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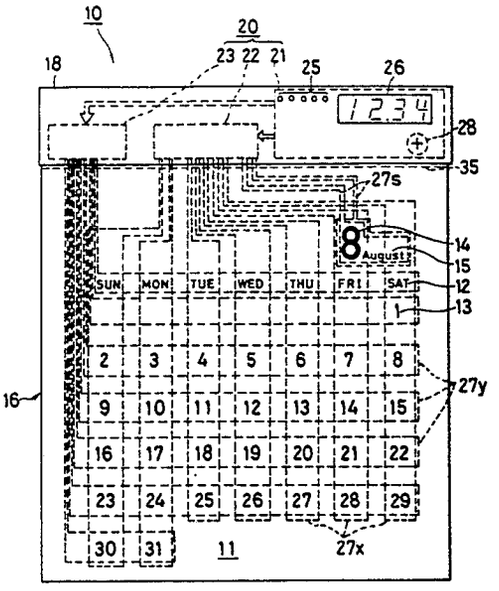
(54) Particular image element indicating device in sheet-shaped printed matter.

(57) An image element indicating devie for visually distinguishably indicating only a predetermined image element among a plurality of image elements (12, 13, 14, 15) indicated on an image indicating surface (11) of a sheet (16) from other image elements, comprises electro-optic element (31, 36) forming each image element and printed on or attached to the image indicating surface of the sheet, the element (31, 36), when being driven by an electric signal, changing between a first optical state to a second optical state which is visually distinguishable from the first optical state, and a drive control circuit (20) for electrically bringing only a single or a plurality of image elements, which are variably determined from among the various image elements, to the second optical state, the drive control circuit (20), conductive wiring lines (27x, 27y) and a power battery (28) being mounted on the sheet (16.)

FIG.1



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PARTICULAR IMAGE ELEMENT INDICATING DEVICE IN SHEET-SHAPED PRINTED MATTER

This invention relates to an indicating device of an image element for visually distinguishably indicating only an image element in a predetermined area on a sheet-shaped image indicating surface such as printed matter from others, utilizing an electro-optic phenomenon.

As one example of a sheet-shaped printed matter, there is the monthly pad calendar (the expression "monthly pad calendar" used herein means a calendar in which when a particular month is over, that particular sheet is turned or torn off for reference to the following sheet indicating the details of the following month). In this type of calendar, the expression "image indicating surface" refers to a surface indicating thereon days corresponding to each day of the week of a calendar sheet for each month. Likewise, the expression "image element(s) indicated on each image indicating surface" refers to at least numerals representing each month and each day and characters representing each day of the week.

Besides the above, such calendars sometimes carry thereon various information such as various kinds of pictures for ornamental use, holidays, and other red-letter days. These are also included in the concept of the image element(s).

However, in such a monthly pad calendar as mentioned, it is difficult for a person to immediately discern what the present date is, or what the day of the week is.

In view of the above, various attempts have been made to distinguish the present day clearly from others in the calendar sheet.

In Japanese Patent Application Public Disclosure No. 56-49298, for example, a semi-transparent disk-shaped colored-body such as thin polyethylene and vinyl chloride is charged by means of static electricity on a calendar sheet and the user moves the disk-shaped colored-body onto the numeral representing that particular day everyday to distinguish "today" from other days.

Another example is of the type in which a magnet is used instead of static electricity and the numeral representing that particular day is encircled with a jig of a round framework. This type of a device is already commercially available.

On the other hand, there is known a calendar using optical emission or coloring as means for indicating all image elements. This is known as a so-called "perpetual calendar".

Such examples can be found in Japanese Patent Application Public Disclosure Nos. 60-8094 and 59-116679. In these Disclosures, a field-effect type or dynamic diffusion type liquid crystal is employed as means for indicating numerals and days of the week, and a combination of all the days of the week and days of the particular month is indicated for each month of a particular year as a group.

According to a conventional method for distinguishing a particular image element, i.e., a numeral representing that day using, for example, the above-mentioned jig, the user must physically operate the jig everyday according to the date of that particular day. This is very troublesome and needs some experience. Besides, the jig may sometimes be accidentally dropped.

In a sense, a calendar is a sort of design article. Therefore, if such a calendar is provided with a jig attached to the calendar sheet in a conspicuous fashion, its appearance is badly spoiled and its commercial value is reduced instead of being increased.

On the other hand, as for a device using a liquid crystal as means for indicating all image elements as a perpetual calendar, insofar as it is viewed from the point of design, it has modern appeal and is thus desirable.

However, in this type of conventional perpetual calendar, all days and days of the week of a particular month are indicated in a similar color tone, or with a change of light transmittance or refractivity as a group. Accordingly, it is practically impossible to distinguish only "today" from the other days. In this respect, this conventional calendar is in no way different from a monthly pad calendar printed in ordinary ink. On the contrary, this conventional calendar is more difficult to see because the all parts thereof are indicated in similar dark and bright tones.

A primary object of the present invention is to provide an indicating device, in which a single or a plurality of particular image elements among various kinds of image elements indicated on a sheet-shaped image indicating surface, are optically indicated so that the single or the plurality of particular image elements can be clearly distinguished from other image elements.

In order to achieve the above-mentioned object, there is provided an image element indicating device for visually distinguishably indicating only a predetermined image element among a plurality of image elements indicated on an image indicating surface of a sheet from other image elements characterized in that electro-optic elements printed on or attached to the image indicating surface of the sheet and, when being driven by an electric signal, changing its state between a first optical state and a second optical state which is visually distinguishable from the first optical state constitute

each image element and that a drive control circuit for electrically bringing only a single or a plurality of image elements, which are variably determined each time from among the image elements, to the second optical state, conductive wiring lines for electrically connecting the drive control circuit and electro-optic elements and a power battery for driving the electro-optic elements are mounted on the sheet or its supporting member.

According to the present invention, each of the image elements drawn on an image indicating surface of a sheet comprises an electro-optic element which is optically changed by an electric signal.

On the other hand, the sheet or its supporting member is provided thereon with a drive control circuit for converting only a single or a plurality of image elements which are variably established each time from along the respective image elements comprising the electro-optic elements to a second optical state, a conductive wiring line for electrically connecting the drive control circuit and the electro-optic element together, and a source battery for generating driving electric energy for the drive control circuit and the electro-optic element.

Therefore, in the sheet to which the present invention is applied, only a single or a plurality of image elements established each time from among a plurality of image elements indicated on the image indicating surface, can be indicated in such a manner as to be clearly and easily distinguished visually from other image elements.

The following is a description, by way of example only, with reference to the accompanying drawings of methods of carrying the invention into effect.

