotropic conductive film 4 is used as a resist and the metallic films 2 and 3 are etch-processed, thereby obtaining a pattern as shown in Fig. 3. On the other hand, as shown in Fig. 4, used as synthetic resin 5 is a polyester (produced by Toyo Boseki Co., Ltd, Vylon GK-130) which is a thermoplastic resin and prepared as a conductive filler is aeolotropic conductive adhesive 7 (produced by Three-Bond Co., Ltd.), containing carbon powder 6, which is stuck on release paper 8. Here, the carbon powder 6 is produced by pulverizing the product obtained by burning and caking phenol resin (produced by Matsushita Denko Co., Ltd., J-1000) 100 part by weight and acetylene black (produced by Denki Kagaku Co., Ltd) 100 part by weight and is used by 5 part by weight (av. dia. 20 μm). Thereafter, as shown in Fig. 5, a film connector 9 is produced by laminating the aeolotropic conductive adhesive 7 on the pattern surface by a laminator under the conditions that rolling temperature is 80°C and film speed is 2m/min so as to obtain a thickness of 30 μm. In Fig. 5, reference 7a designates the fourth aeolotropic conductive film constituted of the aeolotropic conductive adhesive 7 obtained by the lamination.

For a connection test with respect to the film connector, prepared are a base plate, comprising an 1.6 mm thickness glass epoxy base and copper foil lines provided thereon at equal intervals, and a glass plate having a thickness of 1.1 mm. The number of lines is 200, and the line width of each of lines and the line separation are respectively 325 μm, that is, the pitch is 650 μm, and the thickness of the lines is 35 μm. Transparent conductive films (ITO), having a surface resistance of 10 Ω/□, are deposited on the glass plate and etched to have pitch equal to the above-described pitch. Fixed portions of the film connector with a pattern formed to have the same pitch are pressed by a heating application device for tack for 0.5 sec under the conditions of 110^{o}C and 30 kg/cm^2. Thereafter, the release paper is removed, and an electrode of the glass epoxy base is aligned in position with the electrode positioned at one end portion of the film connector, and after lightly pressed by a finger for temporary joint, they are pressed by the heating application device for 30 sec under the conditions of 160^{o}C and 30kg/cm^2. This state is illustrated in Fig. 6. In Fig. 6, numeral 10 represents the glass epoxy base and numeral 11 designates metallic electrodes. Next, similarly, the electrode positioned at the other end of the film connector is pressed for the purpose of tack, and after temporarily attached to the ITO glass plate, they are finally pressed for 40 sec under the conditions of 160^{o}C and 30 kg/cm^2. This state is illustrated in Fig. 7. In Fig. 7, numeral 12 represents the glass plate and numeral 13 designates ITO electrode.

Furthermore, Fig. 8 shows the state that a metallic electrode 15 on a polyimido film 14 is connected to the film connector 9.

With the states after finally pressed, shown in Figs. 6 to 8, it has been confirmed that in the connection between the film connector 9 and the other the connection resistance is not varried under various environments.

The film connector is arranged as described above and generally divided into a film with a pattern and aeolotropic conductive adhesive. In a conventional flexible printed board, the surface of the copper foil pattern is flat, and when heated and pressed with aeolotropic conductive adhesive being interposed, the sufficient flow of resin does not occur, resulting in connection problem due to the generation of insulating covering. On the other hand, in the pattern of the film connector according to the present invention, the conductive paste, constituting the third isotropic conductive film which is positioned uppermost, pushs the aeolotropic conductive adhesive away and comes into contact with the corresponding electrode when heated and pressed. Because the surface of the paste is arranged to be porous and microscopic proections are crushed, a surface-to-surface connection can be made. Furthermore, the carbon filler of the aeolotropic conductive adhesive is sandwiched between the electrode and a member to be connected, and somewhat enters into the paste. This sufficiently ensures the initial connection. As shown in Figs. 6 to 8, during the connection, the resin of the aeolotropic conductive adhesive flows into between adjacent electrodes and the gap is filled up. This firmly fixs the film distorted by pressure. Therefore, the electrodes to be connected are always pressed each other during environment testing period by means of the tensile force by the adhesive and the restoring force of the film, so that the contact resistance becomes stable.

