(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 245 853**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **87106951.4**

(22) Date of filing: **13.05.87**

(51) Int. Cl.³: **F 21 Q 1/00**
F 21 Q 3/00

(30) Priority: **14.05.86 JP 109776/86**

(43) Date of publication of application:
19.11.87 Bulletin 87/47

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **Marui Industry Co. Ltd.**
1-10 Sotokanda 5-chome Chiyoda-ku
Tokyo(JP)

(72) Inventor: **Nakagawa, Yoshio**
3866, Ohba
Fujisawa-shi Kanagawa-ken(JP)

(74) Representative: **Wagner, Karl H. et al,**
WAGNER & GEYER Patentanwälte
Gewuerzmuehlstrasse 5 Postfach 246
D-8000 München 22(DE)

(54) **Light-transmitting material for illuminated indicator.**

(57) A light-transmitting material which is used as an outer surface member of a device having a light source therein and which is illuminated with light from the light source when turned on comprises a light-transmitting layer which transmits light and which is lightly tinted, and a light-shielding layer provided on or adjacent the reverse surface of the light-transmitting layer. The light-shielding layer is composed of a light-shielding portion which transmits substantially no light and a light-transmitting portion which is defined by minute apertures, slits or the like provided at a predetermined density. Accordingly, when the light source is not turned on, the exterior of the light-transmitting material appears to be a composite color which is composed of the color of the light-shielding portion and the color of the light-transmitting layer.

EP 0 245 853 A2

LIGHT-TRANSMITTING MATERIAL FOR ILLUMINATED INDICATOR

The present invention relates to a light-transmitting material which may be employed as a cover for a winker lamp, brake lamp or the like to be mounted on an automobile, or as an outer surface member of the indicating sections of illuminated indicators or decorative means employing light which are provided on household appliances, data communication equipment or the like.

A winker lamp, brake lamp or the like of an automobile generally has a white-light emitting lamp provided therein and a light-transmitting cover colored orange or red, and is arranged such that, when the lamp is turned on, light emitted therefrom passes through the colored light-transmitting cover and light having the color of the cover is thereby emitted to transmit predetermined information to the surroundings.

From the viewpoint of allowing the exterior of an automobile to have an attractive design, it is desirable for these lamps to be such that, when the light source is in the OFF state, the color of the external surface of the lamp is the same as the color of the body or exterior trim part of the automobile in the vicinity of the lamp concerned and, hence, is different from the above-described information transmitting color, such as red or orange, and that light having a desired information transmitting color is emitted only when the light source is turned ON. As yet, however, there has been no example of the practical application of such a technique. There is a similar demand with respect to the lamps used in a variety of illuminated indicators and decorative means provided in, for example, the console box which is disposed at the driver's seat of an automobile.

In view of the above-described circumstances, it is a primary object of the present invention to provide a light-transmitting material which may effectively be employed for the covers of the above-described lamps or those of other illuminated indicators, and which meets such requirements as those described above.

To this end, the present invention provides a light-transmitting material comprising a light-transmitting layer which transmits light and has a light color, and a light-shielding layer provided on the reverse surface of the light-transmitting layer. The light-shielding layer is composed of a light-shielding portion which transmits substantially no light and a light-transmitting portion which is defined by minute slits, a mesh with minute apertures, or the like, the apertures being provided at a predetermined density. The light-shielding portion can be given a deep color using a metal coating or an organic coating.

By virtue of the above-described arrangement, if the light-transmitting material according to the present invention is employed as an outer surface member of an illuminated indicator, when the indicator is in the OFF state, its exterior appears as a composite color which is composed of the light color of the light-transmitting layer and the color of the light-shielding layer. If, for example, the light-transmitting layer is light blue and the light-shielding portion of the light-shielding layer is blue, when the indecator is in the OFF state, the exterior assumes a deep blue color, whereas if, for example, the light-transmitting layer is light blue as in the case of the above and the light-shielding portion is red, the exterior of the indicator when in the OFF state appears to be reddish purple.

If the color of the light which is emitted from the inside of the indicator when turned on (i.e., the color of light from the light source, or the color of light from the light source when it has passed through a predetermined filter) is made different from the above-described composite color, the light passing through the light-transmitting portion of the light-shielding layer and the light-transmitting layer reaches the surface portion of the indicator without being strongly affected by the light color of the light-transmitting layer, that is, the color of light reaching the surface portion is close to the color of light emitted from the light source, so that the indicating portion is illuminated with light having a color which is

different from the color of the exterior of the indicator when in the OFF state. Accordingly, the exterior of the indicator when in the ON state assumes a color which is different from that of the indicator when in the OFF state.

Thus, appropriate selection of the above-described composite color and the color of light emitted from the light source enables the color of the exterior of the indicator when in the ON state to be completely different from that of the indicator when in the OFF state, thereby allowing the above-described object of the present invention to be accomplished.

More specifically, in the illuminated indicator employing the light-transmitting material of the present invention, the color of the exterior of the indicator when in the normal OFF state can be selected almost regardless of the color of the exterior of the indicator when in the ON state (for transmitting predetermined information to the observer). Accordingly, the indicator concerned and surrounding portions can generally be designed free from constraints. Further, a change in color of the exterior as a result of switching the indicator from the OFF state to the ON state gives a very strong impression to the observer and therefore attracts his attention to the indicator. Accordingly, the indicator is capable of exhibiting a superior information transmitting function. In particular, if the light-transmitting portion of the light-shielding layer is formed in the shape of a desired character, pattern or the like, when the indicator is turned on, a pattern of a color which is completely different from the color of the exterior suddenly appears, which effectively attracts the observer's attention. In addition, the difference between the color of the illuminated character, pattern or the like when the indicator is in the ON state and the composite color of the background thereof represents an excellent visual design feature by its use of a sharp contrast and advantageous effects. Since the light-transmitting material according to the present invention has the light-shielding layer having the above-described structure, the interior of

an illuminated indicator employing such a light-transmitting material can be made completely invisible from the outside when the indicator is in the normal state.

The above and other objects, features and advantages of the present invention will become clear from the following description of the preferred embodiments thereof taken in conjunction with the accompanying drawings.

Fig. 1 is a sectional view of an illuminated indicator employing a light-transmitting material according to the present invention;

Fig. 2 is a front view of a light-transmitting material according to one embodiment of the present invention;

Fig. 3 is a sectional side view of the light-transmitting material shown in Fig. 2;

Figs. 4 and 5 are front and sectional side views, respectively, of a light-transmitting material according to another embodiment of the present invention;

Figs. 6(a), 6(b), Figs. 7(a) and 7(b) and Figs. 8(a) and 8(b) are perspective views respectively showing different illuminated indicators which utilize the present invention, in which Figs. 6(a), 7(a) and 8(a) show the illuminated indicators in the OFF state, and Figs. 6(b), 7(b) and 8(b) show the illuminated indicators in the ON state;

Fig. 9 is an exploded perspective view schematically showing a conventional illuminated indicator having an ordinary structure;

Figs. 10, 12, 13 and 14 are chromaticity graphs respectively showing results of different tests; and

Fig. 11 is a chromaticity graph having hue names added thereto.

