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SPRUSON & FERGUSON

AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request I/We be granted a patent for the invention disclosed in the accompanying standard complete specification.

[70,71] Applicant(s)/Nominated Person(s):

Canon Kabushiki Kaisha, incorporated in Japan, of 30-2, 3-chome, Shimomaruko, Ohta-ku, Tokyo, JAPAN

[54] Invention Title:

Invisible Information Recorded Medium, Invisible Information Detecting Apparatus and Recording Agent

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Details of Basic Application(s):

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[33] Country:

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Basic Applicant(s): Canon Kabushiki Kaisha

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Canon Kabushiki Kaisha

By:


Registered Patent Attorney

IRN: 261371

INSTR CODE: 59510

S043312 180194

Australia

Patents Act 1990

NOTICE OF ENTITLEMENT

I, Giichi Marushima, Senior Managing Director
of Canon Kabushiki Kaisha, 30-2, 3-chome, Shimomaruko, Ohta-ku,
Tokyo, Japan

being authorised by the Applicant(s)/Nominated Person(s) in respect of an application entitled:
Invisible Information Recorded Medium, Invisible Information
Detecting Apparatus and Recording Agent
state the following:-

1. The Applicant(s)/Nominated Person(s) has/have, for the following reasons, gained entitlement from the actual inventor(s):- The Applicant/Nominated Person, by virtue of a Contract of Employment between the actual inventors as employees and the Applicant/Nominated Person as employer, is a person which would be entitled to have the patent assigned to it if a patent were granted on an application made by the actual inventors.

2a.* The Applicant(s)/Nominated Person(s) is/are the applicant(s) of the of the basic application(s) listed* on the Patent Request/ *in the Declaration under Article 8 of the PCT.

~~2b.* The Applicant(s)/Nominated Person(s) is/are entitled to rely on the basic application(s) listed* on the Patent Request/ *in the Declaration under Article 8 of the PCT as follows:~~

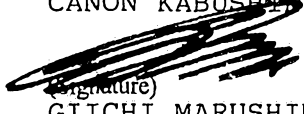
3.* The basic application(s) listed *on the Patent Request/ *in the Declaration under Article 8 of the PCT is/are the application(s) first made in a Convention Country in respect of the invention.

~~4a.* The Applicant(s)/Nominated Person(s) is/are the depositor(s) of the deposit(s) listed in the Schedule hereto.~~

~~4b.* The Applicant(s)/Nominated Person(s) has/have the consent of , of-~~

~~the depositor(s) of the deposit(s) listed in the Schedule hereto, to rely on that/those deposit(s).~~

DATED this 14 th day of January , 19 94 .
CANON KABUSHIKI KAISHA


(Signature)
GIICHI MARUSHIMA
Senior Managing Director
(Name & Title)

* Delete if not applicable.

261371

INSTR CODE 59510



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(12) PATENT ABRIDGMENT (11) Document No. AU-B-53862/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 674360

- (54) Title
INVISIBLE INFORMATION RECORDED MEDIUM, INVISIBLE INFORMATION DETECTING
APPARATUS AND RECORDING AGENT
- International Patent Classification(s)
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- (21) Application No. : 53862/94 (22) Application Date : 18.01.94
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SPRUSON & FERGUSON , GPO Box 3898, SYDNEY NSW 2001
- (56) Prior Art Documents
US 5210411
WO 92/04192
JP 3172857
- (57) Previous authenticity marks do not have the features of invisibility
and infrared absorption.

CLAIMS

4. An invisible information recorded medium, comprising:
a recording medium having different reflective characteristics at a near
infrared wavelength in different areas, wherein said medium has no information
at a visible wavelength.
21. An invisible information detecting apparatus comprising:
detection means for detecting a region having a high reflectance and a region
having a low reflectance with respect to the reflectance of a medium in the same
infrared ray region; and judging means for judging a specific original document
in accordance with the results of detection performed by said detection means.
22. An invisible information detecting apparatus, substantially as
hereinbefore described with reference to the accompanying drawings.
23. A recording agent comprising toner particles containing a resin
and a coloring material, wherein said coloring material is near infrared ray

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absorbing coloring material or pigment free from absorption in a visible region
and absorbed in the near infrared ray region.

- 1 -

1 Invisible Information Recorded Medium,
Invisible Information Detecting Apparatus
And Recording Agent

5 BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an invisible
information recorded medium on which invisible
information has been recorded, a detecting apparatus
10 for detecting the invisible information and a
recording agent for recording the invisible infor-
mation.

Related Background Art

(1) Hitherto, the trend of improving the
15 performance of copying machines arises a risk of
forgery of bills, securities and notes and the like.
Therefore, there arises a necessity of judging
whether or not forgery of the bill or the like has
been performed. Further, the forgery of the bills
20 must be previously detected and prevented. In order
to prevent the forgery, there have suggested a marking
method using a ultraviolet ray exciting fluorescent
pigment, a method using a diffraction phenomenon such
as hologram, a method of applying a magnetic substance
25 to be detected by a magnetic head, a method using
color change occurring due to photochromism and a
method of discriminating a specific image, such as a

1 bill, by image recognition.

(2) With the improvement in the performance of the copying machine and so forth, copying of various information items can easily be performed.

5 On the other hand, privacy guarding and trade secret confidence have been considered important, causing a problem to arise in that copying can easily be performed.

Hitherto, the foregoing copying has been
10 prevented by bonding a special film to the document or the like to cause the copied image to be deteriorated or to cause the forgery to be informed.

(3) A method has been known which is arranged in such a manner that an image is formed on the
15 surface of a photoconductive material by an electrostatic method and then the image is developed. As disclosed in U.S. Patent No. 2,297,691 filed by C.F. Curlson, the basic electrophotographic method comprises the steps of uniformly loading static
20 electricity onto a photoconductive insulating layer, exposing the layer to a light and dark image to delete the electric charge of the region exposed to light, and allowing fine substance called a toner to adhere to an electrostatic latent image thus-obtained so that
25 the foregoing electrostatic latent image is developed.

The toner is usually attracted to a region of a layer in which the charge is left, causing a toner

1 image corresponding to the electrostatic latent image
to be formed.

Then, the thus-formed powder image can be
transferred onto the surface of a supporting member,
5 such as paper. The transferred image can perma-
nently be secured onto the surface of the supporting
member with, for example, heat.

In place of forming the latent image by
uniformly charging the layer of the photoconductive
10 layer and by exposing the layer to the light and dark
image, the latent image may be formed by directly
charging the layer in the form of the image.

If the process of transferring the powder
image is intended to be omitted, the powder image
15 may be secured to the photoconductive layer. Another
method may be employed in which an adequate fixing
means, such as solvent treatment or outer layer
coating process, is employed in place of the heat
fixing process.

20 There have been some known methods of using
toner particles as the electrostatic latent image to
be developed. One of the developing methods has been
disclosed in U.S. Patent No. 2,618,552 filed by E.N.
Wise which is a cascade development method.

25 The cascade development method comprises the
steps of carrying a developer composed of relatively
large carrier particles having fine tone particles

1 electrostatically coated on the carrier to the surface
of electrostatic latent image carrying surface as to
be rolled or cascaded.

The composition of the carrier particles is
5 so selected that the toner particles are charged in
a frictional charge manner to a desired polarity.

When the mixture is cascaded or rolled while
exceeding the development carrying surface, the toner
particles are allowed to electrostatically adhere and
10 secure to the charged portion of the dissolved image
but the same does not adhere to the portion, in which
the image is not charged, that is, the base portion.

The toner particles accidentally allowed to
adhere to the base portion are substantially removed
15 with the rolling carrier due to a fact that the
electrostatic attractive force between the toner
and the carrier is larger than that between the toner
and the non-charged base portion.

The carrier and the excess toner are then
20 recirculated. The foregoing method is significantly
effective to develop a linear copied image.

Another method for developing the electro-
static image is a magnetic brush method as disclosed
in, for example, U.S. Patent No. 2,874,063. The
25 foregoing method comprises the step of carrying a
developing substance containing a toner and magnetic
carrier particles with a magnet. The magnetic field

1 of the magnet arranges the magnetic carrier to be
formed into a brush-like shape. The magnetic brush
comes in contact with the surface of the electrostatic
image carrying surface, causing the toner particles to
5 be attracted from the brush to the latent image with
the electrostatic attractive force.

Another method capable of developing the
electrostatic latent image is a powder cloud method
as disclosed in, for example, U.S. Patent No.
10 2,221,776 filed by C.F. Curlson. The foregoing
method comprises the step of allowing to pass a
developing substance containing electrically charged
toner particles in a gaseous fluid through a
position adjacent to the surface carrying the
15 electrostatic latent image. The toner particles are
attracted from the gas to the latent image by the
electrostatic attractive force. The foregoing method
is significantly effective to develop an image in
which light portions and dark portions are distributed
20 continuously.

A touch-down method disclosed in U.S. Patent
No. 3,166,432 filed by R.W. Gundraha may be employed
if necessary.

Among the foregoing available methods, the
25 magnetic brush method has been widely used.

Although the foregoing methods are used to
make a black and white copied product, they are able

1 to form an image in another color or an image formed
by combining colors.

Similarly to another coloring method, an
electrophotographic coloring method is usually based
5 on a color-additive or subtractive color formation
type synthesis of three colors. That is, if the
electrophotographic method is performed in a full
color manner, three or more color toners, that is,
developing particles must be used to synthesize any
10 desired color.

In order to color-copy a full-color original,
three or more color decomposed images are mutually
matched and combined with one another. In the color
electrophotography, three or more electrostatic
15 images are, as described above, generated by exposing
a photosensitive member to an optical color decomposed
image as disclosed in, for example, U.S. Patent No.
2,962,374.

The electrostatic latent images respectively
20 are developed by different color toners, and then the
three-type toner images are combined with each other
so that a final image is formed. The combination
of the three color toner images are usually formed
on a copying sheet, such as paper, and the toner image
25 is permanently fixed on the sheet.

The most ordinary method for fixing the toner
images on a paper copying sheet is a method comprising

- 1 the steps of using a resin toner containing a coloring agent and fusing the toner image onto the copying sheet with heat.

The image may be fixed by another method, for
5 example, it is exposed to molten vapor. With the progress of the copying method, information confidence becomes an important fact.

Forgery copying has been prevented by a method comprising the step of bonding a special film to the
10 document or the like to deteriorate the quality of the copied image or a method of clearing the forgery copying.

(1) However, the method using the ultraviolet rays exciting fluorescent pigment encounters a problem in
15 that a countermeasure can be taken because the fluorescent pigment can easily be detected by an ultraviolet irradiation means, such as a black lamp. Further, the necessity of using a ultraviolet ray source in the apparatus makes the optical system to
20 be complicated. The method using the diffraction phenomenon, such as hologram, encounters a problem in that the formation of the mark on the bill or the like raises the cost. The method of applying the magnetic substance arises a necessity of bringing the bill or
25 the like into contact with the magnetic head in a hermetical manner, causing a problem to arise in that the structure to be complicated. The method using

1 photochromism suffers from instability of the photo-
chromism compound. The method based on the image
recognition requires a large quantity of data to
recognize all bills and securities and so forth,
5 causing a heavy load to be burden by the apparatus
and the cost to be enlarged.

Another method using near infrared fluo-
rescent has been disclosed to overcome the foregoing
problems, so that a long life light emitting diode is
10 enabled to be used, and therefore an influence of
contamination can be prevented satisfactorily.

If the near infrared ray absorbing film or the
like is used between the detecting apparatus and the
original document, there arises a problem in that the
15 detection cannot easily be performed. The necessity
of individually using a light emitting diode and a
photodiode sensitive to long wavelength causes the
structure of the apparatus to be complicated.

(2) However, each of the foregoing conventional
20 methods has been structured to correspond to analog
copying machines. Therefore, it has been difficult to
prevent the forgery copying and reading in a copying
machine or a printer comprising a reading unit using
a CCD or the like.

25 Therefore, it is preferable that the detection
apparatus identifies that the recorded medium is the
copy and read inhibited medium to stop the operation.

Each of the foregoing identifying marks has a problem.

(3) However, each of the foregoing conventional methods has been structured to correspond to analog copying machines. Therefore, it is unsatisfactory to realize secret confidence with a copying machine or a printer comprising a reading unit using a CCD or the like. The fact that the easy recognition arises a problem in that an effective secret confidence method has not been realized against reproduction writing and photography.

SUMMARY OF THE INVENTION

It is an object of the present invention to ameliorate one or more of the abovementioned problems.

According to one aspect of the invention there is disclosed an invisible information recorded medium comprising an identification mark recorded thereon, said identification mark being composed of a region having a high reflectance and a region having a low reflectance in the same near infrared wavelength as compared with the reflectance of said medium.

According to another aspect of the invention there is disclosed an invisible information recorded medium, comprising:

a recording medium having different reflective characteristics at a near infrared wavelength in different areas, wherein said medium has no information at a visible wavelength.

According to a still further aspect of the invention there is disclosed an invisible information recorded medium comprising a recording medium having



an identification mark recorded thereon, said identification mark being composed of a first region and a second region, wherein

said first region has a higher reflectance than a reflectance of said medium at a near infrared wavelength,

5 said second region has a lower reflectance than the reflectance of said medium at said near infrared wavelength, and

said first region and said second region do not overlap each other,

wherein the reflectance of said medium is represented by a reflectance on a portion at which the identification mark is not recorded.

10 According to a still further aspect of the invention there is disclosed an invisible information detecting apparatus comprising: detection means for detecting a region having a high reflectance and a region having a low reflectance with respect to the reflectance of a medium in the same infrared ray region; and judging means for judging a specific original document in
15 accordance with the results of detection performed by said detection means.

According to a still further aspect of the invention there is disclosed a recording agent comprising toner particles containing a resin and a coloring material, wherein said coloring material is near infrared ray absorbing coloring material or pigment free from absorption in a visible region and absorbed in the
20 near infrared ray region.



BRIEF DESCRIPTION OF THE DRAWING

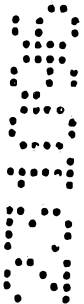
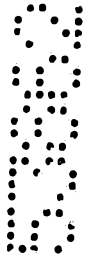
Figs. 1A and 1B are structural views which illustrate a specific original document identification pattern according to a first embodiment of the present invention;

5 Fig. 2 is a structural view which illustrates a color copying apparatus employing the structure according to the present invention;

Fig. 3 is a structural view which illustrates a specific original document identification pattern according to a fourth embodiment of the present invention;

10 Fig. 4 is a 2D-area signal generating portion for detecting the specific pattern according to the first embodiment of the present invention;

Fig. 5 illustrates a reference pixel for detecting the specific pattern according to the first



1 embodiment of the present invention;

Fig. 6 is a structural view which illustrates a specific pattern judgment portion according to the first embodiment of the present invention;

5 Figs. 7A and 7B are structural views which illustrate a CCD according to the first embodiment of the present invention;

Fig. 8 illustrates a spectrum reflectance of a standard white plate;

10 Fig. 9 illustrates a spectrum transmission ratio of a specific pattern;

Fig. 10 are graphs which illustrate spectral sensitivity characteristics of a visible line sensor and characteristics of a filter for an infrared ray reading sensor according to this embodiment;

Fig. 11 illustrates characteristics of a dichroic filter for cutting infrared rays;

Fig. 12 illustrates characteristics of a filter for cutting far infrared rays;

20 Fig. 13 is a view which illustrates a state where an infrared ray cutting glass is fastened to a CCD sensor;

Fig. 14 is a view which illustrates a fastened cover glass in a case where the glass for cutting infrared rays is disposed on the cover glass of the CCD;

Fig. 15 is comprised of Figs. 15A and 15B

1 illustrate an image signal control portion;

Fig. 16 is a timing chart of an image control signal;

Fig. 17 is a flow chart for control performed
5 by a CPU;

Figs. 18A and 18B are structural views which illustrate an image reading apparatus according to a second embodiment of the present invention;

Figs. 19A and 19B are structural views which
10 illustrate an image reading apparatus according to a third embodiment of the present invention;

Figs. 20A and 20B illustrate absorption spectrum and fluorescent spectrum of an ink (fluorescent coloring material) for use in a high
15 reflectance portion of the specific pattern;

Fig. 21 illustrates reflection spectrum of a medium having the identification pattern recorded thereon;

Fig. 22 illustrates reflection spectrum of an
20 image recorded with the toner according to the present invention; and

Fig. 23 illustrates a transmission spectrum of a filter for the CCD for use to reproduce information recorded with the toner according to the present
25 invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

1 First Embodiment

This embodiment is arranged in such a manner that an invisible information recorded medium having an identification mark, which is composed of a region
5 having a relatively high reflectance as compared with the reflectance of a medium at the same near infrared wavelength and a region having a low reflectance, and an apparatus for detecting the medium are used to assuredly judge a specific original document with a
10 low cost.

Further, the specific original document can be judged while preventing an erroneous recognition in a case where a judgment prevention is performed while using an infrared ray absorption film or an infrared
15 reflective film.

Preferred embodiments of the present invention will now be described.

The operation of recording the region will now be described which has a higher reflectance as
20 compared with the reflectance of a medium and arranged to be used to record an identification mark having invisible information recorded for recognizing bills, securities and notes and the like (copy inhibited original documents which are subjects of the forgery
25 inhibition) and inhibiting copying of them. Fluorescent coloring material or pigment is dissolved or dispersed in a binder so that a predetermined

1 pattern is formed on the copy inhibition original
document by printing or the like. The fluorescent
coloring material or pigment may be a material having
the fluorescent wavelength peak in a range of 700 nm
5 or longer, preferably 750 nm or longer. Since the
material having the fluorescent wavelength peak in
a range of 700 nm or shorter can be visually detected,
the secrecy cannot satisfactorily be maintained. If
a material having the fluorescent wavelength peak in a
10 range of 1100 nm or longer is used, sensitivity of a
Si-type photo-detection device, such as a CCD,
deteriorates. In this case, the identification mark
cannot accurately be judged. It is further preferable
to employ a fluorescent coloring material or pigment
15 having the fluorescent wavelength peak in a range of
1000 nm or shorter. Since the near infrared
fluorescent rays can be detected when they are
separated from exciting rays, it is preferable that
the two types of the rays have wavelengths which are
20 considerably different from each other. Therefore,
near infrared fluorescent coloring material or
pigment and exciting rays are selected such that they
are different from each other by 50 nm or more,
preferably 100 nm or more. The exciting wavelength is
25 selected depending upon the type of the light source
and the spectral filter.

The near infrared fluorescent coloring

1 material may be a xanthene, oxazine, thiazine, poly-
methine or stryl compound. As an inorganic compound,
a solid laser material of a type containing a rare
earth element is used.

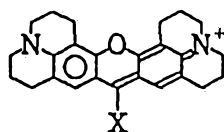
5 More specifically, any one of the following
near infrared fluorescent coloring material may be
used. However, a material may be used regardless of
the exemplified materials if it has fluorescent rays
in the near infrared ray region and exhibits excellent
10 fluorescent quantum yield, weather and light
resistance.

Compounds (1) to (61)

The binder resin for use in the foregoing near
infrared fluorescent coloring material or pigment
15 may be a urea resin, melamine resin, alkyd resin,
acryl resin, vinyl chloride resin, aromatic
sulfonamide resin, or a benzoquanamine resin or their
copolymer. By using a ultraviolet absorber or an
anti-oxidant with the foregoing resin, the light
20 resistance of the resin can be improved. The binder
resin can be manufactured by a block resin crushing
method, emulsification polymerizing method or a resin
precipitation method or the like.

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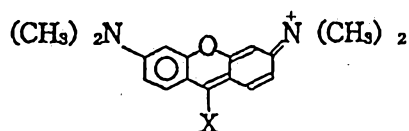
1 (1)



X = CN λ abs 680nm

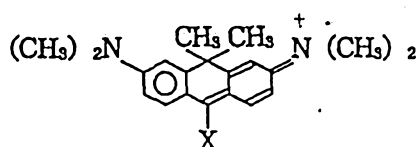
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X = CN λ abs 650nm

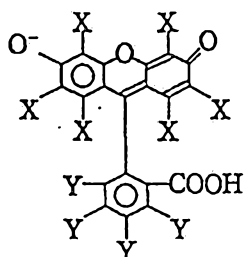
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X = CN λ abs 710nm

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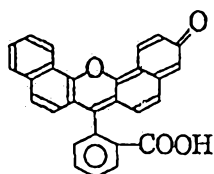
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X = I Y = Cl Rose Bengal

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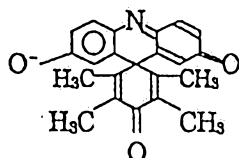
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Naphthalofluorescein 126

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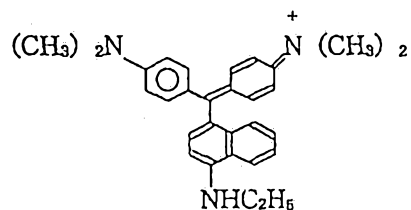
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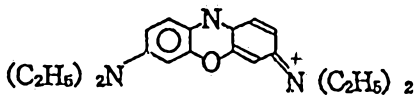
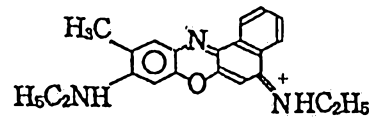
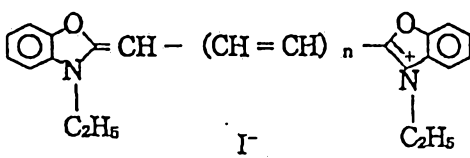
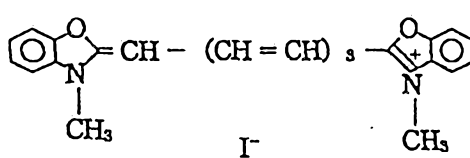
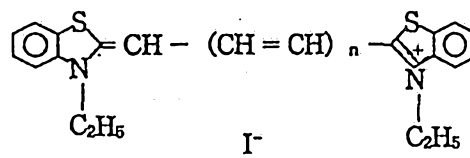
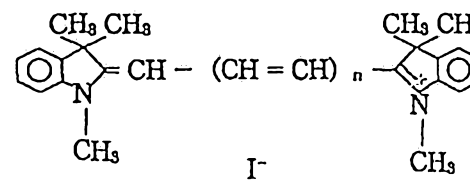
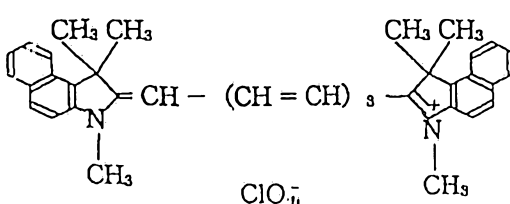
Carbazine 122

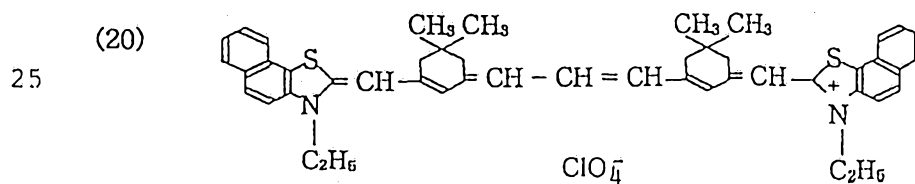
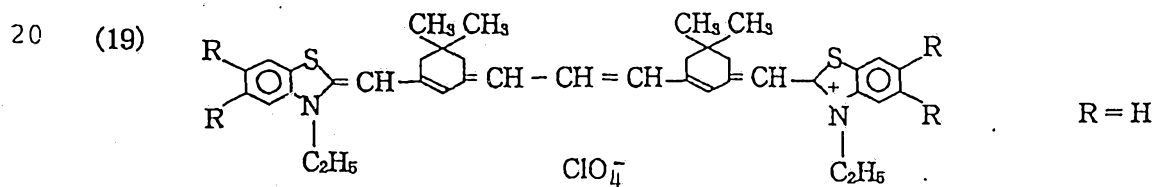
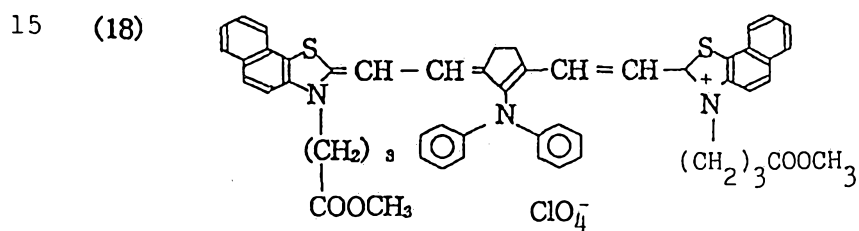
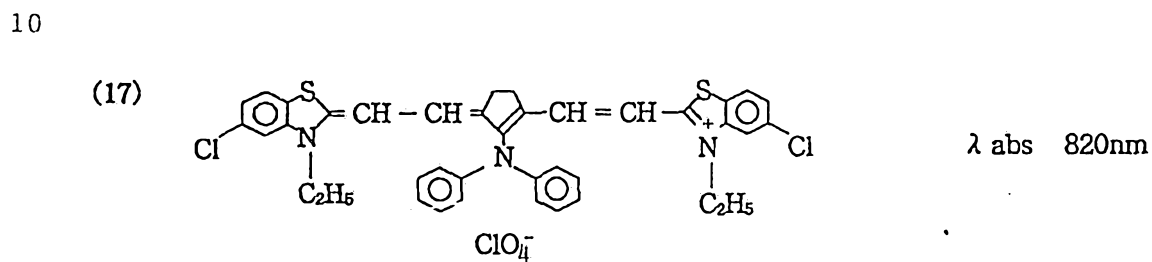
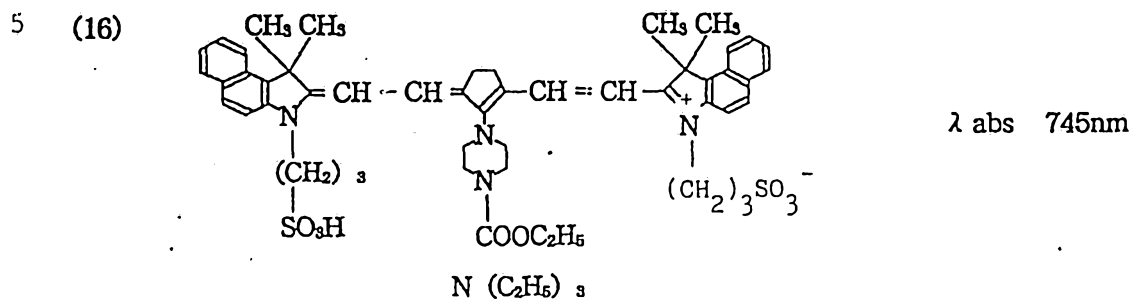
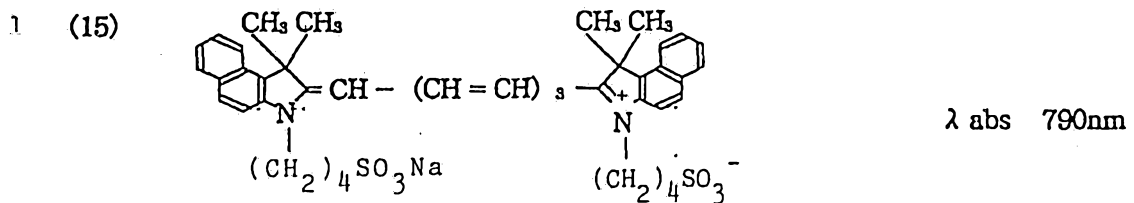
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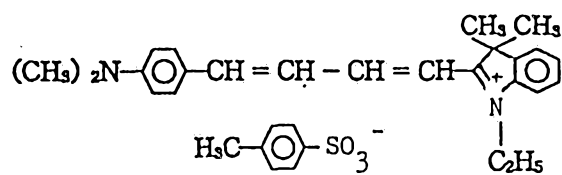


Victoria Blue R

- 1 (8)  λ abs 650nm
- 5 (9)  λ abs 620nm
- 10 (10)  $n = 3$ λ abs 690nm
- 10 (11)  λ abs 680nm
- 15 (12)  $n = 2$ λ abs 650nm
 $n = 3$ λ abs 760nm
- 20 (13)  λ abs 740nm
- 25 (14)  λ abs 780nm

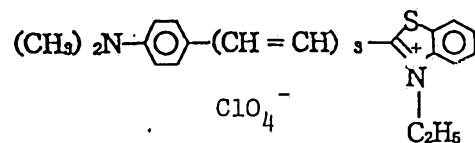


1 (21)



λ abs 620nm

5 (22)



λ abs 580nm

(23) $\text{NdP}_5\text{O}_{14}$

(24) $\text{LiNdP}_4\text{O}_{12}$

10

(25) $\text{Na}_5\text{Nd}(\text{WO}_4)_4$

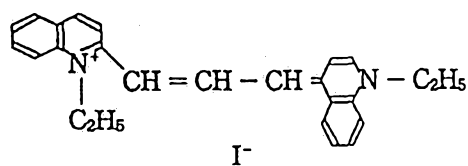
(26) $\text{Al}_3\text{Nd}(\text{BO}_3)_4$

(27) $\text{Cs}_2\text{NaNdCl}_6$

15

(28) $\text{Li}(\text{Nd}_{0.9}\text{Yb}_{0.1})\text{P}_4\text{O}_{12}$

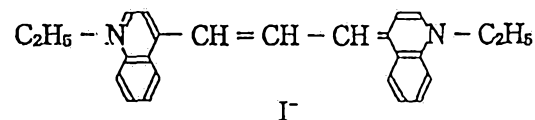
(29)



λ abs 655nm

20

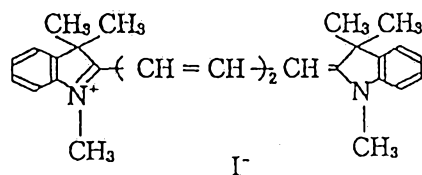
(30)



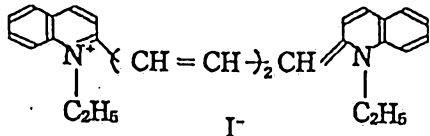
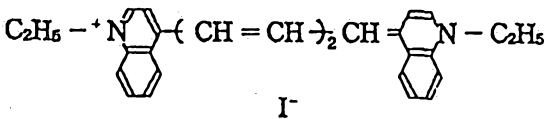
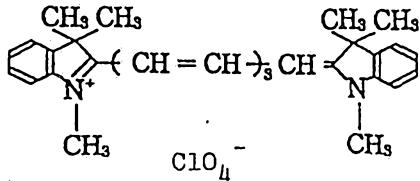
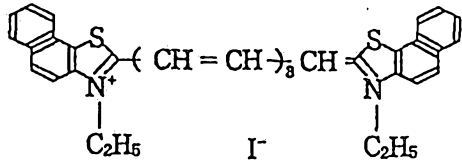
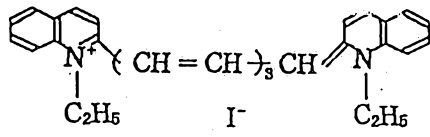
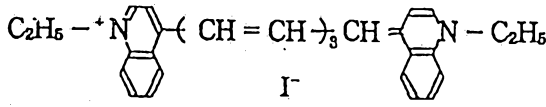
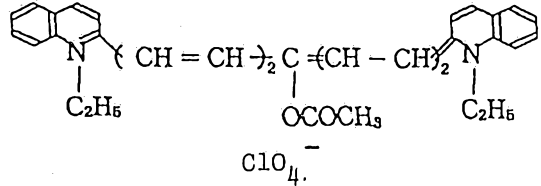
λ abs 700nm

