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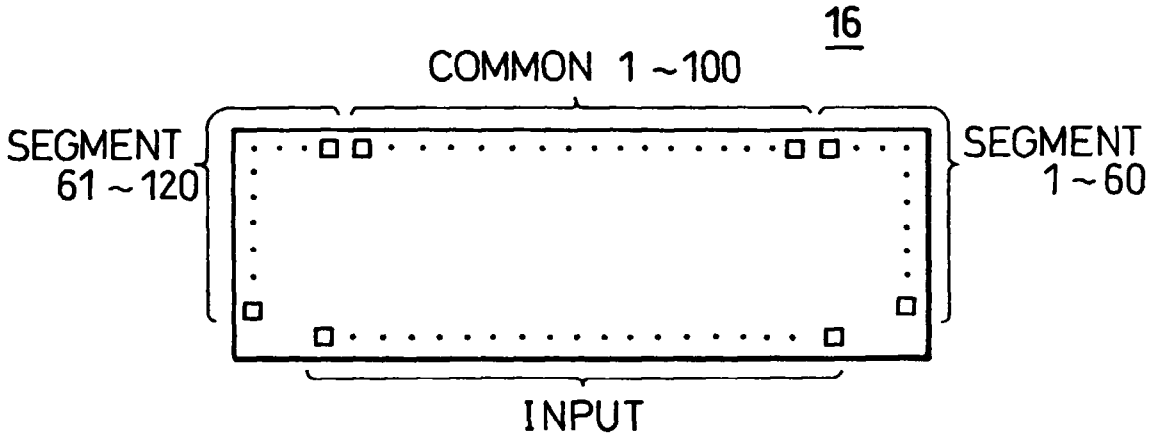
(54) Flat panel display apparatus with modified connection between driver IC and panel

(57) A matrix driven display apparatus can be scanned with less scanning electrodes than originally required for the display section. This can be done without changing the arrangement of the display section and the drive IC of the display apparatus if the number of the scanning electrodes of the display panel exceeds the number of the selection electrodes. To accomplish this, the layout of the outputs for selection signal and scanning signal generated by the drive IC device is reversed so that the selection electrodes of the display panel are scanned while scanning electrodes are selected by the selection signal, thereby permitting scanning of the display with less electrodes. Accordingly, duty per scanning electrode is sufficiently large.

FIG.1



EP 1 071 066 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a matrix driven display apparatus for use in portable phones such as cellular phones.

BACKGROUND OF THE INVENTION

[0002] Matrix driven display panels have been used as display means for portable phones. In a portable phone unit, in order to make it compact, a display panel is provided on the upper section thereof and an integrated circuit for driving the display panel (hereinafter referred to as drive IC) on the lower section of the phone unit.

[0003] Fig. 5 shows a liquid crystal display (LCD) panel of a typical portable phone unit. As shown in this figure, the LCD panel 40 includes an LCD section 41, a drive IC device 46, and leads for connecting these elements together.

[0004] The display section 41 has a multiplicity of common electrodes (not shown) extending in the direction of X axis and a multiplicity of segment electrodes (not shown) extending in the direction perpendicular to the common electrodes, i.e. in the direction of Y axis, forming together a matrix of electrodes for activating selected LCD elements or pixels. A pixel will be turned on if it is activated by both the segment electrode and the common electrode associated with it. The common electrodes are each connected, by means of lead wires, with associated right common electrode leads 42 on the right end of the LCD or left common electrode leads 43 on the left end of the LCD. The segment electrodes are each connected with respective segment electrode leads 44 at the lower end of the LCD section 41.

[0005] On the other hand, the driver IC device 46 has a generally parallelepiped configuration as shown in Fig. 6, including a set of input terminals INPUT along the lower (and longer) end, and a set of segment terminals SEGMENT at the central section of the opposite ends of the IC device 46. Provided adjacent to the opposite sides of the segment terminals and on the opposite shorter ends of the IC device 46 as well are a set of common terminals COMMON, as shown in Fig. 6.