In the drawings:-

Figure 1 is a schematic view of a monthly pad calendar according to one embodiment of the present invention;

Figures 2(A), 2(B), 2(C), and 2(D) are illustrations for explaining the steps for preparing a calendar sheet for one month portion of the calendar shown in Figure 1;

Figure 3 is a schematic view of a mount of the calendar shown in Figure 1;

Figure 4 is a schematic view of one example of an electric connecting method for connecting a conductive wiring line of each calendar sheet laminated on the mount and a drive control circuit provided on the mount;

Figure 5 is a schematic side view of a calendar finally assembled;

Figure 6 is a schematic view of another example of an electric connecting method for connecting a conductive wiring line of each calendar sheet laminated on the mount and a drive control circuit provided on the mount;

Figure 7 is a schematic view of a finished calendar which is formed based on Figure 6;

Figure 8 is a schematic view of another example of a mechanism for selectively distinguishably indicating image elements;

Figure 9 is a schematic view of another example regarding a way of expression of image elements;

Figures 10(A) and 10(B) are schematic views of the forms of image elements actually expressed according to the way of expression of Figure 9;

Figure 11 is a schematic view of a nest structure of a conductive wiring line in a case where a week is indicated in an overlapping fashion; and

Figure 12 is a schematic view in which the present invention is used for an image element distinguishing indication on an image indicating surface of a poster.

Figure 1 is a schematic view of a monthly pad calendar according to one embodiment of the present invention, in which a particular day of the week and a date corresponding thereto, i.e., "today", are selectively indicated so as to be visually clearly distinguished from other days and other days of the week.

That is, in this embodiment, image elements 12, 13, 14, and 15 relating to the subject matter of the present invention include letters (12) and numerals (13) representing the day of the week and the day of the month, as well as numerals (14) and letters (15) representing the month.

Furthermore, in this embodiment, a mount 17 (Figure 3) for supporting each sheet 16 indicating a month of the calendar is provided thereon with a drive control circuit 20, and the day 12 of the week and the date 13, which are selectively indicated, are automatically shifted every day.

The calendar 10 illustrated in Figure 1 shows the month of August of 1987 and the calendar sheets showing the months from January to July have already been torn off.

The operation of a device according to the present invention will be described first with reference to Figure 1. The numeral "8" as an image element 14 showing the month numerically and "August" as an image element 15 showing the month by letters, are represented by different color tones from those of other image elements or otherwise they are varied, in turn, between a first color tone (e.g., blue color) and a second color tone (e.g., green color) at a predetermined time interval. This produces an impression somewhat similar to a blinking of light. The terms "first color tone" and "second color tone" correspond to one example of the terms of "first optical state" and "second optical state" used in connection with the present invention.

On the other hand, the image element 12 representing the days of the week and the image element 13 representing the date (numeral), when not selected, are shown, for example, in blue color as the first color tone. However, when selected or, in other words, when they correspond to "today", they are changed from the blue color to a green color as the second color tone.

Therefore, a person who looks at this calendar 10, can immediately know what date and what day of the week it is only by looking at the numeral 13 and letters 12 which have been changed to green color. More precisely, he can immediately sense that an eye-catching character is present among a plurality of figure rows and then immediately understand that this character indicates "today". The same is true with the day of the week.

In this way, the date and day of the week are shifted one by one every day and reach the 31st day and the day of the week "Monday". When the month of "August" shown in Figure 1 is over, the sheet 16 for this month is torn off. Then, the sheet for the month of "September" shows the day of "1" and the day of the week "Tuesday". This procedure is continued to the month of "December".

Upon purchasing this calendar 10, the user operates a set switch group 25 for "hour", "minute", "day of the week", "month", and "date" provided at a timer control circuit 21 of this calendar and inputs information for the setting day into the timer control circuit 21. At that time, as seen in an ordinary digital watch, the information is inputted with reference to figures indicated on a numeral indicating section 26 of, for example, 4-figure and 7-segment display type. Since recent watches are mostly designed such that each item of information is set into the control circuit by means of operating two button switches alternately in a predetermined manner, such watches may be employed.

At any rate, once the above-mentioned setting operation is completed, the correct date indication is automatically performed.

The numeral indicating section 26 which is used for setting the information, can also be used as an ordinary clock after the setting.

In the embodiment of Figure 1, in order to selectively and distinguishably express various image elements 12 through 15, a liquid crystal sealed in a microcapsule and changeable in color tone by electric field is used, and each numeral and each letter are expressed by printing.

In order to drive the numerals and days of the week, conductive wiring lines 27x and 27y which are in x, y matrix arrangement, are formed by printing using a transparent conductive ink. Based on information which the timer control circuit 21 issues each day in the drive control circuit 20, a particular wiring line among the x-direction conductive wiring lines is selected by an x decoder driver 22 and a particular wiring line among the y-direction conductive wiring lines is selected by a y decoder driver 23. By applying electric field between them, only the image elements 12 and 13 positioned at the cross point thereof are changed into the second optical state or second color tone. Wiring lines 27s to the image elements 14 and 15 which participate in the month indication are always applied with an electric voltage at a predetermined time interval so that they are always indicated in a particular color tone or the color tone is changed from the first to the second.

An example for making the illustrated calendar 10 perform such operation as described, will be described hereunder with reference to Figures 2 through 5.

Figure 2 illustrates an example of making the calendar sheet 16 for each month. In the figure, the thickness of each lamination layer is shown very exaggerately.

As is shown in Figure 2(A), the outer surface of the sheet 16, which may be ordinary paper, or a suitable synthetic resin sheet, is formed with an insulating film 30a which also serves to protect the outer surface. This insulating film 30a can be formed by a conventional printing or laminating technique using a suitable synthetic resin material.

A transparent conductive wiring line 27y of either x- or y-direction (y-direction in the illustrated embodiment) is formed on the insulating film 30a by laminating or printing.

In this case, the y-direction conductive wiring lines are arranged in 7 rows in total, including the row for the days of the week, corresponding to a maximum of 6 weeks. On each y-direction conductive wiring line 27y, as shown in Figure 2(B), by using a liquid crystal ink 31 having sensitivity to electric field, changeable in color tone and contained in a microcapsule of a cholesteric liquid crystal as an electronic optical element, the letters representing the days of the week and the numerals representing dates are printed at the corresponding positions on the image indicating surface 11 as the corresponding image element 12 or 13.

Thereafter, an insulating film 30b is formed as shown in Figure 2(C), and 7 rows of x-direction conductive wiring line 27x which correspond to "7" days of the week, are laminated or printed using a transparent conductive ink thereon.

Then, a transparent insulating film 32 serving also for protection, is formed thereon using a suitable material and in the same procedure as the aforementioned insulating films 30a and 30b. In this way, a calendar sheet for each month is completed

as shown in Figure 2(D).

Both the x- and y-direction conductive wiring lines 27x and 27y are formed such that they extend to one end of the sheet 16 or to the end positioned above Figure 1 in this embodiment, and conductive faces 27x′ and 27y′ are exposed from the insulating film 32 at the ends thereof. This arrangement is made for the purpose of adopting an electric connection with the drive control circuit 20 for commonly controlling each sheet as will be described afterwards. The wiring lines 27s for the month are likewise exposed.

The so-formed calendar sheets 16 are then placed one upon another in the order of the month and placed on the mount 17 as one of the supporting members illustrated in Figure 3. As clearly shown in the figure in the case of this embodiment, the timer control circuit 21, the x-direction decoder driver 22, the y-direction decoder driver 23, and wiring and battery 28 (Figure 1) related thereto, are mounted on a mount end portion 33 which is left vacant when the sheets 16 are placed one upon another at a predetermined position.