The present invention will be described hereinunder in detail by way of embodiments and with reference to the accompanying drawings.

Fig. 1 shows a basic arrangement of an illuminated indicator 12 such as a winker lamp, a brake lamp or an indicator in a console box provided in an automobile, the indicator 12 employing as its outer surface member or cover a light-transmitting material 10 according to a first

embodiment of the present invention.

The indicator 12 has a casing 14, a lamp 16 as a light source and a color filter 18 which is disposed on the inner side of the light-transmitting material (surface member) 10. In the case where the illuminated indicator 12 is, for example, a winker lamp, the filter 18 is defined by an orange filter which transmits only orange light.

Figs. 2 and 3 show the light-transmitting material 10 in detail. The light-transmitting material 10 consists of an outer light-transmitting layer 22 which is only slightly tinted with such light colors as blue, red or white and an inner light-shielding layer 24 which is formed on the reverse surface of the light-transmitting layer 22. The light-shielding layer 24 has a light-shielding portion 26 which is made of a metal or a non-light transmitting paint and which transmits substantially no light, and a light-transmitting portion 28 which is defined by a multiplicity of apertures which are formed in the light-shielding portion 26 at a predetermined density.

The light-transmitting layer 22 is defined by a colored sheet or film made of acrylic, polyester, polycarbonate, nylon or other synthetic resins, or colored glass. The light-transmitting layer 22 does not necessarily need to be completely transparent so long as it transmits light.

Although in the illustrated embodiment the apertures defining the light-transmitting portion 28 are formed in the light-shielding layer 24 in the form of a mesh, they may be shaped and arranged as desired. For example, the apertures may be defined by slits. The light-shielding layer 24 may be formed by any of the following various methods.

(1) A metal layer is formed on the reverse surface of the light-transmitting layer 22 by vacuum deposition or sputtering, and a mask which corresponds to the pattern of the light-shielding portion 26 of the light-shielding layer 24 is formed on the metal layer by means of pattern printing or a photoresist technique. Then, the non-masked portion is removed by etching to define the light-transmitting portion 28.

In another example of this type of method of forming the light-shielding layer 24, the reverse surface of the light-transmitting layer 22 is first colored by pattern printing, and a metal layer is then formed thereon. Thereafter, a mask is formed on the metal layer by pattern printing or a photoresist technique, and the non-masked portion is removed by etching.

(2) A non-light transmitting coating of a metal, paint or ink is formed on the reverse surface of the light-transmitting layer 22 by means of vapor deposition, sputtering, painting, printing or a combination thereof. Then, the coating is removed in accordance with the pattern of the light-transmitting portion 28 using, for example, a laser beam.

(3) A hot stamping foil having apertures defining the light-transmitting portion 28 is hot-stamped on the reverse surface of the light-transmitting layer 22 to thereby attach a coating.

(4) Pattern printing is effected on the reverse surface of the light-transmitting layer 22 using a non-light transmitting ink.

(5) A black pattern is formed on the reverse surface of the light-transmitting layer 22 utilizing a photographic developing process to define the light-shielding layer 24.

Figs. 4 and 5 show in combination a light-transmitting material 10' in accordance with a second embodiment of the present invention. As will be understood from Fig. 5, this light-transmitting material 10' consists of two plate materials 30 and 32. The plate material 30 is a light-transmitting material having a light color which is similar to the light-transmitting layer 22 in the first embodiment, and defines a light-transmitting layer 22' in the second embodiment. The second plate material 32 is defined by a light-transmitting sheet or film made of acrylic, polyester, polycarbonate, nylon or other synthetic resins, or a light-transmitting sheet of glass. A light-shielding layer 24' is formed on the obverse surface of the plate material 32 by a method similar to that employed to

form the light-shielding layer 24 in the first embodiment.

In actual use of an illuminated indicator 12 employing the above-described light-transmitting material 10 or 10' as its surface member, when the lamp 16 provided therein is in the OFF state, the exterior of the indicator 12 assumes a color representing a combination of the color of the light-transmitting layer 22 or 22' of the light-transmitting material 10 or 10' and the color of the outer surface of the light-shielding layer 24 or 24'. If, for example, the light-transmitting layer 22 or 22' is light blue and the outer surface of the light-shielding layer 24 or 24' is deep blue, the exterior of the indicator 12 when in the OFF state appears to be a deep blue. Since, in this case, the external light is prevented from entering the interior of the indicator 12 by means of the light-shielding layer 24 or 24', there is substantially no risk of the interior of the indicator 12 being seen. If the size of the apertures provided in the light-shielding layer 24 or 24' is made sufficiently small, they can hardly be seen unless special attention is given.

When the illuminated indicator 12 is turned ON, the light emitted from the lamp 16 passes through the filter 18 and is transmitted by the light-transmitting portion 28 or 28' of the light-shielding layer 24 or 24' and the light-transmitting layer 22 or 22' to the outside. Accordingly, light of a predetermined color, for example, orange light in the case of an orange filter 18, is transmitted by the light-transmitting portion 28 or 28' and the light-transmitting layer 22 or 22'. Since the light-transmitting layer 22 or 22' is only slightly tinted as described above, the color of light which is transmitted therethrough is only slightly changed; in the case, for example, of an orange filter 18, the orange light is emitted to the outside with substantially no change in color.

Figs. 6(a) and 6(b) show in combination an indicator 12 which is designed to be capable of emitting three different kinds of light by utilizing the above-described basic illuminated indicator arrangement. More specifically,

the outer light-transmitting layer made of the light-transmitting material 10 of this indicator 12 is slightly tinted black, the light-shielding layer of the material 10 is formed from a black paint, and the light-transmitting portion in the light-shielding layer is defined by three square regions which are spaced apart from each other. The lamp provided inside the indicator 12 is defined by a lamp emitting white light, and three filters, that is, orange, red and transparent filters, are provided in that order from the right-hand side as viewed in the figure in correspondence with the three light-transmitting regions, respectively. It should be noted that the transparent filter may be omitted as desired.

Accordingly, when the indicator 12 is in the OFF state (shown in Fig. 6(a)), the surface thereof assumes a deep black color, whereas when the indicator 12 is in the ON state (shown in Fig. 6(b)), orange, red and white rays of light are emitted from the three light-transmitting regions in that order from the right to the left as viewed in the figure.

