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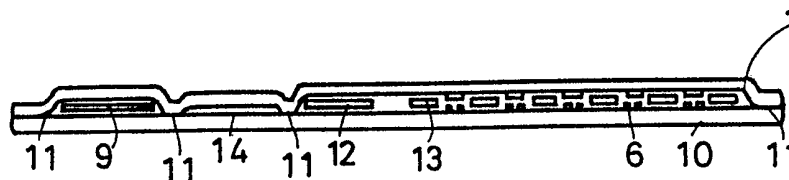
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(54) **Thin flexible electronic apparatus**

(57) An electronic apparatus e.g. a calculator, includes a first flexible base 1 and a second flexible base 10 carrying a circuit wiring pattern, the first flexible base and the second flexible base being integrally laminated, e.g. at 11.

FIG. 2



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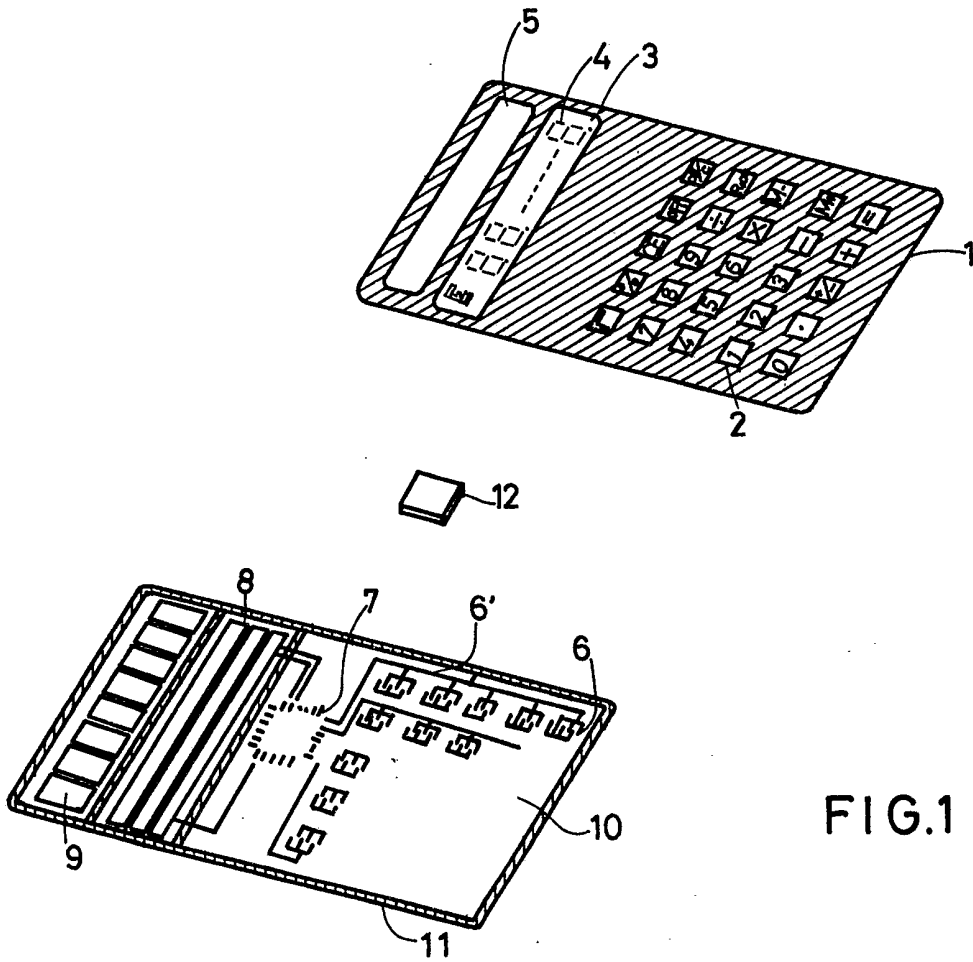


FIG. 1

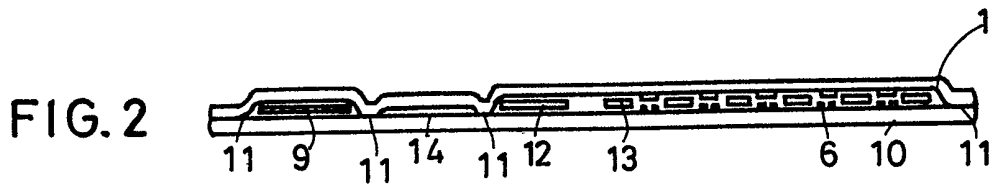


FIG. 2

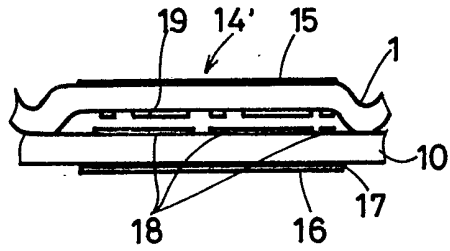


FIG.3(a)