In addition, the aeolotropic conductive adhesive formed on the pattern has functions to protect the pattern and insulate its surface. For example, it has the effect to relax a strong bending of the pattern. Even if the metallic film is partially raised due to rust and the conductive paste is cracked, the damage of the pattern can be prevented beause the pattern or insulating film is strongly pressed by the coating aeolotropic conductive adhesive layer. Furthermore, it has the effect to protect the metallic pattern against moisture. Therefore, the film connector according to the present invention provides great reliability.

Industrial Applicability

As described above, a film connector according to the present invention has various advantages and enables performing an electrical connection between a drive module and a liquid crystal display panel, which is in great demand, and connecting parts such as electric parts with high-density terminal leads to a circuit substrat, peripheral module or the like with great reliability. Therefore, the film connector can be advantageously applied for industries.

List of Reference Numerals

1.....insulating film

2.....first metallic film

3.....second metallic film

4.....third isotropic conductive film

5.....synthetic resin

6.....carbon powder

7.....aeolotropic conductive adhesive

7a....fourth aeolotropic conductive film

8.....release paper

9.....film connector

10....glass epoxy base

11....merallic electrode

12....glass plate

13....ITO (transparent conductive film) electrode

14....polyimido film

15....meattlic electrode

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WHAT IS CLAIMED IS:

1. A film connector characterized by comprising an insulating film with flexibility and first to fourth films formed on a main surface of said insulating film, said first film being a metallic film made of one selected from copper, silver, nickel and aluminium, or made of an alloy essentially consisting of them, said second film being a metallic film made of one selected from nickel chromium, tungsten and silver, or made of an alloy essentially consisting of them, said third film being an isotropic conductive film essentially consisting of a carbon powder and a synthetic resin, and said fourth film being an aeolotropic conductive film essentially consisting of a carbon powder and a synthetic resin.

2. A film connector as claimed in claim 1, characterized in that the amount of carbon powder of said fourth aeolotropic conductive film is less than that of said third isotropic conductive film and the particle diameter of the carbon powder of said fourth aeolotropic conductive film is greater than that of said third isotropic conductive film.

3. A film connector as claimed in claim 1, characterized in that said first metallic film is constituted of copper

and said second metallic film is consituted of nickel.

4. A film connector as claimed in claim 1, charaterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

5. A film connector as claimed in claim 2, characterized in that said first metallic film is made of copper and said second metallic film is made of nickel.

6. A film connector as claimed in claim 2, charaterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

7. A film connector as claimed in claim 4, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

8. A film connector as claimed in claim 6, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

9. A film connector characterized by comprising an insulating film with flexibility and first to fourth films formed on a main surface of said insulating film, said first film being a metallic film made of one selected from copper, silver, nickel and aluminium, or made of an alloy essentially consisting of them, said second film being a metallic film made of one selected from nickel chromium, tungsten and silver, or made of an alloy essentially consisting of them, said third film being an isotropic conductive film essentially consisting of a carbon powder and a synthetic resin, and said fourth film being an aeolotropic conductive film essentially consisting of a carbon powder and a synthetic resin, the amount of carbon powder of said fourth aeolotropic conductive film being less than that of said third isotropic conductive film and the particle diameter of the carbon powder of said fourth aeolotropic conductive film being greater than that of said third isotropic conductive film.

10. A film connector as claimed in claim 9, characterized in that said first metallic film is constituted of copper and said second metallic film is consituted of nickel.

11. A film connector as claimed in claim 9, charaterized in that said first metallic film comprises a lower layer

made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

12. A film connector as claimed in claim 10, charaterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

13. A film connector as claimed in claim 11, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

14. A film connector as claimed in claim 12, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

15. A film connector characterized by comprising an insulating film with flexibility and first to fourth films formed on a main surface of said insulating film, said first film being a metallic film made of copper, said second film being a metallic film made of nickel, said third film being an isotropic conductive film essentially consisting of a carbon powder and a synthetic resin, and said fourth film

being an aeolotropic conductive film essentially consisting of a carbon powder and a synthetic resin, the amount of carbon powder of said fourth aeolotropic conductive film is less than that of said third isotropic conductive film and the particle diameter of the carbon powder of said fourth aeolotropic conductive film is greater than that of said third isotropic conductive film.

