

The present invention relates to a plasma panel according to the first part of Claim 1, the electrodes of which are arranged in a novel manner, so as especially to make it possible to increase the speed of obtaining
5 images displayed by this panel.

Plasma panels are flat-screen, visual-display devices, well known now, which allow the display of alphanumeric images, graphics or other images, in colour or otherwise. Generally, plasma panels comprise two
10 insulating slabs delimiting a volume occupied by a gas (generally a neon-based mixture). These slabs support conducting electrodes arranged in columns, called column electrodes, and electrodes arranged in lines, called line electrodes. These column and line electrodes are crossed
15 so as to define a matrix of cells each forming an elementary image point or pixel. The operating principle is the selective generation of electrical discharges in the gas (at the intersection of line and column electrodes, that is to say in the region of selected pixels). The visual
20 display of the information is provided by an emission of light which accompanies these discharges.

Certain plasma panels operate continuously, but it is most often preferred to use panels of the so-called "alternating" type the operation of which is based on an
25 excitation of the electrodes in an alternating mode. In this case, the electrodes are covered by a layer of dielectric material, and they are no longer in direct contact with the gas nor with the discharge. One of the advantages of this type of so-called "alternating" type
30 plasma panel is that of exhibiting a memory effect which makes it possible to address the useful information only to the pixels the state of which (lit or extinguished) it is desired to change; on the other elementary image points or pixels, the state of the latter is simply held
35 by repetition of alternating electrical discharges, called hold discharges, which are obtained only for the pixels which are in the lit state, that is to say written.

In these conditions, the control of the pixels

may consist of a point-by-point addressing, that is to say pixel by pixel addressing, so that the addressing time duration which limits the rate of refreshment of the information is not generally a problem.

5 It should be noted that among the plasma panels of the so-called "alternating" type, some use only two electrodes to define one pixel: a column electrode crossed with a line electrode. The operation of such a plasma panel is known especially by the French Patent No.
10 78 04 893 in the name of THOMSON-CSF, published under No. FR-B-2,417,848; this patent also describing a method of control of such a panel.

 There are also known so-called "alternating with coplanar hold" plasma panels, in which three or more
15 electrodes are used to define one pixel. In this case, most often, each pixel of the matrix consists of three electrodes, more precisely at the crossing between a column electrode with two parallel hold electrodes forming a pair of hold electrodes. With this type of
20 screen, it is known that the holding of the discharges, that is to say the repetition of the previously mentioned alternating electrical discharges, is carried out between the two hold electrodes of the same pair, and that the addressing is done by discharge generation between two
25 crossed electrodes. The column electrode in this case has an addressing function only, and, between the two electrodes of the same pair of electrodes, one has a hold function only and the other carries out a hold function and an addressing function.

30 A plasma panel of the alternating type with coplanar hold, with three electrodes per pixel, is known especially from the European patent document EP-A-0135 382, which also describes a method of control of this screen. The hold electrodes may include a pro-
35 tuberance or projecting surface in the region of each pixel: in the same pair of hold electrodes, the projecting surfaces of an electrode are oriented towards those of the other electrode, the hold discharges taking place between these projecting surfaces. On this technical

point, mention may also be made of the article "Structure to reduce glow spreading in DC panel" published in IBM TECHNICAL DISCLOSURE BULLETIN, vol. 23, no. 10, March 1981, pages 4536-4537, New York, US; M.O. ABOELFOTOH;
5 this article describes crossed electrodes the surfaces of which are widened in line with the crossings so as to reduce the striking voltages and to localize the discharges.

Another panel structure of the alternating type
10 with coplanar hold is described, with its control method, in an article by G.W. DICK published in PROCEEDINGS OF THE SID, volume 27/3 1986, pages 183-187. It should be noted that, in the structure described in this document, the hold electrodes have a constant width, that is to say
15 that they do not include projecting, opposing surfaces in a pair of hold electrodes, but in contrast include barriers made of insulating material, which serve to confine the hold discharges in the crossing region of the column electrode.

20 In all these types of plasma panels, the column electrodes are individualized, so that it is possible to select only one from among them, that is to say that they are each linked to a particular output of a control and addressing device. It is the same for the line electrodes
25 in the case in which a pixel is defined at the crossing of a column electrode and of a single line electrode (as much for the continuous-type plasma panels as for the alternating type); and as far as the plasma panels with coplanar hold are concerned, among the hold electrodes,
30 those which carry out the hold function for the discharges and the addressing function (addressing/hold electrodes) are also all individualized.

Whatever the type of plasma panel, the rate of refreshing the information is not in general a problem,
35 when the control method used is of the type with point-by-point addressing. There exist applications, however, in which it is desired to be able to carry out the addressing in the fastest way: this relates particularly to plasma panels for which compatibility with

conventional video signals is required, and for which it is desired in particular to exert intermediate luminance-level control ("grey tones" or "half-tone").

5 The time necessary for forming an image depends on the number of pixels and of the overall time necessary for addressing operations (erase addressing and/or write addressing) and for hold operations.

10 In order to reduce the time necessary for forming an image, it is sought to reduce the overall addressing time, and, to this end, the known method consists in controlling the pixels by a semi-selective-type addressing (which is generally a command either for erasing, or for writing, of all the pixels of a given line), followed by a selective-type addressing (in which one or more
15 selected pixels of this line are driven to be brought to the state opposite that to which they were brought by the semi-selective addressing). These two addressing phases constitute an addressing cycle, the duration of which it currently seems difficult to lower to less than 20 micro-
20 seconds.