25

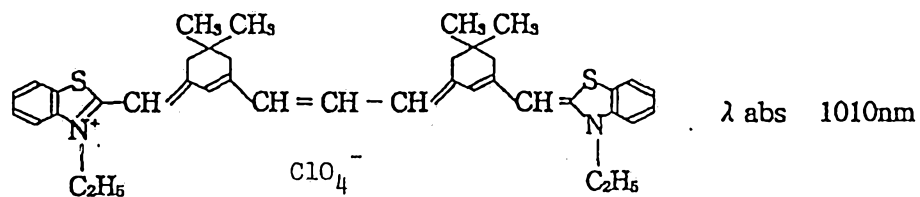
(31)



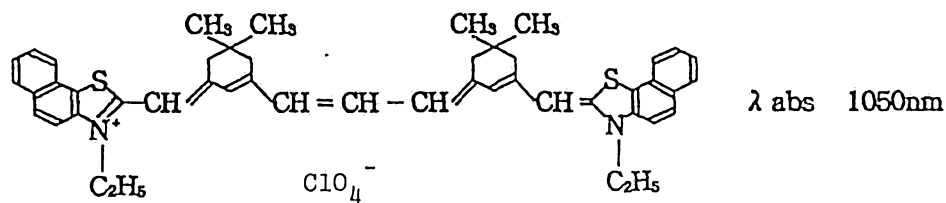
λ abs 640nm

- 1 (32)  λ abs 705nm
- 5 (33)  λ abs 810nm
- 10 (34)  λ abs 740nm
- 15 (35)  λ abs 790nm
- 20 (36)  λ abs 820nm
- 25 (37)  λ abs 930nm
- (38)  λ abs 930nm

1 (39)

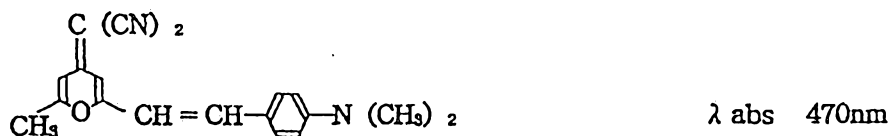


5 (40)

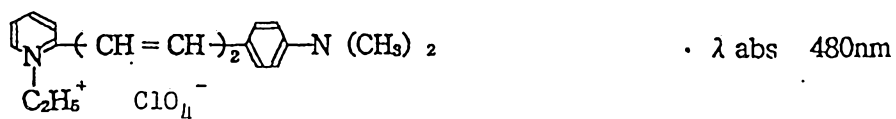


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(41)

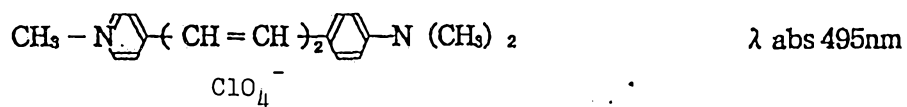


(42)

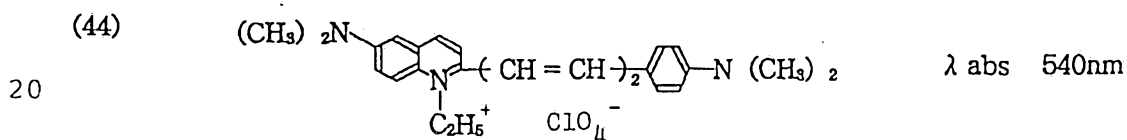


15

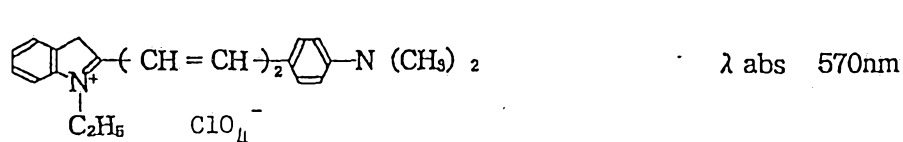
(43)



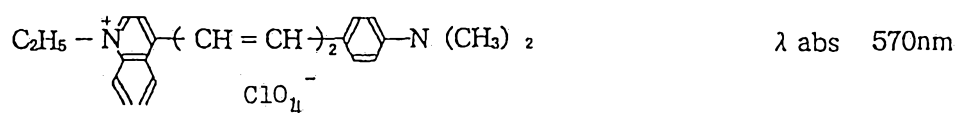
(44)

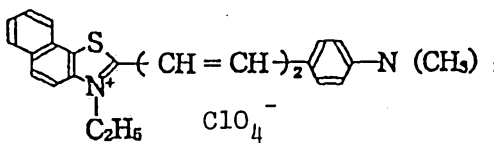
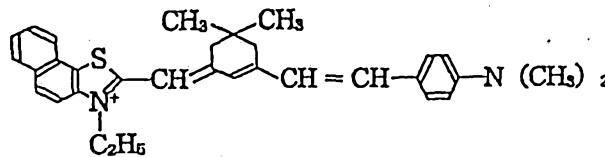
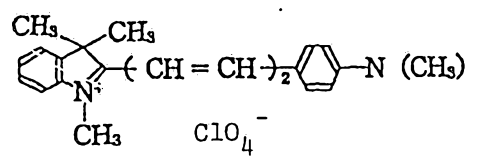
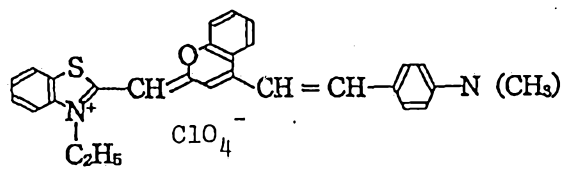
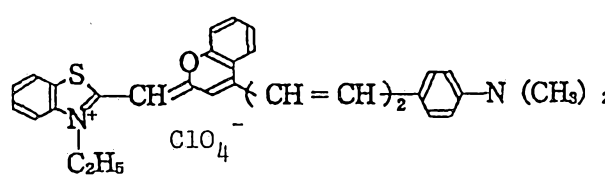
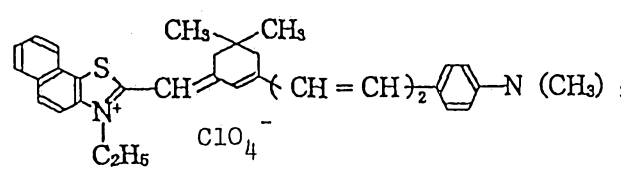
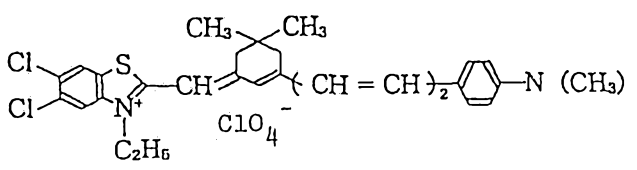


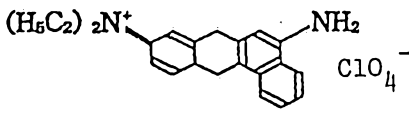
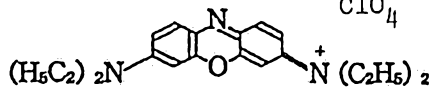
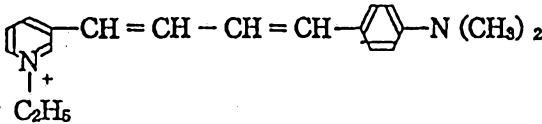
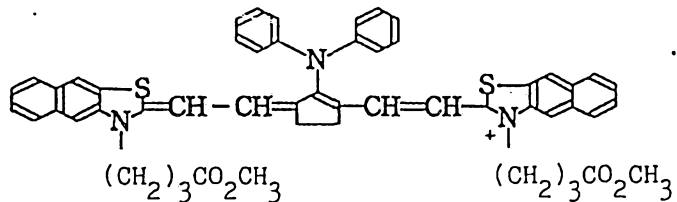
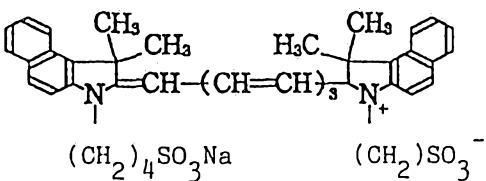
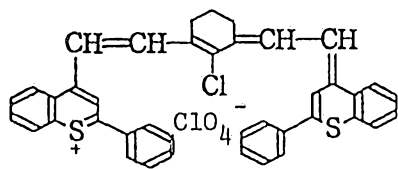
(45)



25 (46)



- 1 (47)  λ abs 570nm
- 5 (48)  λ abs 580nm
- 10 (49)  λ abs 610nm
- (50)  λ abs 600nm
- 15 (51)  λ abs 610nm
- 20 (52)  λ abs 580nm
- 25 (53)  λ abs 615nm

- 1 (54)  ClO_4^- λ abs 630nm
- 5 (55)  ClO_4^- λ abs 645nm
- (56)  λ abs 480nm
- 10 (57)  λ abs 830nm
- 15 (58)  λ abs 795nm
- (59)  λ abs 1080nm
- 20 (60) Nichia Chemical Industry NP-870 λ abs 250nm
- 25 (61) $\text{LiAlO}_2 : \text{Fe}^{3+}$ λ abs 250nm

1 The material of a type in which the near
infrared fluorescent coloring material is dispersed
or mixed in the binder may be used while being
combined with a usual coloring material or pigment.
5 It is preferable that the usual coloring material or
pigment to be used while being combined do not absorb
the exciting wavelength for the near infrared
fluorescent coloring material. If the exciting
wavelength for the near infrared fluorescent coloring
10 material or pigment is not included in the visible ray
region, covering with the usual coloring material or
pigment or white pigment is able to improve the
confidentiality of the copy prevention function.

 The region which has a higher reflectance as
15 compared with the reflectance of the medium and
arranged to be used to record an identification mark
having invisible information recorded for recognizing
bills, securities and notes and the like (copy
inhibited original documents which are subjects of
20 the forgery inhibition) and inhibiting copying of them
is formed by dissolving or dispersing the color
material or pigment which is absorbed in the infrared
ray region and by printing a predetermined pattern
in the copy-inhibited original document.

25 The near infrared fluorescent coloring
material or pigment can be a material having the
absorption wavelength peak in a region of 700 nm or

1 longer, preferably 750 nm or longer. Since the
material having the fluorescent wavelength peak in a
range of 700 nm or shorter can be visually detected,
the secrecy cannot satisfactorily be maintained. If
5 a material having the fluorescent wavelength peak in a
range of 1100 nm or longer is used, sensitivity of a
Si-type photo-detection device, such as a CCD,
deteriorates. In this case, the identification mark
cannot accurately be judged. It is further preferable
10 to employ a fluorescent coloring material or pigment
having the fluorescent wavelength peak in a range of
1000 nm or shorter. The material of a type in which
the near infrared fluorescent coloring material is
dispersed or mixed in the binder may be used while
15 being combined with a usual coloring material or
pigment. It is preferable that the near infrared
fluorescent coloring material do not absorb the
exciting wavelength for the near infrared fluorescent
coloring material. The inhibition of the absorption
20 of visible rays enables covering and improves the
confidentiality of the copy inhibition function.

Specifically, the near infrared fluorescent
coloring material or pigment that can be used is as
follows. However, a material which can be absorbed
25 in the infrared region, which has a large absorption
coefficient and which exhibits excellent weather and
light resistance.

1 Compounds (62) to (126)

The binder resin for use in the foregoing
near infrared fluorescent coloring material or

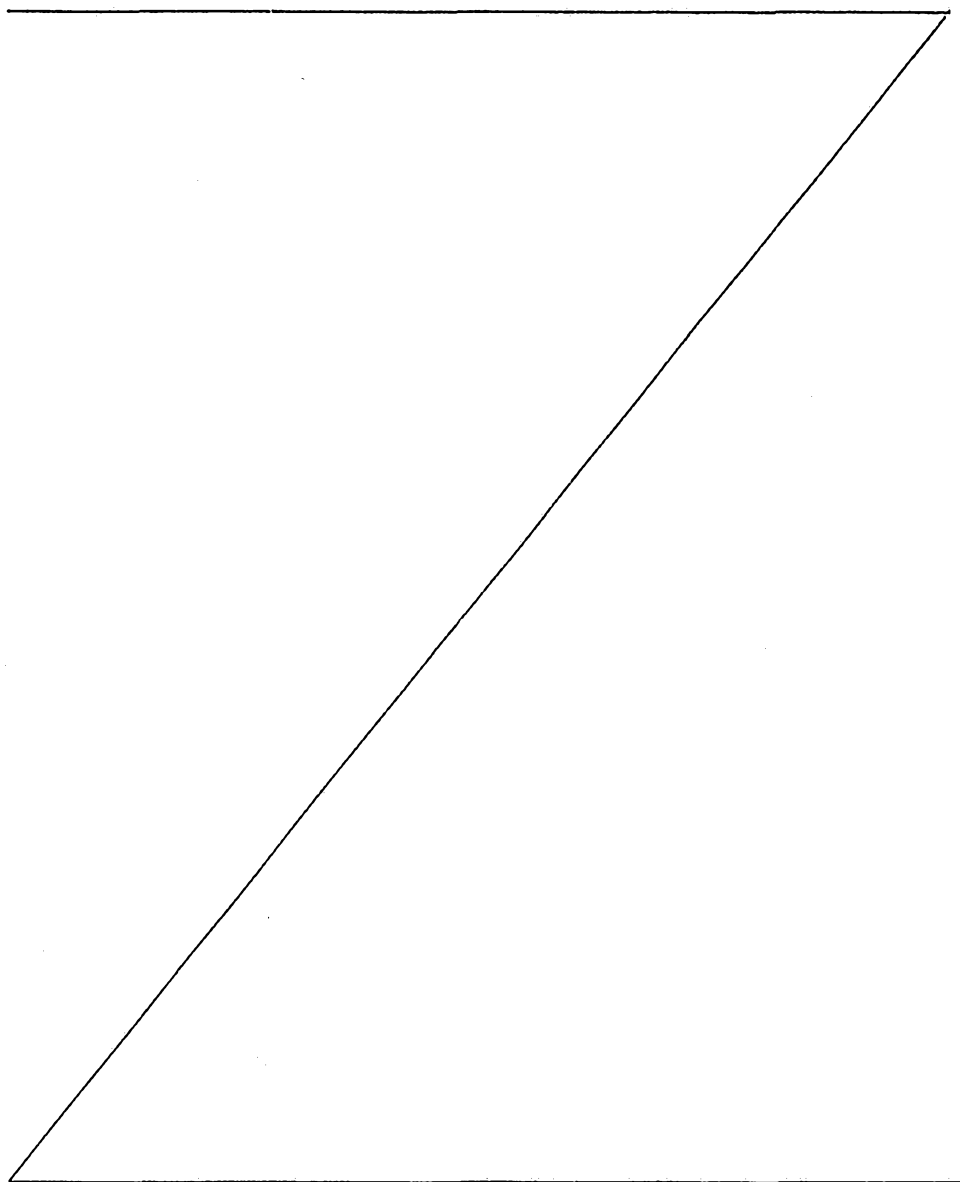
5 resin, acryl resin, vinyl chloride resin, aromatic
sulfonamide resin, or a benzoquanamine resin or their
copolymer.

10

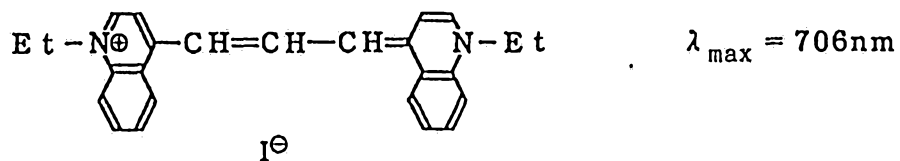
15

20

25

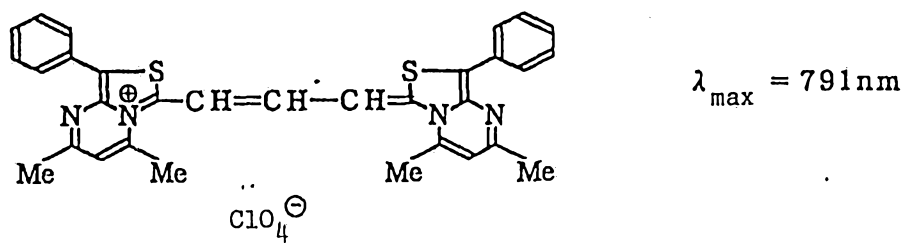


1 (62)



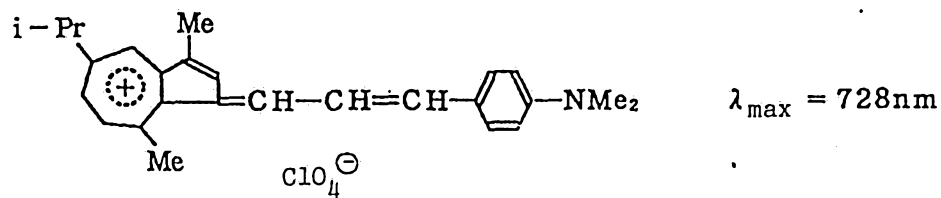
5

(63)



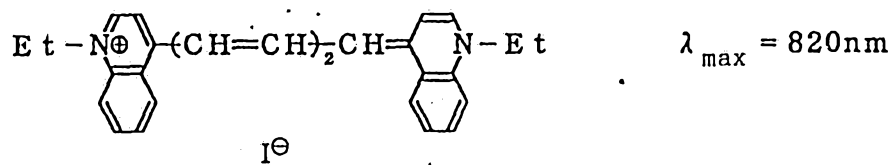
10

(64)

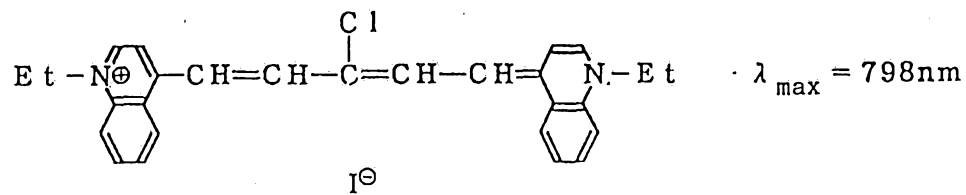


15

(65)

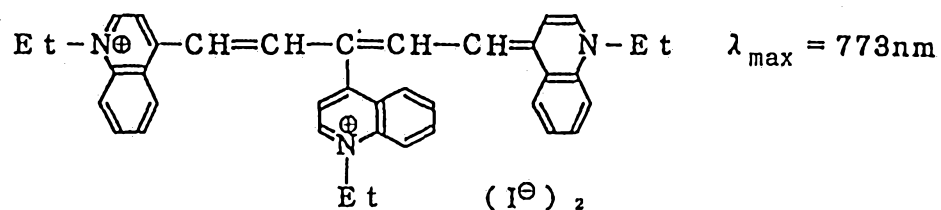


20 (66)



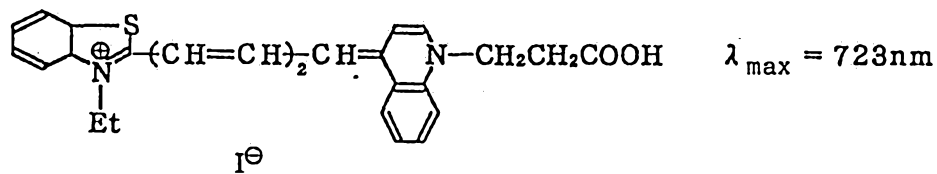
25

1 (67)



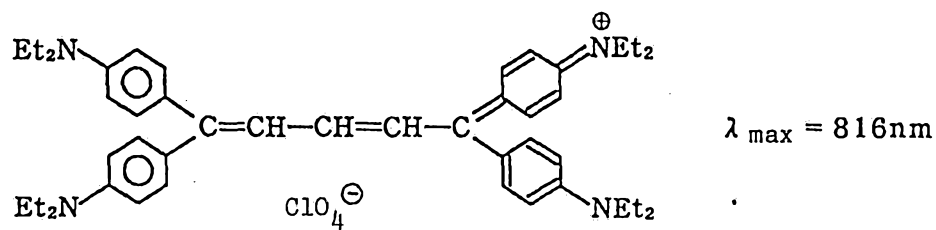
5

(68)



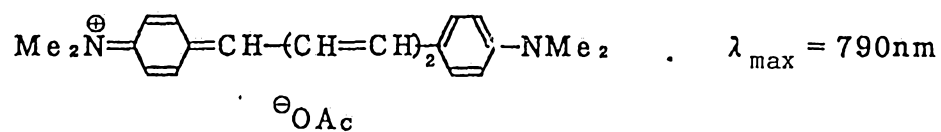
10

(69)



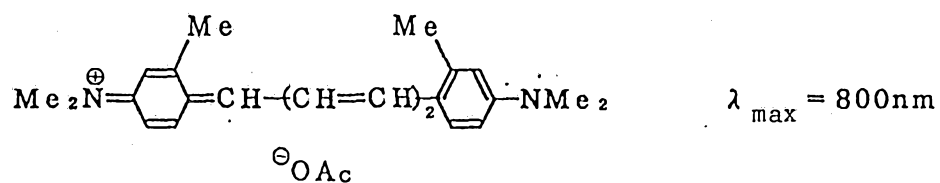
15

(70)



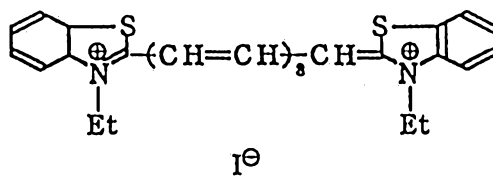
20

(71)



25

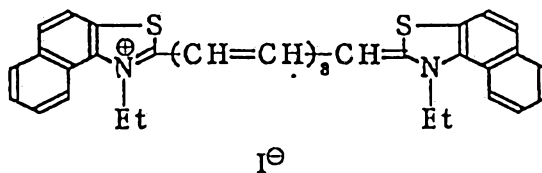
1 (72)



$\lambda_{\max} = 759\text{nm}$

5

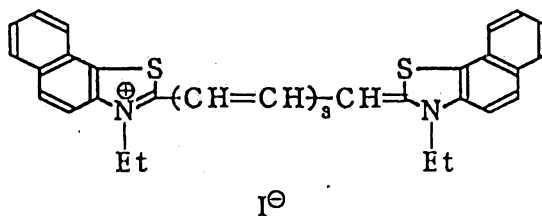
(73)



$\lambda_{\max} = 796\text{nm}$

10

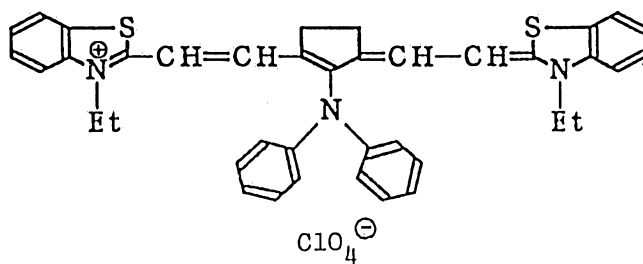
(74)



$\lambda_{\max} = 793\text{nm}$

15

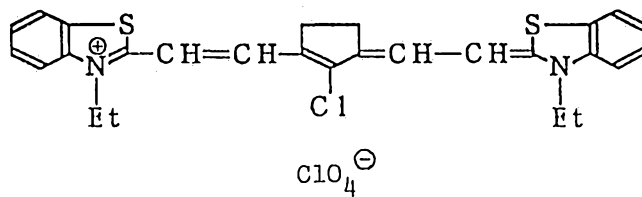
(75)



$\lambda_{\max} = 801\text{nm}$

20

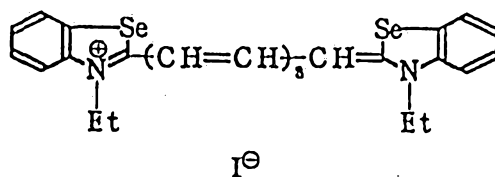
(76)



$\lambda_{\max} = 819\text{nm}$

25

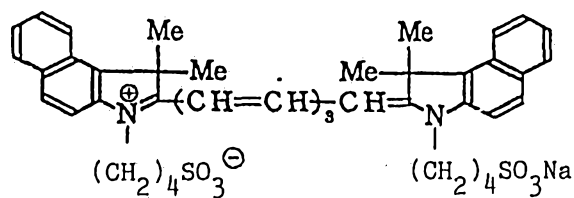
1 (77)



$\lambda_{\max} = 769\text{nm}$

5

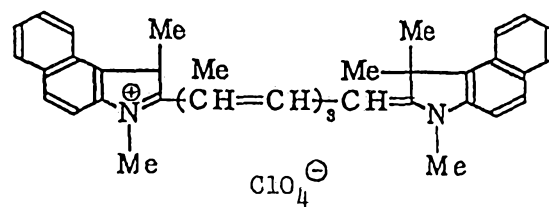
(78)



$\lambda_{\max} = 785\text{nm}$

10

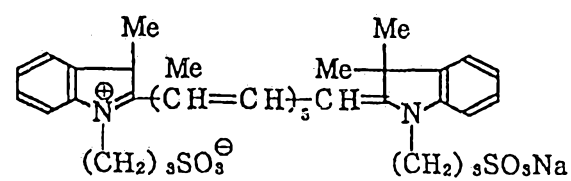
(79)



$\lambda_{\max} = 778\text{nm}$

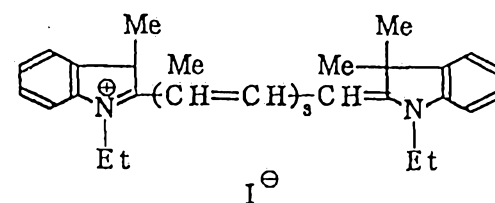
15

(80)



$\lambda_{\max} = 746\text{nm}$

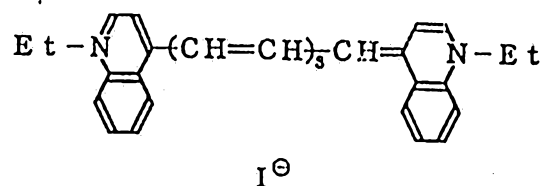
20 (81)



$\lambda_{\max} = 743\text{nm}$

25

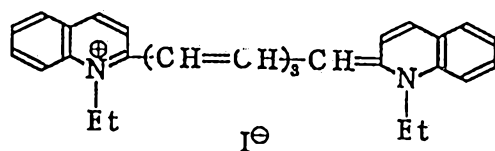
1 (82)



$\lambda_{\text{max}} = 928\text{nm}$

5

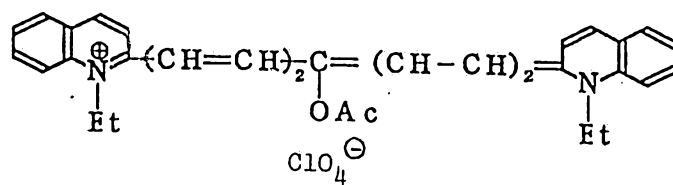
(83)



$\lambda_{\text{max}} = 816\text{nm}$

10

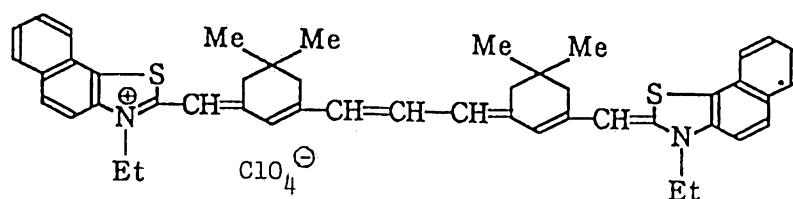
(84)



$\lambda_{\text{max}} = 927\text{nm}$

15

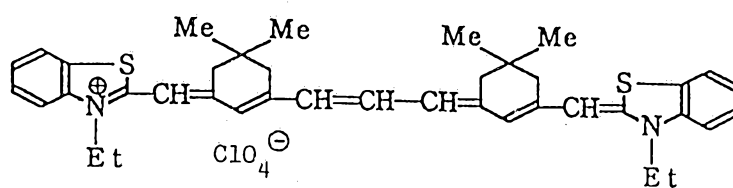
(85)



$\lambda_{\text{max}} = 1050\text{nm}$

20

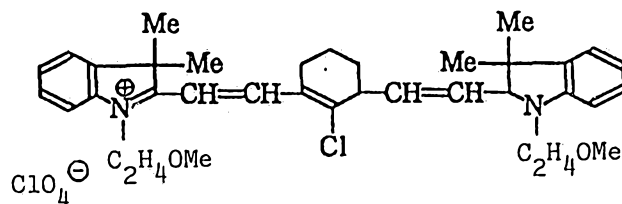
(86)



$\lambda_{\text{max}} = 1010\text{nm}$

25

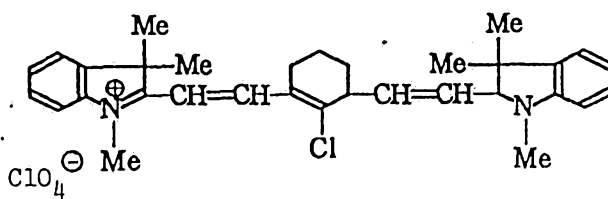
1 (87)



$\lambda_{\max} = 787\text{nm}$

5

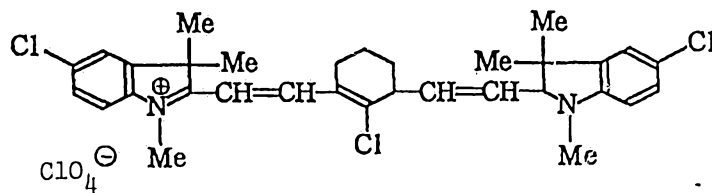
(88)



$\lambda_{\max} = 785\text{nm}$

10

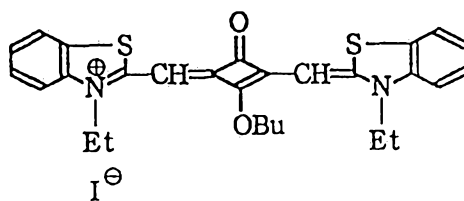
(89)



$\lambda_{\max} = 794\text{nm}$

15

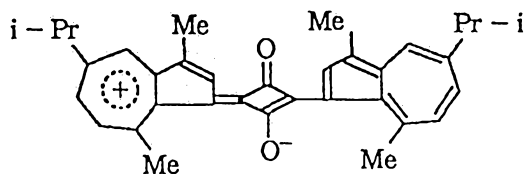
(90)



$\lambda_{\max} = 796\text{nm}$

20

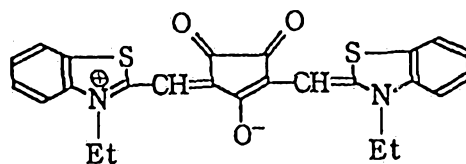
(91)



$\lambda_{\max} = 766\text{nm}$

25

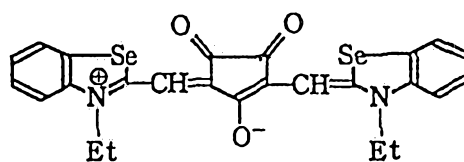
1 (92)



$\lambda_{\max} = 771\text{nm}$

5

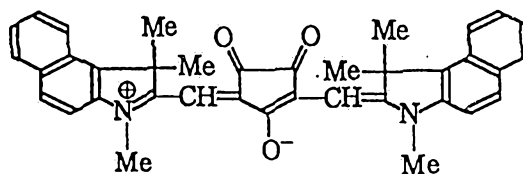
(93)



$\lambda_{\max} = 790\text{nm}$

10

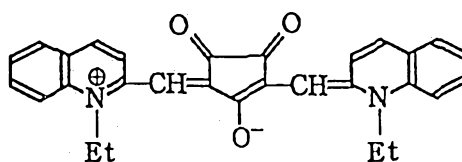
(94)



$\lambda_{\max} = 791\text{nm}$

15

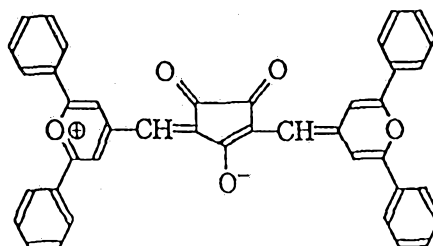
(95)



$\lambda_{\max} = 831\text{nm}$

20

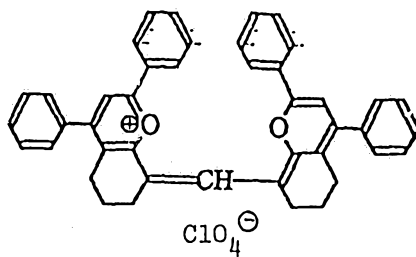
(96)



$\lambda_{\max} = 954\text{nm}$

25

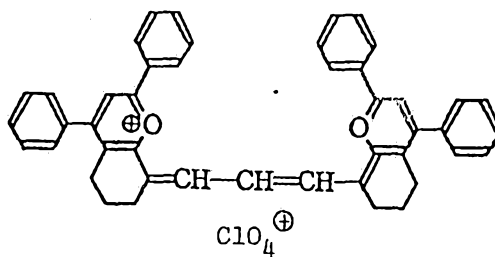
1 (97).