The timer control circuit 21, the x-direction decoder driver 22, y-direction decoder driver 23, etc. forming the drive control circuit 20 can all be made very thin even by means of conventional electronic circuit making techniques. For example, an integrated circuit of the type used for a conventional digital watch and having dimension of less than the mm order may be used in the timer control circuit 21. This circuit 21 may even contain therein the power battery 28.

In order to selectively drive one of the x-direction conductive wiring line 27x, one of the y-direction conductive wiring lines 27y, and the conductive wiring line 27s for indicating the month by the x decoder driver and the y decoder driver 23, they are required to be electrically connected to those of each sheet. To this end, output lines 27x″, 27y″, and 27s″ from each of the decoder drivers 22 and 23, when each sheet is placed thereon extend to a portion positioned at the edge of the sheet 16 (Figure 3). Of course, it is preferable that these are formed by printing as in the case with the conductive wiring line between each decoder driver 22 and 23. However, this portion is not necessarily applied with a transparent conductive ink in particular but may be applied with a colored conductive ink.

On such mount 17, a total of twelve sheets are placed one upon another in order from the sheet 16 for the month of December to the one for the month of January as shown by the phantom lines of Figure 3. Such state is shown in Figure 4.

As is apparent from Figure 4, the conductive wiring lines 27x, 27y and 27s of each sheet, when viewed from above, are in alignment at the ends with the ends of the output lines 27x″, 27y″ and 27s″ of each decoder driver 22 and 23. Therefore, when a conductive paint lamination layer 29 is applied or printed in line-shape along the edges of all sheets using a suitable conductive ink or the like, the paint enters into spaces between adjacent sheets in a liquid phase state before it drys and electrically contacts the end conductive faces 27x′, 27y′ and 27s′ of the conductive wiring lines of each sheet. On the other hand, the paint also contacts the outer surfaces of the corresponding output lines 27x″, 27y″ and 27s″ to each decoder driver 22 and 23. Accordingly, when the paint drys, a conductive communicating line 29 extending in the vertical direction is formed through a contact portion 34 permeated into spaces between the adjacent sheets, thereby to complete a wiring system as shown in Figure 1. As the sheet for each month is torn off when its use is over, the conductive paint line 29 is cut off at that position. However, the contact between the conductive wiring lines of the remaining sheets and each decoder driver is maintained.

Thereafter, each sheet 16, as well as the mount 17, as shown in Figure 5, are mechanically clamped and secured by a suitable binding device 18 made of metal or the like in the same manner as the ordinary calendar. By this, the calendar 10 to which the present invention is applied is completed as shown in Figure 1.

The binding device 18 is required to be formed larger than a metal piece merely used for a conventional calendar by a portion in which the drive control circuit 20 is contained. In addition, the various set switches 25 provided at the timer control circuit 21 of the drive control circuit 20 and an opening for exposing the numeral indicating section 26 therefrom, etc. are required, too.

However, its shaping is very simply performed by means of ordinary machining. It is desirable that a machine perforation 35, as shown in Figure 1, be drawn along a cutting-off line except at portions where the conductive wiring lines are present, by means of a conventional method.

There are also other methods which may be employed for connecting the conductive wiring lines 27x, 27y and 27s of each sheet with the output lines 27x″, 27y″ and 27s″ of the drive control circuit. Examples are shown in Figures 6 and 7.

That is, as shown in Figure 6, each of the sheets 16 to be placed one upon another may be formed gradually shorter in length going from the bottom sheet, i.e., the sheet for the month of December, to the top sheet so that the end conductive faces 27x′, 27y′ and 27s′ of the conductive wiring lines 27x, 27y and 27s of the sheets 16 are exposed in tiered fashion, and the drive control output lines 27x″, 27y″ and 27s″ formed on the

upper inner surface of the binding device 18 are contacted with all conductive face angle portions thereof. In this case, as shown in Figure 7, the drive control circuit 20 is preferably secured to the binding device 18 as another supporting device instead of being secured to the mount 17.

In the manner as described in the foregoing, the calendar 10 as one embodiment of the present invention is made and the above-mentioned functions are performed. However, such image elements as, for example, an advertising portion for the company name and an image element showing a picture or the like which are on this calendar, may be indicated at a suitable place such as at the upper or lower side of the mount 17, on the intermediate insulating films 30a and 30b, or on the upper insulating film 32 by means of ordinary printing.

In the above embodiment, a cholesteric based liquid crystal sealed in a microcapsule is used for the image elements 14 and 15 for indicating "month", the image elements 12 for indicating "day of the week", and the image elements 13 for indicating dates. Alternatively, an electrochromic element which is made by hardening a liquid crystal may be used. In addition, since it is known that a twisted nematic (TN) based liquid crystal, a smectic (SM) based liquid crystal, a phase transition type liquid crystal, a supertwisted birefringence effect (SBE) liquid crystal, a guest-host type (GH) liquid crystal, a dynamic scattering mode (DSM) liquid crystal, etc. can be used for printing in a state of being contained in a microcapsule by controlling the crystal orientation, they may be likewise used as the electro-optic element of this embodiment.

Instead of printing the electro-optic elements in the form according to the details of the image elements to be indicated as in the case with the above-mentioned embodiment, if the conductive wiring lines are formed in a predetermined form of numerals or letters at the crossing point of x and y, the present invention can be practised by using a plane-shaped electro-optic element.

Figure 8 illustrates an important part of an embodiment in such case.

First of all, a colored image element 37 is printed on the mount 17 using an ordinary ink. The figure shows a case where a numeral "3" is indicated as one of the image elements 13 for representing dates. Of course, all image elements 12 through 15 which the present invention is applied are subjected to the ordinary printing treatment.

A transparent insulating film 38 for protection is formed on the ink print type image element 37, and the x-direction conductive wiring line 27x is formed thereupon, This can be laminated or printed by using a transparent conductive ink as in the case with the preceding embodiment. The characteristic point is that the conductive wiring line of a portion $13''$ corresponding to the image element is formed in the shape of the image element (in the shape of the numeral "3" in this case).

In this way, when the x-direction conductive wiring line 27x having the image element portion $13'$ which is formed in the shape of each image element to be indicated is formed by printing, a flat sheet type electro-optic element 36 with, for example, an electric field effect type liquid crystal contained therein is laminated thereupon. Of course, as is the rule with this kind of electric field effect type liquid crystal device, a polarizing sheet, etc. is also laminated in advance, where necessary, so that transparency is maintained when the electric field is not applied, thereby to allow the image element 37 thereunder printed in ordinary ink to be seen.

The y-direction conductive wiring line 27y having the image element portion $13'$ in a form corresponding to an image element to be indicated, is laminated or printed using a transparent conductive ink on the liquid crystal sheet 36 as in the case with the aforementioned x-direction conductive wiring line 27x. However, since the x-direction conductive wiring line 27x and the y-direction conductive wiring line 27y are different in direction to the next image element by 90°, the leader portions naturally intersect with the portion of the numeral "3" at right angles.

When this y-direction conductive wiring line 27y is formed, an insulating film (not shown) for protection is formed thereupon. In this way, a calendar sheet for each month is completed.

The steps followed may be suitable selected from those already described with reference to Figures 3 through 7.