 Moreover, if it is desired to avoid visually troublesome flicker, the renewing of the images, in the case of dynamic images or images with a grey tone, must be carried out at least 50 times per second (frame time
25 less than 20 milliseconds), so that the number of lines written per frame can scarcely exceed one thousand.

 If the image is formed by only 512 lines, for example, and if the image is renewed 50 times per second, it is possible to obtain four grey tones, having regard
30 to the method used for the control of these grey tones. Or furthermore, with images of only 256 lines, these 256 lines may each be written four times per second, which leads to 16 luminance levels or grey tones for each image point, and an image limited to only 128 lines would
35 make it possible to obtain 64 luminance levels; although it would nevertheless be desirable to obtain 128 luminance levels or grey tones, for example, for 512-line images.

 The current state of the art does not allow a

sufficient increase in the line-by-line addressing speed, either with a view to obtaining a sufficient number of half-tones as set out above, or further with a view to other results such as for example increasing the number of lines which constitute an image.

The present invention relates to a plasma panel, as much of the continuous type as of the alternating type with coplanar or non-coplanar hold, in which the novel configuration, particularly in the matter of the electrodes, makes it possible, with respect to a plasma panel of the prior art, considerably to reduce the time necessary for the addressing of all the lines which constitute an image, for the same number of pixels per line. This novel configuration of electrodes especially makes it possible to carry out the simultaneous addressing of several lines of pixels both for the semi-selective addressing phase and for the selective addressing phase.

However, this is obtained at the cost of an increase in the number of electrodes, with respect to the number of electrodes necessary in the prior art for the same number of pixels, from which a difficulty results, which resides in the fact that the crossings between electrodes reach a number higher than the number of pixels desired.

The novel configuration proposed by the present invention makes it possible simply to overcome this latter difficulty, and it is noted that the drawbacks entailed by this novel configuration are more than compensated for by the advantages which it procures as far as the speed of obtaining an image is concerned.

According to the invention, a plasma panel including pixels arranged in lines and columns, column electrodes crossed by line electrodes and defining a plurality of crossings, a column control and addressing device to which the column electrodes are linked, a line control and addressing device to which the line electrodes are linked, each crossing including a crossing surface formed by the corresponding opposite surfaces of

the line electrode and of the column electrode, characterized in that the crossings consist, on the one hand, of simple crossings and, on the other hand, of widened crossings having a larger crossing surface than that of the simple crossings, each pixel being defined substantially in the region of a widened crossing, and in that at least two line electrodes are linked to the same output of the line control and addressing device, the number M of column electrodes being greater than the number N of pixels contained in a line formed with the aid of a line electrode belonging to a group of electrodes.

The authors of the invention have noted that the voltages necessary between the electrodes in order to obtain the striking and the holding of the electrical discharges in the region of the pixels depend on the crossing surfaces: smaller crossing surfaces require higher voltages and vice versa. So much so that the voltage applied between the electrodes may be sufficient to cause electrical discharges in the region of the crossings having a sufficient given crossing surface area (widened crossing where the pixels are constituted), and this voltage may be insufficient to cause discharges in the region of the other crossings the surface area of which is smaller.

The invention will be better understood with the aid of the description which follows, given by way of non-limiting example, by reference to the attached figures among which:

- Figure 1 shows, diagrammatically, by way of non-limiting example, a plasma panel according to a first version of the invention in which column electrodes are in a straight line and make it possible to obtain pixels having a first type of distribution.

- Figure 2 shows, diagrammatically, by way of non-limiting example, a plasma panel in a second version of the invention, in which the column electrodes are equipped with bends forming changes of direction and making it possible to obtain a second shape of

distribution of the pixels;

- Figure 3 shows, diagrammatically, by way of non-limiting example, a plasma panel according to a preferred version of the invention, in which the column electrodes include a smaller number of bends for the same distribution of pixels as in Figure 2;

- Figure 4 shows, diagrammatically, by way of non-limiting example, a plasma panel of the type with coplanar hold including an arrangement of electrodes in accordance with the invention;

- Figure 5 shows, diagrammatically, a different embodiment of electrodes shown in Figures 1 to 4.

Figure 1 shows a plasma panel which is represented mainly by electrodes arranged in columns X1, X2, ..., X8, called column electrodes, and line electrodes Y1 to Y4 which are perpendicular to the column electrodes X1 to X8; the column electrodes X1 to X8 being represented in a deeper plane than the plane in which the line electrodes Y1 to Y4 are situated.

The column electrodes X1 to X8 are each linked to a different output SX1 to SX8 of a first addressing device or column control and addressing device 2, and the line electrodes Y1 to Y4 are linked to a second addressing device or line control and addressing device 3.

According to one characteristic of the invention, the line electrodes Y1 to Y4 are constituted into groups G1, G2 each linked to a different output SG1, SG2 of the line control and addressing device 3. In principle, at least one group of at least two lines Y1 to Y4 is thus constituted, in practice, however, it may be thought that it is simpler to form a plurality of groups each including the same number N, at least equal to 2, of line electrodes. In this light, in the non-limiting example of the description in which only 4 line electrodes Y1 to Y4 are represented in order to simplify Figure 1, these line electrodes are constituted into two groups G1, G2; the first group G1 comprising the first and the second line electrode (sic) Y1, Y2, and the second group G2

comprising the third and the fourth line electrodes Y3, Y4; the two electrodes Y1, Y2 of the first group G1 are linked to the same output SG1 of the line control and addressing device 3 the second output SG2 of which is
5 linked to the two electrodes Y3, Y4 of the second group G2.