Figs. 7(a) and 7(b) show in combination an illuminated indicator 12 having an arrangement similar to that of the indicator 12 shown in Figs. 6(a) and 6(b). The indicator 12 shown in Figs. 7(a) and 7(b) mainly differs from that shown in Figs. 6(a) and 6(b) in that the light-transmitting regions in the light-shielding layer are arranged in the shape of A, B and C so as to display desired patterns.

Figs. 8(a) and 8(b) show in combination still another example of an application of the present invention. The indicator 12 in this example is arranged such that the light-transmitting layer 22 of the light-transmitting material 10 is colored light blue and three light-transmitting regions provided in the light-shielding layer 24 are respectively colored green, red and blue in that order from the right to the left as viewed in the figures, so that, when the light source is in the OFF state, the light-transmitting regions appear to be blue-green, red-purple and blue, respectively, from the right to the left.

The filter of this indicator 12 is defined by a red filter. Accordingly, when the indicator 12 is turned on, the external portions which appear to be blue-green, red-purple and blue, respectively, when the device is in the OFF state are all illuminated with red light. It should be noted that in this case a lamp which emits red light may be employed in place of the white-light emitting lamp to eliminate the need to employ a red filter.

To confirm the functional effects of the present invention, the following tests were carried out.

(Test 1)

An illuminated indicator according to the present invention and a conventional illuminated indicator of this type having a structure such as that shown in Fig. 9 were tested under the following conditions.

In the indicator according to the present invention, the light-transmitting material had the structure shown in Figs. 4 and 5. The light-transmitting layer 22' was defined by a light-transmitting material colored light blue, and the light-shielding layer 24' was produced in such a manner that a metal coating was formed on the surface of the plate material 32 by means of sputtering and a pattern of a light-shielding portion was printed on the metal coating with deep blue ink to form a mask, and the metal coating was then subjected to etching to form light-transmitting portions.

The surface wall material 40 of the indicator shown in Fig. 9 was made by coating a transparent acrylic sheet with a blue paint.

The lamps 16 and 42 (emitting orange light) of both the indicators were defined by tungsten-filament lamps and the filters 18 and 44 were defined by orange filters. The results of the test are shown in Table 1 below. In Table 1, "transmittance" is the transmittance of the light-transmitting material 10' of the indicator according to the present invention and that of light transmitted by the surface wall material 40 of the indicator shown in Fig. 9, and "illuminance" means the illuminance of the transmitted light.

Table 1

Chromaticity of Color of Light from Light Source

x = 0.556, y = 0.430 (orange)

Indicator shown in Fig. 9								
Sample	Transmittance (%)	Illuminance (Lx)	Light source ON			Light source OFF		
			Chromaticity of transmitted light		External appearance	Chromaticity of exterior		External appearance
			x	y		x	y	
A	20	16	0.267	0.584	yellowish green	0.212	0.188	blue
B	16	10	0.221	0.595		0.215	0.190	
Indicator according to the present invention								
Sample	Transmittance (%)	Illuminance (Lx)	Light source ON			Light source OFF		
			Chromaticity of transmitted light		External appearance	Chromaticity of exterior		External appearance
			x	y		x	y	
A	20	116	0.513	0.460	yellow-orange	0.210	0.204	blue
B	15	89	0.517	0.459		0.210	0.204	

Note: Chromaticity is shown by the XYZ color specification system established by International Lighting Committee, and illustrated in a chromaticity diagram. Fig. 11 shows a chromaticity having hue names added thereto.

The following facts will be observed from Table 1. In the case where both the indicators have the same level of transmittance and their respective exteriors colored blue and are so designed that the interior of the indicators cannot be seen from the outside when they are in the OFF state, if these indicators are turned on, the colored light emitted from the indicator according to the present invention is much brighter than that from the indicator shown in Fig. 9 and is yellow-orange, which is close to the color of light from the light source, without being affected by the blue color of the light-transmitting layer. The term "color of light from the light source" is used herein to mean the color of light which is transmitted by the filter to pass through the light-transmitting material. The relationship between the color of light from the light source and the color of the transmitted light may be illustrated by a chromaticity diagram such as that shown in Fig. 10.

(Test 2)

In this test, the two indicators were compared with each other under conditions where the illuminance of the transmitted light was set at the same level. The filter was removed from each indicator, and a tungsten-filament lamp alone was employed for the light source.

(a) Results of the test in the case where, when the light source is in the OFF state, the chromaticity of the exterior is red are shown in Table 2 and Fig. 12. The results show that the change in the color of the transmitted light with respect to the color of light from the light source is much smaller in the indicator according to the present invention than in the indicator shown in Fig. 9.

Table 2

Chromaticity of Color of Light from Light Source

x = 0.491, y = 0.382 (orange)

Illuminance of transmitted light (LX)	Indicator shown in Fig. 9 (no filter)						
	sample	Light source ON			Light source OFF		
		Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance
		x	y		x	y	
220 | 225	A	0.688	0.302	red-orange	0.591	0.341	red-orange
273 | 276	B	0.674	0.308		0.587	0.341	
Illuminance of transmitted light (LX)	Indicator according to the present invention (no filter)						
	sample	Light source ON			Light source OFF		
		Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance
		x	y		x	y	
220 | 225	A	0.523	0.368	orange to orange-pink	0.571	0.329	red-orange
273 | 276	B	0.517	0.459		0.569	0.324	

(b) Results of the test in the case where, when the light source is in the OFF state, the chromaticity of the exterior is blue are shown in Table 3 and Fig. 13. The results show that the change in the color of the transmitted light with respect to the color of light from the light source is much smaller in the indicator according to the present invention than in the indicator shown in Fig. 9.

Table 3

Chromaticity of Color of Light from Light Source

x = 0.491, y = 0.382 (orange)

Illuminance of transmitted light (LX)	Indicator shown in Fig. 9 (no filter)							
	sample	Light source ON			Light source OFF			
		Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance	
		x	y		x	y		
135 | 137	A	0.230	0.321	achromatic color close to blue-green	0.217	0.211	blue	
226 | 228	B	0.281	0.351		0.210	0.210		
Illuminance of transmitted light (LX)	Indicator according to the present invention (no filter)							
	sample	Light source ON			Light source OFF			
		Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance	
		x	y		x	y		
135 | 137	A	0.368	0.379	achromatic color close to orangy yellow	0.180	0.153	blue	
226 | 228	B	0.391	0.401		0.181	0.143		

(Test 3)

The two indicators were compared with each other under conditions where the chromaticity of the transmitted light was set to be the same.

The filter was removed from each indicator and a tungsten-filament lamp alone was employed for the light source in the same way as in the case of Test 2. Results of the test are shown in Table 4. A chromaticity diagram corresponding to Table 4 is shown in Fig. 14. It will be understood from the results of the test that, as the chromaticity of the transmitted light in the indicator shown in Fig. 9 is made to approach the color (orange) of light from the light source, the external appearance at the time when the indicator is in the OFF state is almost transparent and has a light orange-pink color which is closer to an achromatic color and the transmittance is considerably high, i.e., 70%, which means that the interior is fully exposed to view.