[0006] Coupled with the input terminals INPUT of the drive IC 46 are input leads 50 for connection thereof with the respective input leads of the display section, as shown in Fig. 5. Coupled with the segment terminals SEGMENT are IC segment leads 49 for connection thereof normally with the respective segment leads 44 of the display section. Coupled with the common terminals COMMON are right and left common leads 47 and 48, respectively, for connection thereof normally with the respective common electrodes 42 and 43, respectively. Incidentally, the leads that extend from the drive IC 46 are installed on a thin tape carrier package 45 in the form of a thin film.

[0007] In the LCD section 41 of an ordinary matrix display apparatus, the segment electrodes serve as selection electrodes, i.e. electrodes that can be selected by a segment selection signal (referred to as selection signal) by raising them to a predetermined electric potential, while the common electrodes serve as scanning electrodes to turn on the LCD pixels located at the selected matrix points.

[0008] Thus, in response to picture information supplied to the drive IC 46 via the input leads 50, selection signal is applied to the segment electrodes of the LCD section 41 serving as selection electrodes. On the other hand, a scanning signal is periodically applied from the common terminals COMMON of the drive IC 46 to the common electrodes of the LCD section 41, so as to display on the LCD section 41 an image associated with the picture information.

[0009] As described above, the LCD section 41 is provided in the upper part of the display panel, and the drive IC device 46 below the display section 41. Since scanning is performed downward on the display section 41, the common electrodes terminate on the opposite ends of the LCD section 41, and the segment electrodes terminate at the lower end of the LCD section 41. In correspondence with such arrangement of the electrodes, the drive IC device 46 has the segment terminals in the central region of the upper end of the IC 46 and the common terminals on the opposite ends of the IC 46.

[0010] Hence, in a conventional or normal display apparatus as shown in Fig. 6 having 120 common electrodes and 100 selection electrodes for example, the 100 selection electrodes are selectively set to the prescribed electric potential in accord with the information to be displayed on the LCD, while the 120 common electrodes are sequentially scanned at a given scanning frequency. In the example shown herein the duty cycle is 120, and each of the common electrodes is driven in time divisional mode for a period of 1/120 of the duty cycle. The duty of one common electrode is then 1/120.

[0011] In such prior art display apparatuses, however, a higher average voltage must be impressed upon each common electrode when the number of common electrodes is increased, due to the fact that the duty per common electrode inversely decreases with the number of the common electrodes and that the required illumination density for visual perception of the display is proportional to the product of voltage impressed on the display and of total selection time, i.e. duty of one common electrode.

[0012] It is noted that in the display panel of the kind as discussed above, it is difficult to place the drive IC 46 and the display section 41 beside each other, i.e. one to the right or left to the other.

SUMMARY OF THE INVENTION

[0013] Therefore, it is an object of the invention to provide a matrix driven display apparatus that can be operated by scanning less electrodes of the matrix than originally designed. This can be done without changing the layout of the display section and the drive IC device of the display apparatus, even when the display section has more scanning electrodes (i.e., electrodes originally designed to be scanned by a scanning signal) than selection electrodes (i.e., electrodes originally designed to be selected or activated by a given selection signal or picture signal), thereby allowing the display apparatus to be driven by the drive IC at a higher duty and hence at a lower output voltage, which in turn allows the drive IC device to be made in a compact size. In LCD displays, scanning electrodes and selection electrodes are provided in the form of common electrodes and segment electrodes, respectively.

[0014] In one aspect of the invention, a display apparatus comprises:

a display section having a first multiplicity (N) of selection electrodes extending in one direction and a second multiplicity (M, M > N) of scanning electrodes extending in another direction perpendicular to said one direction and arranged to face said selection electrodes; and

a transistorized drive IC device generating the first multiplicity N of scanning signal outputs and the second multiplicity M of selection signal outputs, wherein

said N scanning signal outputs driving said selection electrodes while said M selection signal outputs driving said scanning electrodes.

[0015] With the inventive arrangement for the display apparatus, given a display section having more scanning electrodes than selection electrodes, duty per electrode can be sufficiently large, and hence the drive voltage of the display panel low. It should be appreciated that in the invention the roles of the selection electrodes and scanning electrodes of the display section as originally intended are interchanged, that is, the selection electrodes and scanning electrodes of the display section are now scanned by a scanning signal and selected by a selection signal, respectively, of the inventive apparatus.