In these conditions, the line electrodes Y1, Y2 of the first group G1 correspond to the same address and are therefore addressable simultaneously, and the line
10 electrodes Y3, Y4 of the second group G2 are at a second same address and are therefore addressable simultaneously; in such a way that, to a certain extent, the first and the second line electrode Y1, Y2 of the first group G1 constitute a single line electrode G1 having at
15 least two branches Y1 and Y2, and the second group G2 constitutes a second single line electrode having two branches Y3 and Y4.

It will be noted that each of the column electrodes X1 to X8 form a crossing with each of the
20 groups G1, G2 at as many points as there are branches or line electrodes Y1 to Y4 belonging to this group: hence, for example, considering the first column electrode X1, the latter crosses the first group G1 in the region of the first line electrode Y1 and in the region of the
25 second line electrode Y2; the first column electrode X1 next crosses the second group G2 in the region of the third line electrode Y3 then in the region of the fourth line electrode Y4; the same is true for the other column electrodes X2 to X8.

In such a configuration, it is clear that a pixel cannot be constituted at each crossing between a column electrode X1 to X8 and a line electrode Y1 to Y4 (as in
30 the prior art) due to the fact that it is not possible, with a traditional method for control and addressing of the pixels, such as described, for example, in the documents which were mentioned previously, to generate a
35 selective discharge at the crossing between a given column electrode and given line electrode without avoiding (sic) a discharge also between this same column

electrode and another line electrode belonging to the same group. Hence, for example, it is not possible to constitute a pixel at the intersection or crossing between the first column electrode X1 and the first line electrode Y1 and to constitute another pixel at the crossing of the same first electrode X1 with the second line electrode Y2, these two line electrodes Y1, Y2 belonging to the same first group G1.

Thus, with a view to producing only one pixel at the crossing of a given column electrode X1 to X8 with a given line electrode Y1 to Y4 without constituting pixels at the other crossings between this same column electrode and one or more line electrodes Y1 to Y4 belonging to the same group as the given electrode, according to a particularly important characteristic of the invention the crossing or intersection intended to define a pixel is endowed with a crossing surface Sc (represented in the figure by hatching) which is larger than the crossing surface or intersection surface St (represented by hatching) of a simple crossing Cs, that is to say a crossing which is not intended to define a pixel; the crossing surface and the intersection surfaces Sc, St are defined by an opposing surface of the line electrodes Y1 to Y4 and of the column electrodes X1 to X8 which form these crossings.

In the non-limiting example represented in Figure 1, there are found, according to the concept:

- along the first line electrode Y1 of the first group G1: a first pixel Px1 (sic) formed by a crossing surface Sc at the intersection with the first column electrode X1; then a simple crossing Cs is found, having a reduced intersection surface St, formed at the intersection with the second column electrode X2; then a second pixel PX2 is found, formed by a crossing surface Sc at the intersection with the third column electrode X3; then a second simple crossing Cs formed at the intersection with the fourth column electrode X4; and so on up to a fourth simple crossing Cs formed at the intersection St with the eighth column electrode X8;

- along the second line electrode Y2 are found:
a simple crossing Cs formed at the intersection with the
first column electrode X1; then a fifth pixel PX5 formed
by a crossing surface Sc at the intersection with the
5 second column electrode X2; then a simple crossing Cs
formed at the intersection with the third column
electrode X3; then a sixth pixel PX6 formed by a crossing
surface Sc at the intersection with the fourth column
electrode X4; and so on up to an eighth pixel PX8 formed
10 by a crossing surface Sc at the intersection with the
eighth column electrode X8.

According to a similar arrangement, the line
electrodes Y3, Y4 of the second group G2 determine, at
their crossing with the column electrodes X1 to X8,
15 pixels PX9 to PX12 for the third line electrode Y3 and
pixels PX13 to PX16 for the fourth line electrode Y4.

The crossing surfaces Sc (in the region of the
pixels PX1 to PX16) may be made larger than the inter-
section surfaces St which the simple crossings Cs
include, for example by a widening either of the column
20 electrodes X1 to X8 as represented in Figure 1, or by a
widening of the line electrode Y1 to Y4 or even by a
widening of both these electrodes. Taking, for example,
the crossing surface Sc which defines the first pixel PX1
25 (this example being equally valid for the other crossing
surfaces), the first column electrode X1 in this region
possesses a width l1 which is greater than the width l2
which it possesses in the region of a simple crossing Cs
where this column electrode constitutes only a conductor.
30 It has been noted, for example, that by making the width
l1 of a crossing surface Sc (forming a pixel) 0.1 mm more
than the second width l2 (simple crossing), the surface
area increase which results therefrom makes it possible
to lower, by about 10 volts, the voltage necessary to
35 produce discharges for priming (erasure or writing) or
for hold. Consequently, the potential differences devel-
oped between column electrodes X1 to X8 and line elec-
trodes Y1 to Y4, during the phases, which are conven-
tional in themselves, of semi-selective addressing, of

selective addressing and of holding, may be adjusted so that, having regard to the increase in the crossing surface Sc in the region of the pixels PX1 to PX16, these potential differences are sufficient to generate the electrical discharges in the region of the pixels, and insufficient to generate the discharges in the region of the simple crossings Cs; these potential differences being generated, for example, in a way which is known per se, by voltage pulses (not represented), which are applied to these electrodes (X1 to X8 and Y1 to Y4) by the line and column control and addressing devices 3, 2 the latter having a common reference potential, earth for example; the amplitude of these pulses determining the values of the voltages VY applied to the line electrodes Y1 to Y4 and the values of the voltages VX applied to the column electrodes X1 to X8.