$\lambda_{\text{max}} = 838\text{nm}$

5

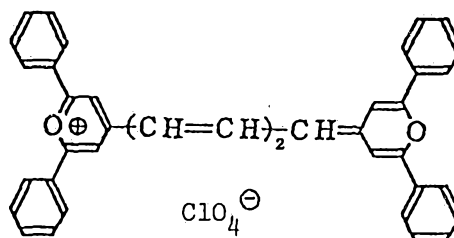
(98)



$\lambda_{\text{max}} = 940\text{nm}$

10

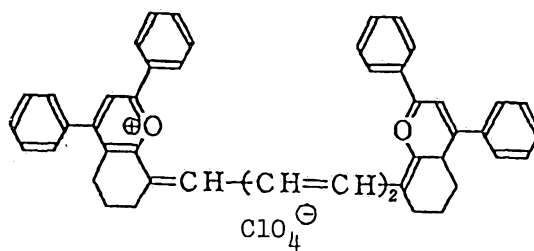
(99)



$\lambda_{\text{max}} = 805\text{nm}$

15

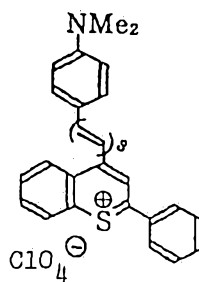
(100)



$\lambda_{\text{max}} = 1060\text{nm}$

20

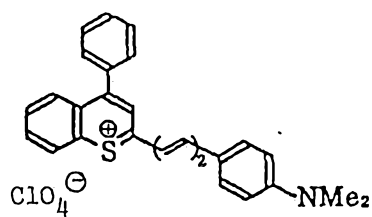
(101)



$\lambda_{\text{max}} = 944\text{nm}$

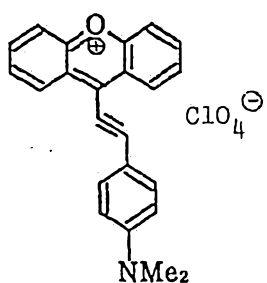
25

1 (102)



$\lambda_{\text{max}} = 807\text{nm}$

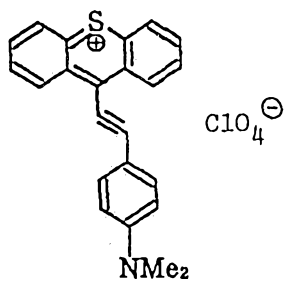
5 (103)



$\lambda_{\text{max}} = 737\text{nm}$

10

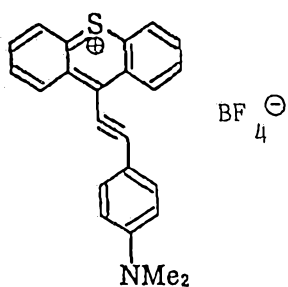
(104)



$\lambda_{\text{max}} = 775\text{nm}$

15

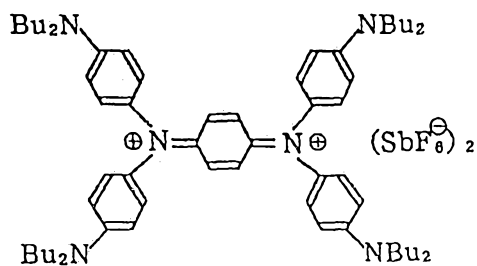
(105)



$\lambda_{\text{max}} = 775\text{nm}$

20

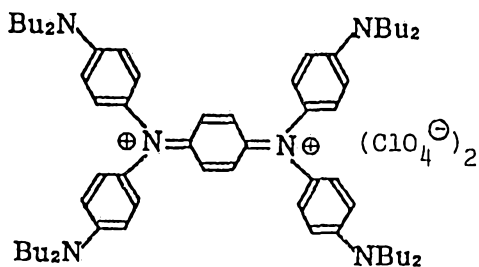
(106)



$\lambda_{\text{max}} = 1090\text{nm}$

25

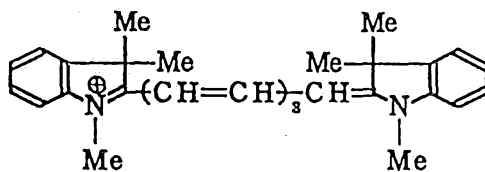
1 (107)



$\lambda_{\max} = 1090\text{nm}$

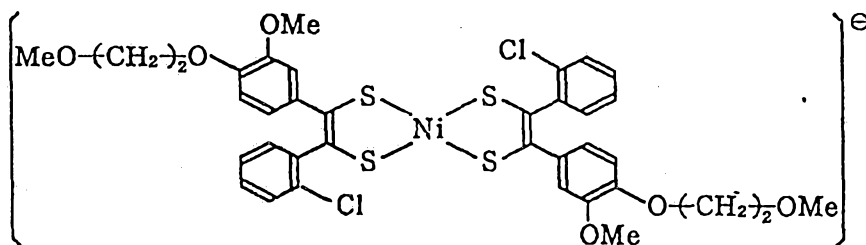
5

(108)



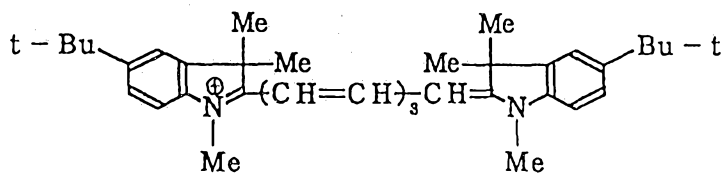
$\lambda_{\max} = 750\text{nm}$

10



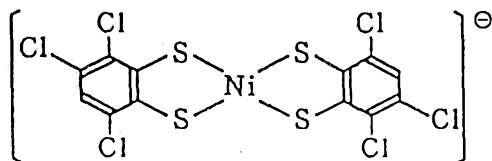
15

(109)



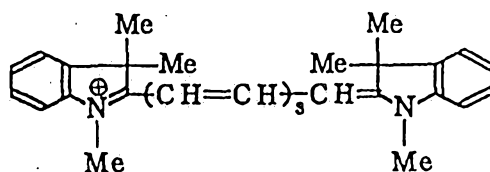
$\lambda_{\max} = 765\text{nm}$

20



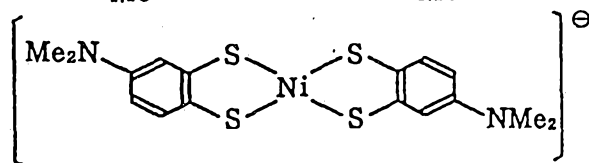
25

1 (110)

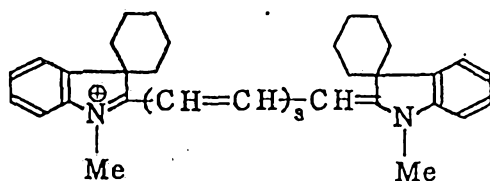


$\lambda_{\max} = 750\text{nm}$

5

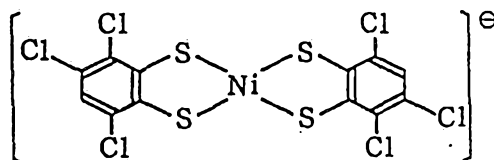


(111)

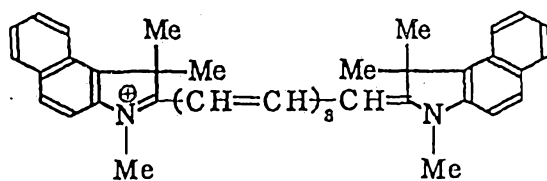


$\lambda_{\max} = 765\text{nm}$

10

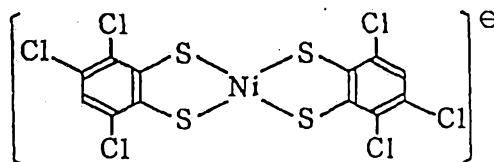


15 (112)

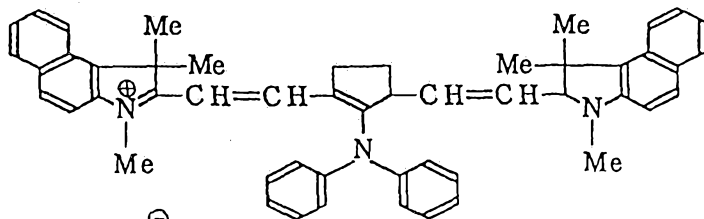


$\lambda_{\max} = 790\text{nm}$

20



(113)

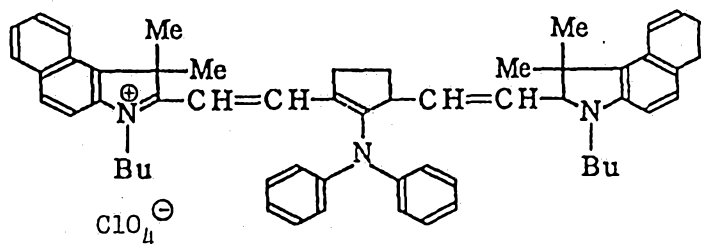


$\lambda_{\max} = 835\text{nm}$

25



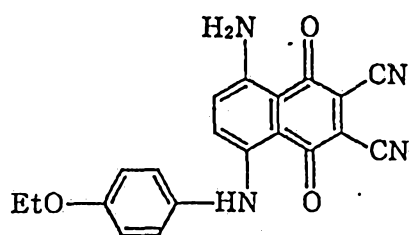
1 (114)



$\lambda_{\max} = 840\text{nm}$

5

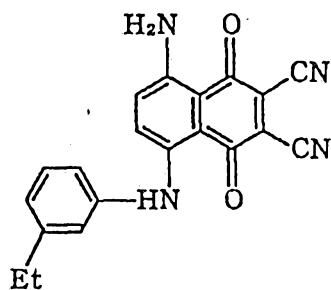
(115)



$\lambda_{\max} = 772\text{nm}$

10

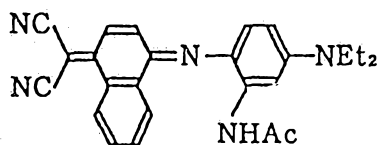
(116)



$\lambda'_{\max} = 771\text{nm}$

15

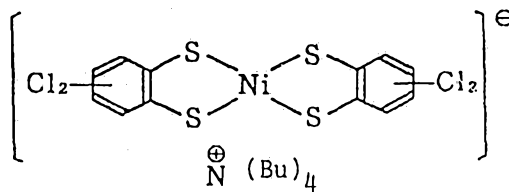
(117)



$\lambda_{\max} = 772\text{nm}$

20

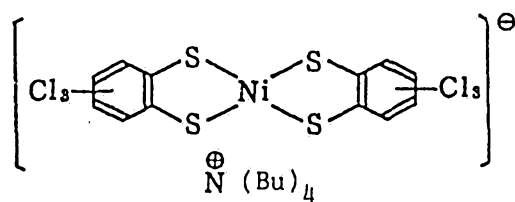
(118)



$\lambda_{\max} = 850\text{nm}$

25

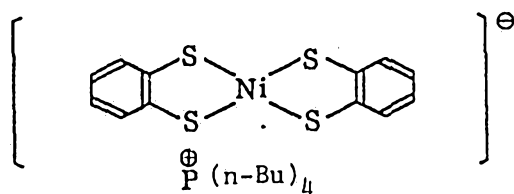
1 (119)



$\lambda_{\text{max}} = 870\text{nm}$

5

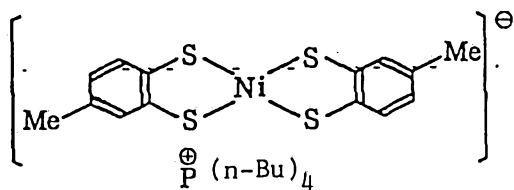
(120)



$\lambda_{\text{max}} = 875\text{nm}$

10

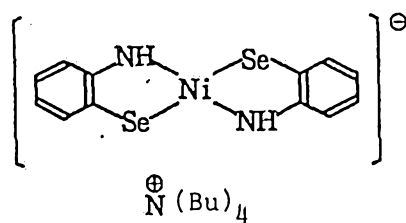
(121)



$\lambda_{\text{max}} = 905\text{nm}$

15

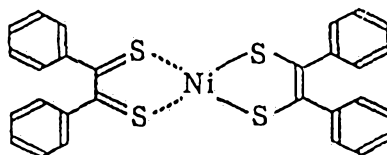
(122)



$\lambda_{\text{max}} = 858\text{nm}$

20

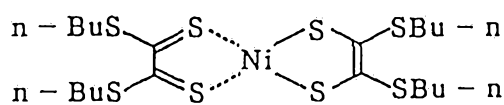
(123)



$\lambda_{\text{max}} = 855\text{nm}$

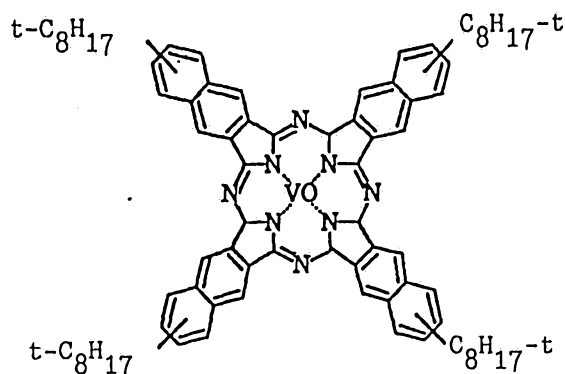
25

(124)



$\lambda_{\text{max}} = 1010\text{nm}$

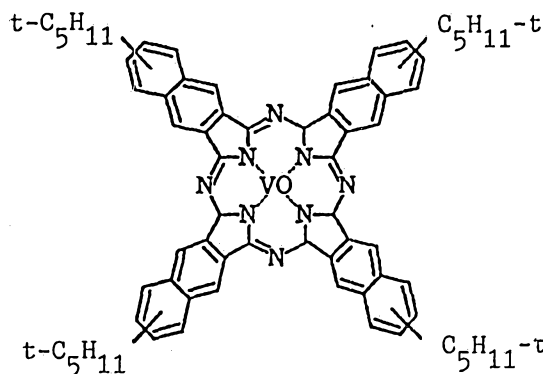
1 (125)



$\lambda_{\max} = 770\text{nm}$

5

10 (126)



$\lambda_{\max} = 765\text{nm}$

15

20 By using an ultraviolet absorber or an anti-oxidant in the resin, the weather resistance of the resin can be improved. The resin can be manufactured by a block resin crushing method, emulsification polymerizing method or a resin precipitation method or the like.

25 The maximal wavelength of the fluorescent spectrum of the near infrared fluorescent coloring material or pigment and the maximal wavelength of the absorption spectrum of the near infrared fluorescent coloring material must be the same. In usual, the

1 difference between them is 100 nm or shorter, more
preferably 50 nm or shorter.

If the maximal wavelength of the fluorescent
spectral and that of the absorption spectral are
5 different from each other by 100 nm or more, the
transmission wavelength region of the CCD for
detecting the near infrared rays is enlarged
excessively, causing the contrast to be lowered
undesirably.

10 Fig. 21 is a graph of a reflectance of a
copying paper for a copying machine. Since the
copying paper has a substantially constant reflectance
in a range from 450 to 1200 nm, it is preferable to
be used as a medium in the present invention.

15 Although a copying machine will now be
described as an example of application of the
detection apparatus of the present invention, the
present invention is not limited to this. The
present invention may, of course, be applied to
20 various apparatus, such as an image scanner.

Fig. 2 is a schematic view which illustrates
the copying machine according to the present
invention.

Referring to Fig. 2, reference numeral 201
25 represents an image scanner portion for reading an
original document and performing a digital signal
process. Reference numeral 200 represents a printer

1 portion for transmitting a full color image corresponding to the image of an original document read by the image scanner 201 on to paper.

5 In the image scanner portion 201, reference numeral 202 represents a thick plate for an original document for securing an original document 204 placed on an original document retainer glass (hereinafter called a platen) 203. The original document 204 is irradiated with light emitted from a halogen lamp 205.

10 Light reflected by the original document 204 is introduced by mirrors 206 and 207 so that an image is, by a lens 208, formed on a four-line sensor (hereinafter called a "CCD") composed of four line CCD line sensors. The CCD 210 decomposes the color of

15 optical information of the original document to transmit, to a signal processing portion 209, red (R), green (G) and blue (B) components of full color information and infrared ray information (IR) component. The elements 205 and 206 are moved

20 mechanically at speed v and the element 207 is moved also mechanically at speed $1/2v$ in a vertical direction (hereinafter a "sub-scan direction") with respect to the electrical scan direction (hereinafter called a "main scan direction) of the line sensor so that the

25 overall surface of the original document is scanned.

Reference numeral 211 represents a standard white plate for generating data for correcting read

1 data corresponding to the line sensors 210-1 to
210-4 for IR, R, G and B components when shading
correction is performed.

The standard white plate has substantially
5 uniform reflecting characteristics with respect to
visible rays to infrared rays as shown in Fig. 8, the
standard white plate being white with respect to
visible rays.

The standard white plate is used to correct
10 data transmitted from the IR sensor 210-1 with respect
to infrared rays and data transmitted from the R, G,
and B visible-ray sensors 210-2 to 210-4.

The signal processing portion 209 electrically
processes the read signal to decompose the signal
15 into magenta (M), cyan (C), yellow (Y) and black (BK)
components which are then transmitted to the printer
portion 200. One of the M, C, Y and BK components is
plane-sequentially transmitted to the printer 200
whenever the image scanner portion 201 scans the
20 original document. When the original document has
been scanned four times, a color image can be formed.

The M, C, Y and BK image signals transmitted
from the image scanner portion 201 are transmitted to
a laser driver 212. The laser driver 212 modulates
25 and operates a semiconductor laser 213 in response to
the image signals. Laser beams are allowed to pass
through a polygonal mirror 214, a f- θ lens 215, and

1 the mirror 216 as to scan the surface of a photo-sensitive drum 217.

Reference numerals 219 to 222 represent developing units comprising a magenta developing unit
5 219, a cyan developing unit 220, a yellow developing unit 221 and a black developing unit 222. The four developing units 219 to 222 alternately come in contact with the photosensitive drum so that M, C, Y and BK electrostatic latent images formed on the
10 photosensitive drum 217 are developed by corresponding toners.

Reference numeral 223 represents a transfer drum for winding paper supplied from a paper cassette
224 or 225 around a transfer drum 223 to transfer a
15 toner image developed on the photosensitive drum 217 on to the paper.

Thus, the four colors, that is, M, C, Y and BK are sequentially transferred, and then the paper is allowed to pass through a fixing unit 226 before
20 it is discharged.

The halogen lamp 205 is commonly used to read visible ray information and to read infrared ray information, the halogen lamp 205 having both irradiation wavelength components required to read
25 the two types of information items. By using the common irradiation system as described above,

1 irradiation light beams having different wavelength
components for reading visible and infrared rays
information are effectively applied to the original
document.

5 Fig. 7A illustrates the structure of the CCD
210 for use in this embodiment.

Referring to Fig. 7A, reference numeral 210-1
represents a light receiving device array for reading
infrared ray (IR), and 210-2, 210-3 and 210-4
10 represent light receiving device arrays for
respectively reading R, G and B wavelength components.

The IR, R, G and B sensors 210-1 to 210-4
respectively have openings having a diameter of 10 μ m
in the main scan direction and the sub-scan direction.

15 The four light receiving device arrays having
different optical characteristics are disposed on the
same silicon chip in a monolithic manner so that the
IR, R, G and B sensors are disposed in parallel to
each other to read the same line of the original
20 document.

By using the CCD constituted as described
above, the common optical system, such as the lens,
can be used to read the visible rays and infrared
rays.

25 As a result, accuracy in the optical
adjustment can be improved and the adjustment can
easily be completed.

1 Reference numeral 210-5 represents a glass
plate having a characteristic capable of cutting
infrared rays in the diagonal line section thereof,
the glass plate 210-5 having a thickness of about 300
5 μm .

The characteristic of cutting infrared rays is realized in the diagonal line section due to a diachronic mirror 210-11. The characteristic of cutting infrared rays is shown in Fig. 11.

10 The glass plate is bonded to the surface of the chip in such a manner that the evaporated surface of the glass plate faces the sensor side.

Fig. 7B is an enlarged view which illustrates the light receiving device. Each sensor has a length
15 of 10 μm per length in the main scan direction. Each sensor includes 5,000 pixels in the main scan direction as to read the shorter side direction (297 mm) of an A3-size original document at a resolving power of 40 dpi. The R, G and B sensors are disposed
20 at a line interval of 80 μm while being disposed at each 8 lines when the resolving power in the sub-scan direction is 400 lpi (line per inch).

The line interval between the IR sensor 210-1 and the R sensor 210-2 is made to be 160 μm (16 lines)
25 which is twice the other line interval. As a result of the foregoing structure in which the interval between the IR sensor 210-1 and the R sensor 210-2

1 is made to be longer than the interval between the
other sensors, the evaporated surface 210-11 of the
glass plate 210-5 can be made to face the sensors
210-2 to 210-4 while making the non-evaporated
5 portion to face the sensor 210-1 at a low fastening
position accuracy at the time of bonding the glass
plate 210-5 to the surface of the chip.

The glass plate 210-5 is fastened adjacent to
the sensor surface, while the evaporated film 210-11
10 for blocking infrared rays is fastened to face the
sensor. The reason for this is that light beams
passing toward the sensor are converged by the lens
209 and therefore the light beams passing toward the
sensors are superposed at a position distant from the
15 surface of the sensor as shown in Fig. 13. That is,
if the infrared ray cutting filter 210-11 is made
to filter only light beams passing toward the sensors
210-2 to 210-4, the infrared ray cutting filter 210-11
must be fastened to a position adjacent to the sensor
20 at which the IR light beam and the R light beam are
not superposed.

The arrangement made in such a manner that
the infrared ray cutting filter 210-11 is disposed
adjacent to the surface of the sensor enables the
25 allowable width a for fitting the IR filter between
the IR light beams and the R light beams to be
widened. Therefore, the accuracy for fitting the

1 glass plate 210-13 to the sensor chip can be lowered.

If the infrared ray cutting filter is fastened to the surface of the glass plate 210-5 opposing the sensor, the IR light beams and the R light beams are
5 superposed. As a result, if the infrared ray cutting filter is disposed to sufficiently filter the R light beams, a major portion of the IR light beams focused on to the IR sensor 210-1 is undesirably cut, causing the level of the IR signal to be lowered excessively.

10 As an alternative to the structure in which the glass plate 210-5 is fastened as shown in Fig. 14, the infrared ray cutting filter 210-11 may be disposed on the surface of the cover glass 210-13 facing the sensor. In this case, the distance d from
15 the surface of the sensor to the internal surface of the cover glass must sufficiently be shortened by constituting a ceramic package 210-12 of the CCD sensor so that the infrared ray cutting filter 210-11 disposed on the internal surface of the cover glass
20 does not substantially interrupt the IR light beams.

With reference to Fig. 10, the filter spectrum characteristic of the IR, R, G and B line sensors of the CCD 210 will now be described.

The characteristics R has sensitivity with
25 respect to light beams in the red wavelength region and the infrared ray wavelength region. The characteristics G has sensitivity with respect to light beams

1 in the green wavelength region and the infrared
wavelength region. The characteristics B has
sensitivity with respect to light beams in the blue
wavelength region and the infrared wavelength region.

5 Since filters 210-6 and 210-7 are superposed
on the IR sensor 210-1, the IR sensor 210-1 has
sensitivity with respect to infrared light beams
represented by the diagonal lines shown in Fig. 10.

10 As can be understood from Fig. 10, the R, G
and B filters 210-8 to 210-10 have sensitivity with
respect to infrared rays in a range of 700 nm or
longer. Therefore, the infrared ray cutting filter
210-11 has characteristics shown in Fig. 11.

15 Fig. 9 shows spectrum absorption ratio of an
infrared ray absorber SIR-159 manufactured by Mitsui
Toatsu for used to form a detection mark of a specific
original document according to this embodiment. This
embodiment is arranged in such a manner that the
presence of the infrared ray absorber is read by the
20 IR sensor that is arranged to detect only infrared
rays ranging from 750 nm to 850 nm.

In order to achieve this, a far infrared ray
cutting filter of a diachronic mirror as shown in Fig.
12 is disposed on the lens 209. Since the foregoing
25 filter does not adversely affect the R, G and B
sensors 210-2 to 210-4 as well as the IR sensor 210-1,
it is disposed in the lens portion commonly provided

1 for the visible rays and infrared rays. As a result,
the filter to be fastened to the lens 209 can be
designed to simply have the far infrared ray cutting
characteristics. Therefore, excellent far infrared
5 ray cutting characteristics can be realized by a
simple interference film structure.

Figs. 15A and 15B are block diagrams which
illustrates the flow of an image signal in the image
scanner portion 201. The image signal transmitted from
10 the CCD 210 is received by an analog signal processing
portion 3001 as to be subjected to a gain adjustment
and an offset adjustment, and then converted by A/D
converters 3002 to 3005 into 8-bit digital image signals
for each color signal. Then, the image signal is
15 supplied to shading correction portions 3006 to 3009 as
to be subjected to a known shading correction using a
read signal of the standard white plate 211 for each
color.

Reference numeral 3019 represents a clock
20 generating portion for generating clocks in a pixel
unit. Reference numeral 3020 represents a line
counter for counting clocks to generate a pixel
address output for one line. Reference numeral 3021
represents a decoder for decoding main scan address
25 supplied from the main scan address counter 3020 to
generate CCD drive signals, such as shift pulses and
reset pulses, VE signals representing an effective

1 region in a read signal for one line supplied from the
CCD, and a line synchronizing signal HSYNC. The counter
3020 is cleared in response to the HSYNC signal to
start counting the main scan address of the next line.

5 Since the light receiving portions 210-1,
210-2, 210-3 and 210-4 of the CCD 210 are disposed
while having predetermined intervals, the spatial
deviation in the sub-scan direction is corrected in
line delay devices 3010, 3011 and 3012. Specifi-
10 cally, the IR, R, and G signals for reading infor-
mation about the original document in the sub-scan
direction with respect to the B signal are line-delayed
in the sub-scan direction to be made coincide with the
B signal.

15 Reference numerals 3013, 3014 and 3015
represent light quantity/density conversion portion
each comprising a look up table ROM to convert R, G
and B brightness signals into C, M and Y density
signals. Reference numeral 3016 represents a known
20 masking and UCR circuit which receives three primary
color signals Y, M and C to sequentially transmit Y,
M, C and Bk signals while having a predetermined bit
length, for example, 8 bits whenever a reading
operation is performed.

25 Reference numeral 3 represents an identifying
portion for detecting a specific pattern in the
original document which is the characteristic of the

1 present invention.

Reference numeral 3018 represents a CPU
portion for controlling an optical system for reading
the original document, controlling the sequence for
5 controlling the operation for turning on/off an
original document irradiation lamp 205 and generating
a pixel region signal VSYNC in the sub-scanning
direction. In accordance with the result of
judgment supplied from the recognition portion 3,
10 the CPU portion 3018 controls a selector 3017 to
transmit, to the printer, a port output in place of
the read signal to inhibit the operation of copying
the specific original document.

Fig. 16 shows timings of the respective
15 control signals.

The VSYNC signal is an image effective region
signal in the sub-scan direction as to be used to
form sequential output signals (M), (C), (Y) and (Bk)
with which the image is read in a region of "1". The
20 VE signal is an image effective region signal in the
main scan direction to arrange the balance of the
main scan start position in the region of "1".
The CLOCK signal is a pixel synchronizing signal
which transfers image data at the first transition
25 timing 0 → 1.

The image pattern to be detected in the
present invention will now be described with reference

1 to Figs. 1A and 1B. Figs. 1A and 1B illustrate near
infrared fluorescent coloring materials which do not
absorb visible rays having the characteristics shown in
Fig. 9 is used together with a coloring material which
5 absorbs about 600 nm to record low reflectance
portions 101.

Near infrared fluorescent coloring material
having characteristics shown in Fig. 20A is used in
high reflectance portions 102. Since the high
10 reflectance portions 102 are printed as small
patterns in the form of squares each having a side of
about 12.0 μm and they are substantially the same
color in the visible region, the image pattern shown
in Figs. 1A and 1B cannot be identified visually. However,
15 it can be detected in an infrared region. Although
a pattern in the form of a square having a side of
about 120 μm is described as an example to make
ensuing descriptions, the foregoing region has a
size of about four pixels if the same is read at 400
20 dpi (dot per inch). It should be noted that the
method of forming the pattern is not limited to the
foregoing method.

With reference to Fig. 4, the identifying
portion shown in Figs. 15A and 15B will now be described.
25 Reference numerals 10-1 to 10-4 shown in Fig. 4
represent image data line delay portions each
comprising a FIFO. An address pointer is initialized

1 in response to a line synchronizing signal HSYNC
(omitted from illustration), while data is written
or read for pixel unit in response to the CLOCK
signal. Each of the image data line delay portions
5 10-1 to 10-4 delay R, G, B and IR data of 32 bits
by one line.

First, an input signal is held in flip flops
11-1 and 11-2 to be delayed for two pixels to
generate data for pixel A. Further, the line memories
10 10-1 and 10-2 delay the data for two lines to
generate data for pixel C. Data items for the pixel
C respectively are delayed by two pixels and four
pixels to generate data about subject pixel data X
and data about pixel B. Similarly, data about pixel
15 D is supplied to a judging portion 12.