Table 4

Chromaticity of Color of Light from Light Source

x = 0.491, y = 0.382 (orange)

Indicator shown in Fig. 9 (no filter)						
Trans-mittance (%)	Light source ON			Light source OFF		
	Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance
	x	y		x	y	
70	0.514	0.304	orange-pink close to orange	0.439	0.328	orange-pink close to achromatic color
Indicator according to the present Invention (no filter)						
Trans-mittance (%)	Light source ON			Light source OFF		
	Chromaticity of transmitted light		Color tone	Chromaticity of exterior		External appearance
	x	y		x	y	
13	0.523	0.368	orange-pink close to orange	0.571	0.329	red-orange close to red

As will have been understood from the above, the light-transmitting material according to the present invention permits the color of light transmitted thereby to be close to the color of light from the light source without being affected by the color of the external surface. Accordingly, this light-transmitting material is capable of meeting the requirements described in the section entitled "Background of the Invention".

Although the present invention has been described through specific terms, it should be noted here that the described embodiments are not necessarily limitative and that various changes and modifications may be imparted thereto without departing from the scope of the invention which is limited solely by the appended claims.

Claims:

1. A light-transmitting material which is used as an outer surface member of a device having a light source therein and which is illuminated with light from the light source when turned on, said material comprising:

a light-transmitting layer which transmits light and is tinted with a light shade of color; and

a light-shielding layer provided on or adjacent the reverse surface of said light-transmitting layer, said light-shielding layer being composed of a light-shielding portion which transmits substantially no light and a light-transmitting portion which is defined by minute apertures, slits or the like provided at a predetermined density,

whereby, when said light source is not turned on, the exterior of said light-transmitting material appears to be a composite color which is composed of the color of said light-shielding portion and the color of said light-transmitting layer.

2. A light-transmitting material according to Claim 1, wherein said light-transmitting portion of said light-shielding layer is defined by an organic coating of a paint, ink or the like.

3. A light-transmitting material according to Claim 1, wherein said light-shielding portion of said light-shielding layer is defined by a metal coating.

4. A light-transmitting material according to Claim 1, wherein said light-shielding portion of said light-shielding layer is defined by a combination of a metal coating and an organic coating.

5. A light-transmitting material according to Claim 4, wherein said light-transmitting layer and said light-shielding layer are formed on a single substrate.

6. A light-transmitting material according to Claim 1, wherein said light-transmitting layer and said light-shielding layer are formed on a single substrate.

7. A light-transmitting material according to Claim 2, wherein said light-transmitting layer and said light-shielding layer are formed on a single substrate.

8. A light-transmitting material according to Claim 3, wherein said light-transmitting layer and said light-shielding layer are formed on a single substrate.

9. A light-transmitting material according to Claim 4, wherein said light-transmitting layer and said light-shielding layer are respectively formed on substrates which are independent of each other.

10. A light-transmitting material according to Claim 1, wherein said light-transmitting layer and said light-shielding layer are respectively formed on substrates which are independent of each other.

11. A light-transmitting material according to Claim 2, wherein said light-transmitting layer and said light-shielding layer are respectively formed on substrates which are independent of each other.

12. A light-transmitting material according to Claim 3, wherein said light-transmitting layer and said light-shielding layer are respectively formed on substrates which are independent of each other.