16. A film connector characterized by comprising an insulating film with flexibility and first to fourth films formed on a main surface of said insulating film, said first film being a metallic film comprising a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper, said second film being a metallic film made of one selected from nickel chromium, tungsten and silver, or made of an alloy essentially consisting of them, said third film being an isotropic conductive film essentially consisting of a carbon powder and a synthetic resin, and said fourth film being an aeolotropic conductive film essentially consisting of a carbon powder and a synthetic resin, the amount of carbon powder of said fourth aeolotropic conductive film is less than that of said third isotropic conductive film and the particle diameter of the carbon powder of said fourth aeolotropic conductive film is

greater than that of said third isotropic conductive film.

17. A film connector as claimed in claim 16, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

18. A manufacturing method of a film connector characterized by comprising the step of successively forming a first metallic film comprising one selected from copper, silver, nickel and aluminium or comprising an alloy essentially consisting of them and a second metallic film comprising one selected from nickel, chrominum, tungsten and silver or comprising an alloy essentially consisting of them on the whole of one main surface of an insulating film with flexibility, the step of forming a third isotropic conductive film comprising carbon powder and synthetic resin by a printing method in an optional pattern, the step of performing etch removal with respect to the first and second metallic films, and the step of forming a fourth aeolotropic conductive film consisting of synthetic resin and carbon powder on the entire surface of the pattern.

19. A manufacturing method of a film connector as claimed in claim 18, characterized in that the amount of carbon powder of said fourth aeolotropic conductive film is less

than that of said third isotropic conductive film and the particle diameter of the carbon powder of said fourth aeolotropic conductive film is greater than that of said third isotropic conductive film.

20. A manufacturing method of a film connector as claimed in claim 18, characterized in that said first metallic film is made of copper and said second metallic film is made of nickel.

21. A manufacturing method of a film connector as claimed in claim 18, characterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

22. A manufacturing method of a film connector as claimed in claim 19, characterized in that said first metallic film is made of copper and said second metallic film is made of nickel.

23. A manufacturing method of a film connector as claimed in claim 19, characterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made

of a fine conductor such as copper.

24. A manufacturing method of a film connector as claimed in claim 21, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

25. A manufacturing method of a film connector as claimed in claim 23, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

26. A manufacturing method of a film connector, characterized by the step of successively forming a first metallic film comprising one selected from copper, silver, nickel and aluminium or comprising an alloy essentially consisting of them and a second metallic film comprising one selected from nickel, chrominum, tungsten and silver or comprising an alloy essentially consisting of them on the whole of one main surface of an insulating film with flexibility, the step of forming a third isotropic conductive film comprising carbon powder and synthetic resin by a printing method in an optional pattern, the step of performing etch removal with respect to the first and second metallic films, and the step of forming a fourth aeolotropic

conductive film, consisting of synthetic resin and carbon powder whose particle diameter is greater than that of the third conductive film and whose amount is less than that of the third conductive film, on the entire surface of the pattern.

27. A manufacturing method of a film connector as claimed in claim 26, characterized in that said first metallic film is made of copper and said second metallic film is made of nickel.

28. A manufacturing method of a film connector as claimed in claim 26, characterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

29. A manufacturing method of a film connector as claimed in claim 27, characterized in that said first metallic film comprises a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper.

30. A manufacturing method of a film connector as claimed in claim 28, characterized in that said lower layer of said

first metallic film is made of the same material as said second metallic film.

31. A manufacturing method of a film connector as claimed in claim 29, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

32. A manufacturing method of a film connector, characterized by the step of successively forming a first metallic film comprising copper and a second metallic film comprising nickel on the whole of one main surface of an insulating film with flexibility, the step of forming a third isotropic conductive film comprising carbon powder and synthetic resin by a printing method in an optional pattern, the step of performing etch removal with respect to the first and second metallic films, and the step of forming a fourth aeolotropic conductive film, consisting of synthetic resin and carbon powder whose particle diameter is greater than that of the third conductive film and whose amount is less than that of the third conductive film, on the entire surface of the pattern.