In the so-formed calendar sheet, the dates and days of the week, excluding "today", are all indicated in the color of the printing image element 37 using an ordinary printing ink. However, as regards only the numeral for the date and the letters for the day of the week corresponding to "today", since an electric field is applied between the image element portions $13'$ and $13'$ of both the x- and y-direction conductive wiring lines 27x and 27y corresponding thereto, a crystal orientation displacement occurs only at that portion of the liquid crystal sheet 36 and, as a characteristic of this kind of electric field effect type liquid crystal, the light transmittance is greatly decreased. The result is that the numeral "3" indicated by an ordinary printing ink disappears from sight, and a dark (black) numeral "3" appears.

The impression somewhat resembles that of the numerals indicated by a digital watch, etc., known per se.

Besides the above, as an idea for providing a markedly distinguishable indication, as shown for example in Figure 9, the image element 37 indicated with an ordinary printing ink, is formed in a framework tracing the profile of the numeral "3". In this case, if the numeral "3" does not represent "today", in other words, if "today" is not the "third day" of the month, as shown in Figure 10(A), only said framework is represented by a color tone of a particular printing ink together with a plurality of other numerals, whereas if "today" is the "third day", it changes to a numeral "3" with the inner part of its framework darkened or turned to black as shown in Figure 10(B) because the liquid sheet exhibits the aforementioned function by the drive command of a drive control circuit.

This method has a high distinguishing capability. Of course, these ideas or methods can be likewise applied to the image elements 12, 14 and 15 representing the days of the week and the month.

In the calendar illustrated in Figure 1, the number of the indicating line of the numerals representing days are "6" corresponding to "6" of the maximum numbers of "week" in a month. However, since there are actually many months which include 5 weeks or less, it is sometimes more preferable in view of saving the sheet area that the last week be indicated together with the fifth week as in the case of a conventional ordinary calendar.

To meet the requirements in such a case as just mentioned above, as shown in Figure 11, the days in the sixth week, for example, the 30th and 31st days in the aforementioned example of August of 1987, may be indicated together with the 23rd and 24th days falling on the same days of the fifth week dividing them by the mark "/" according to the ordinary method. In this case, a y-direction conductive wiring line 27y-6 for the sixth week and a y-direction conductive wiring line 27y-5 for the fifth week may be patterned so as to be nested.

With regard to embodiments of the above-mentioned calendar, various changes and modifications are conceivable.

It goes without saying that it is meaningless for the idea of the present invention to be applied to a daily pad calendar. However, the present invention is likewise applicable to a calendar showing two months or six months on each of calendar sheets or showing twelve months on a calendar sheet, for example. In this case, although the numbers of conductive wiring lines led out of a calendar sheet and connected to a decoder driver are as a matter of course increased and the pattern of arrangement thereof is required to be suitably designed, circuitry can be made almost unchanged from the case of the aforementioned embodiment.

On the contrary, it is conceivable that, in the monthly pad calendar described with reference to Figure 1, an exclusive-use conductive wiring line is led out of a calendar sheet for an individual month. In other words, in the above-mentioned embodiment, supposing that "today" is indicated on a calendar sheet of the month now placed on the top, the image elements indicated on the sheets thereunder at positionally corresponding places, are driven together. For example, in the year 1987, the dates positionally corresponding to August 3 (Monday) within a two-dimensional image plane on the image indicating surface 11, are September 7 (Monday), October 5 (Monday), November 9 (Monday), and December 7 (Monday). If said August 3 (Monday) is "today", the letters "Monday" of the day of the week and the numeral "3" are indicated on the calendar sheet for the month of "August". At that time, under said calendar sheet and therefore unseen from outside, there are present electro-optic elements driven at hidden places, such as the letters "Monday" and the numeral "7" indicated on the calendar sheet for the month of "September" and the letters "Monday" and the numeral "5" indicated on the calendar sheet for the month of "October".

As a matter of fact, in the case of an electric field effect type element, no matter whether it is printed in the manner as in the first embodiment or formed in a flat sheet shape in the manner as in the second embodiment, almost no electric current flows therein. Accordingly, even if the unseen or hidden image elements are driven, the electric power consumption of the source battery 28 does not become very large. Although it is rather desirable that the wiring pattern be standardized and simplified, if this is intentionally avoided in order to indicate the selected date on a calendar sheet of only this month, x-and y-conductive wiring lines may be led out exclusively depending on the two-dimensional numeral arrangement pattern of the calendar sheet for each month.

Furthermore, it is possible in principle for each exclusive-use drive control circuit to be mounted on a calendar sheet for each month.

A thin film solar cell may be employed as the source battery 28. The converting efficient of this kind of solar cell is greatly improved these days. With its thinness of some um order and its capability of being sufficiently driven by a room fluorescent lamp, the thin film solar cell is well suited to an object like the present invention.

As described in the foregoing, various other information elements such as "holidays" etc. may be included in the distinguishable image elements according to the present invention, in addition to such information elements as month, date and day of the week. On the contrary, the present invention may be applied only to the numeral representing

the date. In an extreme case, it may be constituted as, for example, a manually operated one in which the day is changed each time the user operates a switch instead of the one described in the above embodiment in which a day is automatically changed by means of a timer function. This is in a sense a monthly pad calendar giving the added impression of a daily pad calendar and might make interesting merchandise. In this case, since no jig is attached to the sheet as in the afore-described conventional art, it has excellent artistic sense and improves the commercial value.

In the embodiments described above, the present invention was applied to a calendar. Since the present invention selectively distinguishably indicates one or a plurality of image elements among a plurality of predetermined image elements in the images indicated on an image indicating surface while allowing them to change according to the passage of time, it may be likewise applied to various kinds of printed matters such as posters as in the case with the embodiment shown in Figure 12, for example.

In the illustrated case of Figure 12, in addition to an image element 41 for drawing a Christmas tree by ordinary printing and an image element 42 indicating an advertisement etc. of a company, pictures 40 of a plurality of tiny lamps hung on each branches of the Christmas tree 41 are shown on the image indicating surface 11 of the sheet 16.

Therefore, when a plurality of tiny-shaped image elements are shifted between the first and second optical states in a predetermined order or optional combination using random numbers through a conductive wiring line (not shown) similar to the preceding embodiment, such a dynamic expression can be attained as if the tiny lamps hung on the Christmas tree are actually blinking, thereby to provide a sufficient effect for drawing public's eyes.

Therefore, the present invention can be used in expression of various image elements provided in a large number of other printed matters. For example, the present invention can be likewise applied to a large time table sheet attached to the wall of a station so as to distinguishably indicate only the next departure time whenever the time comes, and a display in which a ground picture is changed to a different picture by means of the driving of an electro-optic element.

Besides the aforementioned one in which a liquid crystal is clamped by a thin synthetic resin film and filled inside, an integrated structure of elements by means of a light emitting structure, etc. such as a combination of a solidified electrochromic element and its solid electric field lamination layer, a light emitting diode (LED), an electro luminescence (EL), can be used as the electro-optic element. In this case, they are all formed so thin as from several cm to several tens cm. The thickness will be able to be supressed to the order of mm at most.

Therefore, these elements can also be used as electro-optic elements of the present invention taking the electric power consumption into consideration.

