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(54) **Method for the location and the relative positioning of the light points intended for the formation of various high-definition figures on a variable-message light board.**

(57) In order to position the light points concurring to form a high number of high-definition figures, which can be alternatively activated on a variable-message light board, the technique is provided of constructing each alternative figure through pre-established grids on which the knots are to be located which are to correspond to the light points that form the figure itself, and of employing for all alternative figures grids which are identical to one another, as well as of performing relative translations of said grids in order to locate relative positions with no points in common or with a umber of points in common which, though decreases the total number of points, does nor give rise, in case of employment of optical fibres, to an increase in the number of total bundles.

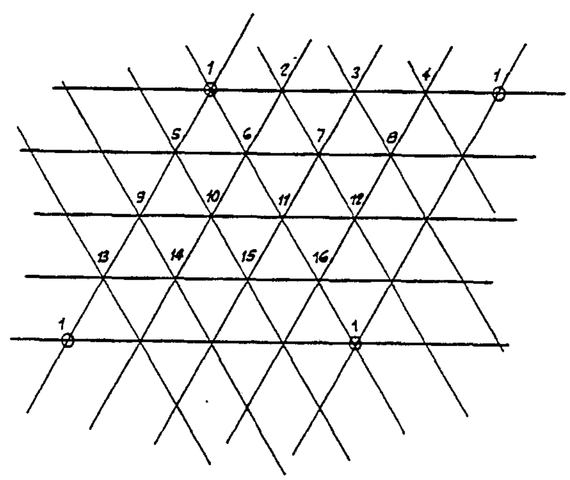

Fig. 1

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A METHOD FOR THE LOCATION AND THE RELATIVE POSITIONING OF THE LIGHT POINTS INTENDED FOR THE FORMATION OF VARIOUS HIGH-DEFINITION FIGURES ON A VARIABLE-MESSAGE LIGHT BOARD

The object of the present finding consists in a method for defining the position of the points to be lighted from time to time in the case of a high-definition, variable-message light board, i.e. a board intended for containing a high number of symbols, to be activated alternatively and not stylized, which symbols are obtained by a high density of light points so as to allow figures usually employed in fixed-type road signs to be visually represented with high fidelity.

Variable-message boards based on the optical-fibre technology are already known. By means of such technique each image is obtained through lighting one or more lamps, each one bearing a bundle of fibres abutted to the same, the ends of such fibres reaching all points concurring to give the configuration of the same image, and just such points only. By mixing points belonging to the various symbols on the same board area, and by lighting the corresponding lamps according to the specific requirements, various alternative messages can be inserted in the same field.

It is quite evident that the density of light points necessary to figure a single image does not only depend on the light intensity of the single point and on the environmental light conditions in which the desired representation is to be activated, but also and above all on the accuracy of details with which the image should reproduce the original; stated otherwise, such density depends on the resolving power that is to be obtained.

At the present state of the art, as regards variable-message road boards, keeping into account the high number of points required, the constructive problem has not been tackled in a full way but just stylized symbols have been realized and always substantially in a handicraft way, said symbols making use of just a limited number of points so that they can give rise to confusion in addition to be poorly visible due to the low number of the light points employed.

It is an object of the present finding that of supplying a rapid and low-cost method for defining, with a view to an industrial reproducibility, the arrangement of the light points in variable-message boards which comprise a high number of unstylized alternative symbols, each one of them being of such a density of points as to give such symbols high-definition characteristics.

More particularly, the object of the present invention consists in supplying a rapid method for defining according to precise modalities the arrangement of the light points in variable-message boards comprising a number of about 10 unstylized alternative symbols, each one of them having such a point density as to allow the visual representation of figures usually employed in road signs to be obtained with high fidelity.