33. A manufacturing method of a film connector, characterized by the step of successively forming a first

metallic film comprising a lower layer made of a material such as nickel with excellent oxidation resistance and an upper layer made of a fine conductor such as copper and a second metallic film comprising nickel on the whole of one main surface of an insulating film with flexibility, the step of forming a third isotropic conductive film comprising carbon powder and synthetic resin by a printing method in an optional pattern, the step of performing etch removal with respect to the first and second metallic films, and the step of forming a fourth aeolotropic conductive film, consisting of synthetic resin and carbon powder whose particle diameter is greater than that of the third conductive film and whose amount is less than that of the third conductive film, on the entire surface of the pattern.

34. A manufacturing method of a film connector as claimed in claim 33, characterized in that said lower layer of said first metallic film is made of the same material as said second metallic film.

FIG. 1

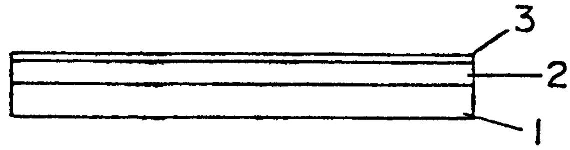


FIG. 2

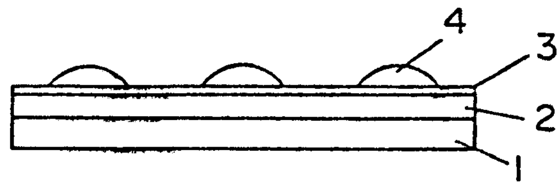


FIG. 3

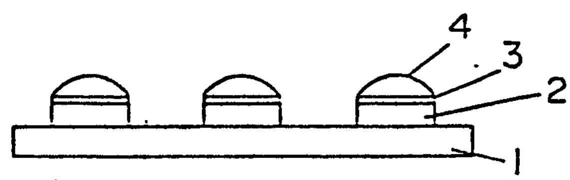


FIG. 4

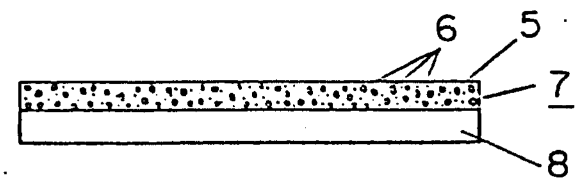


FIG. 5

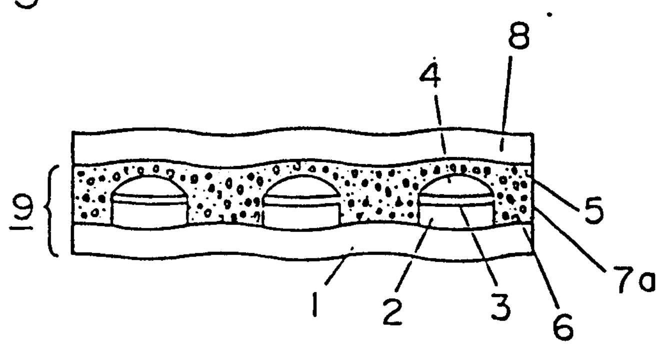