As apparent from the foregoing description, according to the present invention, a plurality of image elements drawn on an image indicating surface of a sheet, comprise an electro-optic element which is optically changed by an electric signal. Accordingly, they can be easily converted into a second optical state from a first optical state.

Therefore, only a predetermined image element among a plurality of image elements indicated on the image indicating surface, can be visually clearly and distinguishably indicated.

For example, when the present invention is applied to a monthly pad calendar, only the date and the day of the week representing "today" can be distinguishably indicated from the numerals representing other days and the letters representing other days of the week, whereas when the present invention is applied to a poster, etc., a dynamic and very fresh expressional effect can be obtained, for example, as if a plurality of tiny lamps were formed on a sheet and as if a plurality of image points were blinking in turn.

Claims

1. An image element indicating device for visually distinguishably indicating only a predetermined image element among a plurality of image elements (12, 13, 14, 15) indicated on an image indicating surface (11) of a sheet (16) from other image elements CHARACTERIZED IN
that each image element (12, 13, 14, 15) is constituted by an electro-optic element (31, 36) printed on or attached to the image indicating surface (11) of the sheet (16) and the electro-optic element, when driven by an electric signal, changes between a first optical state and a second optical state which is visually distinguishable from the first optical state, and
that a drive control circuit (20) for electrically bringing only a single or a plurality of the image elements, which are variably determined each time from among the image elements, to the second optical state, conductive wiring lines (27x, 27y) for electrically connecting the drive control circuit (20) and the electro-optic elements (31, 36), and a battery (29) for driving the electro-optic elements are mounted on the sheet (16) or its supporting member (17).

2. An image element indicating device according to claim 1, wherein said electro-optic elements (31, 36) comprise a liquid crystal which has high sensitivity to electric field, is changeable in color tone and is contained in a microcapsule.

3. An image element indicating device according to claim 2, wherein said liquid crystal is of a cholesteric type.

4. An image element indicating device according to claim 1, wherein said conductive wiring lines (27x, 27y) are transparent.

5. An image element indicating device according to claim 1, wherein said conductive wiring lines (27x, 27y) are formed by printing with a conductive ink.

FIG.1

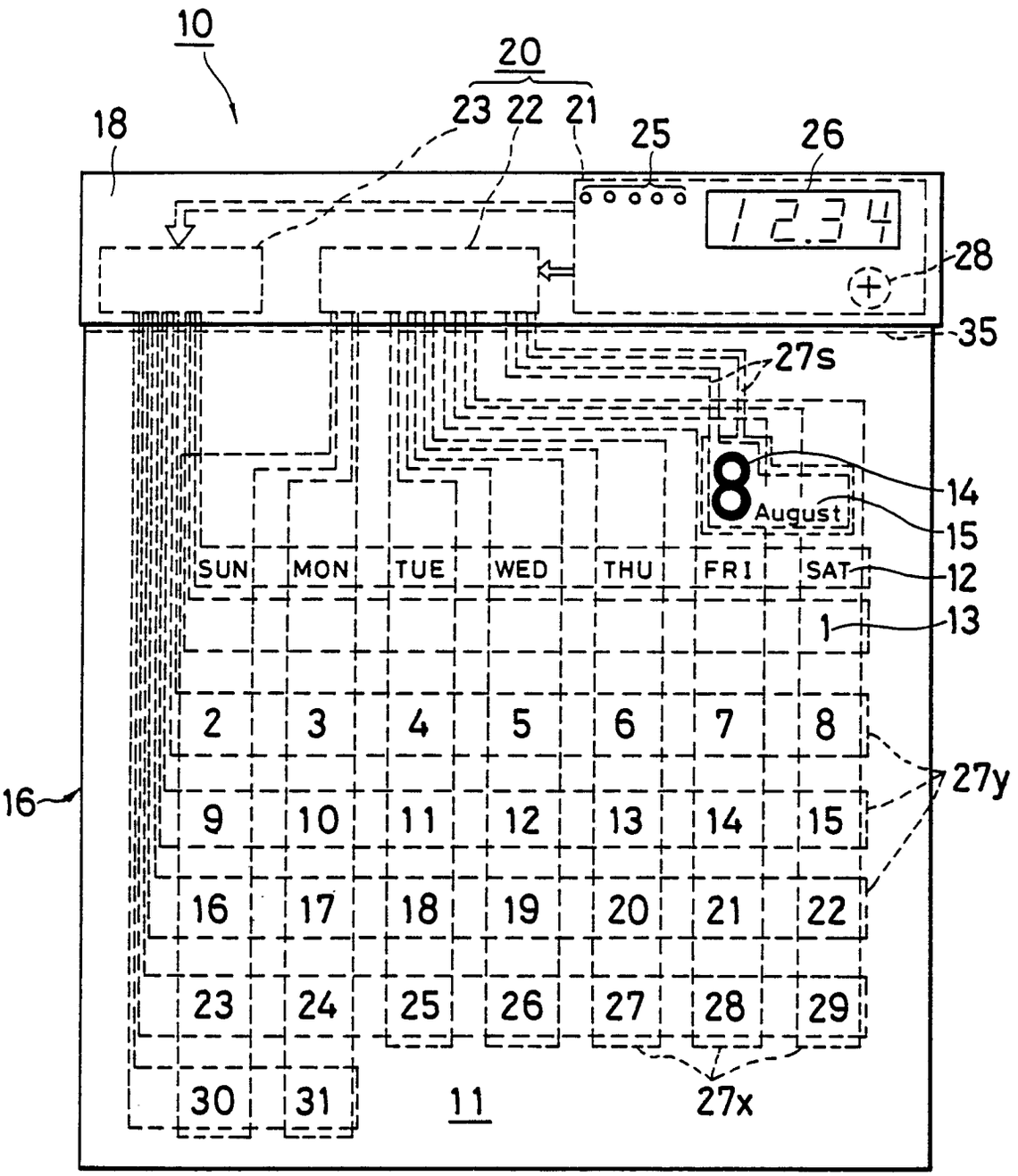


FIG.2 (A)

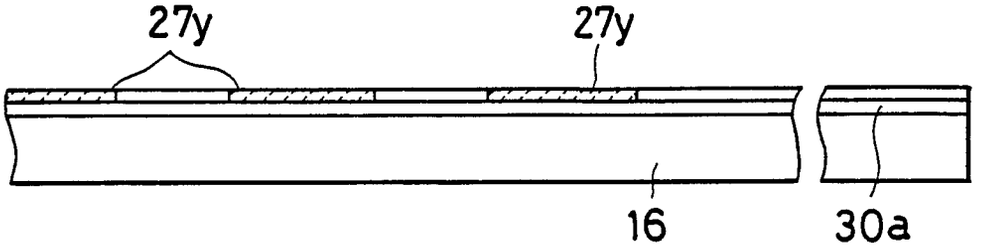


FIG.2 (B)