In this configuration it becomes possible to carry out selective addressing simultaneously for the pixels belonging to lines of pixels L1 to L4 of the same group; the pixels PX1 to PX4 formed with the first line electrode Y1 constitute a first line of pixels L1 which belong to the first group G1, similarly for the pixels PX5 to PX8 which are formed with the second line electrode Y2 and which constitute a second line of pixels L2; the pixels PX9 to PX12 which are constituted with the aid of the third line electrode Y3 form a third line of pixels L3 which belong to the second group G2, similarly for the pixels PX13 to PX16 formed by the fourth line electrode Y3 and which constitute a fourth line of pixels L4.

Hence, for example, by, on the one hand, addressing the first group G1, that is to say the first and the second line electrodes Y1 and Y2 simultaneously, and, on the other hand, by simultaneously addressing the first, second, sixth and eighth column electrodes X1, X2, X6 and X8, it is possible selectively to carry out either the erasing, or the writing, simultaneously of the first pixel PX1 which belongs to the first line L1 and of the fifth, seventh and eighth pixels PX5, PX7 and PX8 which

belong to the second line of pixels L2.

It should be noted, in the non-limiting example described, that each group G1, G2 includes only 2 line electrodes Y1, Y2 and Y3, Y4, but, needless to say, each group G1, G2 could be constituted by a larger number n of line electrodes Y1 to Y4; thus the number of line addresses (which corresponds to the number of groups G1, G2) would be smaller compared with the total number of line electrodes Y1 to Y4, so that there would be an increase in the number of simultaneously addressable line electrodes and consequently the number of lines L1 to L4 of pixels of which the pixels PX1 to PX16 may be controlled selectively and simultaneously. But this growth in the number of simultaneously addressable lines L1 to L4 requires the number of column electrodes X1 to X8 to be increased. For example, in the prior art, in order to obtain 16 pixels, 4 line electrodes and 4 column electrodes were sufficient: in contrast, with the present invention, if 4 line electrodes are distributed into two groups G1, G2, each having a number n of two line electrodes linked to the same output of the line control and addressing device 3, the number of line addresses is divided by the ratio of the total number of line electrodes to the number of groups (ie. by 2 in the example), and the number of column electrodes has to be increased in the same ratio; that is to say, that if each group G1, G2 included 4 line electrodes, it would be necessary to use 16 column electrodes to form 16 pixels. Put another way, assuming that all the groups G1, G2 include the same number n of line electrodes, all the lines L1 to L4 may include the same number N of pixels PX1 to PX16 and, in this case, the number M of column electrodes X1 to X4 has to be equal to the product of the number N of pixels per line L1 to L4 and the number n of line electrodes Y1 to Y4 of each group G1, G2, ie. $M = N \times n$ (in this example, $M = 4 \times 2$).

In the non-limiting example represented in Figure 1, the column electrodes X1 to X8 are in a straight line, and, for a given column electrode, it is

necessary, from one region to another, for a pixel to be separated from a following pixel by a simple crossing Cs; hence, for example, in the non-limiting example described, the first pX1 (sic) is separated from the following pixel PX9 by a simple crossing Cs formed with the second line electrode Y2, which constitutes an adjacent pixel PX5 with an adjacent column electrode X2, so that, in this arrangement, the pixels PX1 to PX16 appear placed substantially in zigzag. In fact, a first column of pixels C1 consists of the first and ninth pixels, a second column of pixels C2 consists of the fifth and thirteenth pixels PX5, PX13, a third column C3 consists of the second and tenth pixels PX2, PX10 and so on up to an eighth column of pixels C8 which comprises the eighth and sixteenth pixels PX8, PX16; these columns of pixels being symbolized in the figure by dots and dashes. These pixels are offset from one line electrode to the following line electrode by a distance which corresponds to the pitch P according to which the column electrodes X1 to X8 are arranged. However, it is possible to give the column electrodes X1 to X8 a geometry such that all intersections between a column of pixels and a line electrode Y1 to Y4 are constituted by a pixel.

It should be noted that this arrangement of the line electrodes Y1 to Y4 into a group G1, G2 makes it possible to join together line electrodes Y1 to Y4 of the same group G1, G2 on the same side as their two ends 5, 6 for example, with the aid of linking conductors 12.

A particularly important advantage results from this, which resides in the fact that a cutting 10 of a line electrode, the second line electrode Y2 for example, is self-healing: in fact, in this case, the electrical power supply to the pixels PX6, PX7, PX8 situated on the segment Y2' arranged opposite the first end 5 with respect to the cut 10, is provided by the first line electrode Y1 and by linking conductors 12 which link these two line electrodes Y1, Y2.

Figure 2 represents a matrix 1 in accordance with the invention, in which each crossing between a column of

pixels and a line electrode Y1 to Y4 constitutes a pixel, in such a way that the pixels PX1 to PX16 are no longer distributed in zigzag as in the example of Figure 1.