[0016] In another aspect of the invention, a display apparatus comprises:

a generally rectangular display section having

a first multiplicity (N) of selection electrodes extending in one direction,

selection electrode terminals each connected with corresponding one of said selection electrodes and disposed on one end of said display section,

a second multiplicity (M, M > N) of scanning electrodes facing said selection electrodes and extending in another direction perpendicular to said one direction; and

scanning electrode terminals each connected with corresponding one of said scanning electrodes and disposed on the opposite ends of said display section; and

a generally rectangular drive IC device disposed on substantially the same plane as and adjacent to said display section and having

a multiplicity N of scanning signal output terminals disposed on the central region of one end of said drive IC device, closest to said selection electrode terminals of said display section, said scanning signal output terminals providing N scanning signals to said selection electrodes;

a multiplicity M of selection signal output terminals disposed on the opposite ends adjacent to said one end of said drive IC device, said selection signal output terminals providing M signals to said scanning electrodes;

a first set of leads for connecting respective selection electrode terminals of said display section with corresponding scanning signal output terminals of said drive IC device;

a second set of leads for connecting respective scanning electrode terminals of said display section with corresponding selection signal terminals of said drive IC device.

[0017] In this arrangement also, when the number of the scanning electrodes of the display panel exceeds the number of the selection terminals, the layout of the outputs of the drive IC device is reversed in operation so that the scanning electrodes of the display panel are selected by a selection signal, thereby permitting scanning of less electrodes. Accordingly, duty per scanned electrode may be sufficiently large, and the drive voltage may be low, which implies that the transistors of the drive IC device need not be a high-voltage device and therefore chip size of the IC device can be made small. It would be appreciated that the output layout of the drive IC need not be redesigned for such display panel.

[0018] In a further aspect of the invention, a display apparatus comprises:

a display unit including

a generally rectangular display section having

a first multiplicity (N) of selection electrodes extending in one direction,

selection electrode terminals each con-

nected with said selection electrodes and disposed on one end of said display section,

a second multiplicity (M, M > N) of scanning electrodes extending in another direction perpendicular to said one direction to face said selection electrodes, and

scanning electrode terminals each connected with said scanning electrodes and disposed on the opposite ends of said display section;

selection electrode terminal leads each coupled with corresponding one of said selection electrodes and extending to one end of said display section, and

scanning electrode terminal leads each coupled with corresponding one of said scanning electrode terminals of said display section; and

a drive unit including

a drive IC device having

N scanning signal output terminals disposed on at least in the central region of one end of said drive unit, for providing N scanning signals, and

M selection signal output terminals disposed at least on the opposite ends adjacent to said one end for providing M signals;

scanning signal output terminal leads each connected with corresponding one of said scanning signal output terminals of said drive IC device and extending in one direction, and

selection signal output terminal leads each connected with corresponding one of said selection signal output terminals of said drive IC device and extending in the same direction as said one direction, wherein

said display unit and said drive unit are coupled by connecting said selection electrode terminal leads with respective scanning signal output terminal leads, and connecting said scanning electrode terminal leads with respective selection signal output terminal leads.

[0019] With this arrangement, another type of display apparatuses can be composed without modifying at all a given display unit by simply combining therewith a drive unit having a reversed output layout as described above.

[0020] The display section of the display apparatus can be an LCD, while the selection electrodes and the scanning electrodes are segment and common electrodes, respectively.

[0021] In this case, an LCD apparatus can be made in a simple and cost-effective manner if the LCD panel has more common electrodes than segment electrodes.

[0022] The scanning electrode terminals of the display apparatus can be divided into two groups disposed at least on the opposite ends of the display section, and the selection signal output terminals can be also divided into two groups disposed at least on the opposite ends of the drive IC device.

[0023] In this case, leads for connecting the scanning electrode terminals with the selection signal output terminals of the drive IC device can be provided in two subsets, i.e. right and left subsets, disposed on the opposite ends of the display apparatus, so that the arrangement of the leads is neat and well balanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 shows a layout of terminals of a drive IC device for use in the invention;

Fig. 2 is a schematic diagram showing the arrangement of a drive unit according to the invention;

Fig. 3 is a schematic diagram showing the arrangement of a display unit according to the invention;

Fig. 4 is a schematic diagram showing the arrangement of an LCD apparatus according to the invention;

Fig. 5 is a schematic diagram showing the arrangement of a conventional LCD apparatus;

Fig. 6 shows a layout of terminals of a conventional drive IC device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] The invention will now be described in detail by way of an example where common electrodes and segment electrodes facing the common electrodes of an LCD apparatus are disposed in a matrix form.