The position relationship among the pixels A,
B, C and D around the subject pixel X is as shown in
Fig. 5.

That is, if the subject pixel X is reading the
20 low reflectance portion 101 shown in Figs. 1A and 1B, the
pixels A, B, C and D are reading the pixels of the
patterns positioned around the low reflectance
portion 101.

A judgment algorithm set to the judging
25 portion 12 according to this embodiment will now be
described.

Assuming that R, G, B and IR components of

1 the reading signal which forms the pixel signal for A
are AR, AG, AB and AIR and pixels signals for B, C
and D are defined, average values YR, YG, YB and YIR
of the read signals for each color component R, G,
5 B and IR in each pixel signal are defined by the
following equations:

$$Y_R = \frac{1}{4} (A_R + B_R + C_R + D_R)$$

$$Y_G = \frac{1}{4} (A_G + B_G + C_G + D_G)$$

$$Y_B = \frac{1}{4} (A_B + B_B + C_B + D_B)$$

10 $Y_{IR} = \frac{1}{4} (A_{IR} + B_{IR} + C_{IR} + D_{IR})$

An aimed pattern is judged in accordance with
the difference between average value Y obtained by the
foregoing equation and the subject pixel X.

That is, assuming that the R, G, B and IR
15 components of X are XR, XG, XB and XIR respectively,
the following relationships are held:

$$\Delta R = |Y_R - X_R|$$

$$\Delta G = |Y_G - X_G|$$

$$\Delta B = |Y_B - X_B|$$

20 $\Delta IR = |Y_{IR} - X_{IR}|$

If the following relationships are held, a
judgment is made that a pattern is present:

$$\Delta R < K \text{ and}$$

$$\Delta G < K \text{ and}$$

25 $\Delta B < K \text{ and}$

$$\Delta IR > L1 \text{ or } Y_{IR}/X_{IR} > L2$$

where K, L1 and L2 are constants.

1 That is, if the color tone is not consider-
ably different in the visible region (smaller than
K) between the subject pixel X and the adjacent
pixels A, B, and C and D and if the difference is
5 larger by the constant L1 in the infrared region, or
if the ratio of the level of the subject pixel X and
that of the adjacent pixels is larger than the
constant L1, a judgment is made that a specific
pattern is present.

10 The reason why the ratio is used to make the
judgment as well as the judgment of the infrared
region is that the deterioration in the infrared ray
signal level due to contamination of the original
document must be compensated. In this embodiment,
15 the overall damping of the infrared ray read signal
due to the influence of contamination is compensated
by detecting the ratio.

20 If the high reflectance portion 102 recorded
with ink containing the near infrared fluorescent
coloring material is present adjacent to the subject
pixel X, the level difference for use in the
judgment is further enlarged. Therefore, erroneous
recognition can be prevented.

25 When reading operations 103, 104 and 105 are
performed in different scan directions as shown in
Fig. 1A, the intensities of the IR signals respectively
are as shown in Fig. 1B so that the low reflectance

1 portion, the reflectance portion of the medium and the
high reflectance portion are detected. Therefore,
the recognition rate can be improved while performing
together the foregoing judgment.

5 If a near infrared ray absorbing film is used
to prevent the judgment, the overall IR intensity is
lowered so that the abnormality can be judged.

If a near infrared ray reflecting film is
used to prevent the judgment, the abnormality can
10 be judged because the overall IR intensity is
excessively high.

If an intermediate-density infrared ray
absorbing film or an infrared ray reflecting film is
used, the IR intensity of the medium is simply
15 changed, and therefore the judgment can be performed
normally.

Fig. 6 illustrates the structure of the
judgment portion 12 adapted to the foregoing algorithm.

An adder 121 simply adds the color components
20 for four pixels to transmit the upper eight bits to
obtain YR, YG, YB and YIR. A subtractor 122 obtains
the difference from each component of the subject
pixel signal to supply upper five bits of the
components ΔR , ΔG and ΔB to a judgment LUT 128
25 comprising a ROM. If each of the upper five bits is
smaller than constant K, 1 is transmitted from the
LUT 128.

1 Similarly, 8-bit YIR and XIR are supplied to
an address terminal of a judgment LUT comprising a
ROM in a case of an infrared read signal. If the
judgment $\Delta IR > L1$ or $YIR/XIR > L2$ is resulted in the
5 foregoing calculation $\Delta IR = YIR - XIR$, 1 is trans-
mitted from the LUT 129.

 The logical product of the output from each
LUT is calculated in an AND gate 130, and therefore
a pattern can be detected if 1 is obtained at the
10 output terminal of the AND gate 130.

 The result of the judgment is supplied to a
latch 3022 shown in Figs. 15A and 15B. The latch output is
supplied to an input port P10 of a CPU 3018 so that
the CPU recognizes the detection of the specific mark.
15 The CPU clears the latch 3022 in response to a signal
of an output port P9 prior to starting the copying
sequence to prepare for the next pattern detection.

 A usual copying operation and an operation of
the CPU to control the operation of judging the
recognition mark will now be described with reference
20 to Fig. 17.

 When an operator places the original document
204 on the platen 203 and starts the copying operation
by operating a control portion (omitted from illus-
25 tration), the CPU 3018 controls a motor (omitted from
illustration) to move the reflecting mirror 206 to a
position below the standard white plate 211.

1 Then, the halogen lamp 205 is lit on to
irradiate the standard white plate 211 so that the
shading correction portions 3006 to 3009 sample
shading data for the IR, R, G and B signals (step 1).

5 Then, the port output P9 is made to be zero,
the output from the latch 3022 is made to be zero-
cleared, the output from P8 is made to be zero,
input A of the selector 3017 is selected so that a
masked and UCR-processed image signal is supplied to
10 the printer. Then, the output from P9 is made to be
1, and the clearing operation of the latch 3022 is
completed (step 2).

 Then, the original document is read four
times to correspond to the operation of recording the
15 four colors M, C, Y and BK performed in the printer
portion so that the image is recorded. Further, the
recognition mark is detected, and the recording
operation is controlled in accordance with the result
of the detection.

20 First, a magenta image is recorded in such a
manner that the CPU qualifies the processing condition
for processing the magenta image to be performed by
the masking and UCR processing portion to cause the
optical system to perform the scanning operation and
25 to supply a magenta signal to the printer. After
the scanning operation has been completed, the CPU
returns the optical system to the scan start position

1 (step 3).

The CPU periodically reads the port 10 during the operation of reading the original document to judge whether or not the input to the port 10 is 1.

5 If the P10 is 1, a judgment is made that a specific original document, the normal reproduction of which must not be inhibited, is being copied, and the outputs from P0 to P7 are made to be FFH in step 7.

Further, the output from P8 is made to be 1 to
10 transmit a solid signal FFH to the printer to inhibit the normal copying operation.

Similarly, recording of cyan, yellow and black data is controlled in steps 4 to 6, and the CPU periodically examines the state of P10. If the
15 output from P10 is 1, full black FFH data is transmitted to the printer in step 7.

If P10 = 1 is detected during the operation of recording the cyan data, the magenta data is normally copied. However, all of cyan, yellow and black data
20 items are recorded in the form of solid FFH data.

Second Embodiment

Figs. 18A and 18B illustrate an example of a second structure of an image reading apparatus according to the present invention.

25 A CCD is, as shown in Fig. 18A, is arranged in such a manner that two-line sensors are formed on a common silicon chip in a monolithic manner.

1 A line sensor 3301-1 is an infrared ray reading
sensor (an IR sensor), and a line sensor 3301-2 is a
full color line sensor in which R, G and B sensors are
alternately disposed in pixel units.

5 A glass plate 3301-5 having a dichroic filter
3301-11 for cutting infrared rays evaporated thereof
is fastened on to the foregoing sensor by a method
similar to that shown in Figs. 7A and 7B.

 The dichroic filter 3301-11 has the infrared
10 ray cutting characteristics shown in Fig. 11
similarly to 210-11.

 The glass plate is fastened to the CCD chip
similarly to the method shown in Figs. 7A and 7B such that
the end of the evaporated portion is positioned between
15 the line sensors 3301-1 and 3301-2.

 Fig. 18B is an enlarged view which illustrates
pixels of the line sensors 3301-1 and 3301-2.

 The IR sensor 3301-1 has a pixel size 18 μ m
x 18 μ m and in which R and B filters having character-
istics shown in Fig. 10 are superposed on the sensor,
20 the IR sensor 3301-1 having the infrared ray trans-
mission characteristics of the IR sensor 210-1.

 By combining the IR sensor 3301-1 with a far
infrared ray cutting filter disposed in the imaging
25 optical system similar to that according to the first
embodiment and having the characteristics shown in
Fig. 12, infrared ray reading characteristics similar

1 to that according to the first embodiment are
attained.

Reference numeral 3301-2 represents R, G and
B sensor arrays positioned away from the IR sensor by
5 180 μm (for 10 lines), the sensor array 3301-2 having
an arrangement in which R, G and B pixels having a
size of 6 μm to correspond to the size of 18 mm of
one pixel of the IR sensor in the main scan direction.
Each of the R, G and B pixels is provided with a color
10 decomposing filter having the characteristics shown
in Fig. 10.

The sensor according to this embodiment has
5,000 pixels in the main scan direction to read an A3-
size original document at 400 dpi, and 5,000 combi-
15 nations of R, G and B are provided.

In order to project the size 63.5 μm (one
pixel of 400 dpi) of the original document retainer
onto a size of 18.5 μm , the contraction ratio of the
optical system is made to be 18.5/63.5.

20 When the identification pattern according to
the first embodiment was measured by the foregoing
detection apparatus, an excellent judgment was
performed.

Third Embodiment

25 Figs. 19A and 19B illustrate an example of
the structure of a third embodiment of the image
reading apparatus according to the present invention.

1 A CCD 3401 comprises a sensor 3402 having R, G,
B and IR pixels formed on lines as shown in Fig. 18A
so that image data for one pixel is color-decomposed
(the wavelength is decomposed) by the combination of
5 IR, R, G and B to read the image data.

Each of the IR, R, G and B pixels has a size
of $63.5/4 \mu\text{m}$ in the main scan direction so that a pixel
of $63.5 \mu\text{m}$ is read by a combination of IR, R, G and B.

Since the sensor according to this embodiment
10 reads an original document at 400 dpi, the contraction
ratio of an optical system is made to be one time so
that the size $63.5 \mu\text{m}$ (one pixel of 400 dpi) of the
original document retainer is projected onto the size
of $63.5 \mu\text{m}$.

15 The IR reading pixel has R and B filters
having the characteristics shown in Fig. 10 and
superposed on the sensor to have the infrared ray
transmission characteristics of the IR sensor 210-1.

By combining it with the far infrared ray
20 cutting filter disposed in the imaging optical system
(omitted from illustration) and having the character-
istics shown in Fig. 12, the infrared ray reading
characteristics similar to that obtainable from that
according to the first embodiment can be attained.

25 The R, G and B reading pixels have color decomposing
filters having the characteristics shown in Fig. 10.

A glass plate 3403 having dichroic filters

1 3403-11 for cutting infrared rays, evaporated at a
pitch of $63.5\text{ }\mu\text{m}$ and having a width of $63.5/4\text{ }\mu\text{m}$ is
fastened on the sensor as shown in Fig. 19A.

The dichroic filter 3404 has the infrared ray
5 cutting characteristics similarly to 210-11.

The glass plate is fastened to the CCD chip
similarly to that shown in Figs. 7A and 7B in such a
manner that its evaporated side faces the surface of the
chip and the portion, which is not evaporated,
10 corresponds to the IR pixels as shown in Figs. 19A
and 19B.

When the identification pattern according to
the first embodiment was measured with the foregoing
detection apparatus, an excellent judgment was
15 performed.

Although the third embodiment is arranged in
such a manner that the IR, R, G and B pixels for
reading one pixel are arranged in the main scan
direction, another structure may be employed which is
20 arranged in such a manner that they are disposed in a
2D manner and the infrared ray cutting dichroic filters
are disposed in only the portions of the glass plate
that correspond to the R, G and B pixels.

Although the foregoing embodiment is arranged
25 in such a manner that the infrared ray cutting filter
is made of transparent material and it is fastened to
the sensor, the filter is not limited to the infrared

1 ray cutting filter. The filter may be a filter for
cutting ultraviolet rays that are not required to
read visible information.

As described above, use of the invisible
5 information recorded medium having the identification
mark composed of a region having a high reflectance
and a region having a low reflectance region as
compared with the reflectance of the medium at the
same near infrared ray wavelength and an apparatus
10 for detecting the invisible information recording
medium enables the specific original document to be
judged assuredly while reducing the cost.

Further, an attempt of judgment prevention
using the infrared ray absorbing film or an infrared
15 reflecting film can assuredly be judged.

Fourth Embodiment

This embodiment is arranged in such a manner
that an invisible information recording medium is
used which serves as a recording medium for inhibiting
20 copying and reading, having no information recorded
in the visible ray region thereof and having an
identification mark which absorbs near infrared rays
so that inhibition of copying and reading is identified.

The invisible information recording medium
25 according to this embodiment and having visible
information comprises the identification mark repre-
senting the copying and reading inhibition so that

- 1 copying and reading are inhibited when the mark is detected.

The identification mark having the invisible information for inhibiting copying is recorded in such
5 a manner that coloring material or pigment which does not absorb visible rays and which absorbs near infrared rays is dissolved or dispersed in a binder and a predetermined pattern is, by printing or the like, formed in the recording medium for inhibiting
10 copying.

The near infrared ray absorbing coloring material or pigment may be a material having the absorption wavelength peak in a range of 700 nm or longer, preferably 750 nm or longer. Since the
15 material having the absorption wavelength peak in a range of 700 nm or shorter can be visually detected, the secrecy cannot satisfactorily be maintained. If a material having the absorption wavelength peak in a range of 1100 nm or longer is used, sensitivity of a
20 Si-type photo-detection device, such as a CCD, deteriorates. In this case, the identification mark cannot accurately be judged. It is further preferable to employ a coloring material or pigment having the absorption wavelength peak in a range of 1000 nm or
25 shorter.

The foregoing near infrared ray absorbing coloring material or pigment may be dispersed or mixed

- 1 with the binder while being combined with an ultra-violet absorber or an antioxidant.

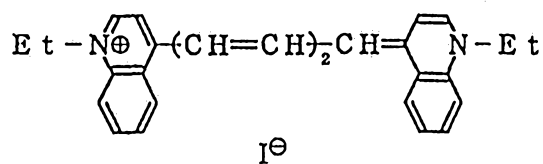
The near infrared ray absorbing coloring material or pigment must be a type that does not
5 absorb visible rays. The absorbance of the maximum absorbing wavelength in the infrared ray region must be 5 times or more the absorbance of the maximum absorbing wavelength, more preferably 10 times or more. If it is 5 times or less, it can easily
10 visibly recognized in a visible ray region if the mark in the near infrared ray region is allowed to have a thickness that can be identified. Therefore, an adverse influence is resulted on the information to be recorded.

- 15 More specifically, any one of the following near infrared ray absorbing coloring material or pigment may be used. However, a material may be used regardless of the exemplified materials if it absorbs near infrared rays and exhibits large absorbance and
20 excellent weathering and light resistance.

Compounds (1) to (44)

- The binder resin for use in the foregoing near infrared ray absorbing coloring material or pigment may be a urea resin, melamine resin, alkyd resin,
25 acryl resin, vinyl chloride resin, aromatic sulfonamide resin, or a benzoquanamine resin or their copolymer.

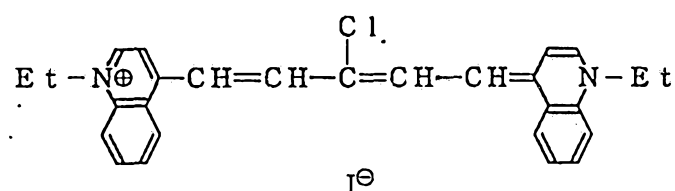
1 (1)



$\lambda_{\text{max}} = 820\text{nm}$

5

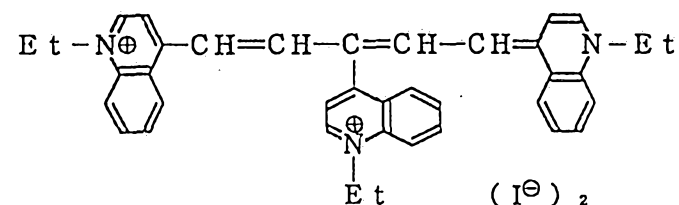
(2)



$\lambda_{\text{max}} = 798\text{nm}$

10

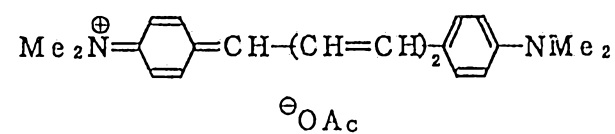
(3)



$\lambda_{\text{max}} = 773\text{nm}$

15

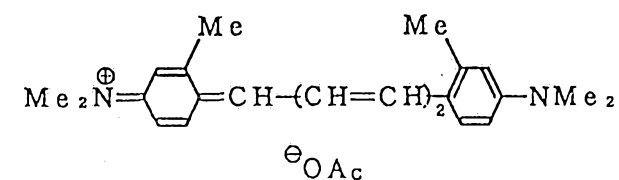
(4)



$\lambda_{\text{max}} = 790\text{nm}$

20

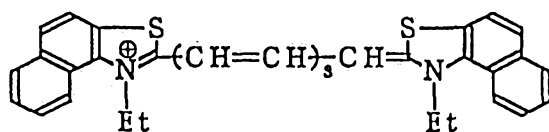
(5)



$\lambda_{\text{max}} = 800\text{nm}$

25

1 (6)

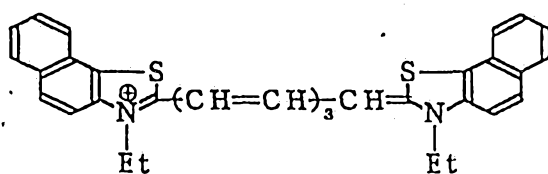


$\lambda_{\max} = 796\text{nm}$

$\text{I}^{\ominus}$

5

(7)

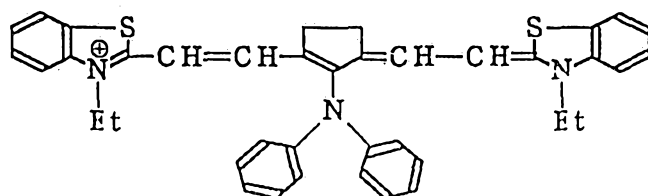


$\lambda_{\max} = 793\text{nm}$

$\text{I}^{\ominus}$

10

(8)

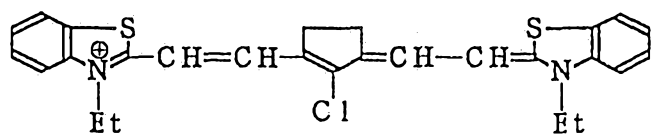


$\lambda_{\max} = 801\text{nm}$

$\text{ClO}_4^{\ominus}$

15

(9)

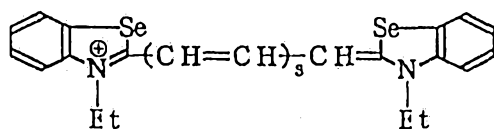


$\lambda_{\max} = 819\text{nm}$

$\text{ClO}_4^{\ominus}$

20

(10)

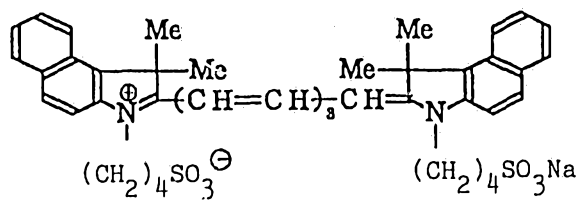


$\lambda_{\max} = 769\text{nm}$

$\text{I}^{\ominus}$

25

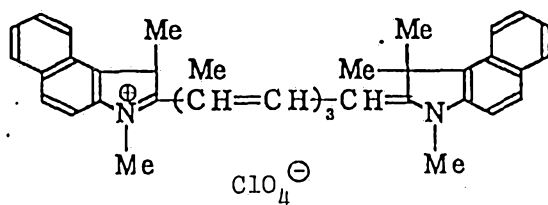
1 (11)



$\lambda_{\max} = 785\text{nm}$

5

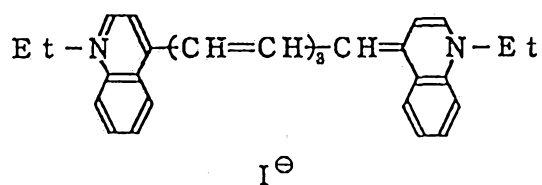
(12)



$\lambda_{\max} = 778\text{nm}$

10

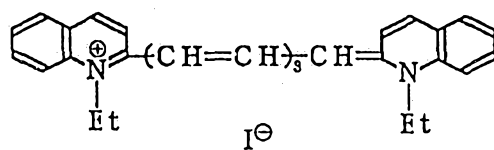
(13)



$\lambda_{\max} = 928\text{nm}$

15

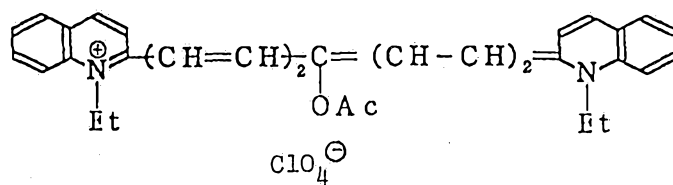
(14)



$\lambda_{\max} = 816\text{nm}$

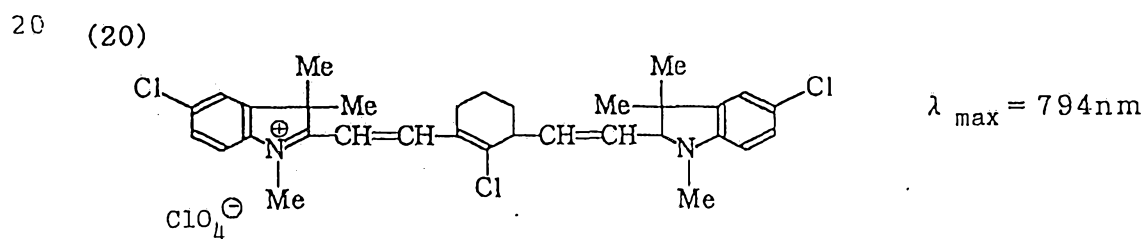
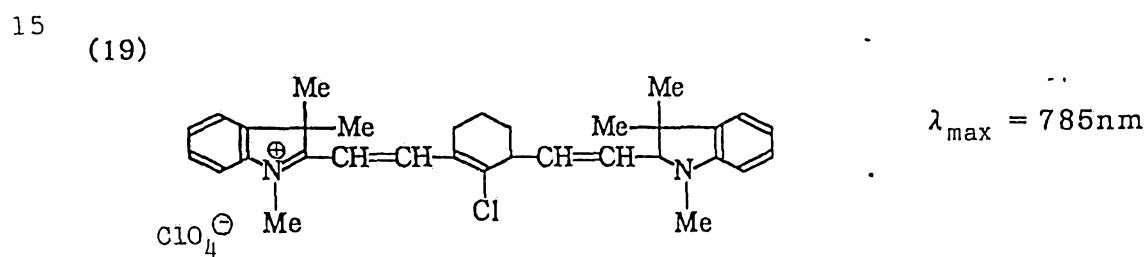
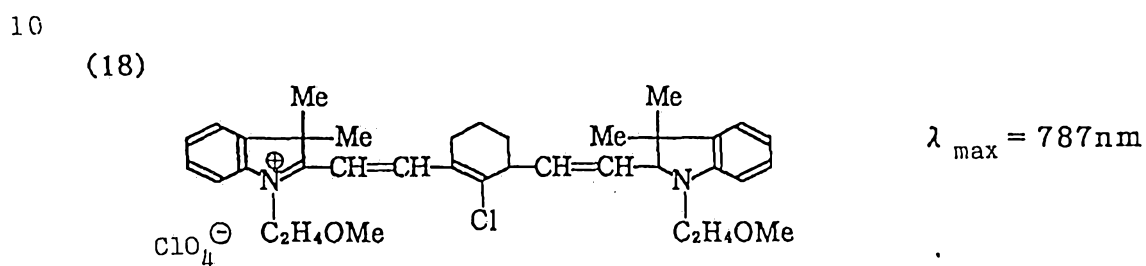
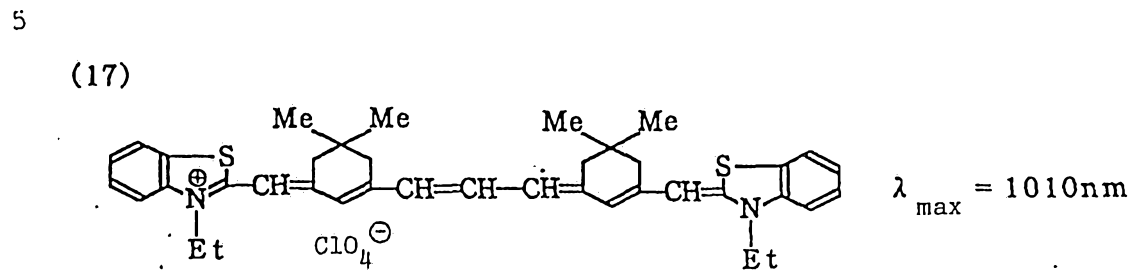
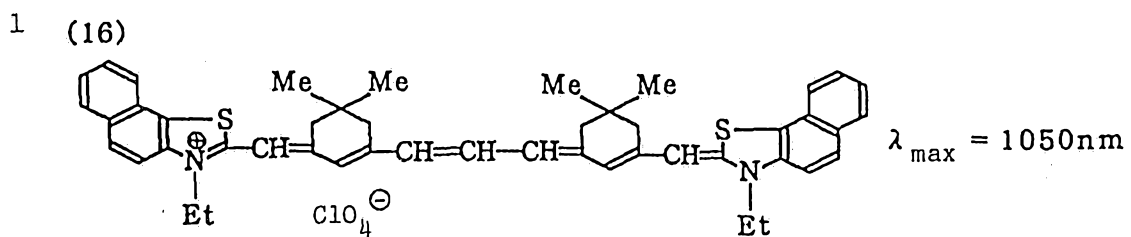
20

(15)



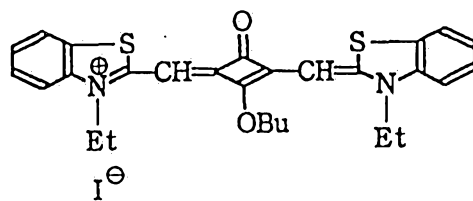
$\lambda_{\max} = 927\text{nm}$

25



25

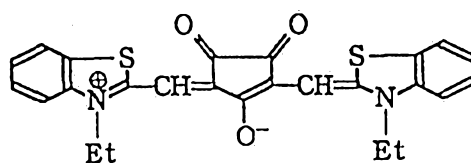
1 (21)



$\lambda_{\max} = 796\text{nm}$

5

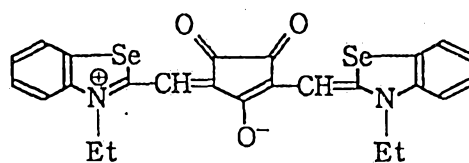
(22)



$\lambda_{\max} = 771\text{nm}$

10

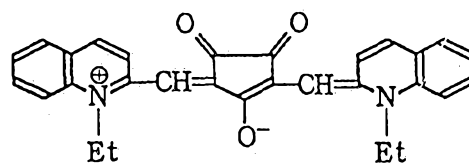
(23)



$\lambda_{\max} = 790\text{nm}$

15

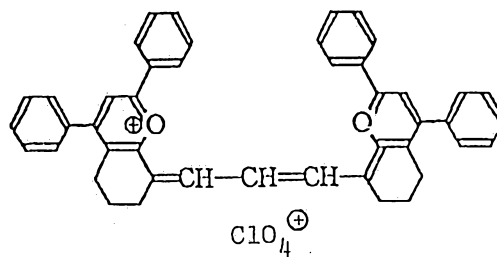
(24)



$\lambda_{\max} = 831\text{nm}$

20

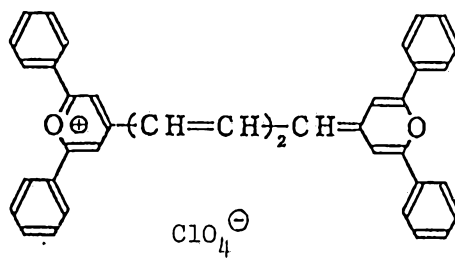
(25)



$\lambda_{\max} = 940\text{nm}$

25

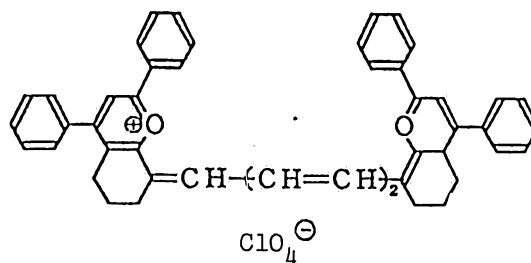
1 (26)



$\lambda_{\text{max}} = 805\text{nm}$

5

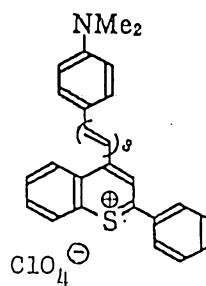
(27)



$\lambda_{\text{max}} = 1060\text{nm}$

10

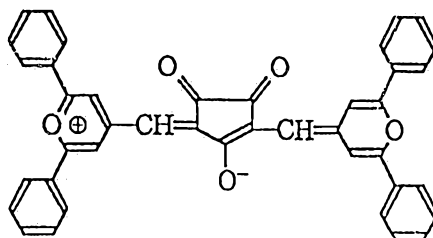
(28)



$\lambda_{\text{max}} = 944\text{nm}$

15

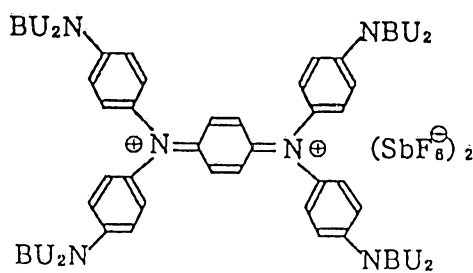
(29)



$\lambda_{\text{max}} = 954\text{nm}$

20

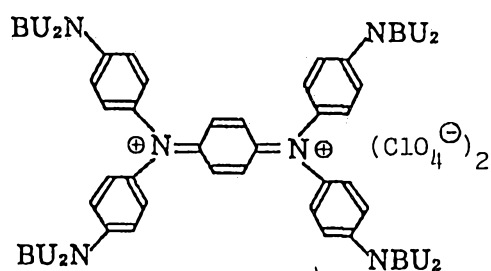
(30)



$\lambda_{\text{max}} = 1090\text{nm}$

25

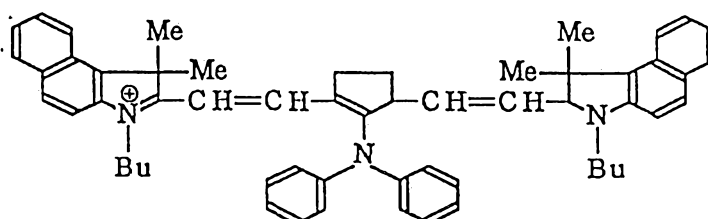
1 (31)