5 In the non-limiting example described, the plasma panel 1 includes line electrodes Y1, Y2, Y3, Y4, arranged in the same way as in the example of Figure 1, and also includes 8 column electrodes X1 to X8 allowing 16 pixels PX1 to PX16 to be produced.

10 In contrast to the example of Figure 1, the column electrodes X1 to X8 are not in a straight line but include a plurality of bends 15 or turns so as to allow pixels PX1 to PX16 formed by adjacent column electrodes X1 to X8 (in the non-limiting example described, 2 adjacent column electrodes) to be aligned on the same
15 column of pixels Ca, Cb, Cc, Cd. In the non-limiting example of the description, the bends of the column electrodes X1 to X8 which serve to define the same column of pixels have a complementary shape, but, needless to say, bends can have a shape different from that
20 represented in Figure 2 and different from one to another.

In the example, the first column electrode X1 crosses the first line electrode Y1, so as to constitute the first pixel P1 which is centered substantially on the
25 line representing the first column of pixels Ca; the first column electrode X1 next becomes parallel to the line electrodes so as to constitute a first separation bend 15 and to free the intersection with the second line electrode Y2 and the first column of pixels Ca, an
30 intersection at which the fifth pixel PX5 is situated, formed by the passage of the second column electrode X2; which second column electrode X2 includes a return bend 16 which allows it to be placed on the column Ca. The intersection between a straight segment T of the first
35 column electrode X1 and the second line electrode Y2 constitutes a simple crossing Cs situated outside the column Ca and, after this simple crossing, the first column electrode X1 includes a return bend 16 which brings it back onto the column Ca of pixels so that, at

its crossing with the third line electrode Y3, it forms the ninth pixel PX9; needless to say, the second column electrode X2 includes a separation bend 15 which allows it to be separated from the column Ca of pixels in order to leave space for the first column electrode X1. As is represented in Figure 2, a similar arrangement is formed for getting round the other line electrodes, and similarly for the other column electrodes X3 to X8; so that the pixels Px1 (sic) to PX16 are aligned on four columns of pixels Ca, Cb, Cc, Cd each including four pixels, while the lines of pixels L1 to L4 also have four pixels as in the example of Figure 1.

It should be noted, in the non-limiting example described, that the turns or bends 15, 16 are formed by changes in direction by the column electrodes X1 to X8 which occur along directions perpendicular and/or parallel to the line electrodes Y1 to Y4 and to the columns Ca to Cd of pixels, but these turns could also be formed by oblique directions, as illustrated, for example, by lines 17 in dotted lines in the region of the seventh pixel PX7 formed between the sixth column electrode X6 and the second line electrode Y2.

Figure 3 shows a plasma panel in accordance with the invention, and illustrates how to simplify the column electrodes so as to reduce the number of bends 15, 16 or turns for the same arrangement of pixels as in the example of Figure 2. In the non-limiting example described, three groups G1, G2, G3 have been represented in Figure 3, linked to an output SG1, SG2, SG3 of the line control and addressing device 3; each group including two line electrodes, Y1 and Y2, Y3 and Y4, Y5 and Y6 respectively, according to an arrangement similar to that previously described; 6 column electrodes X1 to X6 have been represented, assembled in pairs so that the pixels formed by two column electrodes are arranged along the same column of pixels. Thus, for each line electrode Y1 to Y6, three simple crossings Cs and three pixels are formed, that is to say 18 pixels PX1 to PX18 in all in the example, at the rate of three pixels per line L1 to

L6 and six pixels per column Ca, Cb, Cc.

Beginning with the first column electrode X1, the latter is aligned on the line which represents the first column Ca of pixels: it crosses the first line electrode Y1 so as to constitute the first pixel PX1, then moves
5 apart from the first column Ca with a separation bend 15 and next becomes perpendicular to the line electrodes so as to cross the second and the third line electrodes Y2, Y3 according to simple crossings Cs; next, a return bend
10 16 brings it back onto the axis of the first column Ca so that it successively crosses the fourth and the fifth line electrodes Y4 and Y5, forming the pixels PX10 and PX13; a separation bend 15 again separates it from the first column Ca and it resumes a direction perpendicular
15 to the sixth line electrode Y6 which it crosses according to a simple crossing Cs situated outside the first column Ca. The second column electrode X2 at the start is parallel to the first column electrode X1 and crosses the first line electrode Y1 according to a simple crossing
20 Cs, a crossing after which it includes a return bend 16 which places it on the axis of the first column Ca so that it crosses, successively according to the same straight line, the second and the third line electrodes Y2, Y3 with which it constitutes the fourth and the
25 seventh pixels PX4, PX7; next it is offset from the axis of the first column Ca by a separation bend 15 and traverses the fourth and fifth line electrodes Y4 and Y5 by simple crossings Cs before being brought back onto the axis of the first column Ca by a return bend 16. It is
30 then perpendicular to the sixth line electrode Y6 which it crosses, constituting the sixteenth pixel PX16. The same shape is imparted to the third and fourth column electrodes X3, X4 which together allow a second column Cb of pixels to be constituted, formed by the pixels PX2,
35 PX5, PX8, PX11, PX14 and PX17; the fifth and sixth column electrodes X5, X6 similarly constitute pixels PX3, PX6, PX9, PX12, PX15, PX18, aligned along the same column Cc.

In this arrangement, it will be noted that each column electrode X1 to X6 includes straight segments T

between line electrodes Y1 to Y6 which are adjacent but belong to different groups G1, G2, G3, this as much between simple crossings Cs as between widened-surface crossings Sc forming pixels; this results in a reduction
5 in the number of bends and a simplification of manufacture.