On the basis of the classification of road sign symbols in current use according to the sizes of the same, the Applicant has pointed out three kinds of signals, respectively for:

class A, large size, corresponding to the class of triangles whose sides are greater than or equal to 120 cm, of discs of diameter greater than or equal to 90 cm, and of other figures (of square or rectangular shape) of sizes as those mentioned above;

class B, medium size, corresponding to that of triangles of 90 cm side, discs of 60 cm diameter and other corresponding square or rectangular shape;

class C, small size, corresponding to that of triangles having 60 cm side, discs of 40 cm diameter and other corresponding square or rectangular shapes. Experimental tests carried out by the Applicant brought about the following conclusions:

1) a suitable resolving power is obtained in the case of the first class by means of light points of a density of the order of one point per 11 cm^2 or at most per 13 cm^2;

2) the necessary resolving power is obtained for the second class (as the symbols are smaller) with a density not less than one point per 9-11 cm^2;

3) in the case of the third class, the necessary resolving power is obtained with a density not less than one point per 5-7 cm^2.

Following to the experiments carried out employing the technological instruments which are at disposal at the present time, it was also possible to set forth that for the symbols to be visible at the prescribed distances it is sufficient:

a) to employ, with the point densities of the classes A and B, fibres of 1.0 mm diameter abutted to the outlet part of light with a suitable optical device (a cone or a lens in order to reduce the light outlet cone and to increase the light intensity) or otherwise., fibres of 1.5 mm diameter even without any optical device (a cone or a lens);

b) to employ with the point density of class C, fibres of 1.0 mm diameter with or without and optical device (a cone or a lens).

Moreover, it is to be remarked that there is no impediment in employing a density of a lower class (for instance the class B) for figures belonging to the higher class (for instance the class A) so as to obtain a better resolving power, as well as on the contrary, it is possible in case of some particularly simple figures to employ a point density of a higher class, to realize figures belonging to a lower class.

Just for giving the necessary information for the understanding of the following disclosure, it is herein specified that, because of practical reasons of homogeneity and of illumination, by means of a parabolic lamp of 50 mm diameter, such as those usually employed to that aim it is possible to light:
a bundle of about 130 fibres of 1.5 mm diameter;
a bundle of about 270 fibres of 1.0 mm diameter.

In realizing said boards, because of assembling reasons such maximum values not always are exploited (for instance, sometimes it can be more advantageous to realize two bundles instead of one bundle in order to make the tangle of fibres that is formed in the rear part of the board less intricate).

From such data, as well as from the whole number of points of a figure and from their grouping by colour, the number of lamps and of fibre bundles necessary to the realization of the figure itself is derived.

Because, as already mentioned above, for realizing the unstylized symbols of the road signs high amounts of light points are necessary, if boards are to be realized bearing a number of various symbols a very hard task should be faced to locate the points shared by the various figures and to reduce simultaneously the amount of lamps or the number of light points to be provided in the whole assembly to a minimum: all that would be necessary unless some rules are set forth in realizing the single picture-writing.

Indeed, as the single point is of nonzero finite sizes, it is obvious that when studying a symbol, the positioning of the light points cannot be imposed by aesthetic reasons only; otherwise, on mixing the various figures for realizing the multiple signal, a random and practically uncontrollable arrangement of coinciding points belonging to a number of figures would be met with (with a proliferation of necessary lamps or of points which are too close to be realizable in practice).

Such drawbacks are overcome by the method disclosed in the following, which provides the following steps:

a) to construct each figure according to pre-established grids on which the knots are to be located which are to correspond to light points;

b) to employ to that aim identical grids for all figures;

c) to find, at the moment of realizing a multiple board, the right overlapping of grids, by means of relative translation motions of the same, in order to:

- keep the total number of points at a low value;
- minimize the number of bundles (and hence of the lamps) which make up each symbol (this is done for keeping power consumption low and for limiting the problems deriving from dissipation of the heat given off), locating relative positions without points in common or with a number of points in common which does not give rise to an increase of the total number of bundles though decreasing the number of total points necessary.

In order to carry out such operations in a simple way, it is necessary that all grids have the same pitch and that they are based on a pitch which is an integral multiple of the translation pitch employed, whereas at the same time the translation pitch cannot be less than or equal to the size of the space occupied (the diameter) of the single light point.