[0026] Referring to Fig. 1, there is shown a schematic diagram illustrating a layout of terminals of a drive IC device 16 according to the invention. The drive IC device has a generally rectangular configuration with common terminals COMMON provided in the central region of the upper end of the device. In the example shown herein, there are 100 common segment terminals. The drive IC device 16 also has 120 segment terminals SEGMENT, which are divided into two groups of 60 terminals each, with one group provided on the upper right corner as well as on the right end, and another group provided on the upper left corner as well as on the left end of the device. Provided at the lower end of the device 16 are a predetermined number of input terminals INPUT for receiving signals to drive the display apparatus.

[0027] In the example shown in Fig. 1, the common terminals COMMON are provided at the upper end of the drive IC device 16 to provide periodic scanning signals, while the segment terminals SEGMENT are provided at the corners and the opposite ends of the device 16 to provide selection signals. It is thus seen in the figure that these terminals are interchanged in position as compared with conventional drive IC devices.

[0028] Referring now to Fig. 2, there is shown a drive unit 30 including a drive IC device 16 as shown in Fig. 1. The unit includes a tape carrier package 15 on which the drive IC device 16 is mounted, and common leads 19 for connecting the common terminals COMMON with an external device, right segment leads 17 for connecting the right segment terminals of the device 16 with another external device, left segment leads 18 for connecting the right segment terminals of the device 16 with another external device, and input leads 20 for connecting the input terminals INPUT of the device 16 with a further external device.

[0029] In the example shown in Fig. 2, in correspondence with the reversed layout of the outputs of the drive IC device 16 as compared with conventional drive IC device 46, the common leads 19 are disposed in the upper central region of the tape carrier package 15, while the right and left leads 17 and 18, respectively are disposed on the right and left ends of the common leads 19, respectively.

[0030] Referring to Fig. 3, there is shown a display unit 10, which includes an LCD section 11 having a multiplicity (which is 120 in this example) of common electrodes extending in the direction of X axis, such that the upper half of them are connected with common electrode leads 12 located on the right end of the LCD section 11 and the lower half of them are connected with common electrode leads 13 on the left end of the LCD section 11. The LCD section 11 also has a multiplicity (which is 100 in this example) of segment electrodes extending in the direction of Y axis and connected with segment electrode leads 14 at the lower end of the LCD section 11. The right and left common leads 12 and 13, respectively, and the segment electrode leads 14 extend downward for connection with an external device. It would be understood that the configuration of this display unit is the same as conventional ones.

[0031] The drive unit 30 of Fig. 2 is disposed below the display unit 10 of Fig. 3, as shown in Fig. 4. The display unit 10 and the drive unit 30 are connected with each other by connecting the right common leads 12 with the right segment leads 17, the left common leads 13 with the IC left segment leads 18, and the segment leads 14 with the common leads 19, as shown in Fig. 4.

[0032] In the combination of the display unit 10 and the drive unit 30 forming an LCD apparatus, given a signal representing picture information input to the drive IC device 16 via the input leads 20, scanning signals having a predetermined frequency will be generated at the 100 common terminals COMMON at the upper central end of the drive IC device 16, and selection signals will be generated at the 60 right segment terminals SEGMENT 1-60 and the 60 left segment terminals SEGMENT 61-120 distributed on the upper right and the left corners as well as on the right and the left ends of the device 16, respectively.

[0033] It should be understood that, since the right and the left segment terminals 17 and 18 of the drive IC device 16 are connected with the common electrodes of the LCD section 11 via the right common leads 12 and the left common leads 13, respectively, the common electrodes of the LCD section 11 are selected by the selection signals.

[0034] On the other hand, the common terminals of the drive IC device 16 are connected with the segment electrodes of the LCD section 11 via the segment leads 14, so that scanning of the LCD will be performed through the segment electrodes.

[0035] Thus, in the LCD apparatus described above, some or all of the common electrodes are set to a predetermined potential in accord with the selection signal received through the input leads 20. On the other hand, the segment electrodes will be scanned in sequence, defining matrix points of pixels where the selected electrodes are scanned by the scanning, thereby activating these pixels to display the picture information on the LCD 11.