Figure 4 shows that the invention is applicable also to the case of a plasma panel 1 of the coplanar hold type. In the non-limiting example of the description, the
10 panel 1 includes 8 pixels arranged into two columns: a first column of pixels Ca includes four pixels PX1, PX3, PX5, PX7 and the second column Cb includes the four pixels PX2, PX4, PX6, PX8.

The pixels PX1 to PX8 are defined at the crossing
15 between addressing-only electrodes forming, in the non-limiting example described, column electrodes which are four in number, X1, X2, X3 and X4, with pairs of hold electrodes which are four in number, P1, P2, P3, P4 and which are perpendicular to the addressing-only
20 electrodes; the pairs P1 to P4 are consequently arranged along lines. In a way which is conventional in itself, each pair P1 to P4 is constituted by a so-called hold-only electrode E1 to E4, the function of which is only to allow the hold discharges and which, at same instants,
25 are taken to the same potentials; so that these hold-only electrodes do not have to be addressed and thus do not have to be individualized, and can possibly all be linked together on the same side as their first end 25, by a linking conductor 20, and can be linked to the same
30 output 22 of a pulse generator 21.

Each pair P1 to P4 further includes an electrode, called addressing/hold electrode Y'1 to Y'4, which has the function, on the one hand, with the hold-only electrodes E1 to E4, of providing the hold discharges for
35 the pixels PX1 to PX8, and which on the other hand, provides an addressing function; the column electrodes X1 to X4 carry out an addressing function only.

Thus, the addressing/hold electrodes Y'1 to Y'4 have to be individualized as was the case for the

electrodes Y1 to Y4 of the preceding examples. In accordance with the concept of the invention, the addressing/hold electrodes are assembled into groups G1, G2, each group including at least two addressing/hold electrodes linked together and to the line control and addressing device 3 in the same way as in the preceding examples for the line electrodes Y1 to Y4. In the example represented in Figure 4, the first and second addressing/hold electrodes Y'1, Y'2 are linked together on the same side as their first end 5 and linked to the output SG1 of the control and addressing device 3 and they are also linked together on the same side as their second end 6 by a link 12. In the non-limiting example described, with respect to the plane of the figure, the electrodes of the pairs P1 to P4 are represented in a deeper plane than that of the column electrodes X1 to X4.

In this configuration, starting from the top of the figure, a first hold-only electrode E1 forms a pair P1 with a first addressing/hold electrode Y'1; then next a second addressing/hold electrode Y'2 constitutes a second pair P2 with a second hold-only electrode E2; next a third hold-only electrode E3 is found, which, it will be noted, is linked by a link 26 to the second hold-only electrode E2, at the same side as a second end 27 of these electrodes. The third hold-only electrode E3 forms a third pair P3 with a third addressing/hold electrode Y'3; this third addressing/hold electrode Y'3 is followed by a fourth addressing/hold electrode Y'4 which, with a fourth hold-only electrode E4, constitutes a fourth pair P4 of hold electrodes.

As in the preceding examples relating to the line electrodes Y1 to Y4, the addressing/hold electrodes Y'1 to Y'4 belonging to the same group G1, G2 are joined together at the same side as their two ends 5, 6. So that the previously quoted advantage on the self-healing of cuts may also exist in this application of the invention, and this advantage also exists for the hold-only electrodes E1 to E4 which can also be joined at their two ends 25, 27, due to the fact that these hold electrodes

Y'1 to Y'4 and E1 to E4 are arranged along a succession of two hold-only electrodes E1 to E4 followed by two addressing/hold electrodes Y1 to Y4. It should be noted that this arrangement makes it possible furthermore to
5 reduce the lateral capacitances (not represented) formed between pairs P1 to P4 of successive electrodes.

The first column electrode X1 crosses the first pair P1 above projecting parts 30, 31 with which the hold-only electrodes E1 to E4 and the addressing/hold
10 electrodes Y'1 to Y'4 are respectively equipped. These projecting parts 30, 31 constitute localized growths in the surface area of these electrodes, and in the same pair P1 to P4, the projecting parts 30, 31 are facing each other and oriented towards each other. These pro-
15 jecting parts 30, 31 are arranged in the region of the pixels PX1 to PX8, and one of the benefits which these projecting parts exhibit is to localize the hold discharges. Another benefit in the context of the present invention is that at least one of these projecting parts
20 30, 31, especially that which belongs to the addressing/hold electrodes Y'1 to Y'4 makes it possible to obtain a larger crossing surface Sc in the region of each pixel than the intersection surface St formed at the simple crossing Cs of a column electrode X1 to X4 with one of
25 the hold electrodes, that is to say outside one of these projecting parts; the latter crossing then constituting a simple crossing Cs, if the potential differences previously mentioned are sufficiently small that the electrical discharges are generated between a pair P1 to
30 P4 and a column electrode X1 to X4 only in the region of the pixels PX1 to PX8.

As has already been explained, the widened crossing surfaces Sc, that is to say the ones which make it possible to constitute a pixel, may be obtained also
35 by acting on the shape of the line electrodes, which is the case elsewhere in the example described with reference to Figure 4 in which, admittedly, the hold electrodes Y'1 to Y'4 or E1 to E4 are electrodes which are arranged in a line. However, particularly in the case of

plasma panels for which the hold discharges are not produced between coplanar hold electrodes, the line electrodes Y1 to Y4 may have a geometry of the type represented, for example, in Figures 5 (sic), with a view to producing crossing surfaces with a widened surface.