FIG.6

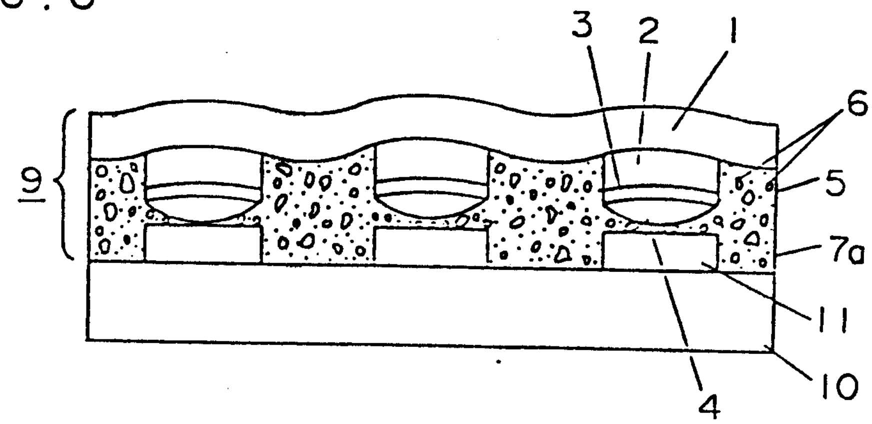


FIG.7

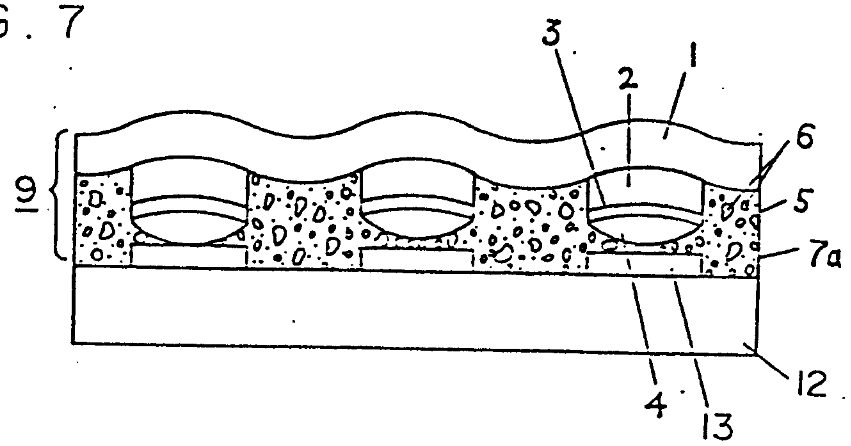
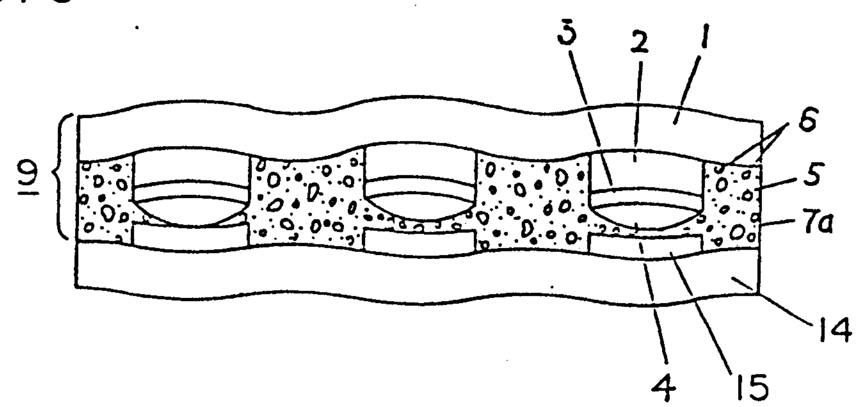


FIG.8



INTERNATIONAL SEARCH REPORT

International Application No. PCT/JP86/00089

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl^4 H01R11/01, 43/00, H01B5/16

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC	H01R11/01, 43/00, H01B5/16

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

Jitsuyo Shinan Koho	1922 - 1986
Kokai Jitsuyo Shinan Koho	1971 - 1986

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category*	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	JP, U, 60-10275 (Casio Keisanki Kabushiki Kaisha) 24 January 1985 (24. 01. 85) Page 1, Figs. 1 to 7 (Family: none)	1-32
Y	JP, A, 58-115779 (Shinetsu Polymer Kabushiki Kaisha) 9 July 1983 (09. 07. 83) Page 5, Figs. 4 and 5 (Family: none)	1-17
A	JP, U, 52-85156 (Seikosha Kabushiki Kaisha) 24 June 1977 (24. 06. 77) Figs. 1 and 3 (Family: none)	1
P	JP, A, 60-140685 (Nippon Shashin Insatsu Kabushiki Kaisha) 25 July 1985 (25. 07. 85) Pages 1 to 4, Figs. 1a to 5 (Family: none)	1-34

* Special categories of cited documents: [15]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
April 24, 1986 (24. 04. 86)	May 12, 1986 (12. 05. 86)
International Searching Authority [1]	**Signature of Authorized Officer** [20]
Japanese Patent Office	