[0036] In this manner, unlike conventional display apparatuses, the invention may advantageously allows the common electrodes of the LCD display section 11 to be selected by a selection signal and the segment electrodes to be scanned by a scanning signal when the number of the common electrodes is greater than that of the segment electrodes, thereby reducing the number of duty cycles in one scan. For example, the display apparatus shown herein will be driven at a duty of 1/100, which duty would be 1/120 without the invention.

[0037] It is known that the perceptivity of an image on an LCD is proportional to the product of the activation voltage and the total selection time in one scanning, so that the shorter the duty cycle is, as in the operation under 1/100 duty, the longer is the drive period for an activated pixel, and hence the lower is the drive voltage of the display apparatus.

[0038] Thus, the drive IC device of the invention need not be a high-voltage device, so that manufacture thereof is simple. The invention may also provide such drive IC device in a compact form by minimizing the dimensions of the transistors in the device.

Claims

1. A display apparatus comprising:

a display section having a first multiplicity (N) of selection electrodes extending in one direction and a second multiplicity (M, M > N) of scanning electrodes extending in another direction

perpendicular to said one direction and arranged to face said selection electrodes; and

a transistorized drive IC device generating the first multiplicity N of scanning signal outputs and the second multiplicity M of selection signal outputs, wherein

said N scanning signal outputs driving said selection electrodes while said M selection signal outputs driving said scanning electrodes.

2. The display apparatus as set forth in claim 1, wherein said display section is an LCD; said selection electrodes are segment electrodes, and said scanning electrodes are common electrodes.

3. A display apparatus comprising:

a generally rectangular display section having

a first multiplicity (N) of selection electrodes extending in one direction,

selection electrode terminals each connected with corresponding one of said selection electrodes and disposed on one end of said display section,

a second multiplicity (M, M > N) of scanning electrodes facing said selection electrodes and extending in another direction perpendicular to said one direction; and

scanning electrode terminals each connected with corresponding one of said scanning electrodes and disposed on the opposite ends of said display section; and

a generally rectangular drive IC device disposed on substantially the same plane as and adjacent to said display section and having

a multiplicity N of scanning signal output terminals disposed on the central region of one end of said drive IC device, closest to said selection electrode terminals of said display section, said scanning signal output terminals providing N scanning signals to said selection electrodes;

a multiplicity M of selection signal output terminals disposed on the opposite ends adjacent to said one end of said drive IC device, said selection signal output terminals providing M signals to said scanning electrodes;

a first set of leads for connecting respective selection electrode terminals of said display section with corresponding scanning signal output terminals of said drive IC device;

a second set of leads for connecting respective scanning electrode terminals of said display section with corresponding selection signal terminals of said drive IC device.

4. The display apparatus as set forth in claim 3, wherein said display section is an LCD; said selection electrodes are segment electrodes, and said scanning electrodes are common electrodes.

5. The display apparatus as set forth in claim 3, wherein

said scanning electrode terminals are divided into two groups disposed at least on the opposite ends of said display section; and

said selection signal output terminals are divided into two groups disposed at least on the opposite ends of said drive IC device.

6. A display apparatus comprising:

a display unit including

a generally rectangular display section having

a first multiplicity (N) of selection electrodes extending in one direction,

selection electrode terminals each connected with said selection electrodes and disposed on one end of said display section,

a second multiplicity (M, M > N) of scanning electrodes extending in another direction perpendicular to said one direction to face said selection electrodes, and

scanning electrode terminals each connected with said scanning electrodes and disposed on the opposite ends of said display section;

selection electrode terminal leads each coupled with corresponding one of said selection electrodes and extending to one end of said display section, and

scanning electrode terminal leads each coupled with corresponding one of said scanning electrode terminals of said display section; and

a drive unit including

a drive IC device having

N scanning signal output terminals disposed on at least in the central region of one end of said drive unit, for providing N scanning signals, and

M selection signal output terminals disposed at least on the opposite ends adjacent to said one end for providing M signals;

scanning signal output terminal leads each connected with corresponding one of said scanning signal output terminals of said drive IC device and extending in one direction, and

selection signal output terminal leads each connected with corresponding one of said selection signal output terminals of said drive IC device and extending in the same direction as said one direction, wherein

said display unit and said drive unit are coupled by connecting said selection electrode terminal leads with respective scanning signal output terminal leads, and connecting said scanning electrode terminal leads with respective selection signal output terminal leads.