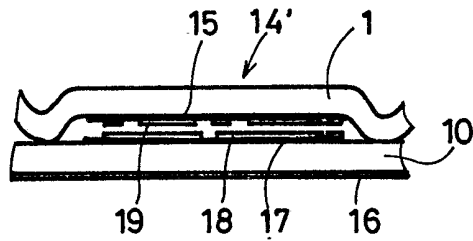


FIG.3(b)

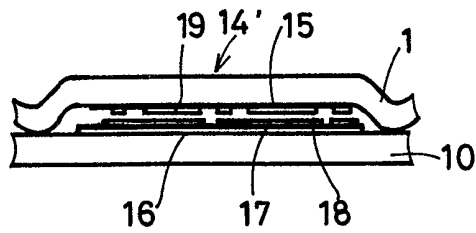


FIG.3(c)

SPECIFICATION

Thin electronic apparatus laminated with two flexible bases

BACKGROUND OF THE INVENTION

5 The present invention relates to a thin electronic apparatus and, more particularly to a thin electronic apparatus, for example, an electronic calculator or the like, laminated with two flexible bases.

10 In recent years, techniques for an electronic apparatus such as an electronic calculator, for example, the miniaturization, the lighting, the reduction of thickness, the low-cost, and the high reliability of the electronic apparatus have been developed. However, the conventional electronic apparatus is packaged by cabinets, and it may be impossible to thin the thickness of the conventional electronic apparatus. For making the electronic apparatus thinner, in place of a hard base or a flexible base, the cabinet which serves as a circuit board is proposed and disclosed in U.S. Patent No. 4,231,098, issued on Oct. 28, 1980, by Akira Tanimoto, entitled "CASING OF ELECTRONIC CALCULATOR". Particularly, the cabinet for the electronic calculator or the like in U.S. Patent 4,231,098 is made of an insulating material such as a plastic, so that key electrodes and a conductive material for a key wiring pattern are directly formed on an inner surface of the cabinet, and a printed base can be eliminated. Accordingly, a keyboard can be thinner. But, in this electronic apparatus, it may not be suitable for mass production and be impossible to reduce a price of the electronic apparatus.

SUMMARY OF THE INVENTION

35 In view of the above disadvantages of the conventional device, an object of the present invention is to provide a thin electronic apparatus such as an electronic calculator, laminated with two flexible bases for the mass-production and the low-cost.

40 Another object of the present invention is to provide a thin electronic apparatus comprising a flexible base which serves as a cabinet and either a circuit base or a display member.

45 Another object of the present invention is to provide a method for manufacturing a thin electronic apparatus comprising two flexible bases, so that electrodes and a circuit wiring pattern are formed on the surface of at least one of the two flexible bases at the same time for a display or the like.

50 Still another object of the present invention is to provide an electronic apparatus in the form of a credit card or a cash card.

55 Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description of and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and

65 scope of the invention will become apparent to those skilled in the art from this detailed description.

According to an embodiment of the present invention, an electronic apparatus comprises a first flexible base and a second flexible base provided a circuit wiring pattern, wherein the first flexible base and the second flexible base are integrally laminated. The first flexible base has a transparent portion.

70 A method for manufacturing an electronic apparatus comprising the steps of providing first flexible base means, forming a wiring pattern and an electrode pattern for at least one circuit element to be mounted on the second flexible base means, positioning the at least one circuit element on the second base means, and combing the first flexible means and the second flexible means.

BRIEF DESCRIPTION OF THE DRAWINGS

85 The present invention will be better understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

90 FIG. 1 shows an exploded sectional view of an electronic calculator of an embodiment of the present invention;

FIG. 2 shows a sectional view of FIG. 1 after a liquid crystal material is filled in a display portion and the display portion is closed; and

95 FIGS. 3(a), 3(b), and 3(c) show sectional views of the liquid crystal display portion of the electronic calculator of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

100 Referring now to FIG. 1, there is illustrated an exploded sectional view of an electronic calculator according to an embodiment of the present invention, which comprises an upper flexible base 1, key symbols 2, a display window 3, display segment electrodes 4, a filter 5 for protecting a solar battery (or solar batteries) and the display window 3, a lower flexible base 10, display common electrodes 8, an electronic part 12 such as an LSI chip, terminals 7 for connecting the electronic part 12, key contacts 6, a key wiring pattern 6', a solar battery (or solar batteries) 9, and a shielding member 11 for connecting or laminating the upper flexible base 1 and the lower flexible base 10.

105 The upper flexible base 1 is made of a flexible film (or a flexible sheet). The key symbols 2, the display window 3, the display segment electrodes 4, and the filter 5 are formed on the upper flexible base 1. Also, key contacts not shown in FIG. 1 are provided on the under surface of the flexible base 1 so as to correspond to the positions of the key symbols 2. The display segment electrodes 4 are made of indium or the like and provided on the under surface of the upper flexible base 1. Indium may be printed or coated with a pattern, or unnecessary parts of indium may be eliminated by etching or the like after indium is printed or coated

on the whole surface of the upper flexible base 1.