Keeping into account the fact that the larger part of the symbols that are to be represented contain horizontal or vertical lines (squares or rectangles) or are along directions at -60° and +60° with respect to the horizontal line (triangles and the inside part of the discs), the base grid according to the present finding turns out to be made up of bundles of horizontal straight lines which are horizontal and at +60° or -60° slope with respect to the horizontal line. The base translation pitch, keeping into account the space occupied by the devices for fastening fibres to the boards (about 7 mm), is in the range between 8 and 10 mm. MOre particularly, it has been set forth that:
- for class A signals, the base grid is to be of 9 mm pitch whereas the grid of the figures is to be based on a multiple pitch equal to four pitches of the base grid (36 mm)
- for class B signals, the base grid is to be of 8.5 mm pitch, whereas the grid of figures is to be based on a multiple pitch equal to four pitches of the base grid (34 mm)
- for class C signals, the base grid is to be of 8.5 mm pitch, whereas the grid of the figures is to be based on a multiple pitch equal to three pitches of the base grid (25.5 mm).

The method disclosed in the following will be more easily understood by reference to the enclosed drawings which illustrate just for exemplification and not for limitative purposes two embodiments of grids which are employed for the three classes of road signals mentioned above. More particularly:

fig. 1 represents a grid which is good for class A and class B signals, said figure showing 16 possible different arrangements of the grids, the positioning of the same being obtained through translation along the axes of the grids themselves;

fig. 2 shows a grid which is good for class C signals, said figure illustrating 9 different arrangements, the positioning being obtained through translation along the axes of the grids themselves;

fig. 3 shows as an alternative the possible employment of two grids at 50 % for realizing symbols of orthogonal structure;

figures 4 and 5 show, as a result of the application of the method according to the present invention the arrangements of the light points concurring to form on a class B multiple board respectively a complex symbol like "Slippery road due to ice" and the symbol "Queue", which points put into evidence the shift of the origins of each symbol obtained through grid translation.

With reference now to the figures mentioned above, it could be observed that, if a symbol could be drawn employing just the points of a grid, the figures of 16 "class A or class B" symbols or 9 "class C" symbols could be interlaced blindly without finding any points in common.

All that in not always true, as sometimes for graphic requirements it is necessary to arrange the points of a figure over a number of grids.

For instance, figure 3 shows, as already mentioned above, a grid of an orthogonal structure symbol which occupies two grids (50 % each). This does not exclude that in this case, should the symbol be realized regularly and in almost all points following the structure pointed above, the remainder 50 % of the two grids employed would be free for another symbol of a similar structure.

On the contrary, in case a symbol employs just a part of a board, the same grids can be employed for another figure in its parts which have not been use, as well as two simple and similar symbols can be housed easily on a same grid by searching for common parts or for a complete interlacing without coincidence of points.

It can be added to the above that shifting the points of a grid along the horizontal lines, the distance of such points from the grid points which are immediately in the upper and the lower position becomes, in the most critical case, equal to the base grid pitch multiplied by cos 30°. If such distance is acceptable taking into consideration the space occupied by the light points, in the rare case in which a figure requires a particularly irregular or anomalous point distribution, such points can be arranged along horizontal lines which are spaced by a pitch equal to the vertical pitch of the grid in the figure, while they can have any horizontal coordinate on condition that the symbol in question occupies all grids which are aligned on the same horizontal line (4 for class A and B grids and 3 for grids of class C).

It turns out from the above that the number of possible positions mentioned above (16 for the "class A and class B" grids, and 9 for the "class C" grids) is not necessarily an upper limit to the total of the numbers of grids employed by the whole of the figures on a multiple board.

The exploitation of one only grid on the part of a given figure not in a rigorous way, as well as the possible employment of points outside the grids for final touches due to graphic reasons does not complicate the work on condition that the following rules are adhered to:

- the employment of a finite number (4 at most for classes A and B and 3 at most for class C) of grids aligned along the same horizontal line for each figure,
- the consideration of the number of points employed outside the grid as an exception (few points for each figure and at most one only figure with many points).