Figure 5 shows line electrodes Y1, Y2 which are represented in a deeper plane than the column electrodes X2, X3 with respect to the plane of the figure; the example being limited to the representation of two line electrodes and of two column electrodes Y1, Y2 and X1, X2 in order to simplify Figure 5. The embodiment shown in Figure 5 allows crossing surfaces Sc with a widened surface to be obtained, that is to say surfaces able to form pixels by a modification of the geometry of the electrodes of the lines (sic) Y1, Y2 at the sites provided for forming these pixels. In the non-limiting example described, this embodiment applies particularly to a distribution of pixels as represented in Figure 1, and, for example, particularly to the case of the crossings formed between the two line electrodes Y1 and Y2 and the two column electrodes X1 and X2; but, needless to say, the geometry which is given to the line electrodes Y1, Y2 could be used with another distribution of the pixels, such as shown, for example, in Figures 2 and 3, and it should be noted moreover that the column electrodes could themselves also have a similar geometry.

The line electrodes Y1, Y2 are each constituted by a first and a second parallel conductor 35, 36 each, for example, having a width l3 which was also the width of the line electrodes in the preceding examples; the column electrodes X1, X2 having the second width l2 (the smaller).

At the crossing between column electrodes X1, X2 and line electrodes Y1, Y2 which are intended to constitute pixels, the two conductors 35, 36 of the same line electrode Y1, Y2 are linked by a linking surface S1 which can be likened to an increase in the width l3 of one or the other of the two conductors 35, 36. It results therefrom that the crossings exhibit a crossing surface

Sc which is larger at the crossings intended to constitute pixels than for the other crossings; hence, for example, starting from the top of the figure, the first column electrode X1 crosses the first line electrode Y1 in the region of a linking surface S1 so that the crossing surface Sc is sufficient to constitute a pixel PX1, that is to say that the voltage applied between the column electrode X1 and the line electrode Y1 allows discharges to be generated in this region; next, the first column electrode X1 crosses the second line electrode Y2 successively in the region of the first and of the second conductor 35, 36, with which it successively constitutes intersection surfaces St which do not allow discharges to be obtained with such low voltage conditions as those which allow discharges in the region of the pixel PX1. For the second column electrode X2, its crossing with the first line electrode Y1 determines two intersection surfaces St of smaller surface areas, and next its crossing with the second line electrode Y2 in the region where the latter includes a linking surface S1 defines a crossing surface Sc which is sufficient to constitute a pixel PX5.

This description constitutes a non-limiting example which shows, on the one hand, that it is possible to form a number of crossings between line electrodes and column electrodes which is greater than the number of pixels desired, by producing the crossing surfaces Sc larger in the region of the pixels than for the other crossings Cs and by adjusting the voltages VX and the voltages VY applied respectively to the column electrodes and to the line electrodes so that the potential differences VX-VY generated by these voltages between these column electrodes and line electrodes are sufficient to obtain electrical discharges in the region of the pixels and insufficient to produce electrical discharges in the region of the other simple crossings; needless to say, other embodiments are possible without departing from the scope of the invention, in the matter, for example, of the shape of the electrodes and their arrangement into

lines or into columns, or also the position of the column electrodes on the same side as the visible part of the panel or on the reverse side. This description shows, moreover, how to configure the various line and column electrodes in order to obtain, in combination with the production of the pixels mentioned above, and an increase in the number of column electrodes, line electrodes which are assembled by groups; the line electrodes of the same group being linked to the same output of the line control and addressing register 3, so that, for the same number of lines of pixels (each line L1 to L4 of pixels corresponding to a line electrode Y1 to Y4) the number of addresses is reduced; and it is possible simultaneously to control the pixels which are formed with the aid of line electrodes situated at the same address, that is to say belonging to the same group G1, G2, the selection of the pixels belonging to the same group being obtained by addressing or choice of the column electrodes, the number of which is increased.

It should be noted that the invention may be applied to all alternating-type plasma panels, whatever the details of their embodiment technology and their control mode. The invention may also be applied to the case of continuous-type plasma panels, for which the implementation of the invention offers additional advantages, due to the fact that, in these continuous-type panels, the number of lines to be controlled limits not only the duration of the total addressing cycle, but also the quantity of light which a pixel can emit. The application of the invention thus, in the case of the continuous-type plasma panel, makes it possible to improve each of these two parameters at once.