7. The display apparatus as set forth in claim 6, wherein said display section is an LCD; said selection electrodes are segment electrodes, and said scanning electrodes are common electrodes.

8. The display apparatus as set forth in claim 6, wherein said scanning electrode terminals are divided into two groups disposed at least on the opposite ends of said display section; and said selection signal output terminals are divided into two groups disposed at least on the opposite ends of said drive IC device.

FIG.1

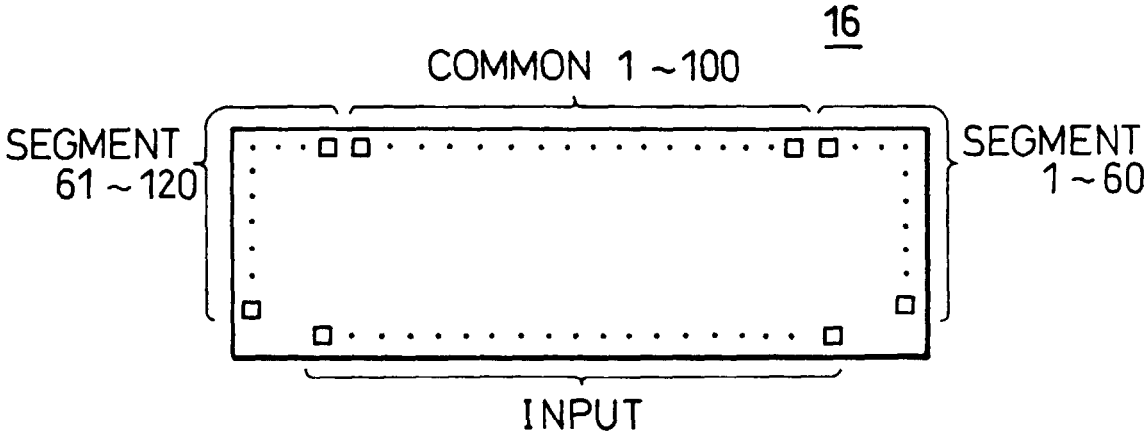

16
COMMON 1 ~100
SEGMENT
61 ~120
SEGMENT
1 ~60
INPUT

FIG.2

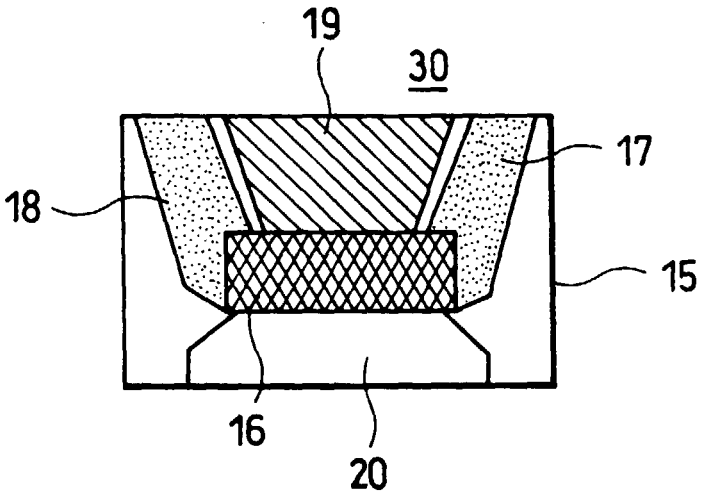

19
30
17
18
15
16
20

FIG. 3

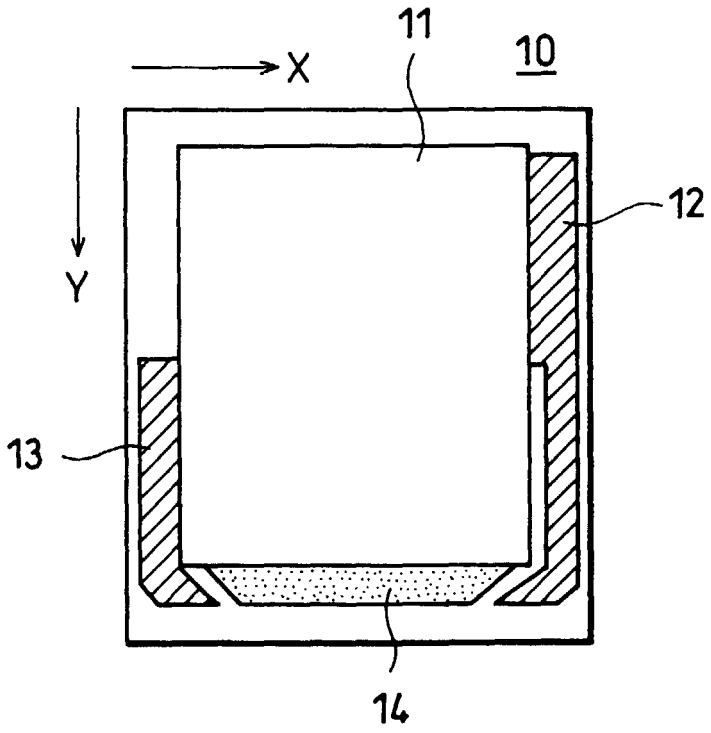


FIG. 4

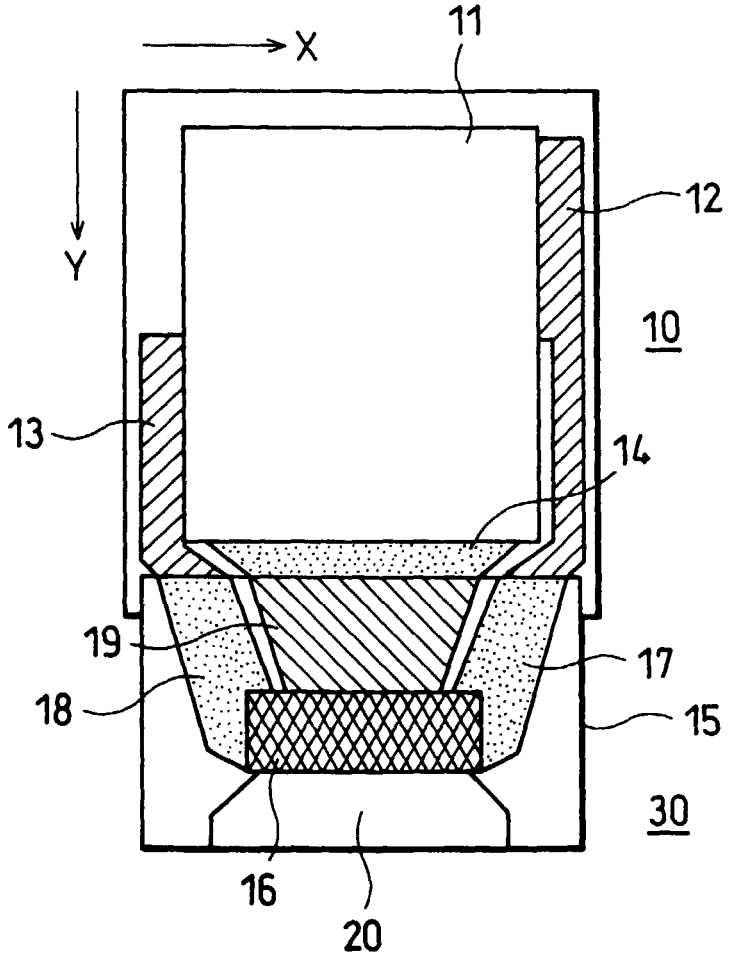
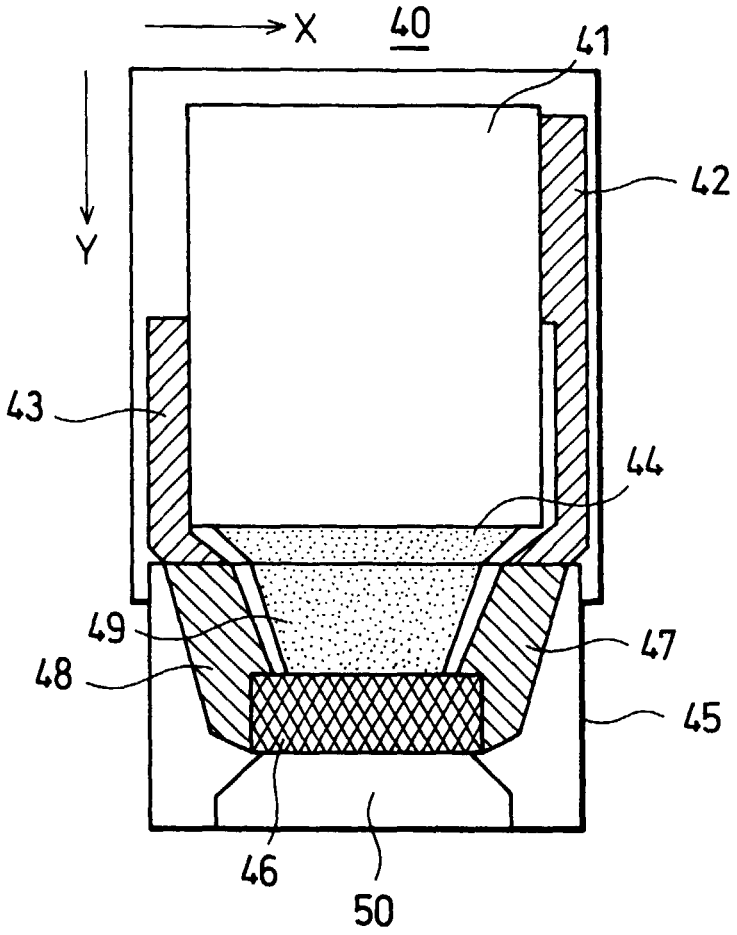