Fig. 1

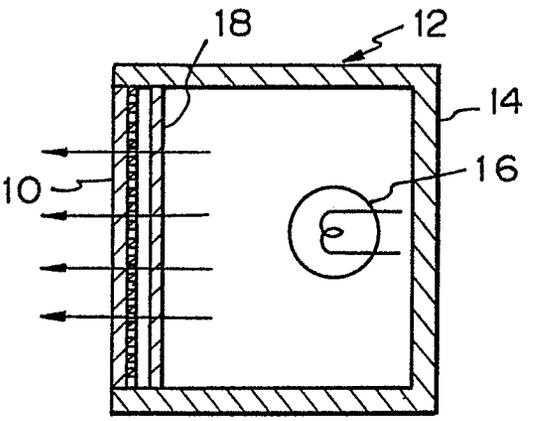


Fig. 2

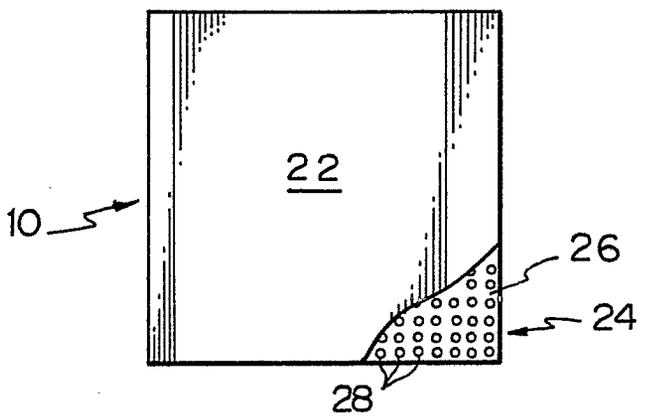


Fig. 3

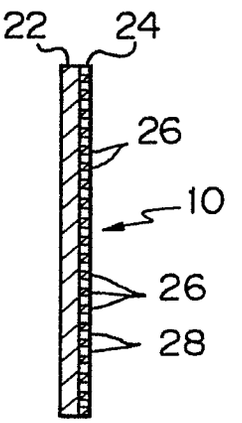


Fig. 4

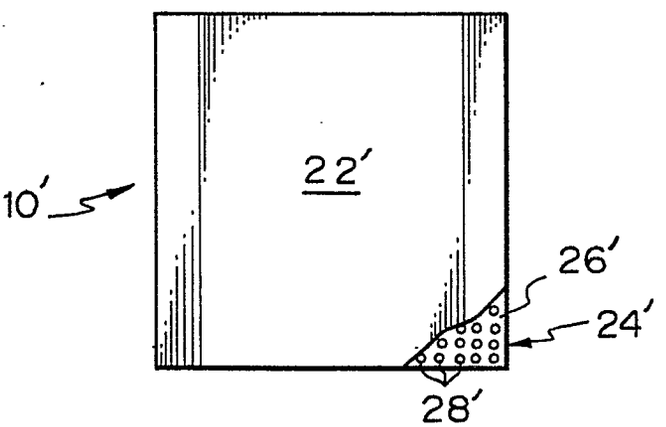


Fig. 5

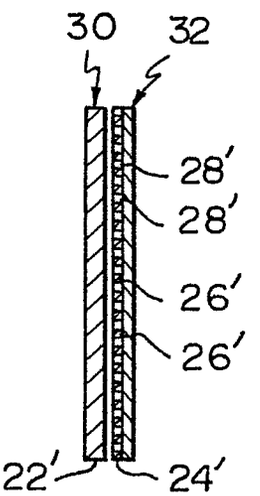


Fig. 6 (a) OFF STATE (b) ON STATE

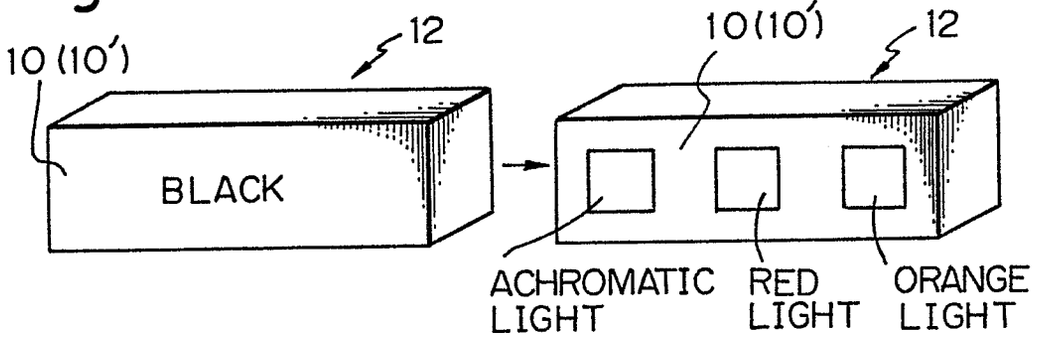


Fig. 7 (a) OFF STATE (b) ON STATE

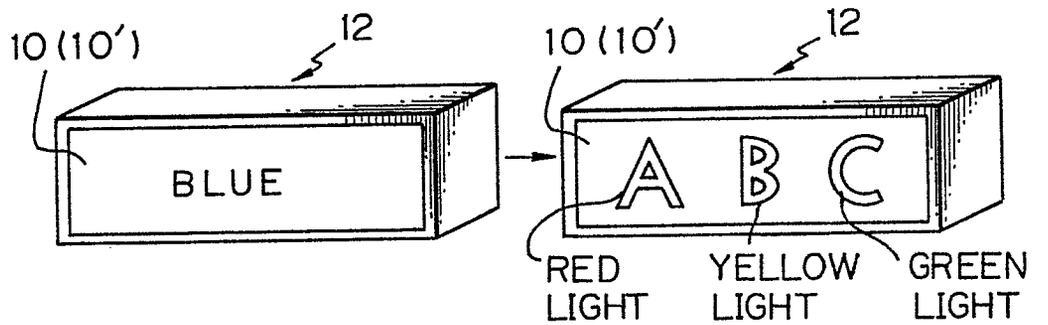
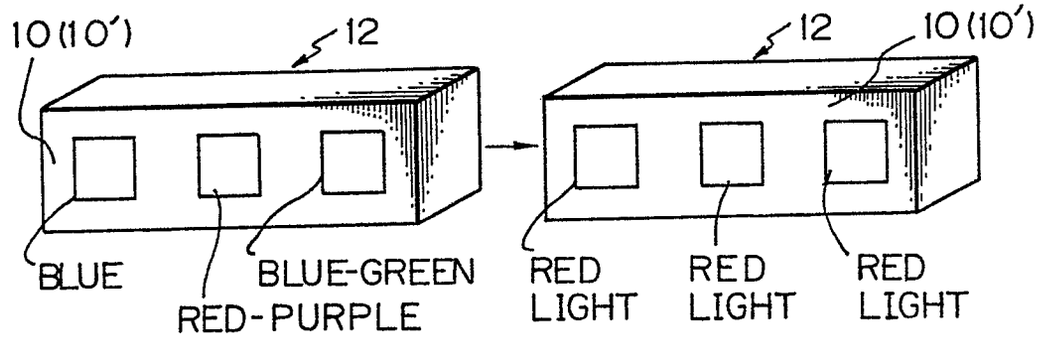