$\lambda_{max} = 1090nm$

5

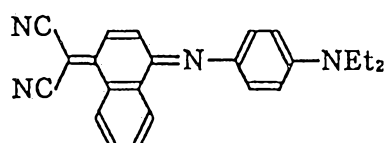
(32)



$\lambda_{max} = 840nm$

10

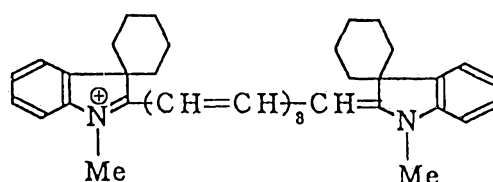
(33)



$\lambda_{max} = 772nm$

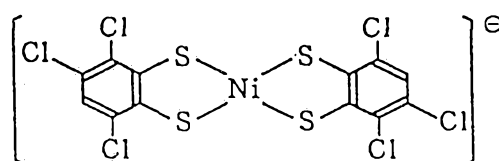
15

(34)



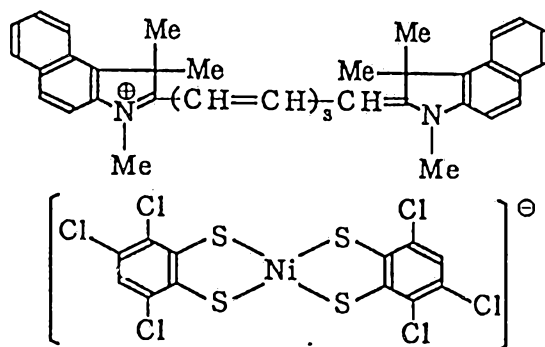
$\lambda_{max} = 765nm$

20



25

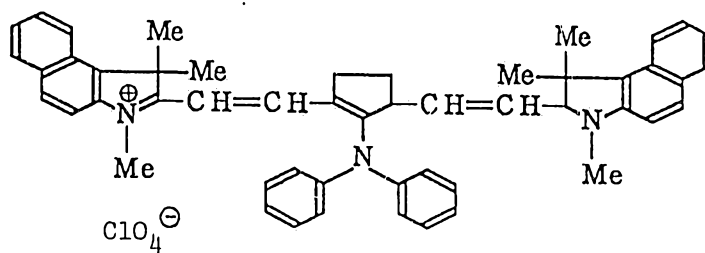
1 (35)



$\lambda_{\max} = 790\text{nm}$

5

(36)

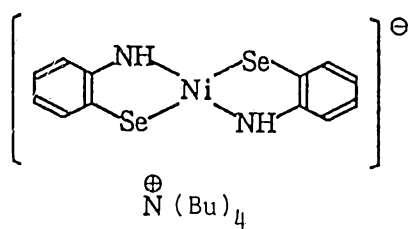


$\lambda_{\max} = 835\text{nm}$

10

15

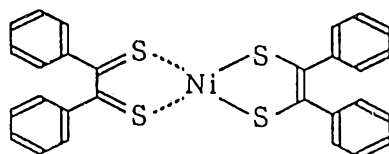
(37)



$\lambda_{\max} = 858\text{nm}$

20

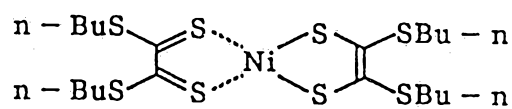
(38)



$\lambda_{\max} = 855\text{nm}$

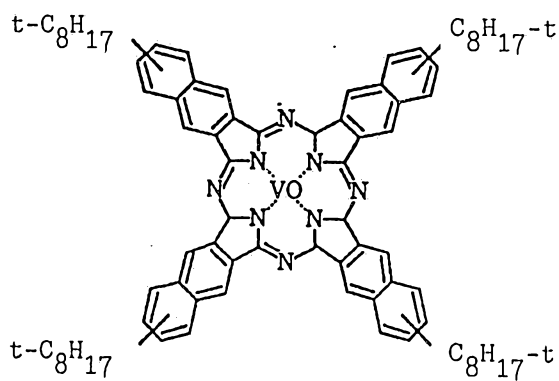
25

1 (39)



$\lambda_{\text{max}} = 1010\text{nm}$

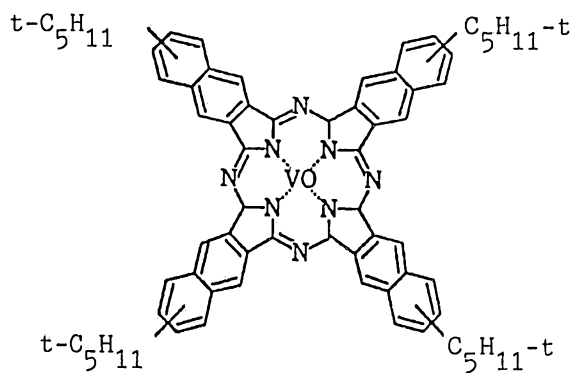
5 (40)



$\lambda_{\text{max}} = 770\text{nm}$

10

(41)

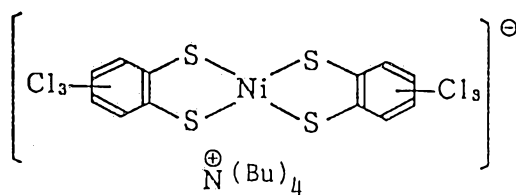


$\lambda_{\text{max}} = 765\text{nm}$

15

20

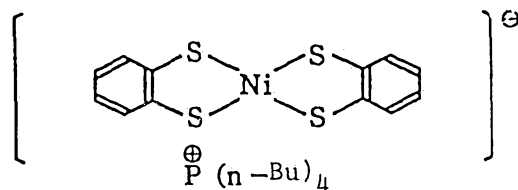
(42)



$\lambda_{\text{max}} = 870\text{nm}$

25

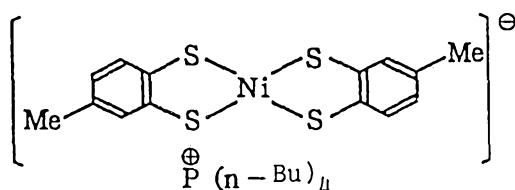
1 (43)



$\lambda_{\text{max}} = 875\text{nm}$

5

(44)



$\lambda_{\text{max}} = 905\text{nm}$

10

As another example of the identification mark having invisible information for inhibiting copying, fluorescent coloring material or pigment which does not absorb the visible rays but which has fluorescent characteristics in the near infrared ray region is dissolved or dispersed in the binder and a predetermined pattern is, by printing or the like, formed on the recording medium for inhibiting copying.

20

The fluorescent coloring material or pigment may be a material having the fluorescent wavelength peak in a range of 700 nm or longer, preferably 800 nm or longer.

25

Since the material having the fluorescent wavelength peak in a range of 700 nm or shorter can be visually detected, the secrecy cannot satisfactorily be maintained. If a material having the fluorescent

1 wavelength peak in a range of 1100 nm or longer is
used, sensitivity of a Si-type photo-detection device,
such as a CCD, deteriorates. In this case, the
identification mark cannot accurately be judged. It
5 is further preferable to employ a fluorescent coloring
material or pigment having the fluorescent wavelength
peak in a range of 1000 nm or shorter. Since the near
infrared fluorescent rays can be detected when they
are separated from exciting rays, it is preferable that
10 the two types of the rays have wavelengths which are
considerably different from each other. Therefore,
near infrared fluorescent coloring material or pigment
and exciting rays are selected such that they are
different from each other by 50 nm or more, preferably
15 100 nm or more.

If the absorption of exciting rays takes place
in the visible region, it can be recognized visually
and information to be recorded is adversely affected.
It is preferable to employ the exciting rays having
20 the absorption wavelength peak of 750 nm or longer.

The exciting wavelength is selected depending
upon the type of the light source and the spectrum
filter. The near infrared fluorescent coloring
material may be a xanthene, oxazine, thiazine,
25 polymethine or stryl compound. As an inorganic
compound, a solid laser material of a type containing
a rare earth element is used.

1 More specifically, any one of the following
near infrared fluorescent coloring material may be
used. However, a material may be used regardless of
the exemplified materials if it has fluorescent rays
5 in the near infrared ray region and exhibits excellent
fluorescent quantum yield, weather and light
resistance.

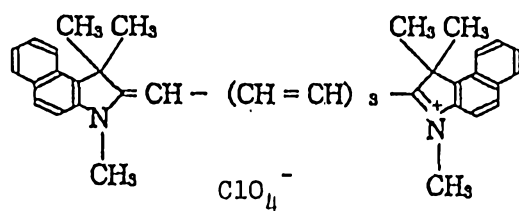
Compounds (45) to (65)

10 The binder resin for use in the foregoing near
infrared fluorescent coloring material or pigment may
be a urea resin, melamine resin, alkyd resin, acryl
resin, vinyl chloride resin, aromatic sulfonamide
resin, or a benzoquanamine resin or their copolymer.
By using a ultraviolet absorber or an anti-oxidant with
15 the foregoing resin, the light resistance of the resin
can be improved. The binder resin can be manufactured
by a block resin crushing method, emulsification
polymerizing method or a resin precipitation method or
the like.

20

25

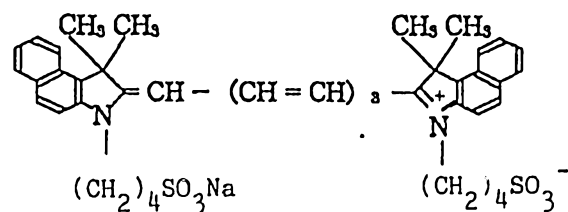
1 (45)



λ_{abs} 780nm

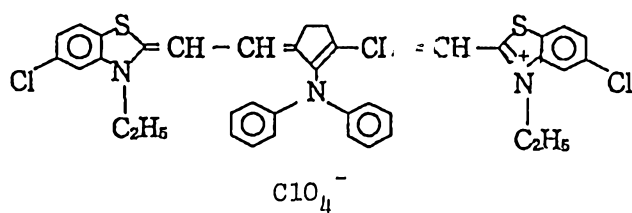
5

(46)



λ_{abs} 790nm

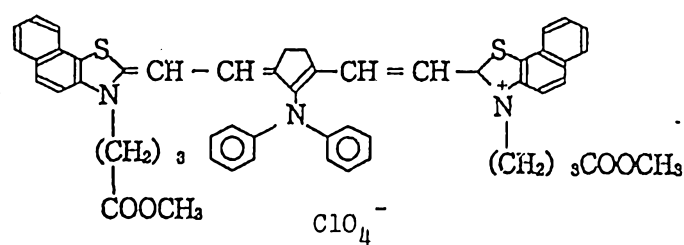
10 (47)



λ_{abs} 820nm

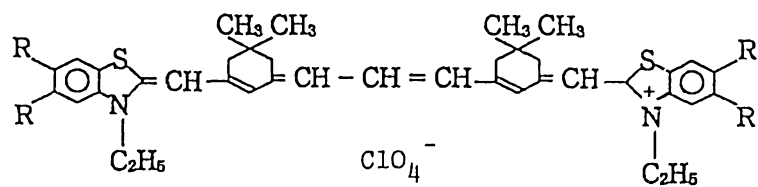
15

(48)



20

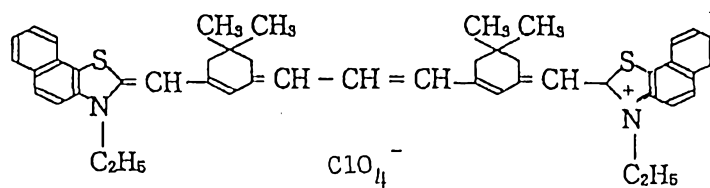
(49)



R = H

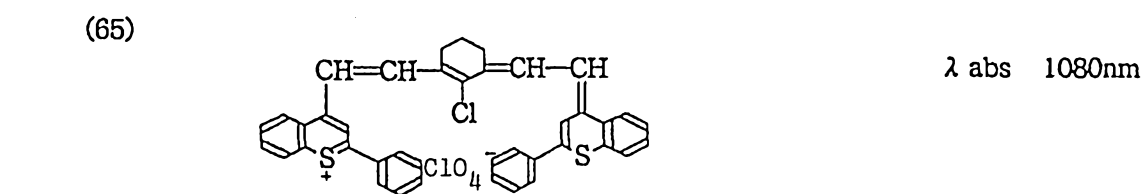
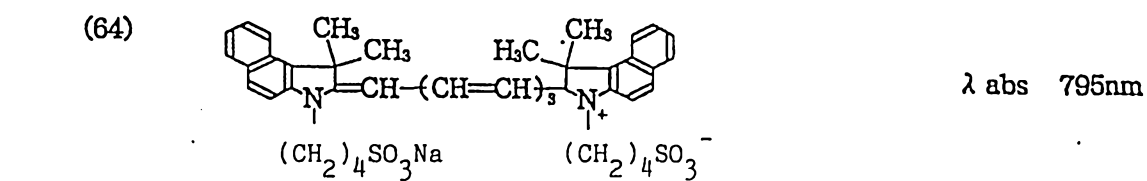
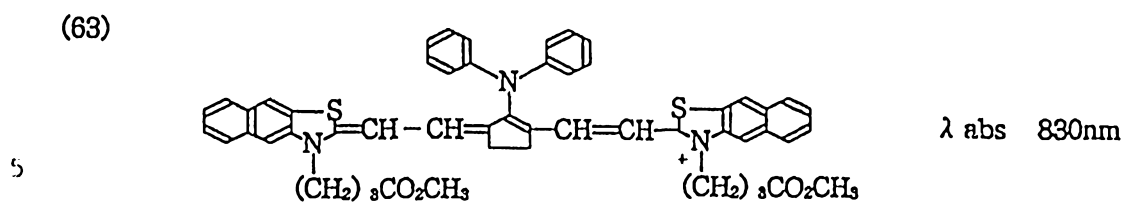
25

(50)



- 1 (51) $\text{NdP}_5\text{O}_{14}$
- (52) $\text{LiNdP}_4\text{O}_{12}$
- (53) $\text{Na}_5\text{Nd}(\text{WO}_4)_4$
- 5 (54) $\text{Al}_3\text{Nd}(\text{BO}_3)_4$
- (55) $\text{Cs}_2\text{NaNdCl}_6$
- (56) $\text{Li}(\text{Nd}_{0.9}\text{Yb}_{0.1})\text{P}_4\text{O}_{12}$
- 10 (57) $\text{C}_2\text{H}_5 - \text{N}^+ \text{ (quinoline ring) } (\text{CH} = \text{CH})_3 \text{CH} = \text{N}^- \text{ (quinoline ring) } - \text{C}_2\text{H}_5$
 I^- $\lambda \text{ abs } 930\text{nm}$
- (58) $\text{C}_2\text{H}_5 - \text{N}^+ \text{ (quinoline ring) } (\text{CH} = \text{CH})_2 \text{C} (\text{OCOCH}_3) = \text{CH} - \text{CH}_2 - \text{N}^- \text{ (quinoline ring) } - \text{C}_2\text{H}_5$
 ClO_4^- $\lambda \text{ abs } 930\text{nm}$
- 15 (59) $\text{C}_2\text{H}_5 - \text{N}^+ \text{ (quinoline ring) } - \text{CH} = \text{C} (\text{CH}_3)_2 - \text{CH} = \text{CH} - \text{CH} = \text{C} (\text{CH}_3)_2 - \text{CH} = \text{N}^- \text{ (quinoline ring) } - \text{C}_2\text{H}_5$
 ClO_4^- $\lambda \text{ abs } 1010\text{nm}$
- 20 (60) $\text{C}_2\text{H}_5 - \text{N}^+ \text{ (quinoline ring) } - \text{CH} = \text{C} (\text{CH}_3)_2 - \text{CH} = \text{CH} - \text{CH} = \text{C} (\text{CH}_3)_2 - \text{CH} = \text{N}^- \text{ (quinoline ring) } - \text{C}_2\text{H}_5$
 ClO_4^- $\lambda \text{ abs } 1050\text{nm}$
- 25 (61) Nichira Chemical Industry NP-370 $\lambda \text{ abs } 250\text{nm}$

1 (62) $\text{LiAlO}_2 : \text{Fe}^{3+}$ $\lambda_{\text{abs}} 250\text{nm}$



20

25

1 Fig. 21 illustrates reflection spectrum of
copying paper for a copying machine as an example of a
recording medium in a state prior to recording the
identification mark. Since the copying paper has a
5 substantially constant reflectance in a range from 450
to 1200 nm, it is preferable to be used as a medium in
the present invention.

 Since the usual paper, such as the copying paper,
has a relatively high reflectance, change due to
10 absorption is suitable as the change in the reflectance
utilized as the identification mark according to the
present invention.

 In case where fluorescent rays are used, the
absorption wavelength for use as the excitement ray is
15 usually shorter than the fluorescent wavelength.
Therefore, the visible region is easily affected. If the
wavelength is lengthened to prevent the influence upon
the visible portion, the fluorescent wavelength is
further lengthened. Therefore, the structure of the
20 optical system becomes difficult to be formed.

 An image pattern to be detected and according
to the present invention will now be described with
reference to Fig. 3. Fig. 3 illustrates a low
reflection portion 101 recorded by using ink formed by
25 dissolving, in a PMMA, infrared absorption coloring
material which has the characteristics shown in Fig. 9
and which is not absorbed in the visible portion.

1 Since the image patterns are printed as small
patterns in the form of squares each having a side of
about 120 μm and they are substantially the same color
in the visible region, the image pattern shown in Fig.
5 3 cannot be identified visually. However, it can be
detected in an infrared region. Although a pattern in
the form of a square having a side of about 120 μm is
described as an example to make ensuing descriptions,
the foregoing region has a size of about four pixels if
10 the region b is read at 400 dpi (dot per inch). It
should be noted that the method of forming the pattern
is not limited to the foregoing method.

 If an attempt is made to prevent the judgment
by forming an infrared ray absorbing film in order to
15 copy an original document recorded by using a recording
medium having the identification mark according to the
present invention, the intensity of the infrared ray
is weakened on the overall surface of the original
document. Therefore, the abnormality can be judged.

20 If an attempt is made to prevent the judgment
by using an infrared ray reflecting film, the intensity
of the near infrared ray is straightened on the overall
surface of the original document, the abnormality can
be judged.

25 If an intermediate-density infrared ray
absorbing film or an infrared ray reflecting film is
used, the change of the reflectance of the

1 identification mark on the original document takes
place usually although the base value deviates.

Therefore, the judgment can be performed.

As described above, the invisible information
5 recording medium is used as a recording medium for
inhibiting copying and reading, the invisible informa-
tion recording medium having no information in the
visible region thereof and having the identification
mark which is absorbed or reflected in the near infrared
10 ray region. As a result, an effect can be obtained in
that copying and reading of a medium having visible
information, copying or reading of which is intended
to be inhibited, can be assuredly prevented by
detecting the identification mark while preventing an
15 influence upon the visible information.

Fifth Embodiment

According to this embodiment, toner particles
containing a resin and a coloring agent are used as
a developer for recording secret information by an
20 electrophotographic method. Further, the coloring
agent is an infrared ray absorbing coloring material
or pigment which is free from absorption in the visible
region and absorption of which takes place in the near
infrared region. Therefore, secret recording can be
25 performed with a usual copying machine or in a usual
photography.

Since use of the toner according to the present

1 invention causes no image to be present in the visible
portion, another visible image can be formed with a
usual toner which is free from absorption in the near
infrared ray region. Therefore, the secrecy of
5 information in the near infrared ray portion can further
be improved.

The toner according to this embodiment is able
to contain, as a coloring agent, an infrared ray
absorbing coloring material or pigment which is free
10 from absorption in the visible portion but which is
absorbed in the near infrared ray portion.

The near infrared ray absorbing coloring
material or pigment may be a material having the
absorption wavelength peak in a range of 700 nm or
15 longer, preferably 750 nm or longer. Since the material
having the absorption wavelength peak in a range of 700
nm or shorter can be visually detected, the secrecy
cannot satisfactorily be maintained. If a material
having the absorption wavelength peak in a range of
20 1100 nm or longer is used, sensitivity of a Si-type
photo-detection device, such as a CCD, deteriorates.
In this case, the identification mark cannot accurately
be judged. It is further preferable to employ a
coloring material or pigment having the absorption
25 wavelength peak in a range of 1000 nm or shorter.

The foregoing near infrared ray absorbing
coloring material or pigment may be dispersed or mixed

- 1 with the binder while being combined with an ultra-violet absorber or an antioxidant.

The near infrared ray absorbing coloring material or pigment must be a type that does not
5 absorb visible rays. The absorbance of the maximum absorbing wavelength in the infrared ray region must be 5 times or more the absorbance of the maximum absorbing wavelength, more preferably 10 times or more.

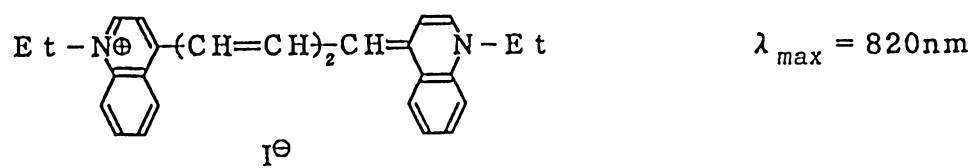
- If it is 5 times or less, it can easily visibly
10 be recognized in a visible ray region if the mark in the near infrared ray region is allowed to have a thickness that can be identified. Therefore, an adverse influence is resulted on the information to be recorded.

- 15 More specifically, any one of the following near infrared ray absorbing coloring material or pigment may be used. However, a material may be used regardless of the exemplified materials if it absorbs near infrared rays and exhibits large absorbance and
20 excellent weathering and light resistance.

Compounds (1) to (44)

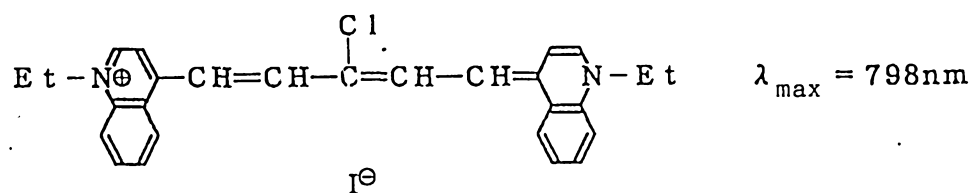
- The binder resin for use in the foregoing near infrared ray absorbing coloring material or pigment may be a urea resin, melamine resin, alkyd resin,
25 acryl resin, vinyl chloride resin, aromatic sulfonamide resin, or a benzoquanamine resin or their copolymer.

1 (1)



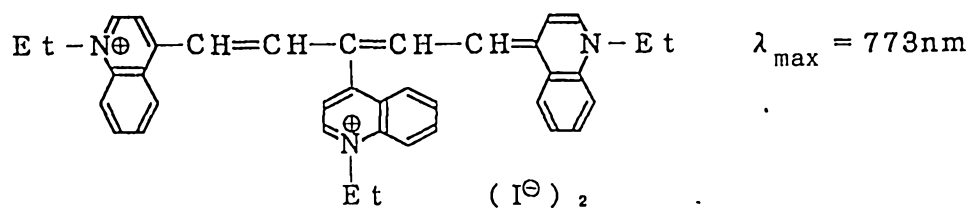
5

(2)



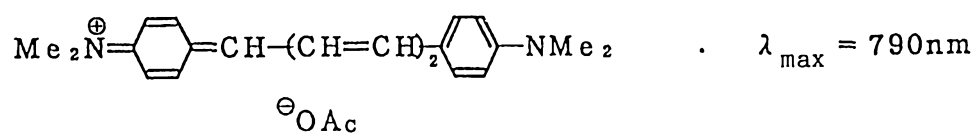
10

(3)



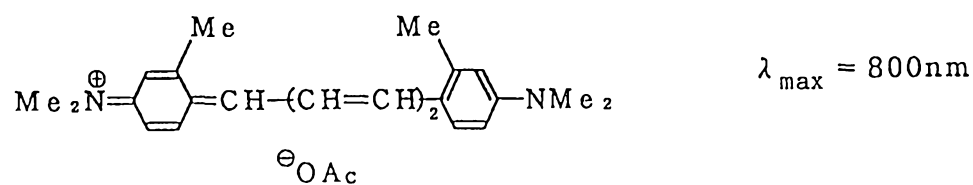
15

(4)



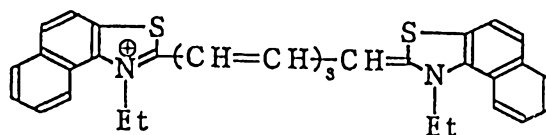
20

(5)



25

1 (6)

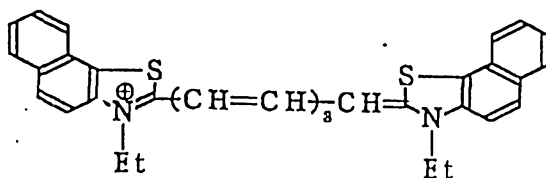


$\lambda_{\max} = 796\text{nm}$

$\text{I}^{\ominus}$

5

(7)

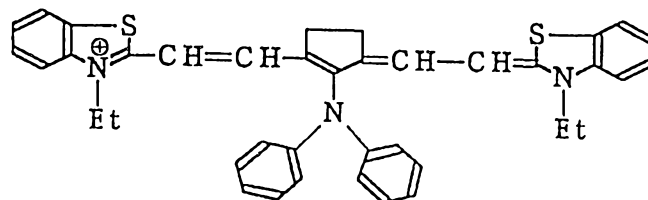


$\lambda_{\max} = 793\text{nm}$

$\text{I}^{\ominus}$

10

(8)

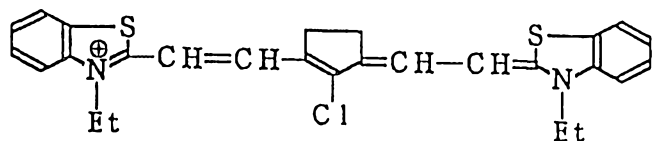


$\lambda_{\max} = 801\text{nm}$

$\text{ClO}_4^{\ominus}$

15

(9)

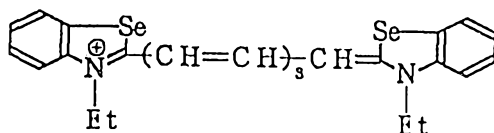


$\lambda_{\max} = 819\text{nm}$

$\text{ClO}_4^{\ominus}$

20

(10)

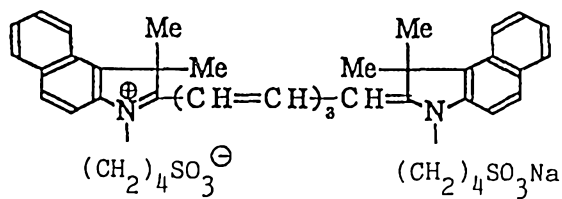


$\lambda_{\max} = 769\text{nm}$

$\text{I}^{\ominus}$

25

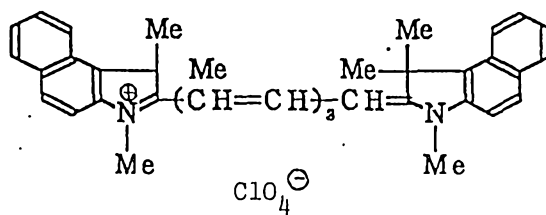
1 (11)



$\lambda_{\text{max}} = 785\text{nm}$

5

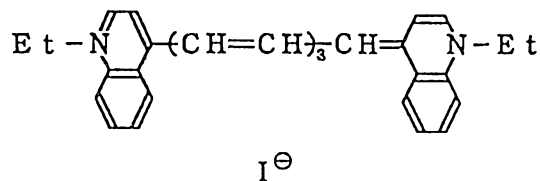
(12)



$\lambda_{\text{max}} = 778\text{nm}$

10

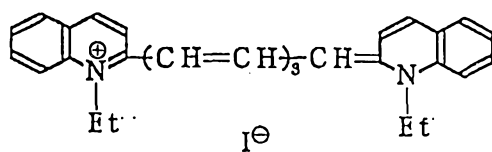
(13)



$\lambda_{\text{max}} = 928\text{nm}$

15

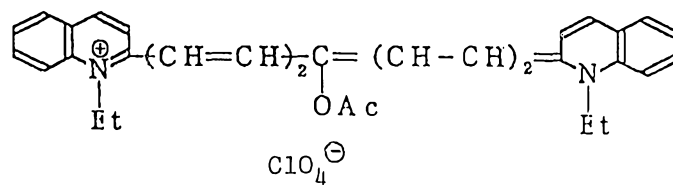
(14)



$\lambda_{\text{max}} = 816\text{nm}$

20

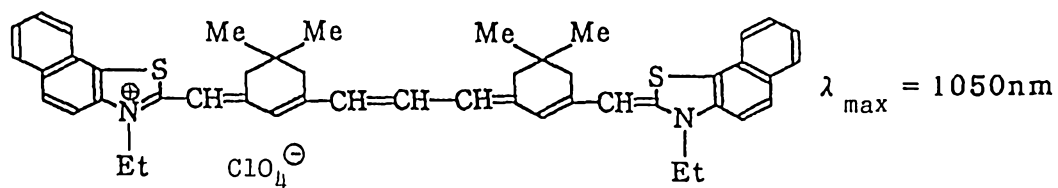
(15)



$\lambda_{\text{max}} = 927\text{nm}$

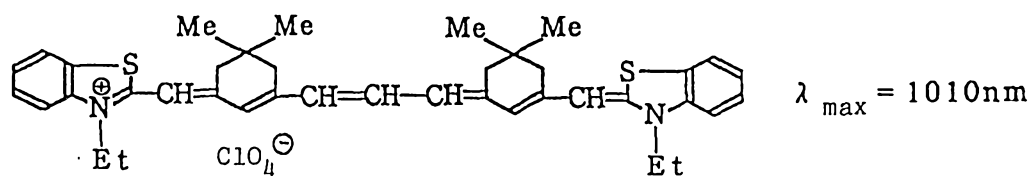
25

1 (16)



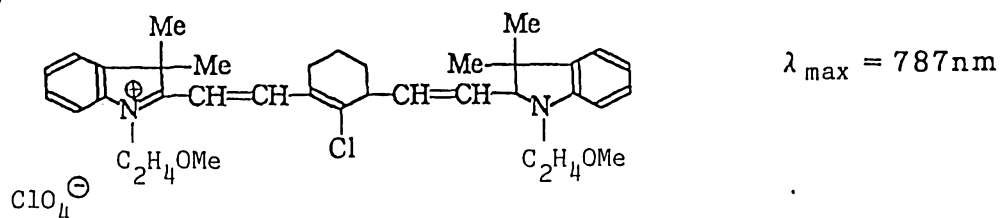
5

(17)



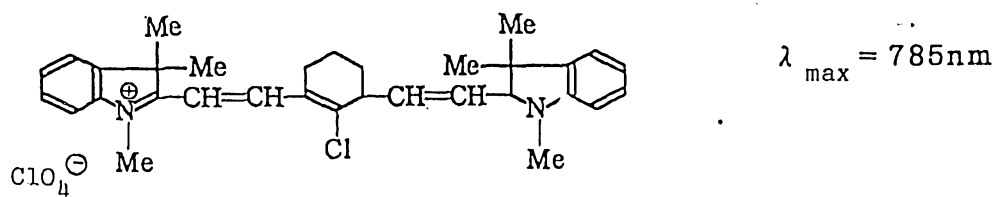
10

(18)