CLAIMS

1. Plasma panel including pixels (PX1 to PX16) arranged in lines (L1 to L4) and columns (C1 to C8, Ca to Cd), column electrodes (X1 to X8) crossed by line electrodes (Y1 to Y4) and defining a plurality of crossings (Cr, Cs), a column control and addressing device (2) to which the column electrodes (X1 to X8) are linked, a line control and addressing device (3) to which the line electrodes (Y1 to Y4) are linked, each crossing including a crossing surface (Sc, St) formed by the corresponding opposite surfaces of the line electrode (Y1 to Y4) and of the column electrode (X1 to X8), characterized in that the crossings consist, on the one hand, of simple crossings (Cs), and, on the other hand, of widened crossings having a larger crossing surface (Sc) than that of the simple crossings (Cs), each pixel (PX1 to PX16) being defined substantially in the region of a widened crossing, and in that at least two line electrodes (Y1, Y2) are linked to the same output (SY1) of the line control and addressing device (3), the number M of column electrodes (X1 to X4) being greater than the number N of pixels (P1 to PX 16) contained in a line (L1 to L4) formed with the aid of a line electrode (Y1 to Y4) belonging to a group of electrodes.
2. Plasma panel according to Claim 1, characterized in that the line conductors (Y1 to Y4) consist of a plurality of groups (G1, G2) each including at least two line electrodes linked together (Y1, Y2 and Y3, Y4), each group (G1, G2) being linked to a different output (SY1, SY2) of the line control and addressing device (3).
3. Plasma panel according to Claim 2, characterized in that all the groups (G1, G2) include the same number n of line electrodes (Y1 to Y4).
4. Plasma panel according to one of the preceding claims, characterized in that the column electrodes (X1 to X4) and/or the line electrodes (Y1 to Y4) have a width (l1, S1) greater in the region of the pixels (PX1 to PX16) than the width (l2, l3) which they possess in the



region of the simple crossings (Cs).

5. Plasma panel according to one of the preceding claims, characterized in that the number M of column electrodes (X1 to X4) corresponds to the product of the number n of line electrodes (Y1 to Y4) which constitute the same group (G1, G4) and the number N of pixels (PX1 to PX16) contained in a line (L1 to L4) of pixels, i.e. $M = n \times N$.
6. Plasma panel according to one of the preceding claims, characterized in that the column electrodes (X1 to X4) are substantially in a straight line.
7. Plasma panel according to any one of Claims 1 to 5, characterized in that the column electrodes (X1 to X4) and/or the line electrodes (Y1 to Y4) include bends (15, 16).
8. Plasma panel according to Claim 7, characterized in that a column (C1 to C4) of pixels is constituted with the aid of at least two column electrodes (X1 to X4).
9. Plasma panel according to Claim 7, characterized in that the bends (15, 16) are constituted by successive changes in direction which are substantially perpendicular from one direction to another.
10. Plasma panel according to one of the preceding claims, characterized in that the column electrodes (X1 to X4) and/or the line electrodes (Y1 to Y4) are formed by at least two parallel conductors linked together by a linking surface (S1) in the region of the widened crossings (Sc) where pixels (PX1 to PX16) are constituted.
11. Plasma panel according to one of the preceding claims, characterized in that at least two line electrodes (Y1 to Y4) of the same group (G1, G2) are linked together at each of their ends (5, 6).
12. Plasma panel according to one of the preceding claims, characterized in that the line and column control and addressing devices (2, 3) deliver voltages (VY, VX) which are sufficient to generate electrical discharges in the region of the pixels (PX1 to PX16) and insufficient to generate these discharges in the region of the simple crossings (CS) (sic).



13. Plasma panel according to any one of the preceding claims, characterized in that it is of the alternating type with coplanar hold.

14. Plasma panel according to Claim 13, characterized in that it includes pairs (P1 to P4) of hold electrodes crossed by addressing-only electrodes (X1 to X4), each pair (P1 to P4) of electrodes being formed by an addressing/hold electrode (Y'1 to Y'4) and a hold-only electrode (E1 to E4), the addressing/hold electrodes (Y'1 to Y'4) and the hold-only electrodes (E1 to E4) including projecting surfaces (30, 31) which, between the two electrodes of the same pair (P1 to P4), are oriented towards one another and make it possible to define, at the crossing by an addressing-only electrode (X1 to X4), a widened surface at which a pixel (PX1 to PX16) is constituted.

15. Plasma panel according to Claim 14, including a first and a second addressing devices (2, 3) to which the addressing-only electrodes (X1 to X4) and the addressing/hold electrodes (Y'1 to Y'4) are respectively linked, characterized in that the addressing/hold electrodes (Y'1 to Y'4) are constituted into a plurality of groups (G1, G2) each including at least two addressing/hold electrodes (Y'1 to Y'4) linked together, each group (G1, G2 (sic) being linked to a different output (Sy1, Sy2) of the second addressing device (3).

16. Plasma panel according to Claim 14, characterized in that the arrangement of the hold-only (E1 to E4) and addressing/hold (Y'1 to Y'4) electrodes includes at least one succession of two hold-only electrodes (E1 to E4) followed by two addressing/hold electrodes (Y'1 to Y'4) of the same group (G1, G2).

17. Plasma panel according to Claim 16, characterized in that two successive addressing/hold electrodes (Y'1 to Y'4) of the same group (G1, G2) are linked together at their two ends (5, 6).

18. Plasma panel according to Claim 17, characterized in that two successive hold-only electrodes (E1 to E4) are linked together at their two ends (25, 26).



19. Plasma panel according to Claim 15, characterized in that, in addition to the widened crossings forming pixels (PX1 to PX16), the crossings between addressing-only electrodes (X1 to X4) and the pairs (P1 to P4) constitute simple crossings (Cs) having a crossing surface (St) smaller than the crossing surface (Sc) of the pixels (PX1 to PX16), and in that the addressing devices (2, 3) deliver voltages (VY, VX) which are sufficient to generate electrical discharges in the region of the pixels (PX1 to PX16), and insufficient to generate these discharges in the region of the simple crossings (Cs).

20. Plasma panel according to Claim 14, characterized in that the addressing-only electrodes (X1 to X4) constitute column electrodes and in that the pairs (P1 to P4) are arranged in lines.