Indeed, the incompatibilities between points of different figures, are thus limited in practice within a few per cent of the total number of points, while the search for points in common (both for creating bundles shared by a number of figures, and for obtaining the doubling of a given point into two or more points at a close distance) can be easily performed by overlapping.

All that can be made easier in addition by employing an electronic processor with specialized programmes for comparison between different figures and for checking the distance between points. Further as a direct result of such processing operations, the list can be automati cally obtained on a suitable support of the coordinates of the various points that make up the board (a single or a multiple board). As it is unthinkable that the resulting points are all contained on a regular grid (such as for instance the grid of commercial, previously drilled plates), such list of coordinates can be employed directly for supplying a digital control machine in drilling the board intended for housing the ends of the fibres.

Two practical examples of the results obtained by the method of the present invention are illustrated in figures 4 and 5. Such figures show the arrangement, on a variable-message board, of the light points concurring to form two of the alternative road symbols obtainable, and they put into evidence the shifts, obtained by translations of the grid, of the origins of each one of said symbols with respect to a common origin.

What has been disclosed above is referred to a preferred embodiment of the invention, i.e. the embodiment consisting of a variable-message board for symbols of road signs.

Anyway, it is to be understood that the method disclosed above allows the ends of optical fibres to be located and positioned, said fibres being capable of forming messages and figures of different kinds, with grid pitches different from those pointed out above and with fibre diameters suitable to the aim, such as for instance the guiding signaletics, advertising messages and in general suitable to any message set forth previously which is based on high-definition symbols.

As an alternative to the optical fibre end, the employment can be obviously contemplated of other light sources though of suitable intensity.

Claims

1. A method for the location and the relative positioning of the light points concurring to form the symbols on a variable-message light points with high number of high-definition symbols to be alternatively activated, characterized in that the following operative steps are provided:
constructing each alternative figure by means of pre-established grids on which the knots to be caused to correspond to said light points are to be located, apart from exceptions due to final touches for graphic reasons;
employing alternative grids which are identical to one another for all figures;
carrying out the work through relative translation of said grids so as to find the right overlapping by locating relative positions without points in common or with a number of points in common which, though decrease the total number of points required, in case of employment of optical fibres, does not give rise to an increase in the total number of bundles of the fibres themselves.

2. A method according to the preceding claim, characterized in that all grids are of the same pitch, said pitch being an integral multiple of the translation pitch employed.

3. A method according to the preceding claims, characterized in that the base grid employed is made up of bundles of horizontal straight lines and of lines at +60° or -60° slope with respect to horizontal line.

4. A method according to the preceding claims, characterized in that for large-size symbols of road signs, their size being related to triangles of sides greater than or equal to 120 cm and to discs of diameter greater than or equal to 90 cm, the visually accurate representation of figures commonly employed in fixed-type road signaletics is obtained with a density of the light points of the order of one point per 11-13 cm^2, the base grid is of 9 mm pitch and the grid of the figures is based on a multiple pitch equal to four pitches of the base grid.

5. A method according to the preceding claims characterized in that, for medium-size signals of road signs, of sizes related to triangles of 90 cm side and to discs of 60 cm diameter, the visually accurate representation of figures currently employed in fixed-type road signaletics is obtained with a density of the light points of the order of one point per 9-11 cm^2, the base grid is of 8.5 cm pitch and that of the figures is based on a multiple pitch equal to four pitches of the base grid.

6. A method according to the preceding claims characterized in that for small-size signals of road signs, of sizes related to triangles of 60 cm side and to discs of 40 cm diameter, the visually accurate representation of figures currently employed in fixed-type road signaletics is obtained with a density of the light points of the order of one point per 5-7 cm^2, the base grid is of 8.5 cm pitch and that of the figures is based on a multiple pitch equal to three pitches of the base grid.

7. A method according to the preceding claims characterized in that employing the point densities of the large-size and the medium-size signals, optical fibres can be used having 1.00 mm diameter, said fibres being abutted to the light outlet part with an optical device suitable to reduce the light outlet cone, so as the light intensity is increased on the axis.