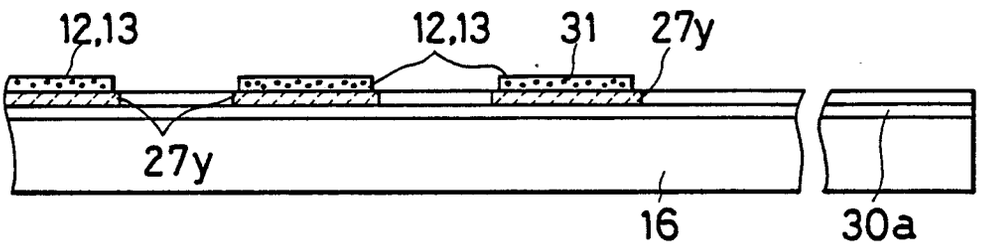


FIG.2 (C)

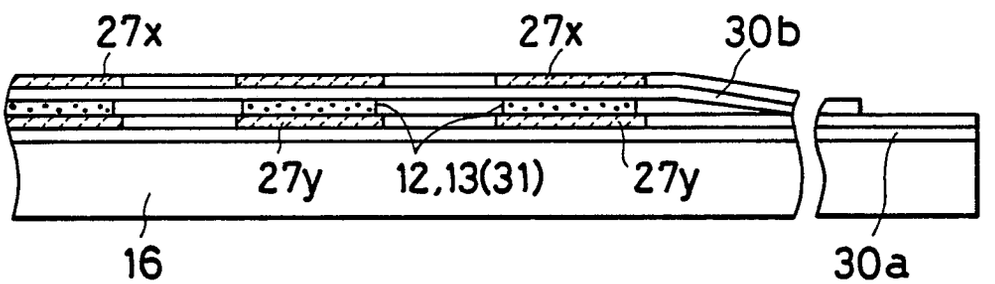


FIG.2 (D)