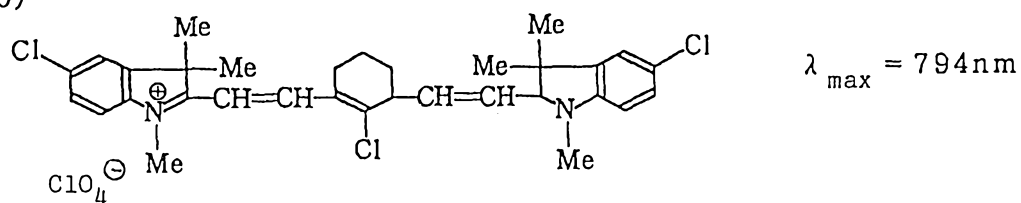


15

(19)

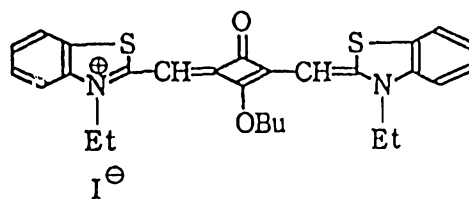


20 (20)



25

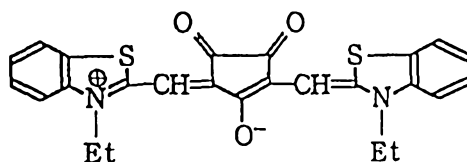
1 (21)



$\lambda_{\max} = 796\text{nm}$

5

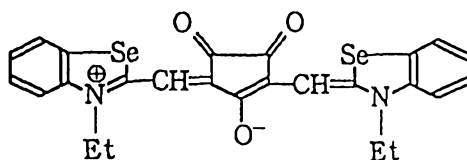
(22)



$\lambda_{\max} = 771\text{nm}$

10

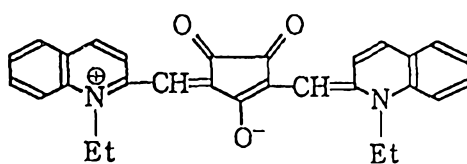
(23)



$\lambda_{\max} = 790\text{nm}$

15

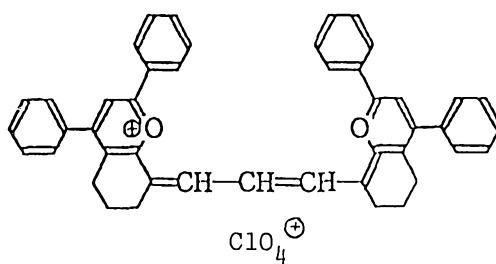
(24)



$\lambda_{\max} = 831\text{nm}$

20

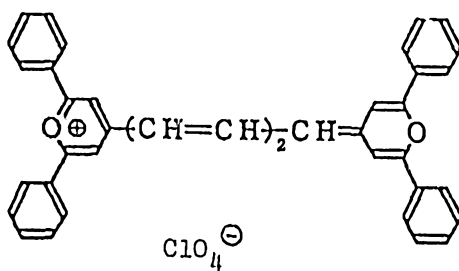
(25)



$\lambda_{\max} = 940\text{nm}$

25

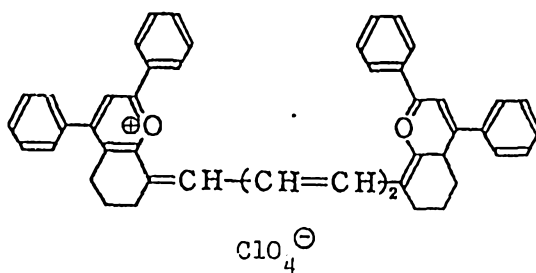
1 (26)



$\lambda_{\text{max}} = 805\text{nm}$

5

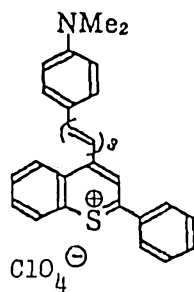
(27)



$\lambda_{\text{max}} = 1060\text{nm}$

10

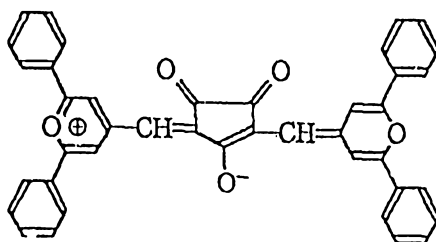
(28)



$\lambda_{\text{max}} = 944\text{nm}$

15

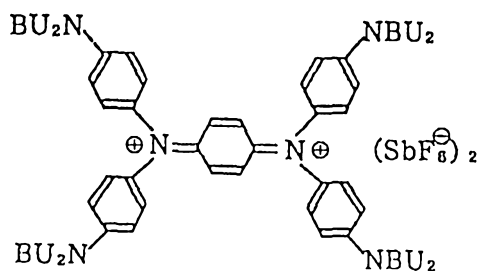
(29)



$\lambda_{\text{max}} = 954\text{nm}$

20

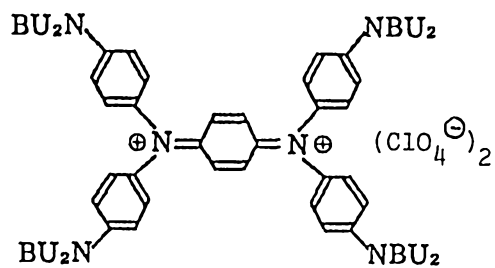
(30)



$\lambda_{\text{max}} = 1090\text{nm}$

25

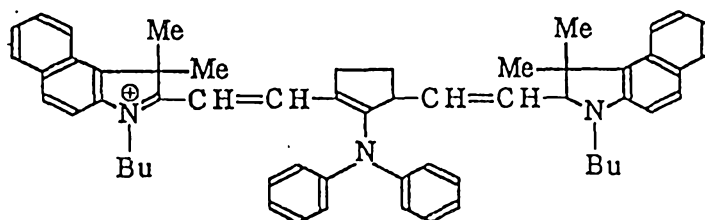
1 (31)



$\lambda_{\text{max}} = 1090\text{nm}$

5

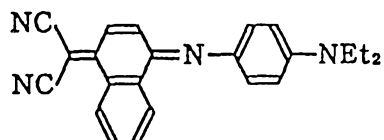
(32)



$\lambda_{\text{max}} = 840\text{nm}$

10

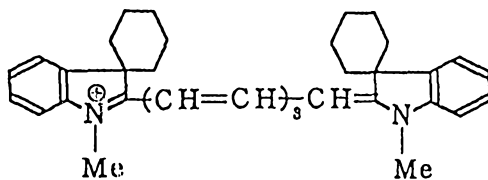
(33)



$\lambda_{\text{max}} = 772\text{nm}$

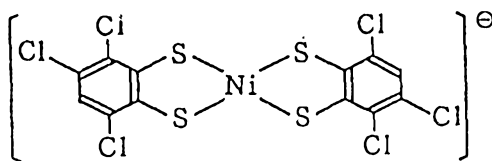
15

(34)



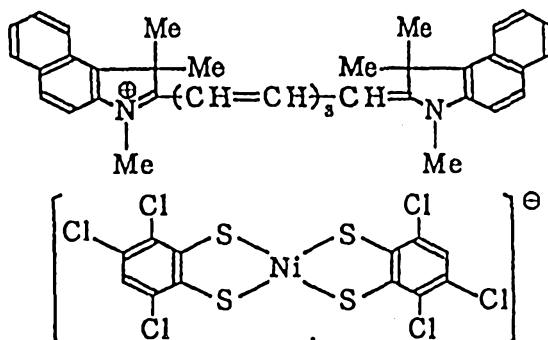
$\lambda_{\text{max}} = 765\text{nm}$

20



25

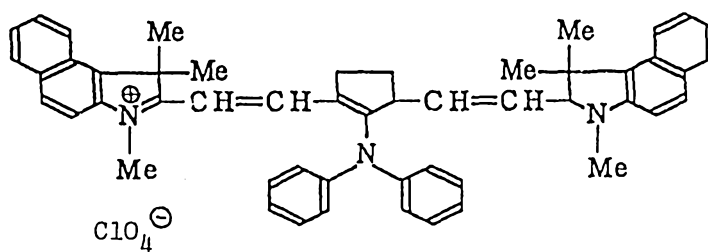
1 (35)



$\lambda_{\max} = 790\text{nm}$

5

(36)

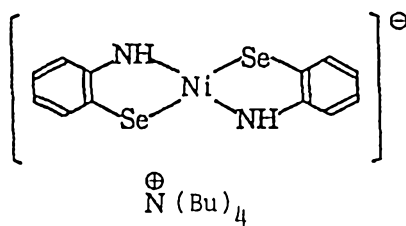


$\lambda_{\max} = 835\text{nm}$

10

15

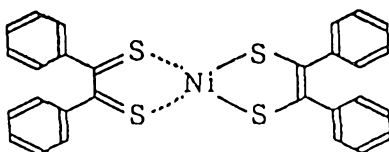
(37)



$\lambda_{\max} = 858\text{nm}$

20

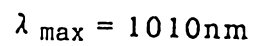
(38)



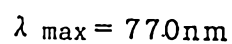
$\lambda_{\max} = 855\text{nm}$

25

1

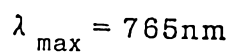


5



10

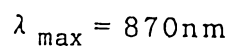
(41)



15

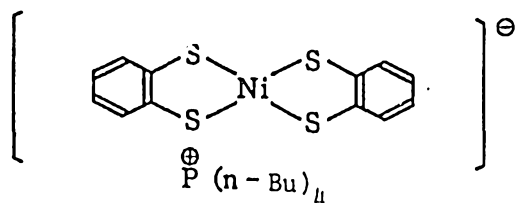
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(4.2)



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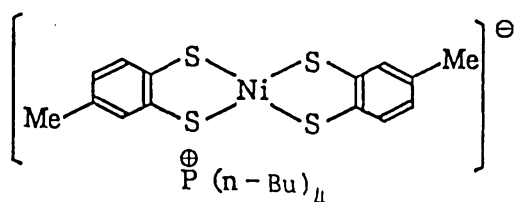
1 (43)



$$\lambda_{\text{max}} = 875\text{nm}$$

5

(44)



$$\lambda_{\text{max}} = 905\text{nm}$$

10

The toner according to the present invention may comprise an adequate resin material. If the toner is used in a full color electrophotographic method, it is preferable to use a substantially transparent resin material. Although the toner may contain the resin comprising the substantially transparent resin material, it is preferable to use a resin having other preferred characteristics.

It is preferable that a resin of a type which is in the form of, for example, a non-viscous solid at room temperature as to be used easily in an ordinary electrophotographic process.

It is preferable that the resin be a thermoplastic resin having a melting point higher than room temperature and lower than a level at which usual

25

1 paper tends to be burnt black so that the resin can be
melted on the paper when heated at the time of
generating a toner image on the paper or transferring
the same on to a paper copying sheet.

5 It should be noted that the necessity of
meeting the foregoing conditions can be eliminated.
The reason for this is that a resin having a higher
melting point may be used and that the foregoing resin
is used in another method (for example, U.S. Patent
10 No. 2,776,907 invented by Curlson) of applying
vapor of a solvent with respect to the foregoing resin
to a paper copying sheet for carrying a toner image so
that it can be melted onto the paper copying sheet.

The toner may, of course, be melted onto another
15 surface.

However, the foregoing surface enables the
heating value required to melt the toner onto the
foregoing surface to be adjusted due to its heat
conductivity and wet characteristics. Further, it is
20 preferable that the toner resin have excellent fric-
tional charging characteristics and satisfactory
insulating characteristics to charge electricity as to
be used in development in various electrophotographic
method, such as a cascade development of an electro-
25 photographic latent image disclosed in U.S. Patent
No. 2,618,552 invented by Wise and U.S. Patent
No. 2,638,416 invented by Walkup and Wise and the other
known development method in the related technical

1 field or an electrostatic powder image transfer method
disclosed in U.S. Patent No. 2,576,047 invented by
Shafart and U.S. Patent No. 2,626,865 invented by
Mayor.

5 Although an arbitrary and adequate transparent
resin may be used in the toner according to the present
invention, use of an esterified product composed of a
vinyl resin and diol comprising dicarboxylic acid and
diphenyl will enable excellent result to be obtained.

10 The toner according to the present invention
may comprise an arbitrary and adequate vinyl resin.
The vinyl resin may be a homopolymer or a copolymer of
two or more types of vinyl monomers. Typical monomers
for use to manufacture the vinyl polymer are exemplified
15 by the following materials.

Styrene; p-chlorostyrene; vinyl naphthalene;
ethylene unsaturated monoolefin such as ethylene,
propylene, butylene or isobutylene; vinyl ester such
as vinyl chloride, vinyl bromide, vinyl fluoride,
20 vinyl acetate, vinyl propionate; vinyl benzonate;
vinyl butyrate; α -methylene aliphatic monocarboxylic
acid such as methyl acrylate, ethyl acrylate, n-butyl
acrylate, isobutyl acrylate, dodecyl acrylate, n-
octyl acrylate, 2-chloroethyl acrylate, phenyl acrylate,
25 α -chloroacrylate, methyl methacrylate, ethyl
methacrylate or butyl methacrylate; acrylonitril,
methacrylonitril or acryl amide; vinyl ether such as

1 vinyl methyl ether, vinyl isobutyl ether or vinyl
ethyl ether; vinyl ketone such as vinyl methyl ketone,
vinyl hexylketone or methyl isobrophenyl ketone;
halogated vinylidene such as vinylidene chloride or
5 vinylidene chlorine fluoride; N-vinyl compound such as
N-vinyl pyrol, N-vinyl carbazole, N-vinyl indol or
N-vinyl pyloridone; and their mixture.

The vinyl resin suitable for use in the toner
usually has weight average molecular weight of about
10 3,000 to 500,000.

It is preferable to use a toner of a type
containing a styrene resin in a relatively large
quantity.

A further thick image can be obtained if the
15 styrene resin is present in the toner in a quantity of
25 wt% or more of the overall weight of the resin in
the toner. The styrene resin may be a homopolymer of
styrene or a homolog of styrene or may be a copolymer
of styrene and another monomer having a single
20 methylene group bonded to a carbon atom with a double
bond.

That is, monomers of a type that can be co-
polymerized with styrene by additional polymerization
are as follows.

25 P-chlorostyrene; vinyl naphthalene; ethylene
unsaturated monoolefin such as ethylene, propylene,
butylene or isobutylene; vinyl ester such as vinyl

- 1 chloride, vinyl bromide, vinyl fluoride, vinyl acetate,
vinyl propionate, vinyl benzonate; vinyl butyrate;
 α -methylene aliphatic monocarboxylic acid such as
methyl acrylate, ethyl acrylate, n-butyl acrylate,
5 acrylic acid, isobutyl acrylate, dedecyl acrylate,
n-octyl acrylate, 2-chloroethyl acrylate, phenyl
acrylate, α -chloroacrylate, methyl methacrylate, ethyl
methacrylate or butyl methacrylate; acrylonitril,
methacrylonitril or acryl amide; vinyl ether such as
10 vinyl methyl ether, vinyl isobutyl ether or vinyl
ethyl ether; vinyl ketone such as vinyl methyl ketone,
vinyl hexylketone or methyl isobrophenyl ketone;
halogated vinylidene such as vinylidene chloride or
vinylidene chlorine fluoride; N-vinyl compound such as
15 N-vinyl pyrol, N-vinyl carbazole, N-vinyl indol or N-
vinyl pyloridone; and their mixture.

The styrene resin may be manufactured by
polymerizing a mixture of two or more types of the
foregoing unsaturated monomers and a styrene monomer.

- 20 The expression "additional polymerization"
includes known methods, such as a free radical
polymerizing method, an anion polymerizing method,
and an action polymerizing method.

- The vinyl resin containing the styrene type
25 resin may be mixed with one or more types of the other
resins.

In the case where the vinyl resin is mixed with

1 the other resin, it is preferable that the resin to
be added be another vinyl resin.

The reason for this is that the obtainable
mixture is characterized in that excellent frictional
5 charging stability and uniform resistance against
physical deterioration.

The vinyl resin to be mixed with the styrene
resin or another resin may be manufactured by
additional polymerization of an adequate vinyl monomer,
10 such as a vinyl monomer.

Another thermal plastic resin may be mixed with
the vinyl resin according to the present invention.

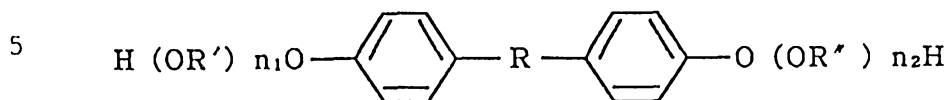
Typical non-vinyl thermal plastic resins are
exemplified by the following materials.

15 In a case where phenol formaldehyde resin
denatured with rosin, epoxy resin denatured with oil,
polyurethane resin, fiber resin, polyether resin or
the resin component of a toner of their mixture contains
a mixture of styrene co-polymerized with another
20 unsaturated monomer or polystyrene and another resin,
it is preferable that the styrene is contained in a
quantity of 25 wt% or more of the total weight of the
resin present in the toner.

The reason for this is that a thicker image can
25 be obtained.

A polymerized ester compound of dicarboxylic
acid and diol containing diphenyl may be used as a

1 preferred resin for the toner according to the present invention, the diphenyl reactant having the following general formula:



where R is an alkylene group which comprises or which does not comprise a substituent having 2 to 12 carbon atoms or alkylidene group having 1 to 12 carbon atoms; R' and R'' are alkylene groups each of which comprises or which does not comprise a substituent having 2 to 12 carbon atoms, an alkylene group having 8 to 12 carbon atoms and allylene group; X and X' respectively are alkyl groups each having 1 to 4 hydrogen or carbon atoms; n_1 and n_2 respectively are 1 or larger and the average sum of n_1 and n_2 is smaller than 21. If R is the alkylidene group having 2 to 4 carbon atoms and R' and R'' are alkylene groups each having 3 to 4 carbon atoms, it is preferable to use diphenol.

The reason for this is that resistance against blocking can be enlarged, the clearness of characters is improved, and the toner image can further completely be transferred.

25 The optimum result can be obtained in a case of diol in which R is an isopropylidene group and R' and R'' are propylene group or butylene group.

1 The reason for this is that the resin
manufactured from the foregoing diol has strong
resistance against aggregation and it is able to
quickly penetrate into a receiving paper sheet under
5 the melted condition. It is preferable that
dicarboxylic acid having 3 to 5 carbon atoms be used.

 The reason for this is that the obtained toner
resin has strong resistance against the formation of
the film on an image generating surface that can be
10 used again. Further, it has strong resistance against
generation of fine powder under condition where the
apparatus is being operated.

 The optimum result can be obtained from use
of α -unsaturated dicarboxylic acid containing fumaric
15 acid, maleic acid or maleic acid anhydride. The reason
for this is that it has the strongest resistance
against physical deterioration of the toner and it can
be quickly dissolved.

 If an unsaturated bond is present in the
20 reactant of the α -unsaturated dicarboxylic acid, tough
resin molecules can be obtained without adverse influ-
ence upon dissolving and crushing characteristics.

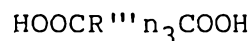
 Any diphenyl expressed by the foregoing formula
may be used. Typical diphenyl having the foregoing
25 general structure is exemplified by the following
materials.

2,2-bis (4- β -hydroxyethoxyphenyl)-propane,

- 1 2,2-bis (4-hydroxyisopropoxyphenyl) propane, 2,2-bis
(4- β -hydroxyethoxyphenyl)-pentane, 2,2-bis (4- β -
hydroxyethoxyphenyl)-butane, 2,2-bis (4-hydroxy-
propoxyphenyl)-propane, 2,2-bis (4-hydroxy-propoxy-
5 phenyl) propane, 2,2-bis (4-hydroxy-propoxyphenyl)
propane, 1,1-bis (4-hydroxy-ethoxy-phenyl)-butane,
1,1-bis (4-hydroxyisopropoxyphenyl) heptane, 2,2-bis
(3-methyl-4- β -hydroxyethoxyphenyl) propane, 1,1-bis
(4- β -hydroxyethoxyphenyl)-cyclohexane, 2,2'-bis
10 (4- β -hydroxyethoxyphenyl)-norvalnan, 2,2-bis (4- β -
hydroxystyloxyphenyl) propane, polyoxyethylene ether
of isopropylidene diphenol (the two phenolhydroxyl
groups are oxyethylated and the average oxyethylene
group per mole is 2.6), polyoxypropylene ether of
15 2-butyli-denediphenyl (the two phenol hydroxy groups
are oxyalkylated and the average oxypropylene groups
is 2.5). It is preferable that diphenol is used in
which R is an alkylidene group having 2 to 4 carbon
atoms and R' and R" are alkylene groups each having
20 3 to 4 carbon atoms.
- The reason for this is that resistance against
formation into a block can be strengthened, the
clearness of characters can be improved and the tone
image transference can be performed further completely.
- 25 The optimum result can be realized in a case where diol
is used which is selected from a group in which R is
isopropylidene and R' and R" are propylene and butylene.

- 1 The reason for this is that the resin obtainable from
the foregoing diol has further strong resistance
against formation of blocks and it can considerably
quickly be penetrated into a paper receiving sheet
5 under the melted condition.

Any arbitrary dicarboxylic acid is able to
react with the foregoing diol so that the toner resin
according to the present invention is manufactured.
The foregoing acid may be substituted, not substituted,
10 saturated or not saturated. The foregoing acid is
expressed by the following general formula:



- 15 where R''' is an alkylene group which has a substituent
or which has no substituent and which has 1 to 12 carbon
atoms, an allylene group or an alkylene allylene group
having 10 to 12 carbon atoms, and n₃ is smaller than 2.
In this specification ("What is claimed is" included),
20 the expression "dicarboxylic acid" includes anhydride
of the foregoing acid (a case where the hydride is
present). Typical dicarboxylic acid includes the
following materials: oxalic acid, malonic acid,
succinic acid, glutaric acid, adipic acid, pimelic
25 acid, suberic acid, azelaic acid, sebacic acid,
phthalic acid, mesaconic acid, homophthalic acid,
isophthalic acid, telephthalic acid, O-phenyl

1 acetate- β -propionic acid, itaconic acid, maleic acid,
maleic anhydride, fumaric acid, phthalic anhydride,
traumatinic acid, and citraconic acid.

It is preferable to use dicarboxylic acid
5 having 3 to 5 carbon atoms. The reason for this is
that the obtainable toner resin has strong resistance
against formation of film on the image generating
surface that can be used again. Further, it has
resistance against generation of fine powder in a state
10 where the apparatus is being operated. The optimum
result can be obtained from α -unsaturated dicarboxylic
acid including fumaric acid, maleic acid or maleic
anhydride.

The reason for this is that maximum resistance
15 against physical deterioration of the toner can be
obtained, and molten substance can quickly be obtained.
Although the mechanism has not been cleared yet, it
can be considered that the presence of an unsaturated
bond in the α -unsaturated dicarboxylic acid reactant
20 enables further tough resin molecules to be obtained
while preventing an adverse influence upon the melting
characteristics and crushing characteristics.

The polymerized esterified product to be
contained in the toner according to the present inven-
25 tion may be copolymerized or mixed with one or more
thermal plastic resins if necessary. If it is mixed
with another thermal plastic resin, it is preferable

1 that the resin to be added is an aromatic resin, an
aliphatic resin or their mixture. The reason for this
is that the obtainable mixture has uniform density
and excellent prediction for each batch due to its
5 physical properties. A great number of types of thermal
plastic resins is able to mix with the resin according
to the present invention. Typical thermal plastic
resins are as follows.

Formaldehyde resin denatured with rosin, epoxy
10 resin denatured with oil, polyurethane resin, fiber
resin, vinyl resin and their mixture.

If the resin component in the toner contains
the additive resin, the additive component must be
contained in a quantity of about 50 wt% or less with
15 respect to the overall weight of the resin present in
the toner. It is preferable that the condensation-
polymerized product of diol and dicarboxylic acid be
present in a relatively large quantity in the resin
component of the toner. The reason for this is that
20 the melting temperature is further lowered if the
additive material is added in a predetermined quantity.
If the condensation-polymerized product of diol and
dicarboxylic acid is contained in the toner in a large
quantity, a clearer and thicker image can be obtained.
25 The additive resin may be contained in the toner
mixture by any one of methods selected from a group
consisting of a hot melting method, a solvent method

1 and an emulsifying method. The obtainable resin
mixture and the copolymer have a substantially uniform
characteristic and they are satisfactorily adaptable
to the pigment and the dye. The coloring agent may be
5 added prior to, simultaneously with or after performing
the polymerizing process.

It is preferable that an adequate vinyl resin
or a polyester alkyd resin be added to the toner
according to the present invention. The optimum result
10 can be obtained in electrophotography if any one of
the following materials is used which is selected from
a group consisting of styrene-butyl methacrylate
copolymer, styrene-vinyl toluene copolymer, styrene-
acrylate copolymer, polystyrene resin, a resin mainly
15 composed of styrene of a type disclosed in U.S. Reissue
Patent No. 25,136 disclosed by Carlson, a resin mainly
composed of polystyrene, and a polystyrene mixture
disclosed in U.S. Patent No. 2,788,288 by Rinefrank
and Jones.

20 The toner composition according to the present
invention can be manufactured by any one of known toner
mixing methods and crushing methods. For example, a
method may be employed in which the components are
mixed and kneaded, and the obtained mixture is fined
25 to sufficiently mix the components. The toner
particles can be formed by another known method, such
as a method using a suspension fluid of the toner

1 composition, a method using a hot molten substance or
a method of spraying and drying a solution.

If the toner mixture according to the present
invention is adapted to a cascade development method,
5 the toner must have an average particle size of about
30 μ or less. In order to obtain the optimum result,
it is preferable that the average particle size ranges
about 5 to about 17 μ . If the toner mixture is used
in the powder cloud development method, it is
10 preferable that the particle size be slightly smaller
than 1 μ .

A coated or non-coated carrier substance has
been known which is adaptable to the cascade development
method or the magnetic brush development method.

15 The carrier particles may be electroconductive,
insulating, magnetic or non-magnetic particles.
However, the necessity lies in that the carrier
particles are supplied with a charge, the polarity
of which is opposite to the polarity of the toner
20 particles when the toner particles adhere to the
carrier particles and the carrier particles are brought
into contact with the toner particles as to surround
the toner particles. If positive copying of an
electrostatic latent image is required, the carrier
25 particles must have a charge, the polarity of which
is opposite to the magnetism of the electrostatic
latent image. If inverse copying of the electrostatic

- 1 latent image is desired, the carrier particles must have the same polarity as that of the electrostatic latent image.

- As described above, the material of the
- 5 carrier particles is selected depending upon the frictional charging characteristics in relation to the toner to be charged such that a first component of the developer is charged positively if the residual component of the developer is at a lower position in
- 10 the frictional charging sequence with respect to the first component of the developer. On the other hand, the residual component is charged negatively if the residual component is at an upper position than the position of the first component in the frictional
- 15 charging sequence. By adequately selecting the material depending upon the influence of the frictional charge of the material, the charged polarity of the materials is made as follows at the time of the foregoing mixture:
- the charged toner particles adhere to the surfaces of
- 20 the carrier particles as to be coated on the surfaces while being allowed to adhere to the portions of the electrostatic image carrying surfaces having larger attracting force.

- Typical carriers are exemplified by sodium
- 25 chloride, ammonium chloride, aluminum potassium chloride, Rochelle salt, sodium nitrate, methyl methacrylate, glass and silicon dioxide. The carrier

1 may be used together with the coating material or used
without the coating material.

A large portion of the typical carriers has
been disclosed in U.S. Patent No. 2,618,551 and U.S.
5 Patent No. 2,638,146 respectively disclosed by L. E.
Warcup and U.S. Patent No. 2,618,552 disclosed by
E. N. Wise.

It is preferable to use carrier particles each
having a diameter of about 50 to about 1,000 μ and
10 finally coated.

The reason for this is that the carrier
particles have sufficient density and inertia to
prevent the adhesion to the electrostatic image. The
adhesion of the carrier particles to the surface of
15 the photosensitive drum must be prevented because the
surface is caused to have a deep flaw in a case where
cleaning is performed by a web cleaner using a web
arranged as disclosed in U.S. Patent No. 3,186,838
disclosed by W. P. Graphjunior and the like during the
20 process of transferring the image and during the
process of cleaning the drum.

When the carrier particles are allowed to
adhere to the image generating surface of the
photosensitive member, deletion of copying takes place.
25 In general, a satisfactory result can be obtained when
a toner in a quantity of about one part by weight is
used together with about 10 to about 200 parts of the
carrier.

1 The toner composition according to the present invention can be used to form an electrostatic latent image on an ordinary photoconductive surface and an adequate electrostatic latent image holding surface.

5 Typical photoconductive substances have been disclosed in U.S. Patent No. 2,803,542 filed by Walrich, U.S. Patent No. 2,970,906 filed by Bigsby, U.S. Patent No. 3,121,007 filed by Midleton, and U.S. Patent No. 3,151,982 filed by Corsin.

10 50 parts by weight of a copolymer of 65 parts by weight of styrene and 35 parts by weight of butyl methacrylate and 1 part by weight of transparent infrared ray absorbing coloring material (SIR-159 manufactured by Mitsui Toatsu) were used so that an infrared
15 ray absorbing toner mixture was prepared. The infrared ray absorbing toner mixture was melted and previously mixed, and then the composition was kneaded in a roll mill so that the near infrared ray absorbing coloring material was uniformly dissolved and dispersed. The
20 obtained composition was cooled, and fined by a jet crushing machine so that near infrared ray absorbing toner having an average particle size of 10 μ m was obtained.

Sixth Embodiment

25 The toner according to the fifth embodiment and the two-component cascade developer disclosed in U.S. Patent No. 2,618,551 were mixed. The foregoing toner was allowed to adhere to the electrostatic

1 latent image formed on an image carrier comprising an
OPC by a cascade development method so that the image
was developed. Then, the image was transferred to
paper by an electrostatic transfer method before it
5 is melted and fixed by a hot roller.

The obtained record could not visually be
judged. Reflection spectrum measured with a spectrum
light intensity meter Shimazu UV-3100S is shown in
Fig. 22.

10 Fig. 22 shows the reflection spectrum of the
paper used in the foregoing process.

Seventh Embodiment

The image recorded in the process according
to the sixth embodiment was read by a digital copying
15 machine (CLC-500 manufactured by Canon) having the
filter shown in Fig. 23, and the read image was con-
verted into a visible image which was then transmitted,
resulting in an excellent image to be obtained.

Eighth Embodiment

20 The image recorded on the paper in the process
according to the sixth embodiment was intended to be
read and copied by the digital copying machine (CLC-
500 manufactured by Canon) having a usual filter,
resulting in no image to be obtained.

25 As described above, the toner particles
containing the resin and the coloring agent were used
as the developer for recording secret information by

1 the electrophotographic method. The fact that the
coloring agent is the near infrared ray absorbing
coloring material or pigment which does not absorb
visible rays but which absorbs near infrared rays
5 enables an effect to be obtained in that secret
recording can be performed with a usual copying
machine or in a usual photography.

According to the present invention, there are
provided a recording medium having invisible informa-
10 tion for assuredly judging a specific image such as
a bill with a low cost and an invisible information
detection apparatus capable of detecting and utilizing
the foregoing mark.