8. A method according to claims 1-7, characterized in that employing the point densities of the large-size and the medium-size signals, optical fibres can be employed of 1.5 mm diameter with no optical device.

9. A method according to claims 1-7, characterized in that employing the point densities of the small-size signals, optical fibres of 1.0 mm diameter can be employed.

10. A method according to claims 1-7, in which the light points are light sources of suitable intensity.

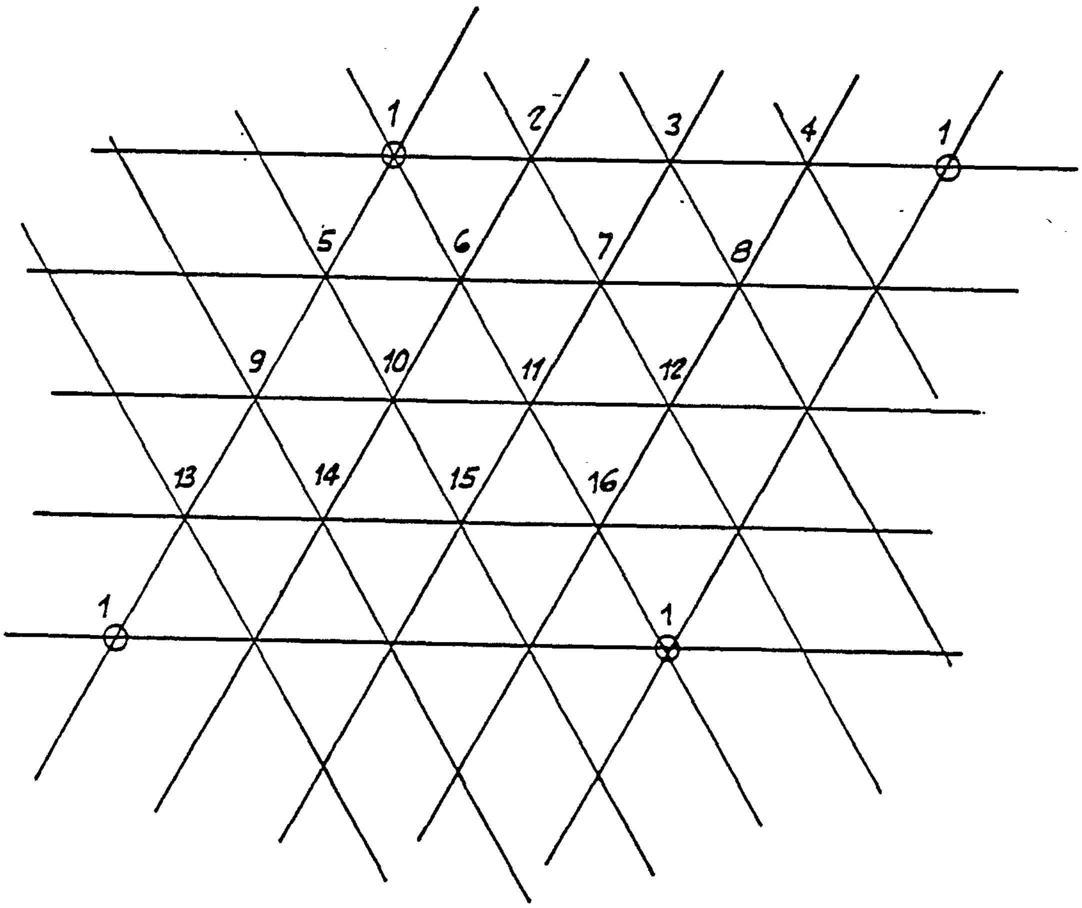

Fig. 1