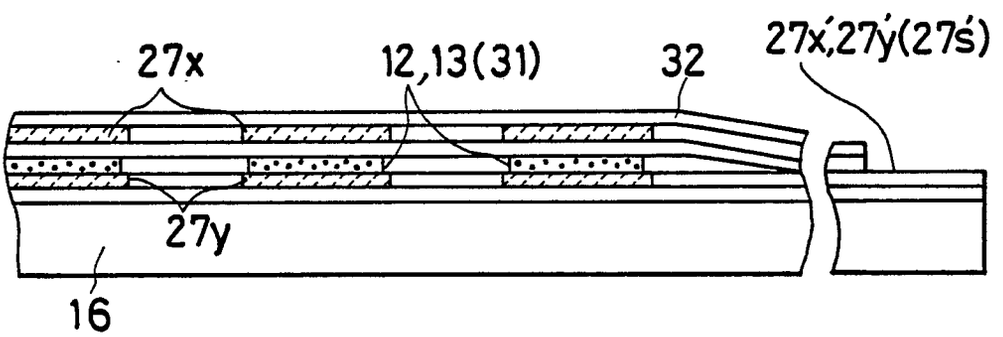


FIG.3

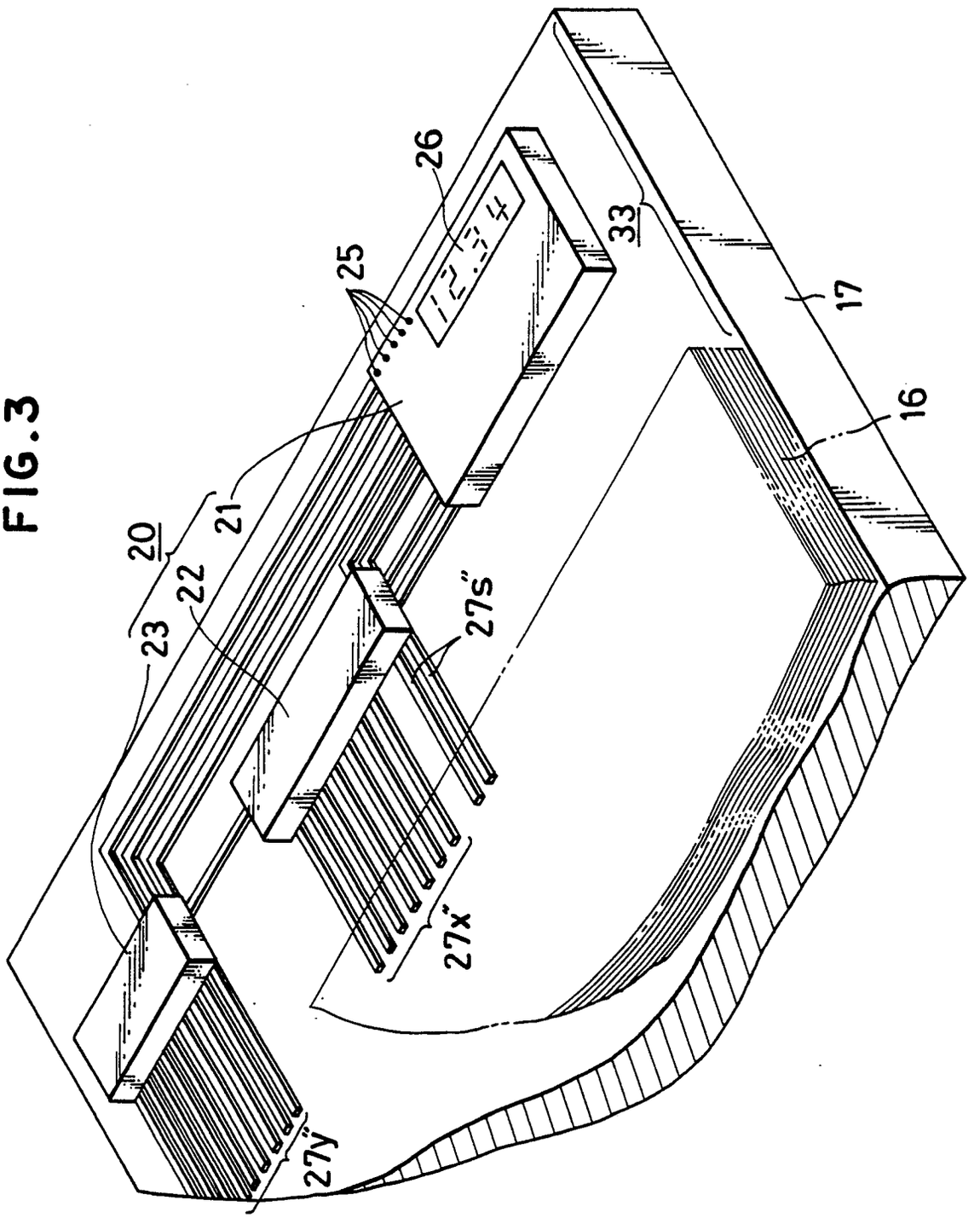


FIG.4

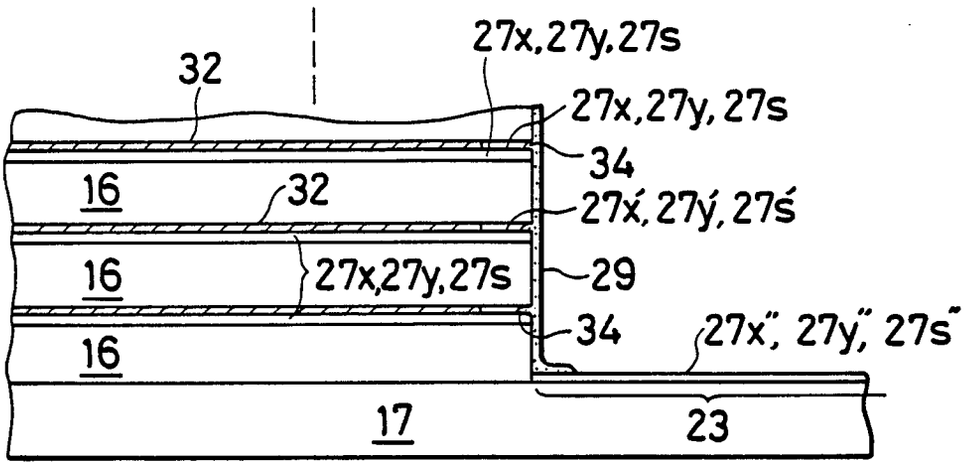


FIG.5

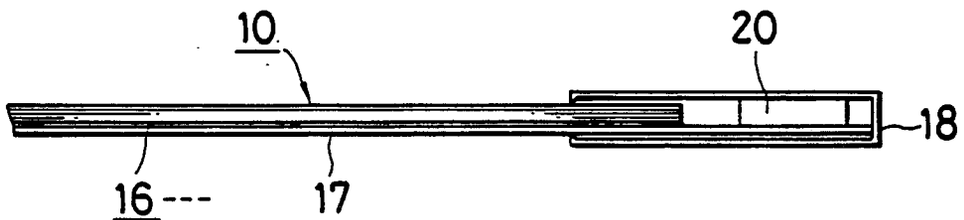


FIG.6

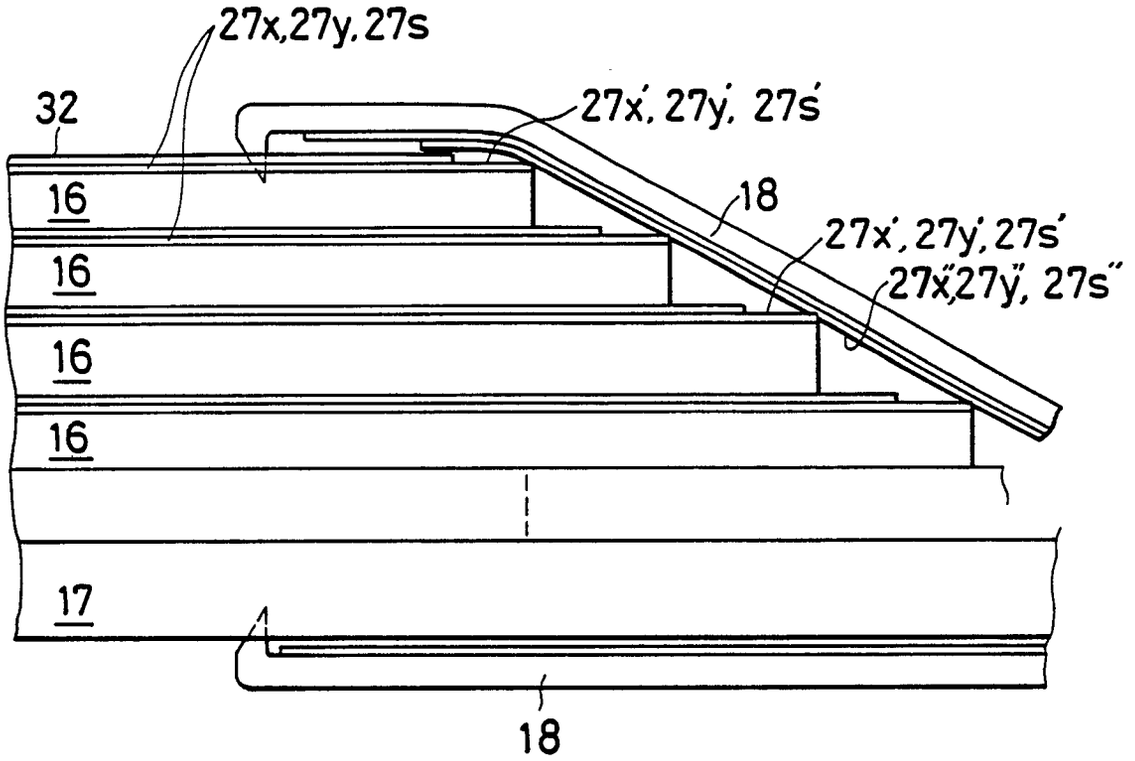


FIG.7

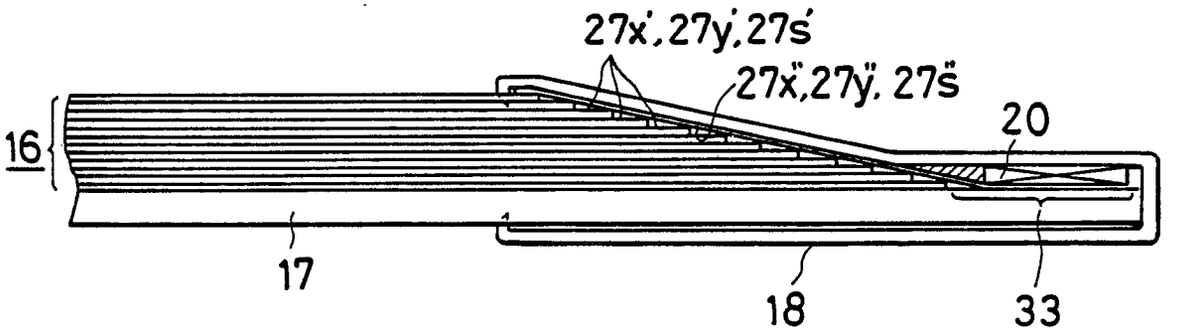


FIG.8

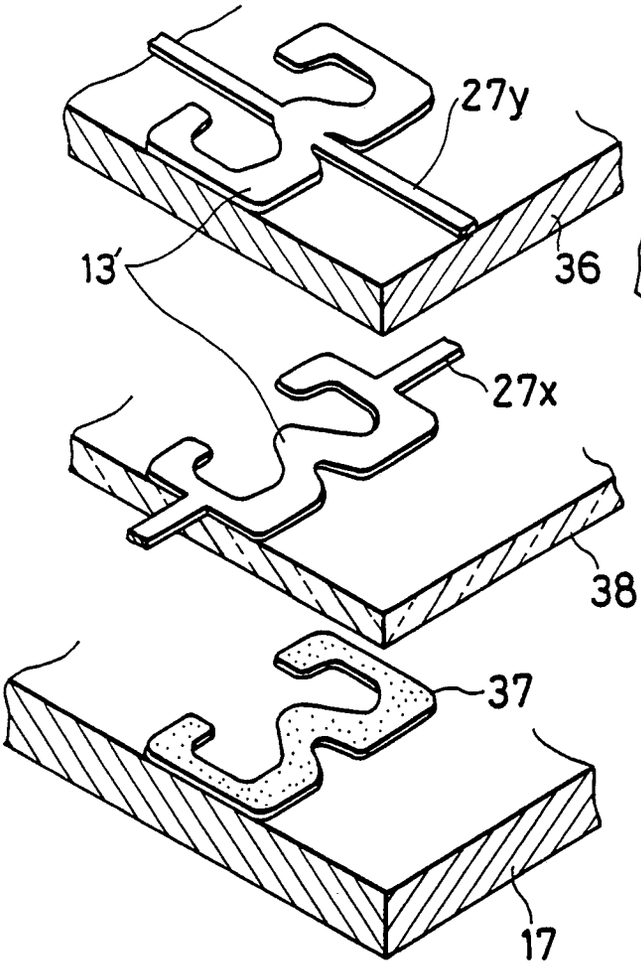


FIG.9

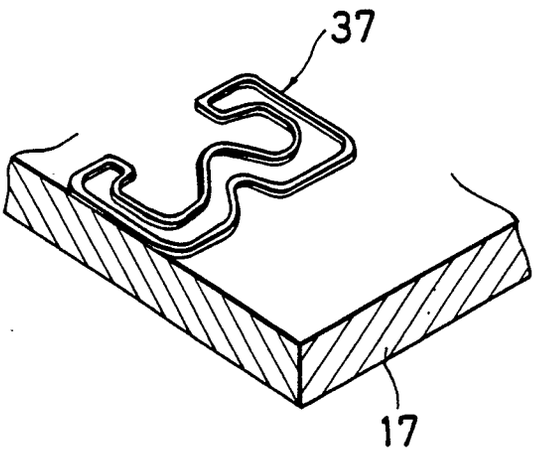


FIG.10 (A)

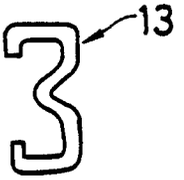


FIG.10 (B)

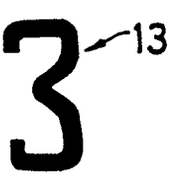


FIG.11

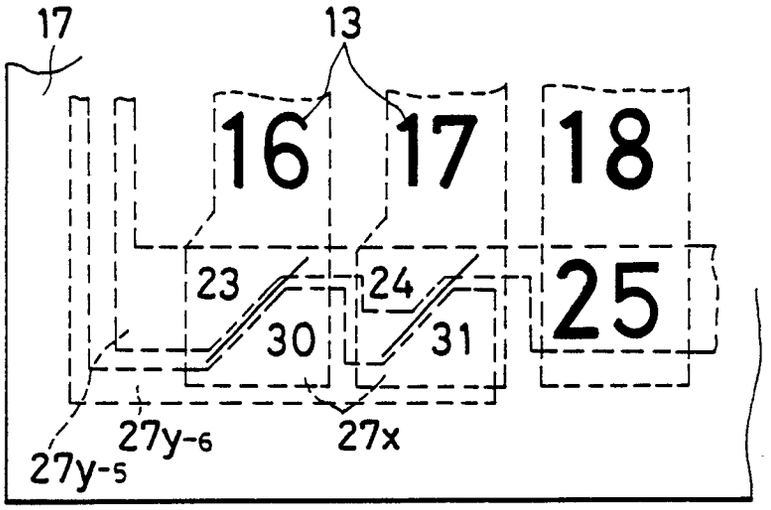
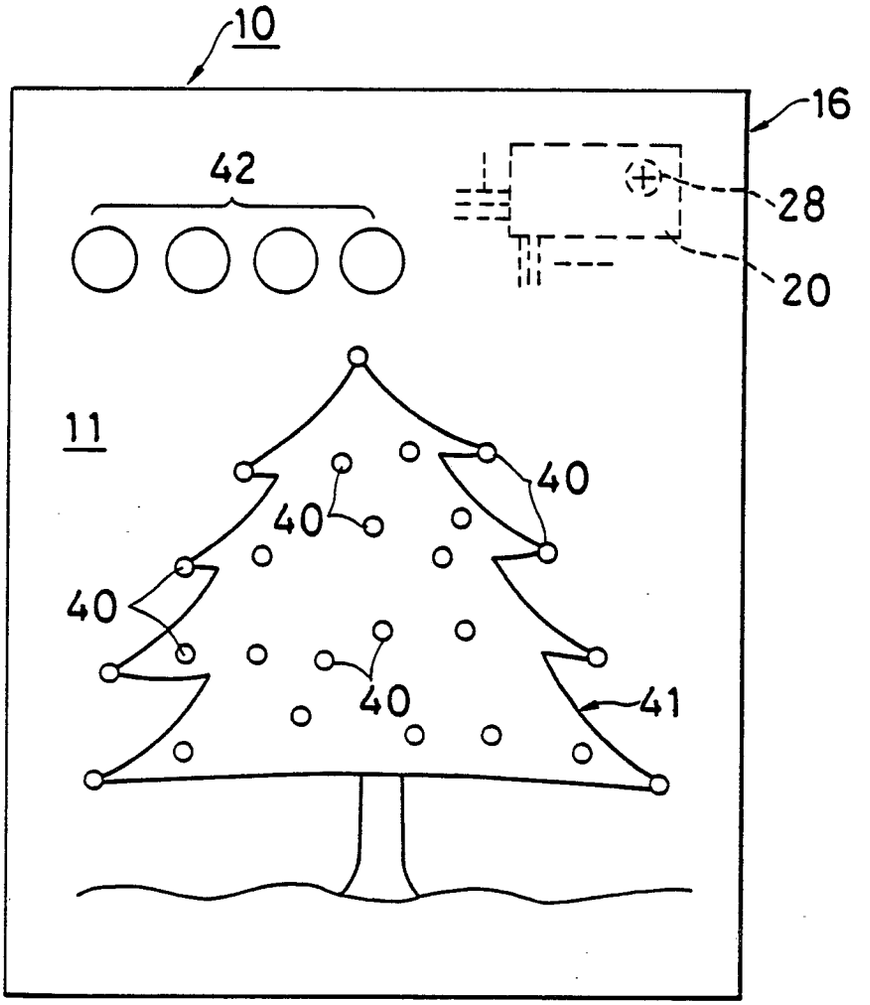


FIG.12



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 30 8049

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.4)
Y	EP-A-0 008 234 (THE MANOR HOUSE LITTLE VENICE) * Claims 1-3; pages 1,2; page 13, paragraph 2 - page 14, paragraph 3; figure 1 *	1	G 09 D 3/12 G 04 G 9/00 // G 02 F 1/13
Y	FR-A-2 155 580 (ROBERT BOSCH HAUSGERÄTE GmbH) * Claims 1,2; page 3, lines 25-38; page 4, lines 23-39; figures 2,4 *	1	
A		2	
A	FR-A-2 162 621 (PRINCETON MATERIALS SCIENCE INC.) * Claim 1; page 7, line 18 - page 8, line 24; page 14, line 9 - page 15, line 16; figure 2 *	1-4	
A	DE-A-3 524 844 (R. FICHTER) * Claims 1,2,5,9; figures 1-3 *	1	
A	US-A-4 194 196 (M.S. MOHIUDDIN) * Claims 1-3; column 1, lines 33-58; figures 1-3 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4) G 09 D G 09 F B 42 D G 02 F G 04 G
A	US-A-4 353 178 (K.K. SUWA SEIKOSHA) * Abstract; figures 2A,7 *	1,4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-05-1988	FRANSEN L.J.L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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