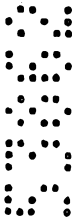
According to the present invention, there is
15 provided an invisible information recording medium
serving as recording paper capable of easily
identifying a specific original document which must
not be copied.

According to the present invention, there is
20 provided a novel recording material for use in an image
forming apparatus, such as a copying machine, and more
particularly, in an electrophotographic apparatus.

Although the invention has been described in
its preferred form with a certain degree of
25 particularly, it is understood that the present
disclosure of the preferred form can be changed in the
details of construction and the combination and

1 arrangement of parts may be resorted to without
departing from the spirit and the scope of the
invention as hereinafter claimed.

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The claims defining the invention are as follows:

1. An invisible information recorded medium comprising an identification mark recorded thereon, said identification mark being composed of a region having a high reflectance and a region having a low reflectance in
5 the same near infrared wavelength as compared with the reflectance of said medium.

2. An invisible information recorded medium according to claim 1, wherein said region having a high reflectance is recorded in ink containing fluorescent coloring material or fluorescent pigment having a fluorescent
10 wavelength in the near infrared wavelength.

3. An invisible information recorded medium according to claim 1 or claim 2, wherein said region having a low reflectance is recorded in ink containing near infrared ray absorbing coloring material or pigment which is free from absorption in the visible region.

4. An invisible information recorded medium, comprising:
a recording medium having different reflective characteristics at a near
infrared wavelength in different areas, wherein said medium has no information
at a visible wavelength.

5. An invisible information recorded medium according to claim
20 4, wherein said different reflective characteristics is caused by absorption at the near infrared wavelength.

6. An invisible information recorded medium according to claim 4, wherein the invisible information is an identification mark.

7. An invisible information recorded medium according to claim
25 4, wherein said recorded medium is paper.



8. An invisible information recorded medium according to claim 4, wherein the invisible information is recorded with a material which fluoresces at the near infrared wavelength.

9. An invisible information recorded medium according to claim 4, wherein the invisible information is recorded with a material which absorbs at the near infrared wavelength.

10. An invisible information recorded medium according to claim 4, wherein the invisible information is recorded with a fluorescent coloring matter or a fluorescent pigment.

11. An invisible information recorded medium according to claim 4, wherein the invisible information is recorded with a near infrared absorbing coloring matter or a near infrared absorbing pigment.

12. An invisible information recorded medium according to claim 4, wherein the different reflective characteristics are caused by fluorescence in the near infrared wavelength region.

13. An invisible information recorded medium comprising a recording medium having an identification mark recorded thereon, said identification mark being composed of a first region and a second region, wherein

said first region has a higher reflectance than a reflectance of said medium at a near infrared wavelength,

said second region has a lower reflectance than the reflectance of said medium at said near infrared wavelength, and

said first region and said second region do not overlap each other,

wherein the reflectance of said medium is represented by a reflectance on a portion at which the identification mark is not recorded.



14. An invisible information recorded medium according to claim 13, wherein said first region is recorded with a material which fluoresces at the near infrared wavelength.

15. An invisible information recorded medium according to claim 13, wherein said first region comprises a fluorescent coloring matter or a fluorescent pigment.

16. An invisible information recorded medium according to claim 13, wherein said second region comprises a near infrared absorbing coloring matter or a near infrared absorbing pigment.

17. An invisible information recorded medium according to claim 13, wherein said second region does not absorb light at a visible wavelength.

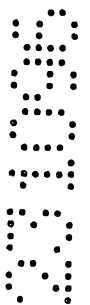
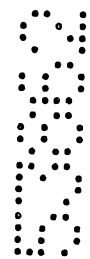
18. An invisible information recorded medium according to claim 13, wherein said first region generates infrared light by receiving a light having a wavelength shorter than that of said near infrared wavelength.

19. An invisible information recorded medium according to claim 13, wherein the reflectance's of said first and second regions respond to substantially similar wavelength lights.

20. An invisible information recorded medium, substantially as hereinbefore described with reference to the accompanying drawings.

21. An invisible information detecting apparatus comprising: detection means for detecting a region having a high reflectance and a region having a low reflectance with respect to the reflectance of a medium in the same infrared ray region; and judging means for judging a specific original document in accordance with the results of detection performed by said detection means.

22. An invisible information detecting apparatus, substantially as hereinbefore described with reference to the accompanying drawings.



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23. A recording agent comprising toner particles containing a resin and a coloring material, wherein said coloring material is near infrared ray absorbing coloring material or pigment free from absorption in a visible region and absorbed in the near infrared ray region.

5 24. A recording agent comprising toner particles containing a resin and a coloring material, substantially as hereinbefore described with reference to the accompanying drawings.

DATED this Twenty-second Day of October 1996

Canon Kabushiki Kaisha

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

10



FIG. 1A

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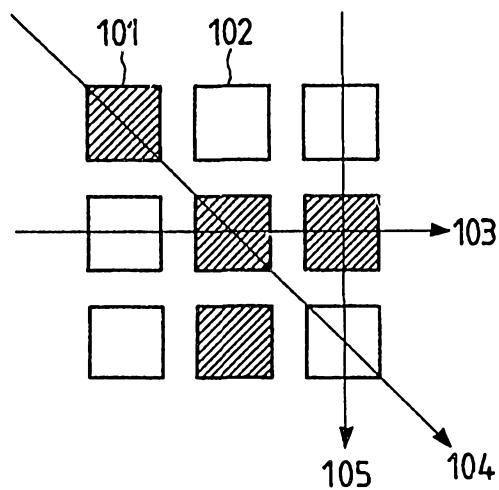


FIG. 1B

IR REFLECTANCE

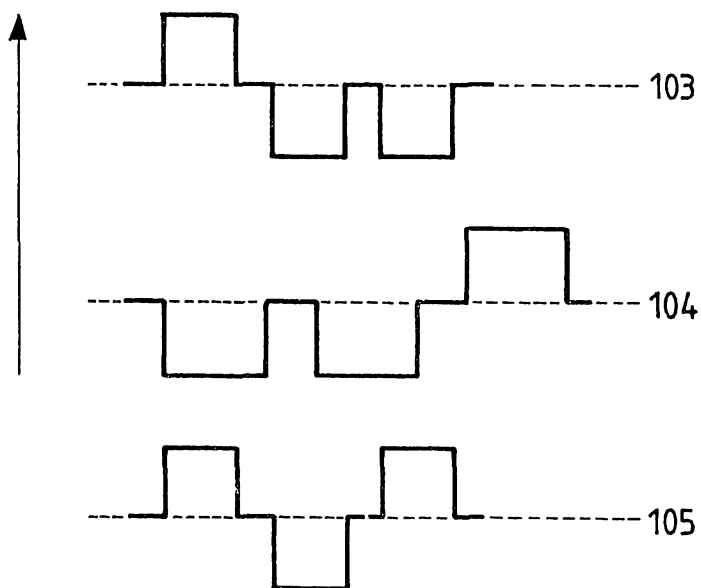


FIG. 2

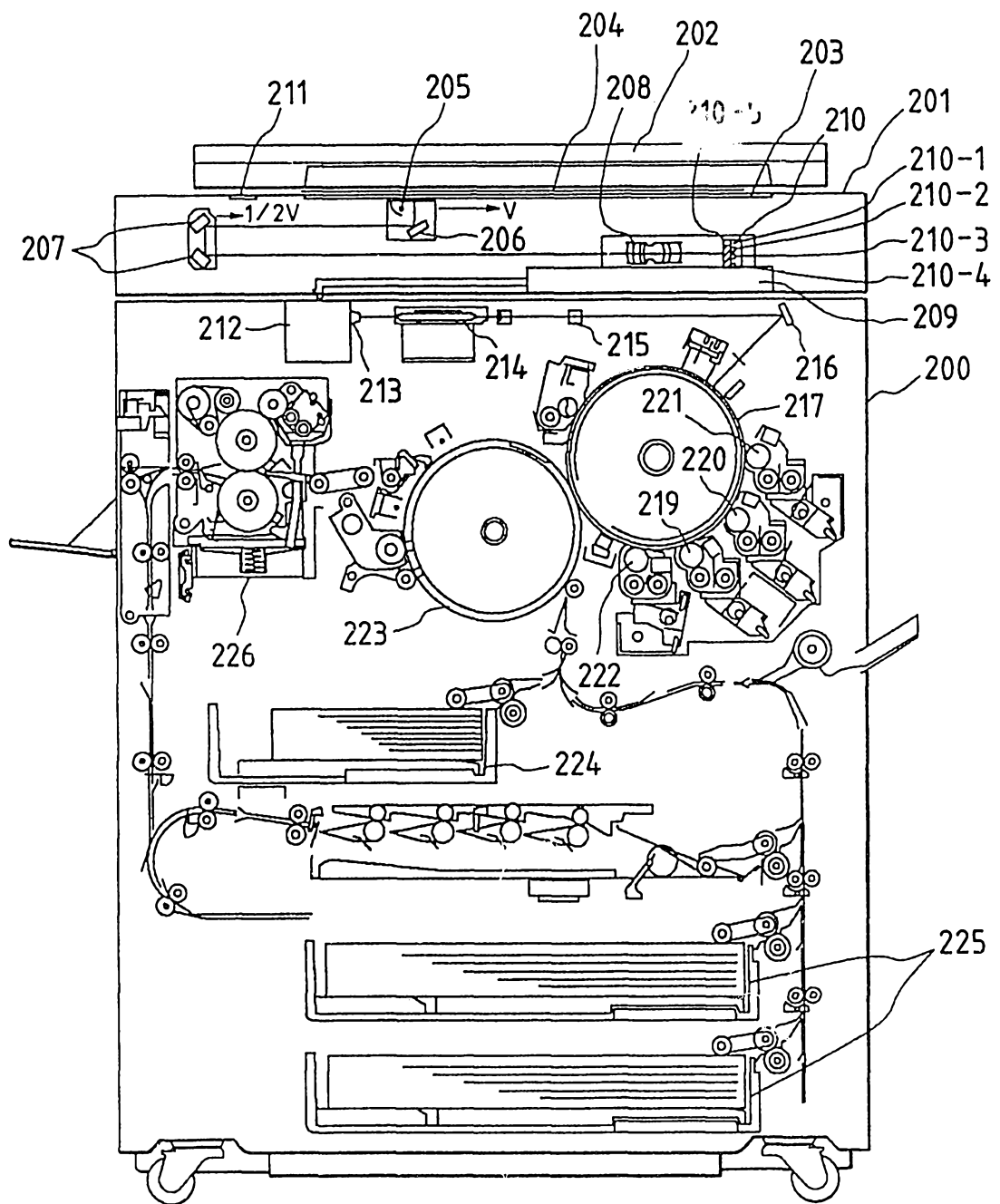


FIG. 3

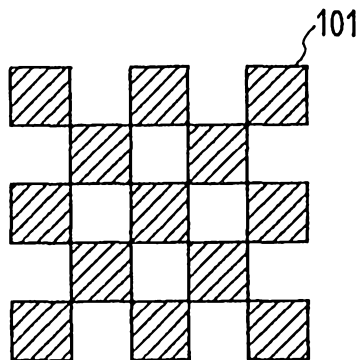


FIG. 5

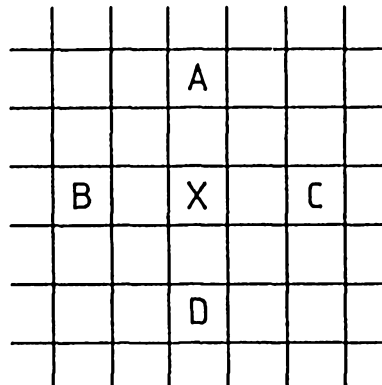


FIG. 4

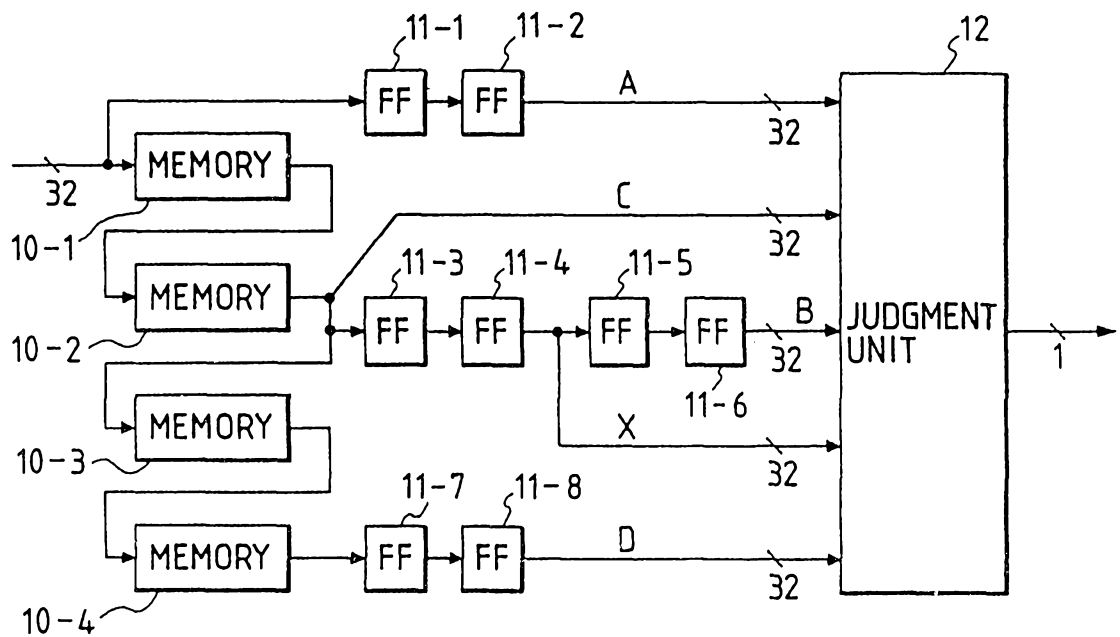


FIG. 6

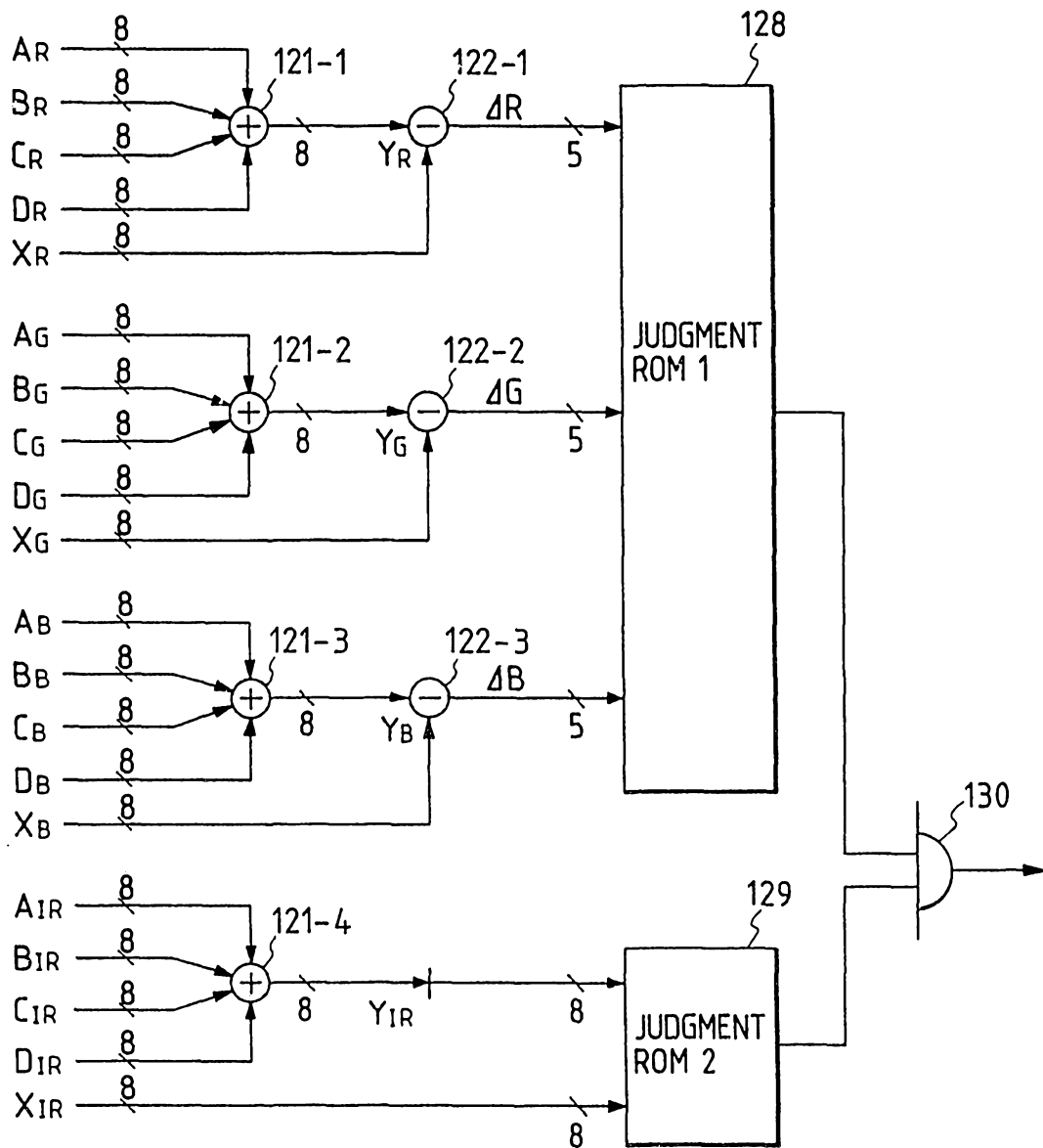


FIG. 7A

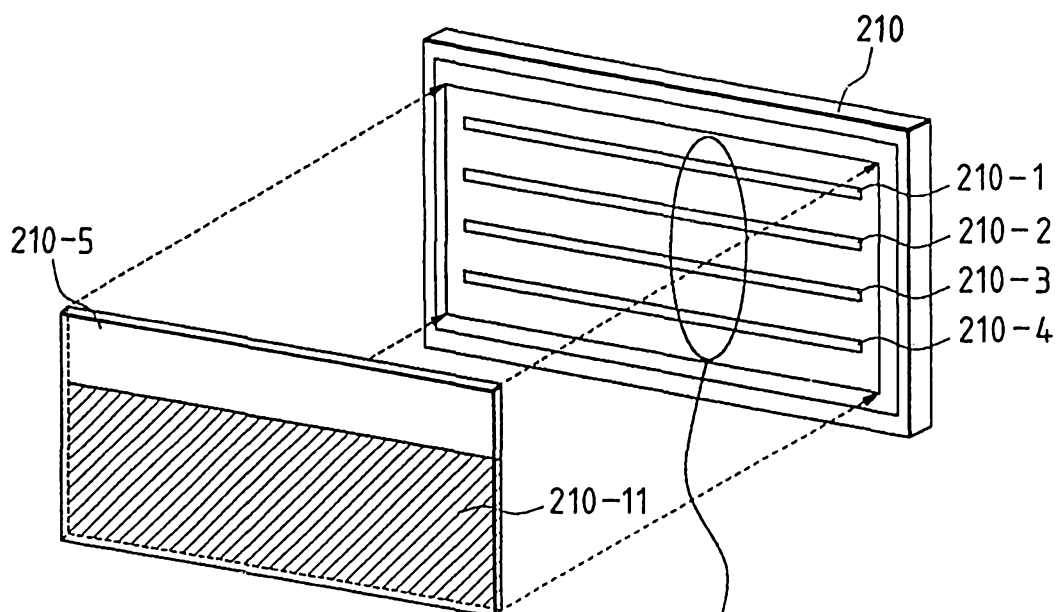


FIG. 7B

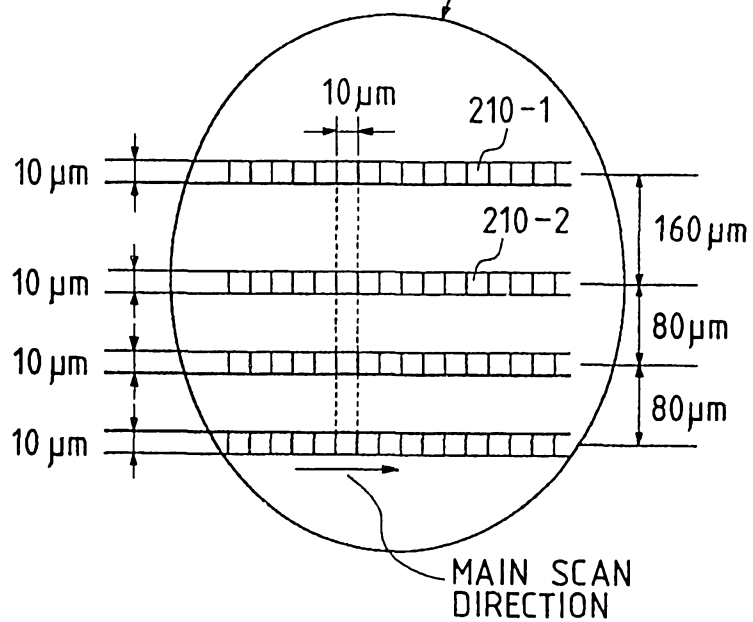
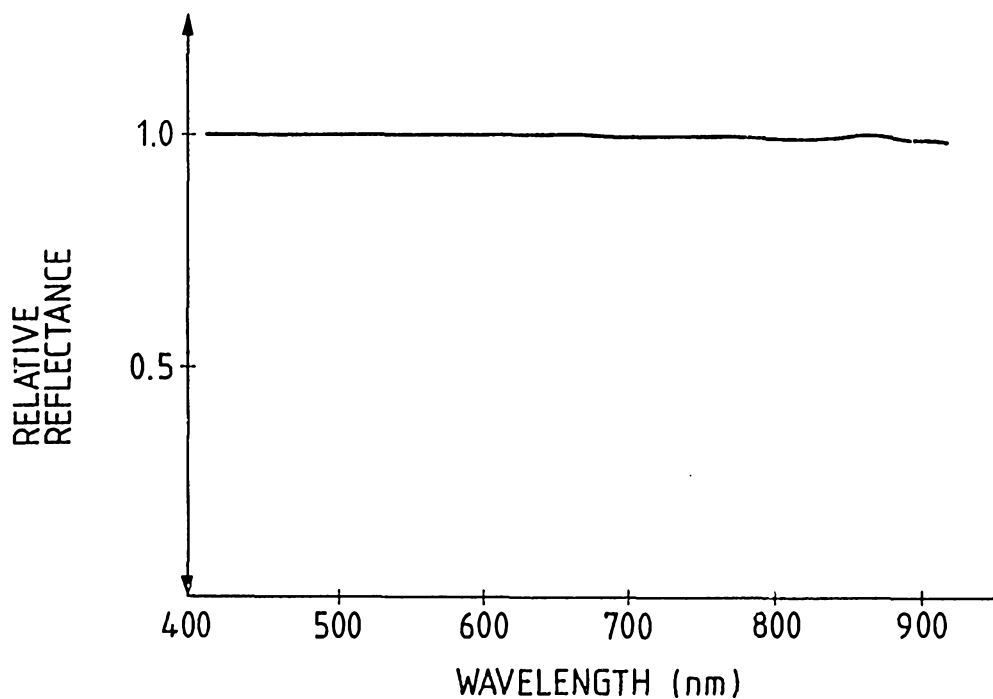


FIG. 8



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FIG. 9

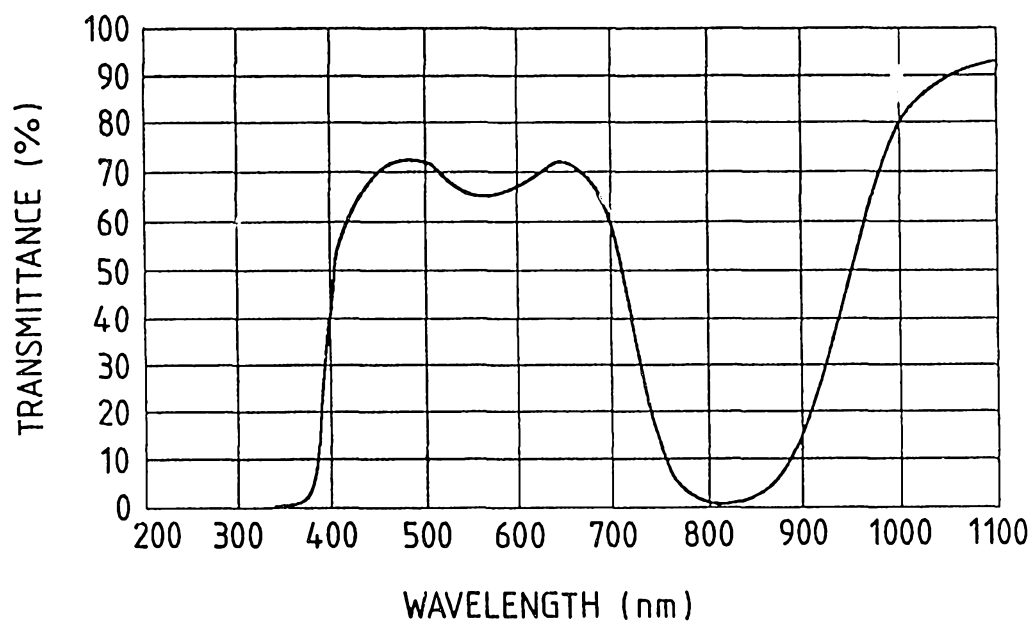


FIG. 10

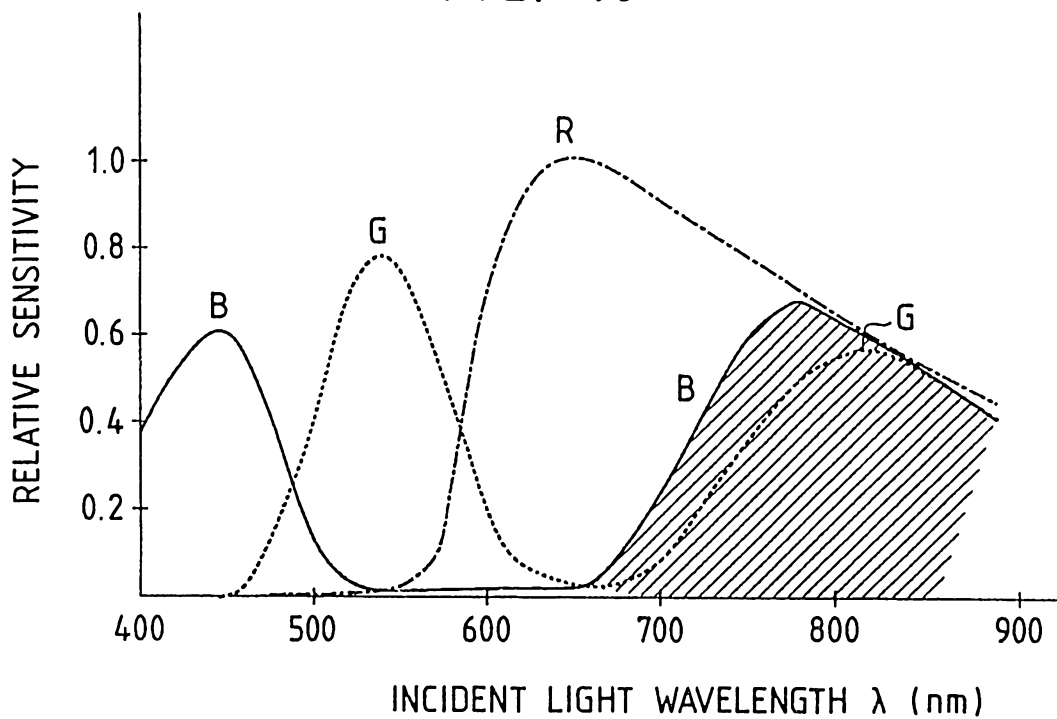
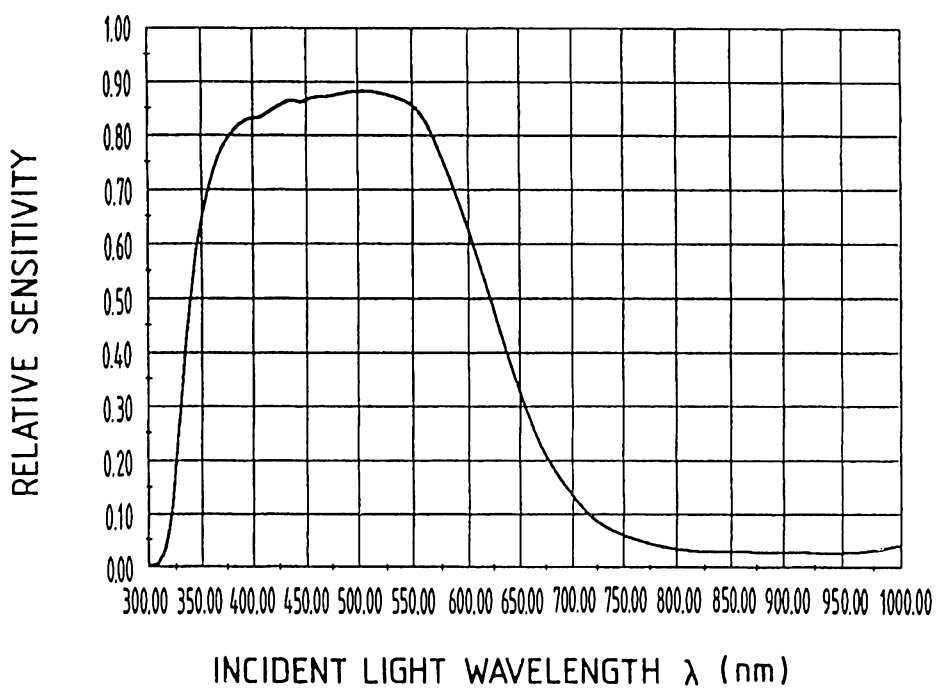