Fig. 8 (a) OFF STATE (b) ON STATE



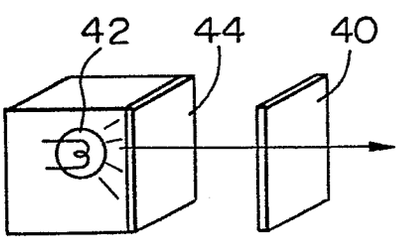


Fig. 9

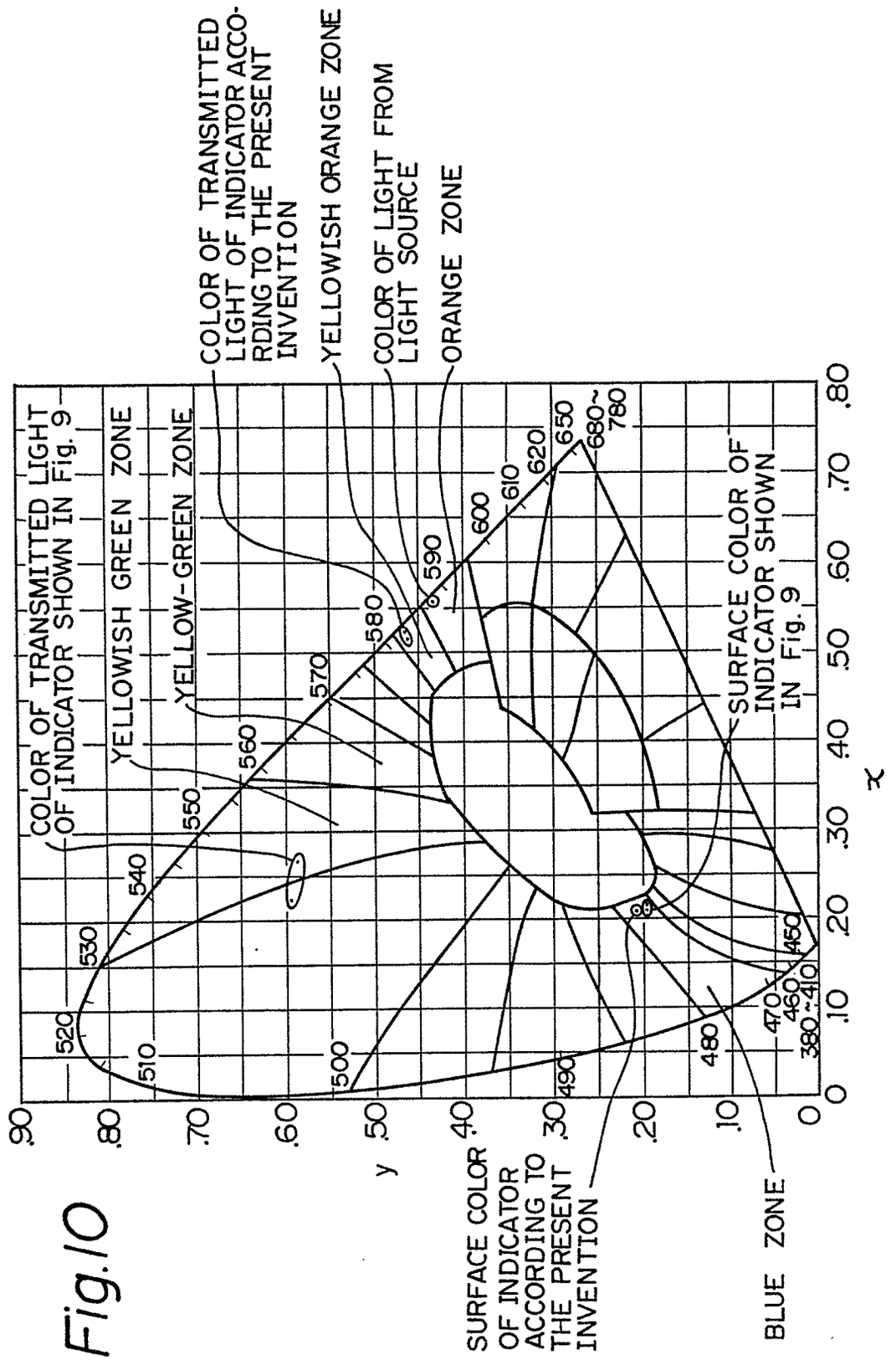

COLOR OF TRANSMITTED LIGHT OF INDICATOR SHOWN IN Fig. 9
YELLOWISH GREEN ZONE
YELLOW-GREEN ZONE
COLOR OF TRANSMITTED LIGHT OF INDICATOR ACCORDING TO THE PRESENT INVENTION
YELLOWISH ORANGE ZONE
COLOR OF LIGHT FROM LIGHT SOURCE
ORANGE ZONE
SURFACE COLOR OF INDICATOR SHOWN IN Fig. 9
SURFACE COLOR OF INDICATOR ACCORDING TO THE PRESENT INVENTION
BLUE ZONE
y
x
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
.10
.20
.30
.40
.50
.60
.70
.80
520
510
500
490
480
470
460
450
380~410
530
540
550
560
570
580
590
600
610
620
650
680~780

Fig. 10

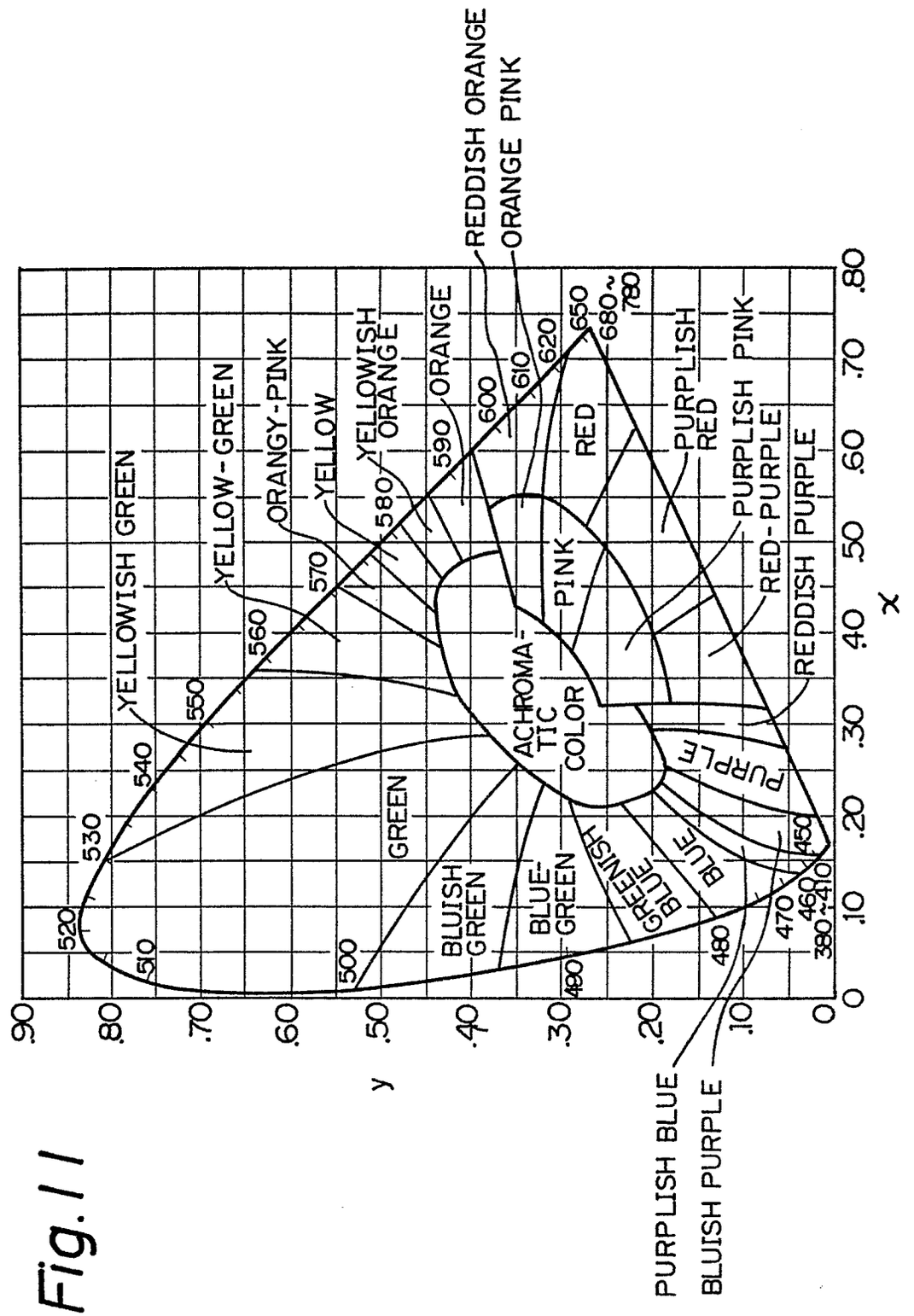

YELLOWISH GREEN
YELLOW-GREEN
ORANGY-PINK
YELLOW
YELLOWISH ORANGE
ORANGE
REDDISH ORANGE
ORANGE PINK
RED
PURPLISH RED
PURPLISH PINK
RED-PURPLE
REDDISH PURPLE
PURPLISH BLUE
BLUISH PURPLE
BLUE
GREENISH BLUE
BLUE-GREEN
BLUISH GREEN
GREEN
ACHROMATIC COLOR
PINK
PURPLE
520
530
540
550
560
570
580
590
600
610
620
650
680~780
510
500
490
480
470
460
450
380~410
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
y
x