FIG. 5


X
40
41
42
Y
43
44
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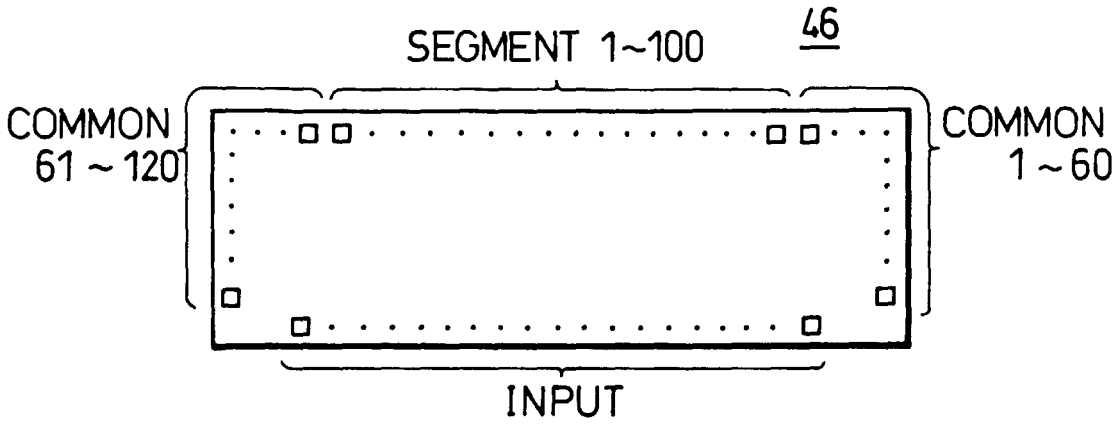
47
48
45
46
50

FIG. 6


SEGMENT 1~100
46
COMMON
61 ~ 120
COMMON
1 ~ 60
INPUT

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 4923

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X	US 5 627 558 A (HOTTO ROBERT) 6 May 1997 (1997-05-06) * column 10, line 15 - line 39 *	1,2	G09G3/20
Y	* column 11, line 21 - line 50 *	3-8	
Y	DE 197 35 774 A (DENSO CORP) 26 February 1998 (1998-02-26) * column 2, line 25 - line 32 * * column 2, line 59 - line 62 * * column 3, line 67 - column 4, line 25 * * column 6, line 21 - line 25 * * figures 1,3-8 *	3-8	
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A	US 4 082 430 A (WILD PETER J ET AL) 4 April 1978 (1978-04-04) * column 8, line 29 - line 31 * * figure 10 *	1,2	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 October 2000	Farricella, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 00 11 4923

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 October 2000	Farricella, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 11 4923

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