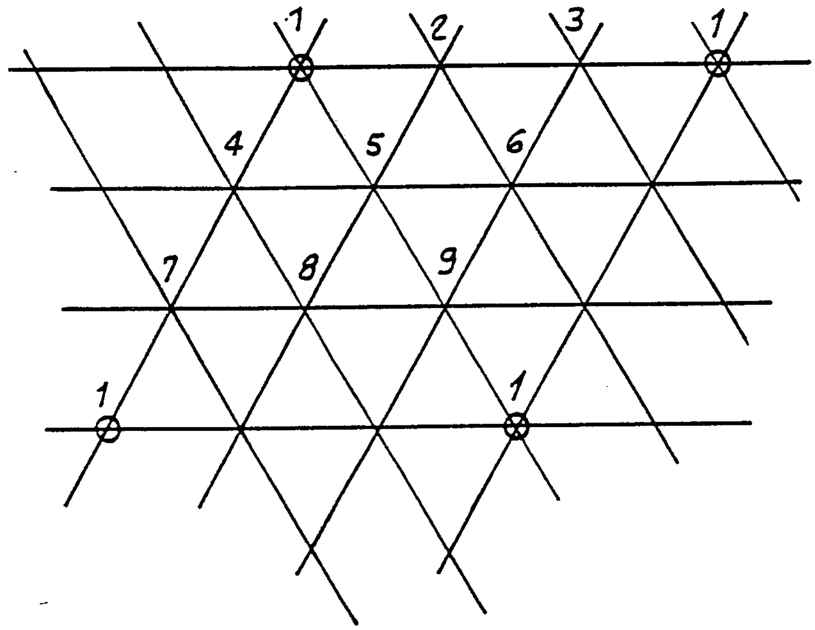

Fig. 2

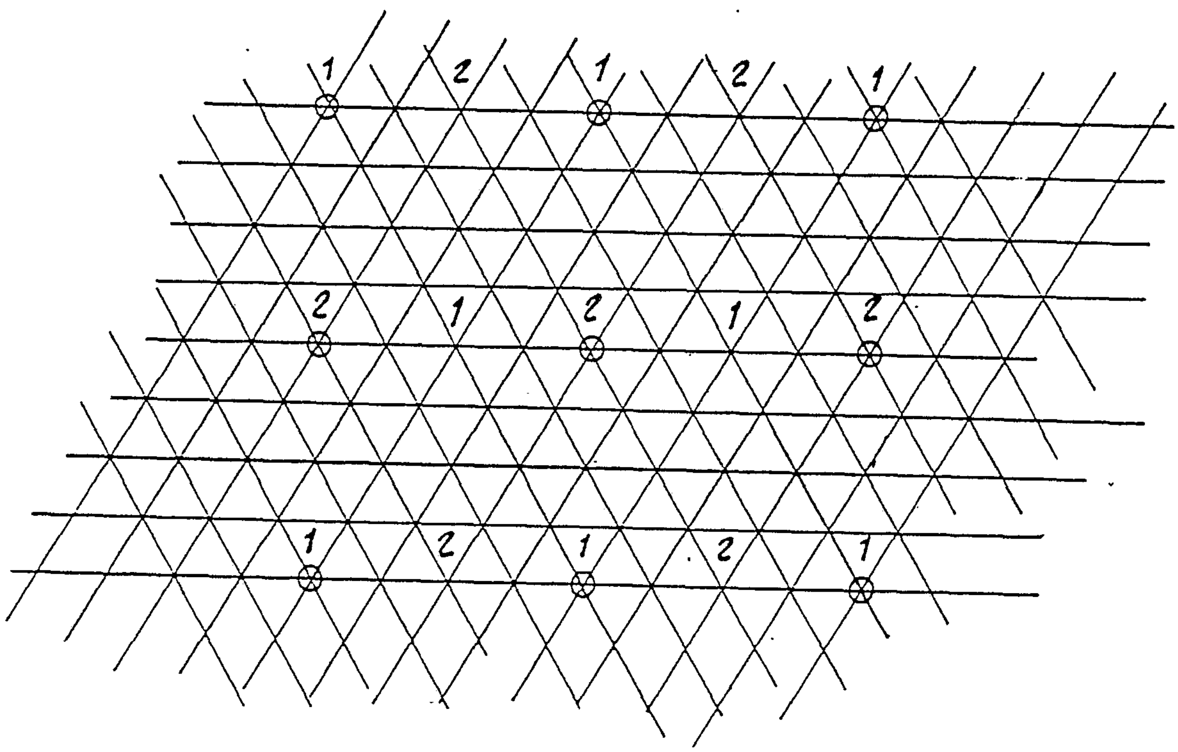

Fig. 3

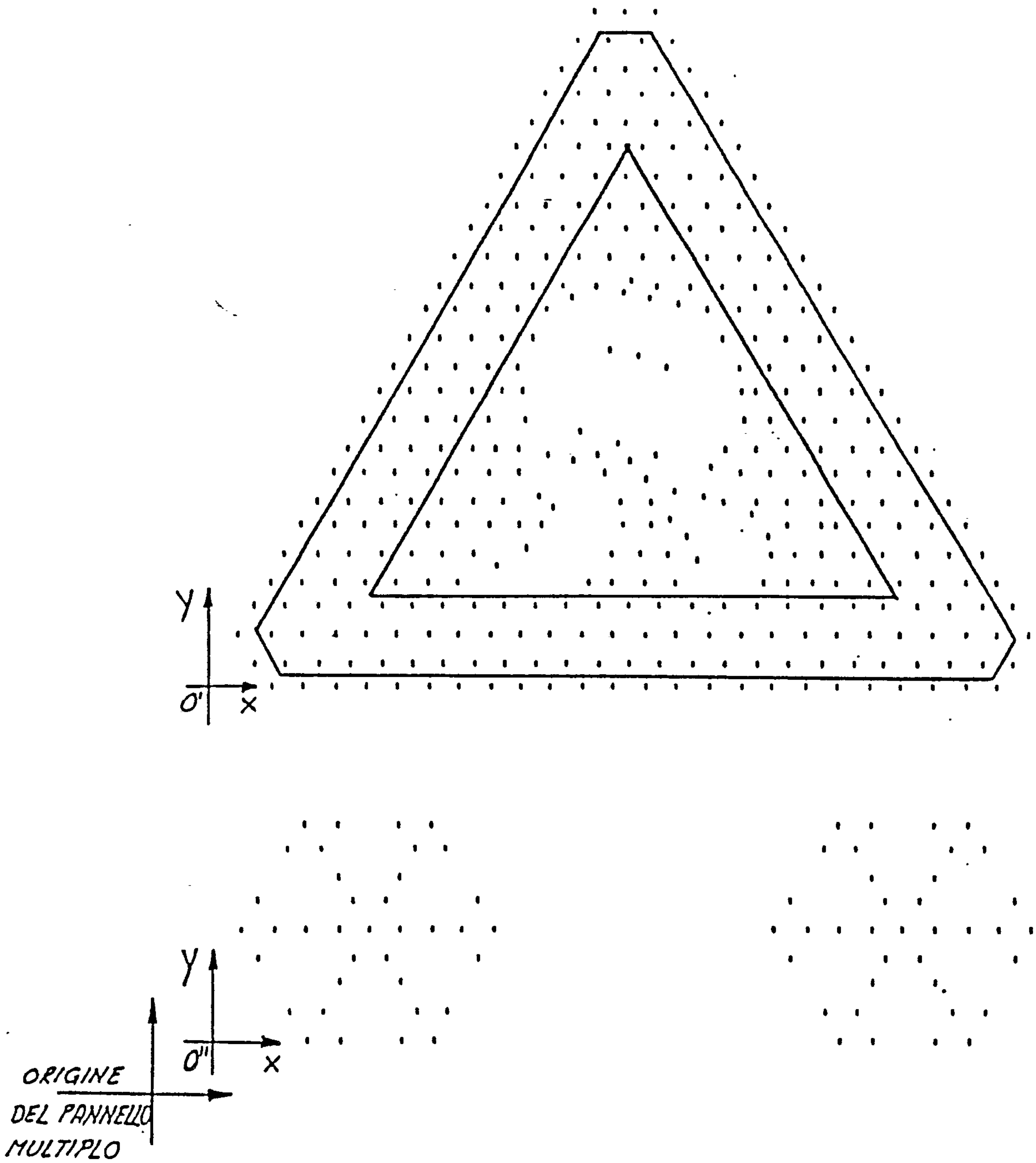

Fig. 4

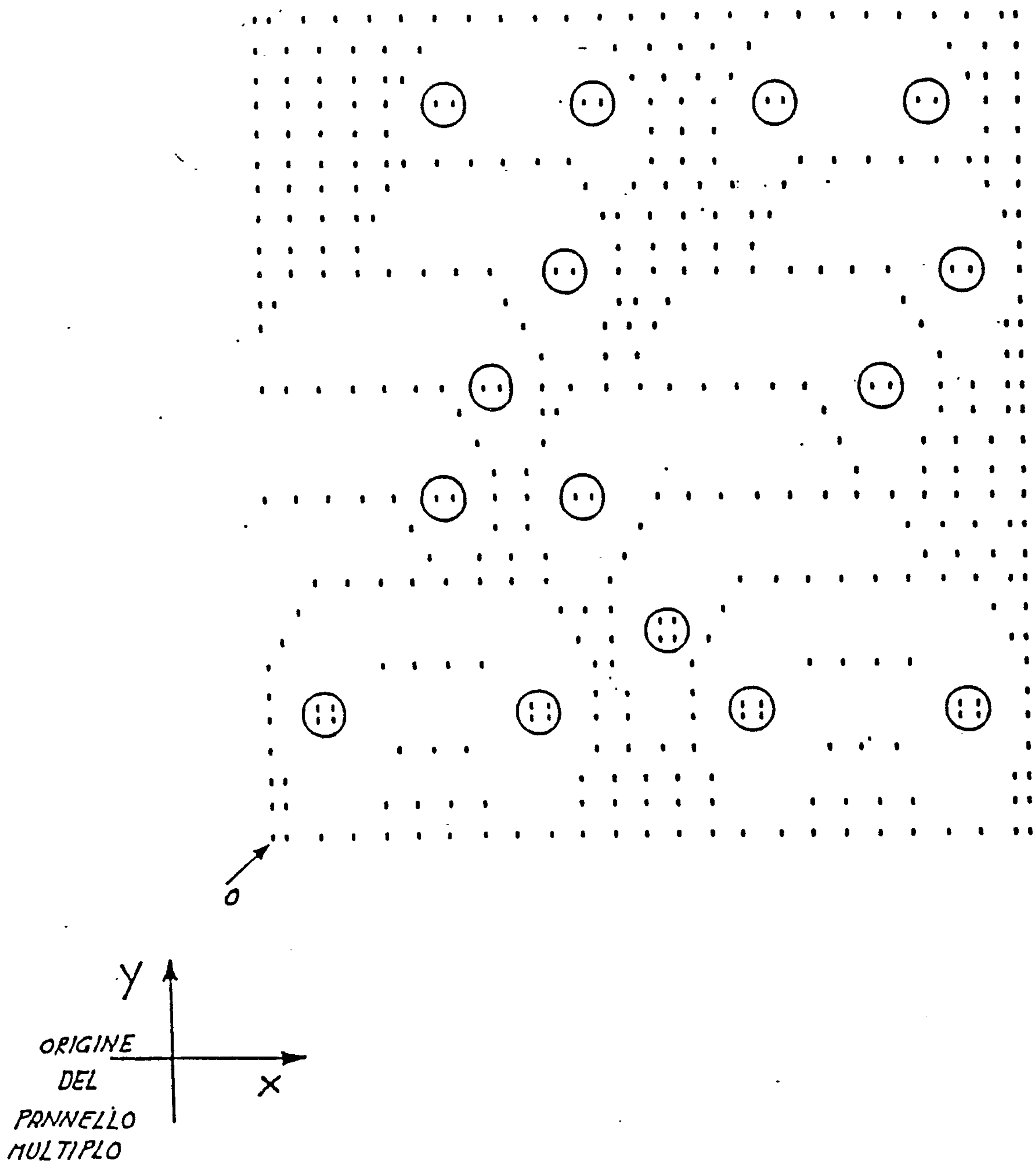

Fig. 5