Fig. 11

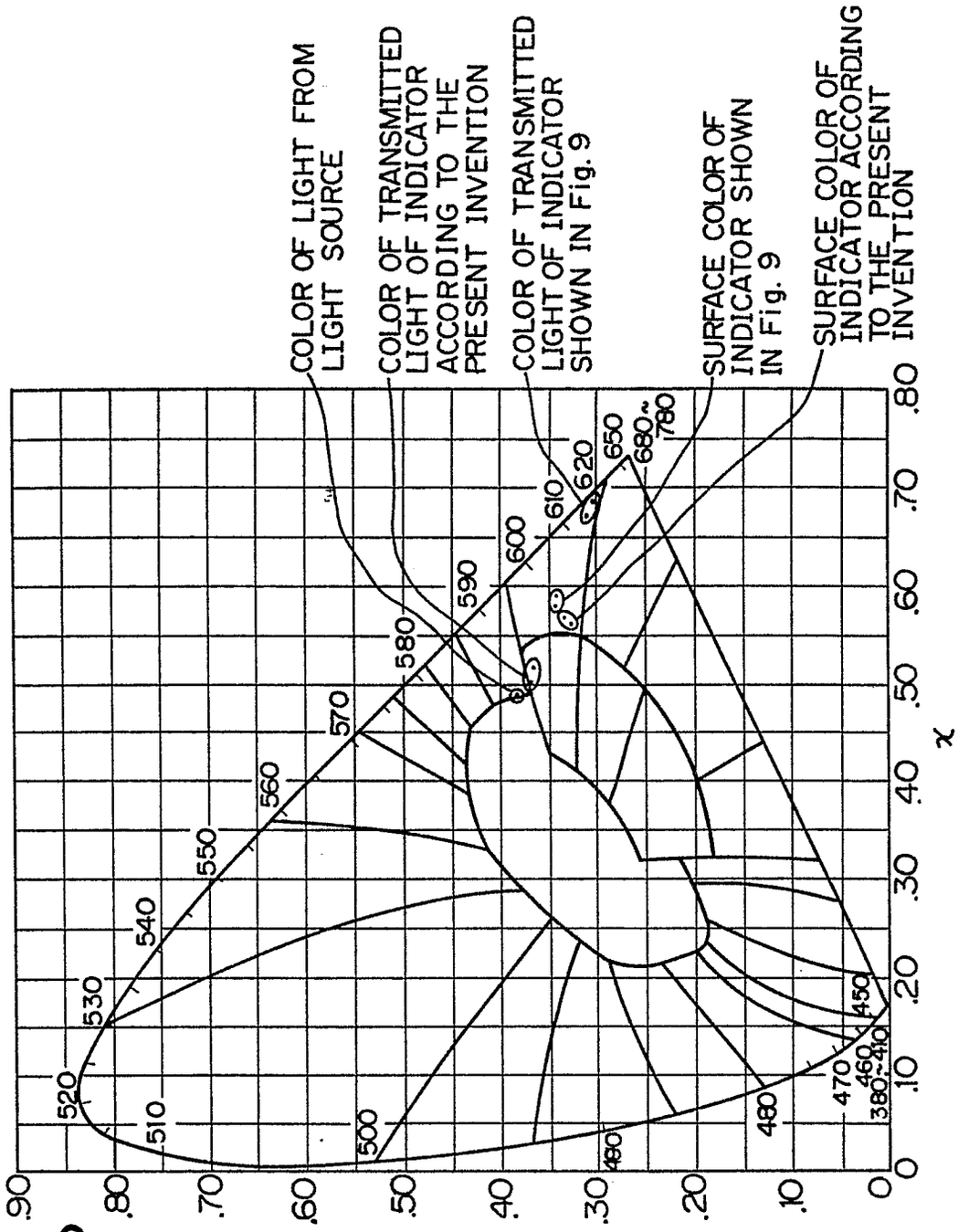

COLOR OF LIGHT FROM LIGHT SOURCE
COLOR OF TRANSMITTED LIGHT OF INDICATOR ACCORDING TO THE PRESENT INVENTION
COLOR OF TRANSMITTED LIGHT OF INDICATOR SHOWN IN Fig. 9
SURFACE COLOR OF INDICATOR SHOWN IN Fig. 9
SURFACE COLOR OF INDICATOR ACCORDING TO THE PRESENT INVENTION
520
530
540
550
560
570
580
590
600
610
620
650
680
780
510
500
490
480
470
460
450
410
380
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
y
x