In the upper flexible base 1, it is necessary that the filter 5 for protecting the display windows 3 and the solar battery 9 are transparent, so that, preferably, the filter 5 is made of a transparent member such as polyester. The upper surface of the upper flexible base 1 except the display window 3 and the filter 5 may be colored by printing thereon, and at the same time, the key symbols 2 can be printed thereon.

On the other hand, the display common electrodes 8, the terminals 7 for wiring the electronic part 12 such as the LSI chip, the key contacts 6, and the key wiring pattern 6' are provided with indium on the upper surface of the lower flexible base 10 in the same way with the display segment electrodes 4 on the upper flexible base 1.

The shielding member 11 is provided on the surrounding edges of the upper surface of the lower flexible base 10 and on the edge of a liquid crystal packaging portion 14' (a display portion) as shown in FIG. 2.

The solar battery (or the solar batteries) 9 such as an amorphous solar cell or cells is also formed by a grow discharge on the electrodes made of indium. The solar battery made by a method except the method for manufacturing the electronic apparatus may be attached on the electrodes.

The electronic part 12 such as the LSI chip is electrically connected with the terminals 7 on the lower flexible base 10 by a hot melt adhesive or by pressure pressing via a conductive rubber.

Although the shielding member 11 is provided on the upper surface of the lower flexible base 10, the shielding member 11 may be provided on the under surface of the upper flexible base 1 in the same way with the lower flexible base 10.

The upper and lower flexible bases 1 and 10 are integrally connected and laminated via the shielding member 11 provided on the upper or the lower flexible base 1 or 10, and after that, a liquid crystal material 14 is filled into the display portion 14' and the display portion 14' is closed.

FIG. 2 shows a sectional view of the electronic calculator of FIG. 1 after the liquid crystal material is filled into the display portion and the display portion is closed. In FIG. 2, 13 designates a spacer.

FIGS. 3(a), 3(b), and 3(c) show sectional views of the display portion of the electronic calculator of the present invention. Like reference characters designate like or corresponding parts. In FIGS.

3(a), 3(b), and 3(c), 18 designates common electrodes for displaying and 19 designates segment electrodes for displaying.

In FIG. 3(a), a polarization filter 15 is provided on the upper surface of the upper flexible base 1, and a polarization filter 17 mounted a reflector 16 is provided on the under surface of the lower flexible base 10. The segment electrodes 19 and the common electrodes 18 are provided on the under surface of the upper flexible base 1 and the upper surface of the lower flexible base 10,

respectively.

In FIG. 3(b), the polarization filter 15 mounted the segment electrodes 19 is provided on the under surface of the upper flexible base 1. The polarization filter 17 mounted the common electrodes 18 is provided on the upper surface of the lower flexible base 10. The reflector 16 is provided on the under surface of the lower flexible base 10.

In FIG. 3(c), the polarization filter 15 mounted the segment electrodes 19 is provided on the under surface of the upper flexible base 1. The reflector 16 mounted the polarization filter 17 and the common electrodes 18, is provided on the upper end of the lower flexible base 10.

Another display unit except examples of FIGS 3(a), 3(b), and 3(c) can be applied to the apparatus of the present invention.

The flexibility of the above embodiment of the present invention is high. If the stiffness of the electronic apparatus is required, a hard plate such as a stainless plate or an aluminium plate or the like may additionally be adhered on the under surface of the lower flexible base 10.

In the above embodiment, although the contacts, the wiring pattern, and the electrodes are formed by indium (a transparent conductive material), the contacts, the wiring pattern, and the electrodes except those positioned at the display portion may be formed by an opaque conductive material.

In the present invention, the electrodes and the circuit pattern are provided at the same time, so that the manufacturing process can be reduced. The manufacturing process can be carried out continuously.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications are intended to be included within the scope of the following claims.

CLAIMS

- 110 1. An electronic apparatus comprising:
 - first flexible base means; and
 - second flexible base means provided a circuit wiring pattern, wherein the first flexible base means and the second flexible base means are integrally laminated.
- 115 2. The electronic apparatus of claim 1, wherein the first flexible base means has a transparent portion.
- 120 3. A method for manufacturing an electronic apparatus comprising the steps of:
 - providing first flexible means;
 - providing second flexible base means;
 - forming a wiring pattern and an electrode pattern for at least one circuit element to be
 - 125 mounted on the second flexible base means;
 - positioning the at least one circuit element on the second base means; and
 - combing the first flexible base means and the

second flexible base means.

4. An electronic apparatus the housing of which is formed by a pair of laminated supports between which the circuitry of the apparatus is disposed.

5 5. Apparatus as claimed in claim 4, including a display layer having display electrodes on opposite sides thereof, the display electrodes on each side being formed on a respective one of the supports.

10 6. Apparatus as claimed in claim 5, wherein one of the supports has a transparent display area

for permitting the display to be viewed.

7. Apparatus as claimed in any one of claims 4 to 6, wherein the circuitry comprises a wiring pattern formed directly on one of said supports.

15 8. A calculator according to any one of claims 4 to 7.

9. A calculator substantially as herein described with reference to Figures 1 and 2 with any one of Figures 3(a) to 3(c) of the accompanying

20 drawings.