Fig. 12

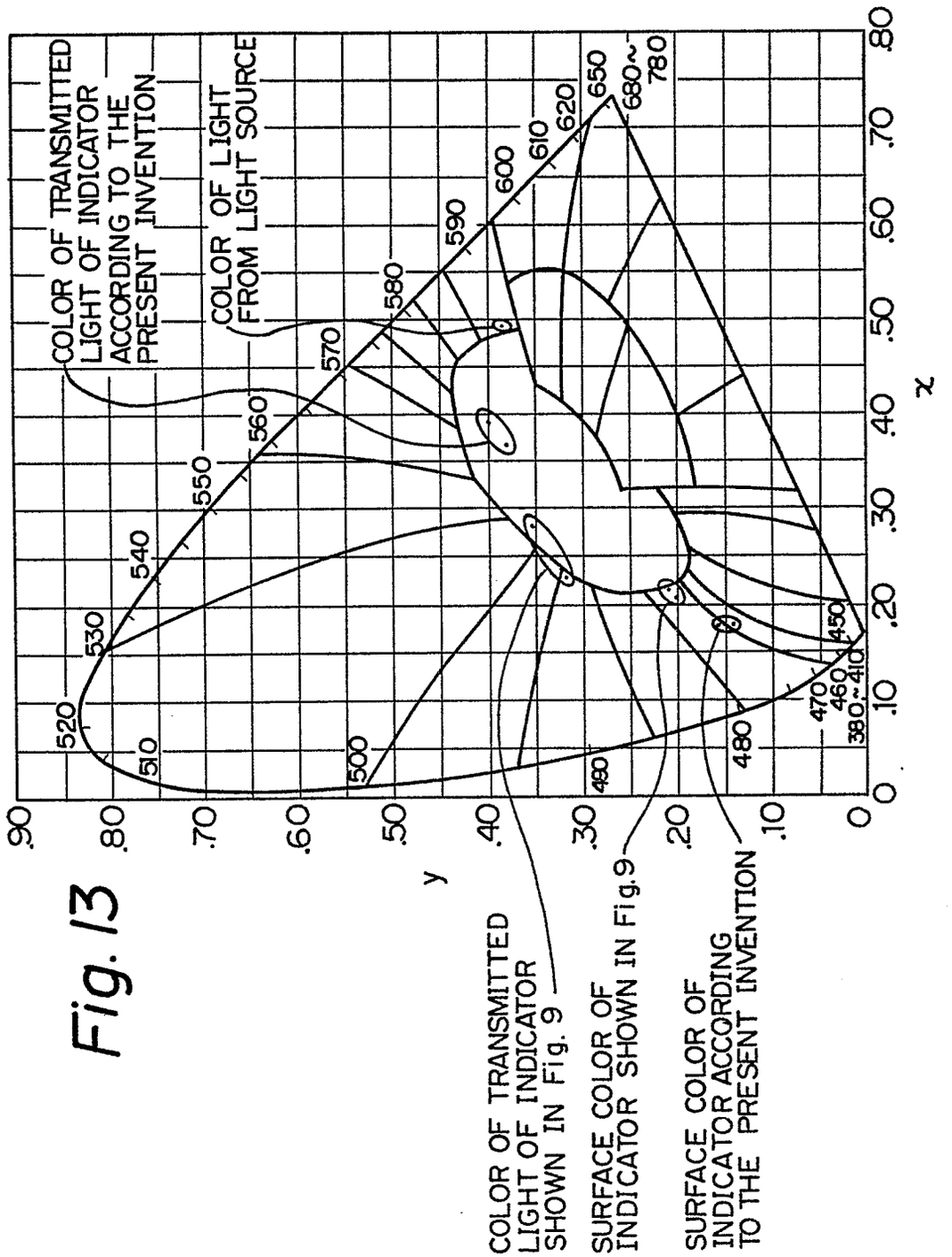

COLOR OF TRANSMITTED LIGHT OF INDICATOR ACCORDING TO THE PRESENT INVENTION
COLOR OF LIGHT FROM LIGHT SOURCE
520
510
530
540
550
560
570
580
590
600
610
620
650
680~780
500
490
480
470
460
450
380~410
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
y
x
COLOR OF TRANSMITTED LIGHT OF INDICATOR SHOWN IN Fig. 9
SURFACE COLOR OF INDICATOR SHOWN IN Fig.9
SURFACE COLOR OF INDICATOR ACCORDING TO THE PRESENT INVENTION

Fig. 13

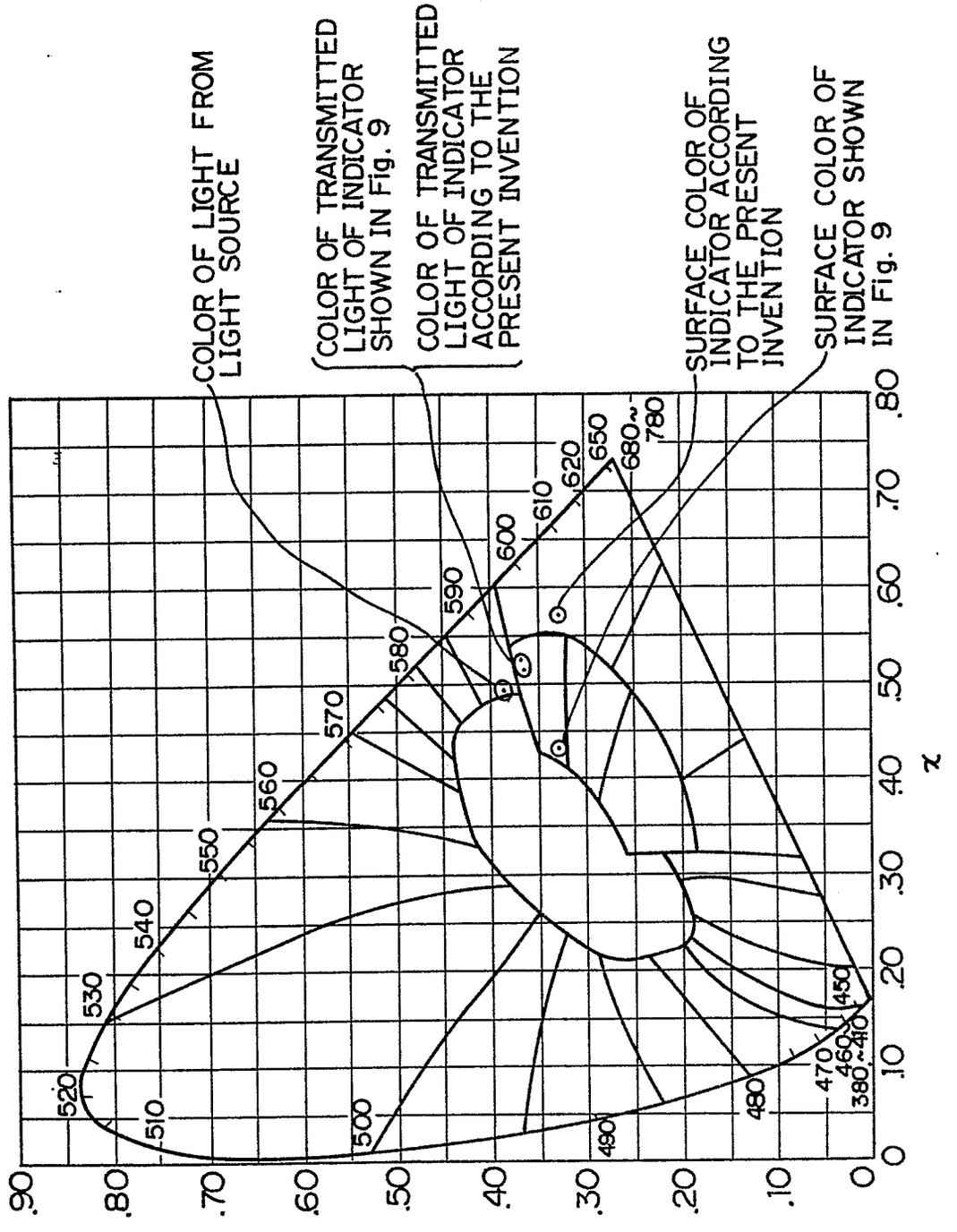

COLOR OF LIGHT FROM LIGHT SOURCE
COLOR OF TRANSMITTED LIGHT OF INDICATOR SHOWN IN Fig. 9
COLOR OF TRANSMITTED LIGHT OF INDICATOR ACCORDING TO THE PRESENT INVENTION
SURFACE COLOR OF INDICATOR ACCORDING TO THE PRESENT INVENTION
SURFACE COLOR OF INDICATOR SHOWN IN Fig. 9
520
530
540
550
560
570
580
590
600
610
620
650
680~780
510
500
490
480
470
460
450
440
380~
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
y
x

Fig. 14