FIG. 11



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FIG. 12

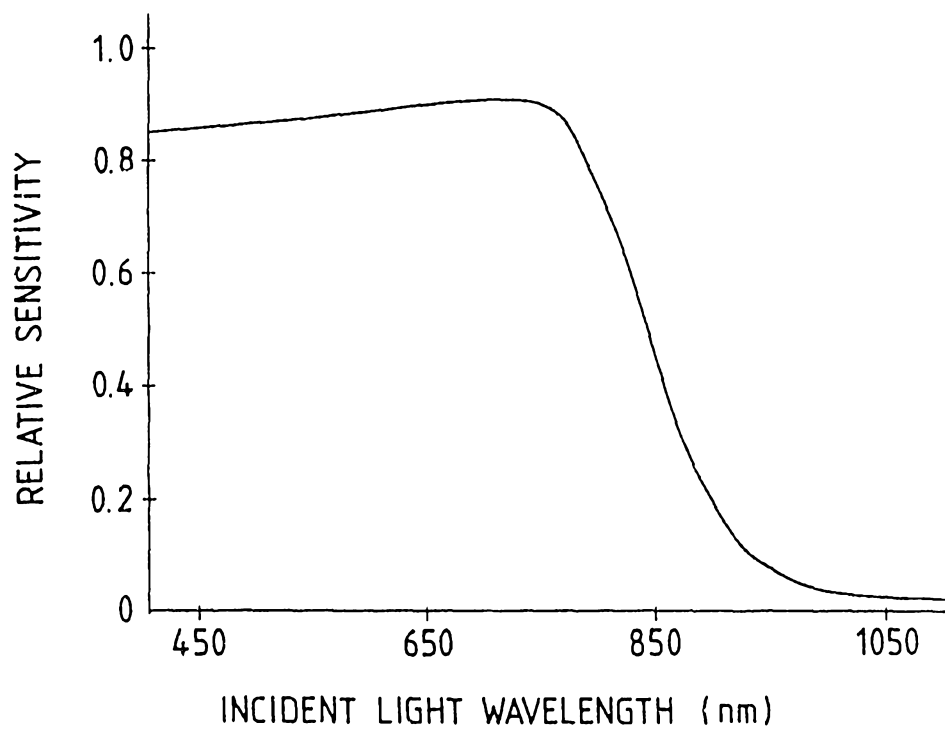


FIG. 13

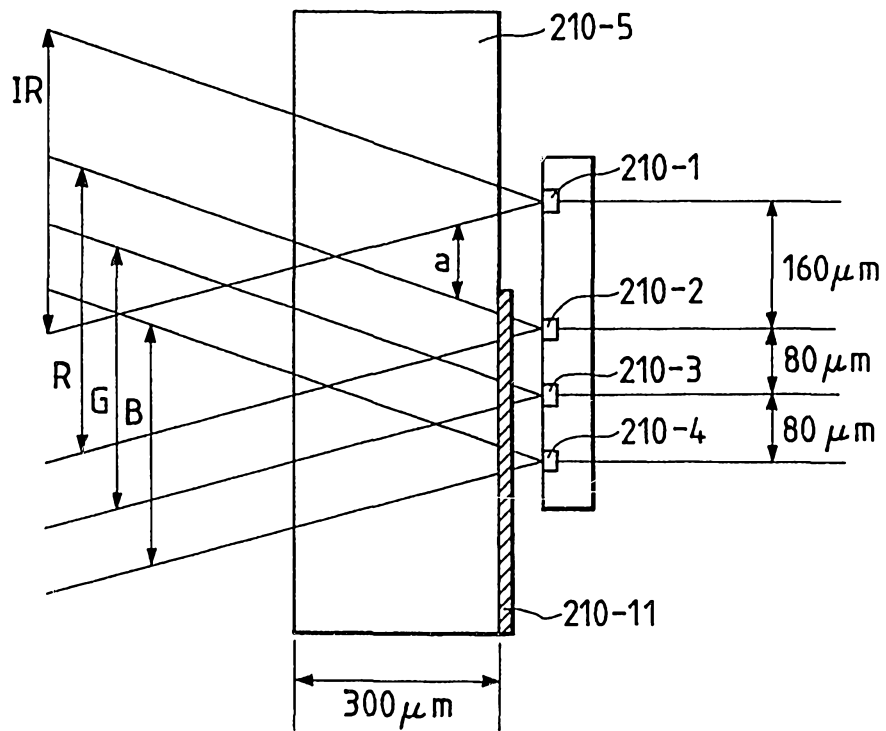
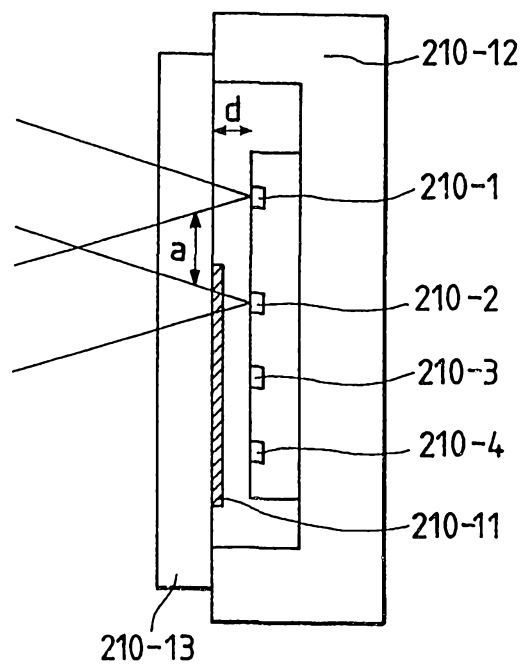


FIG. 14

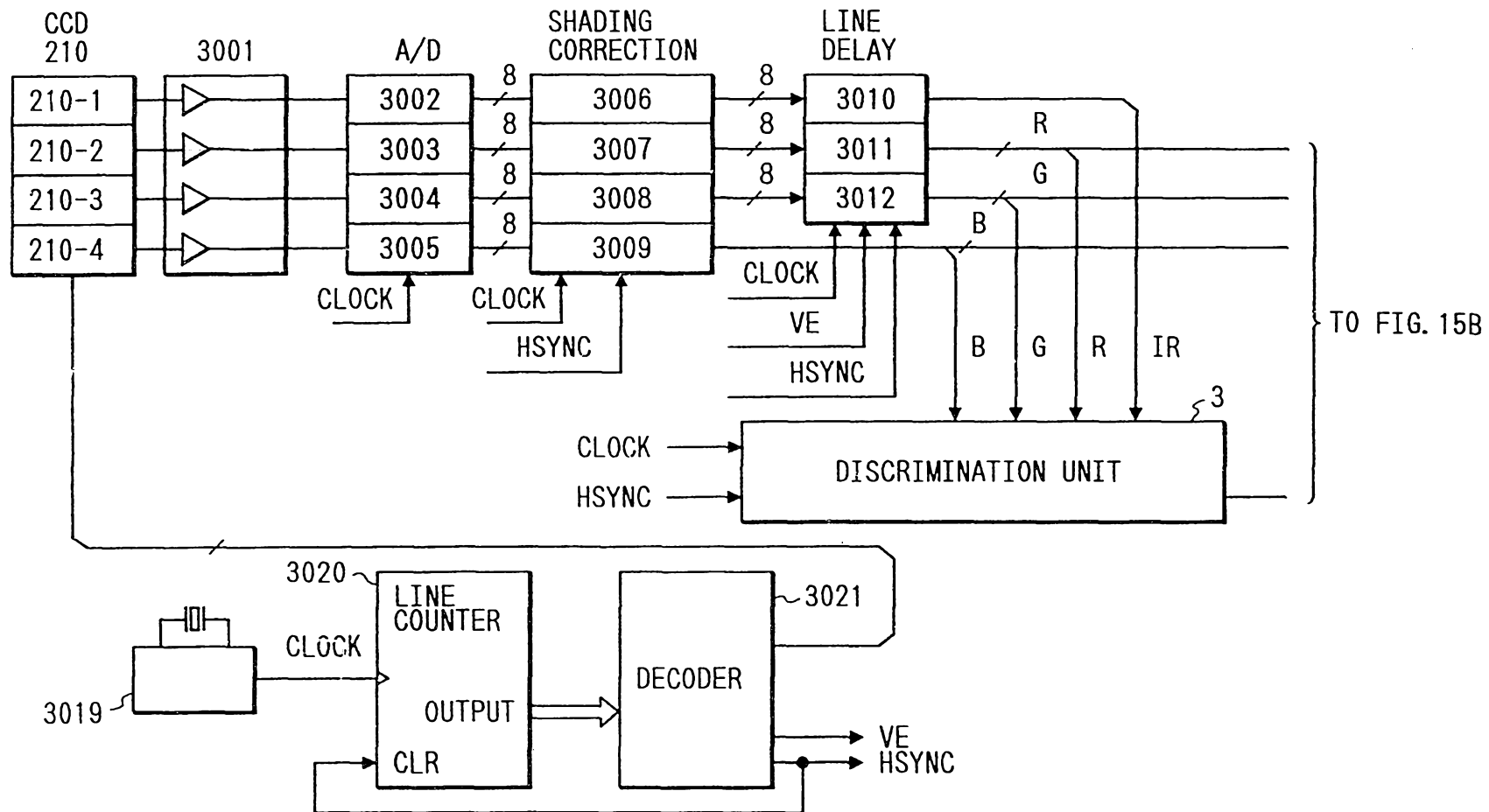


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FIG. 15A

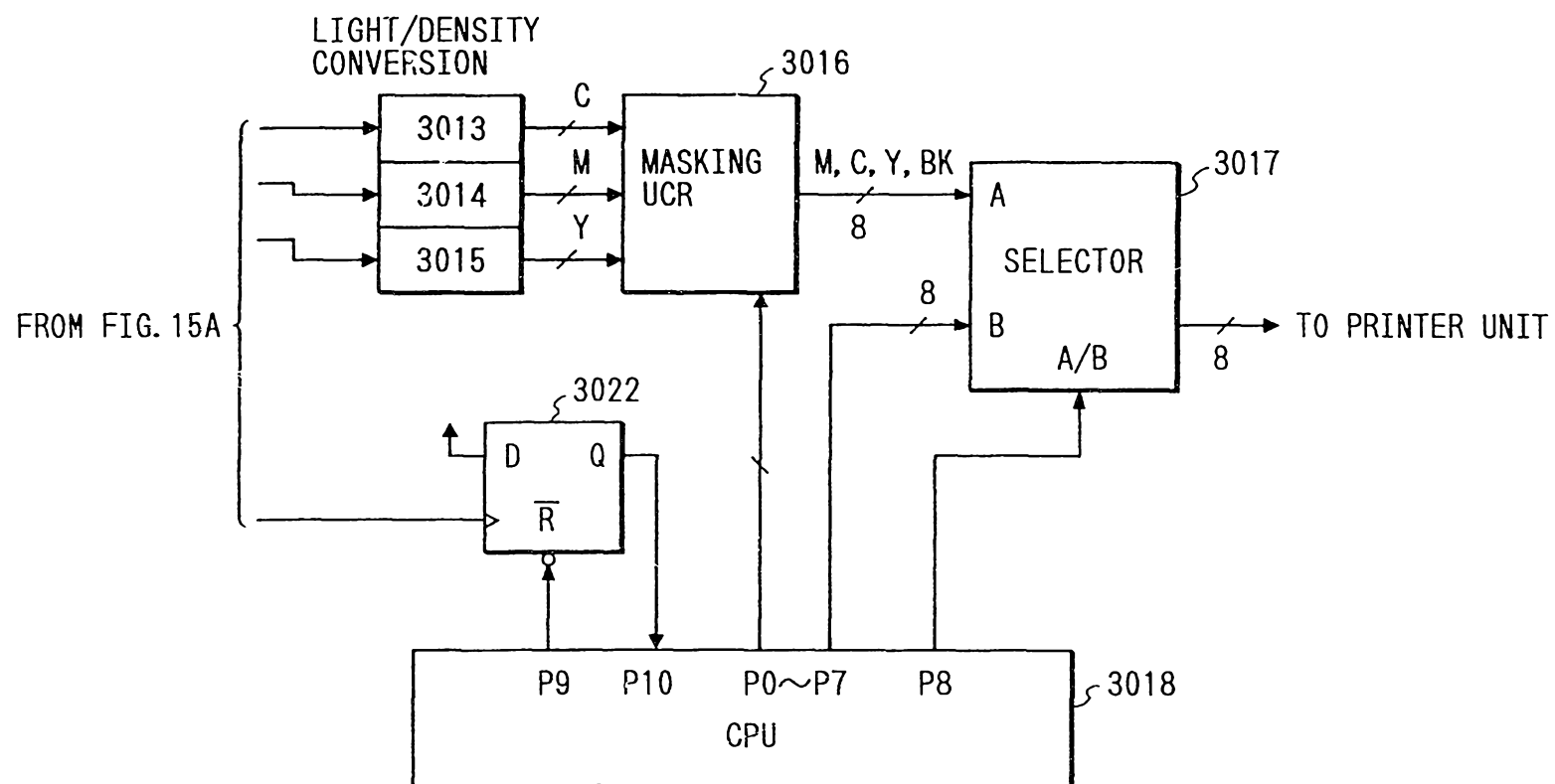
FIG. 15

FIG. 15A	FIG. 15B
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FIG. 15B



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FIG. 16

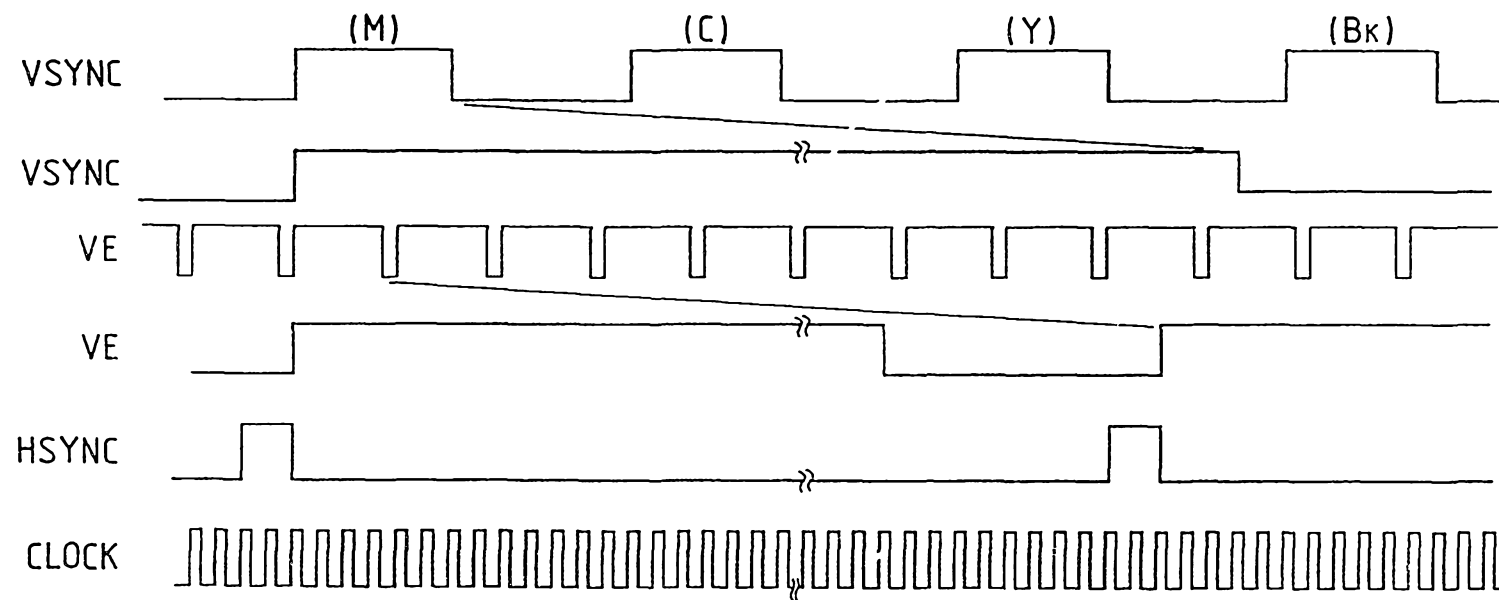


FIG. 17

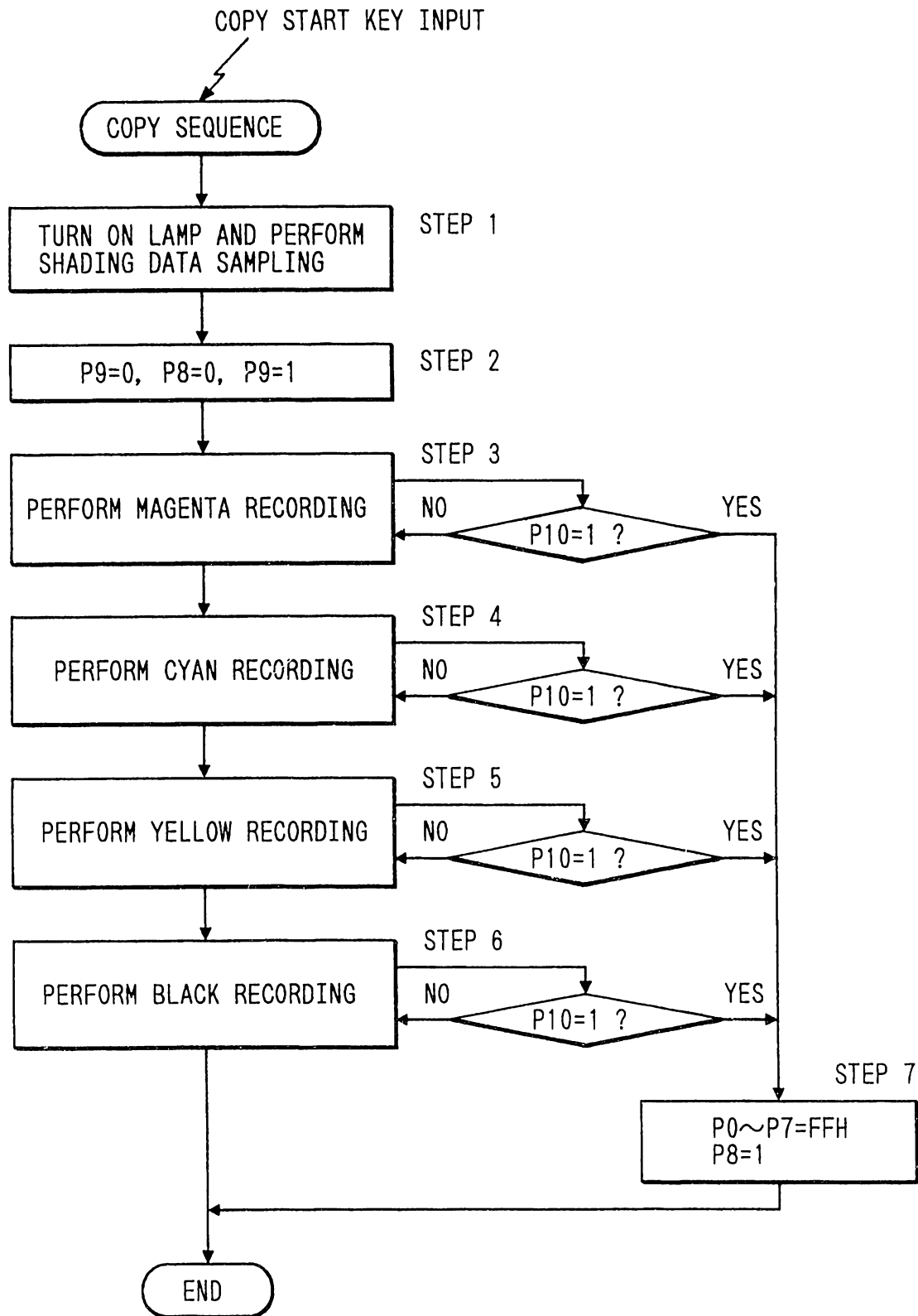


FIG. 18A

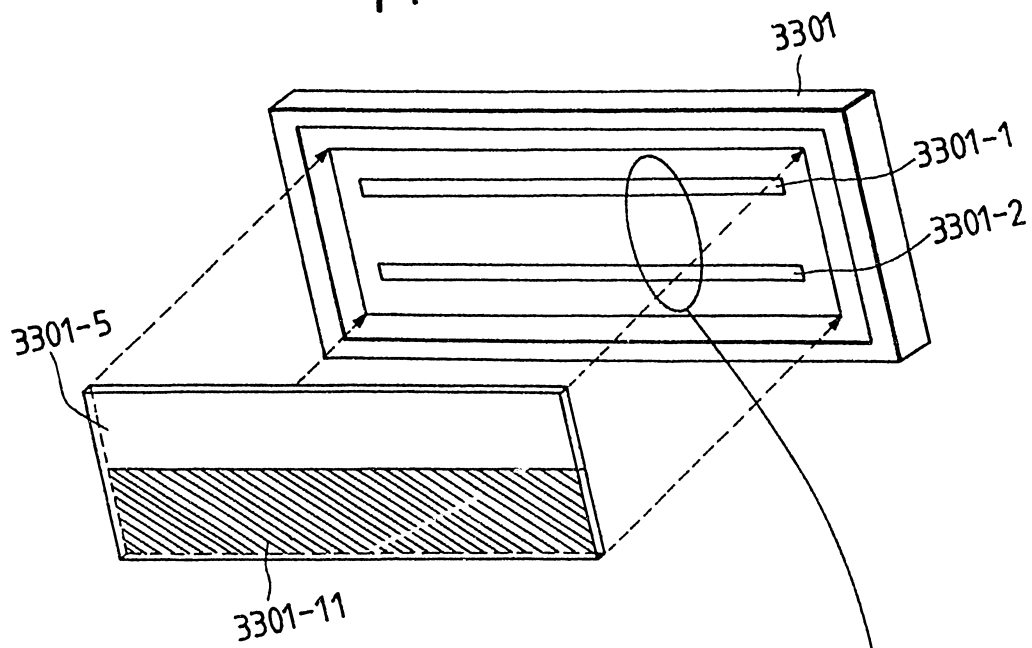


FIG. 18B

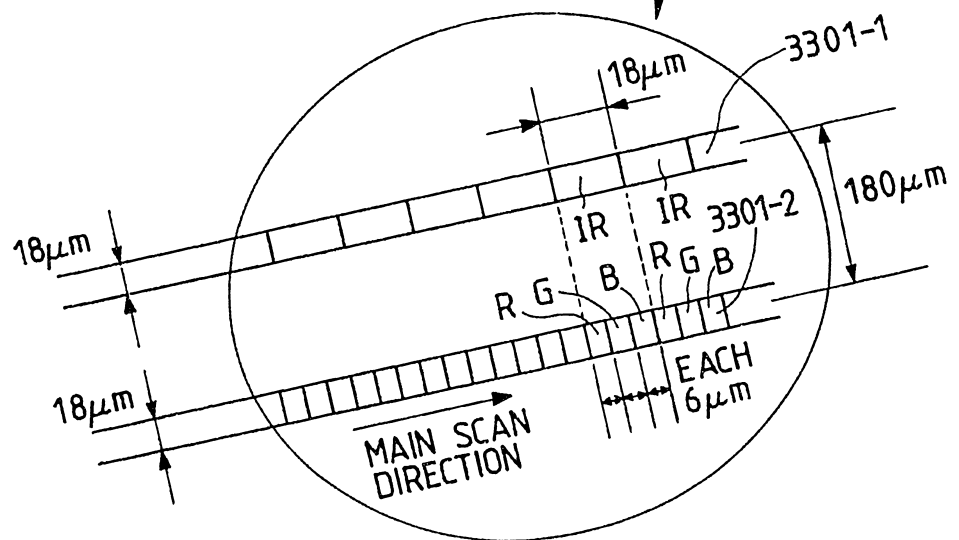


FIG. 19A

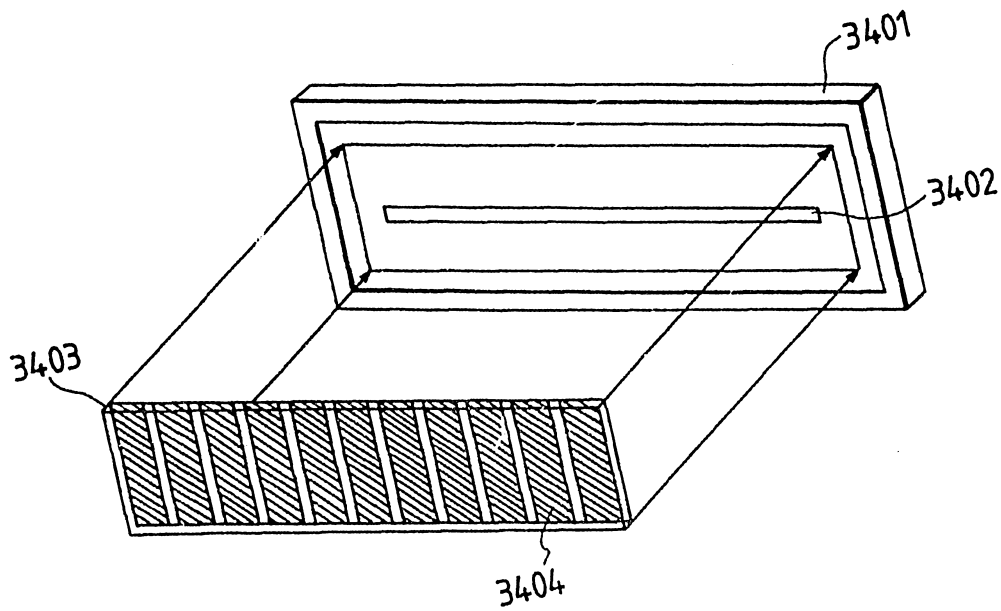


FIG. 19B

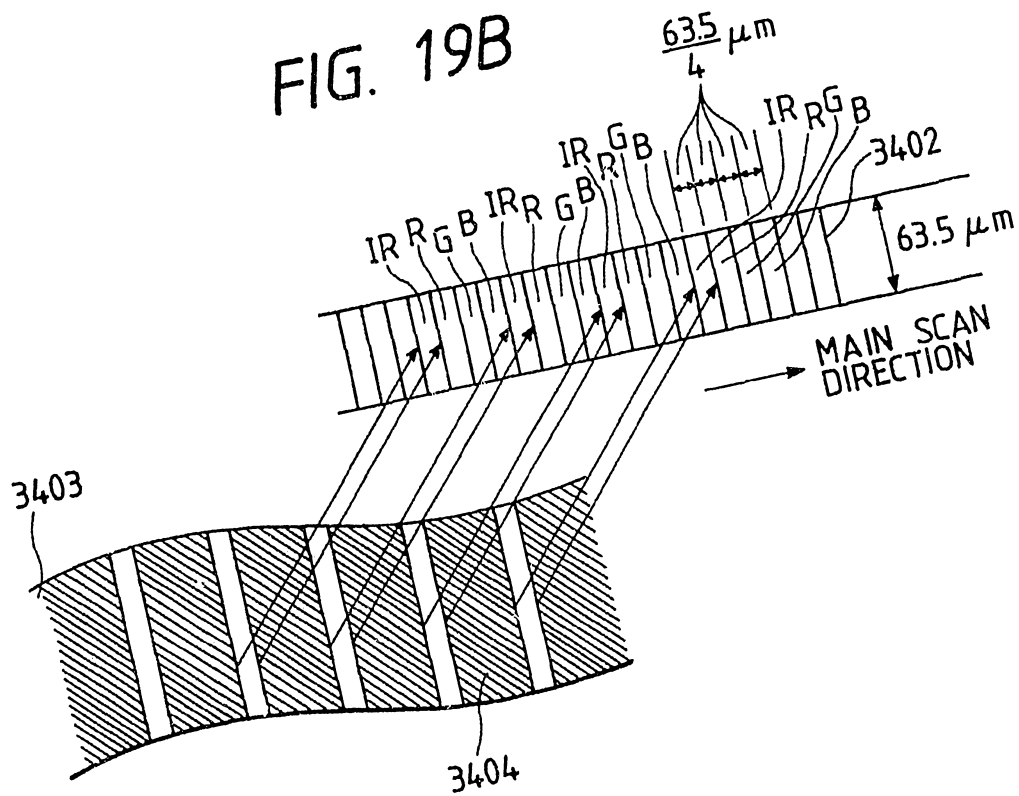


FIG. 20A

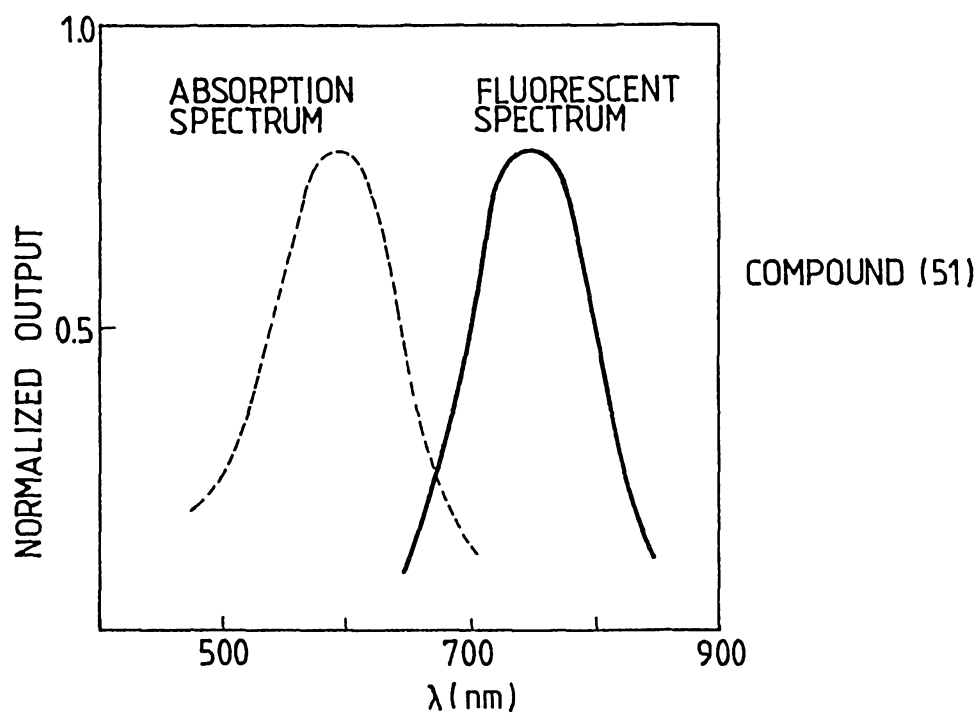
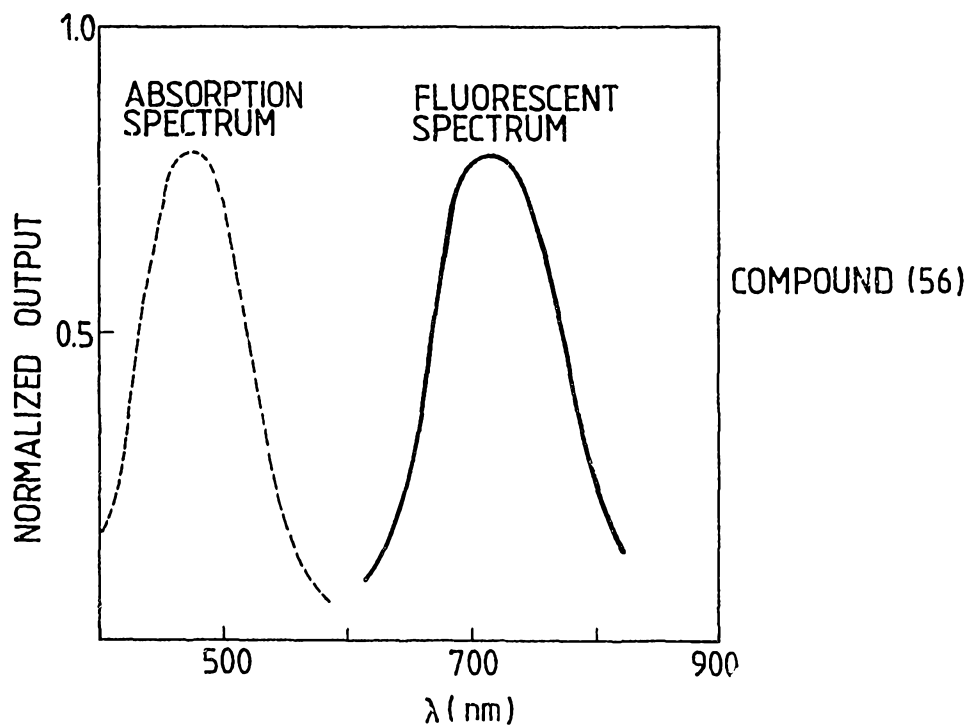
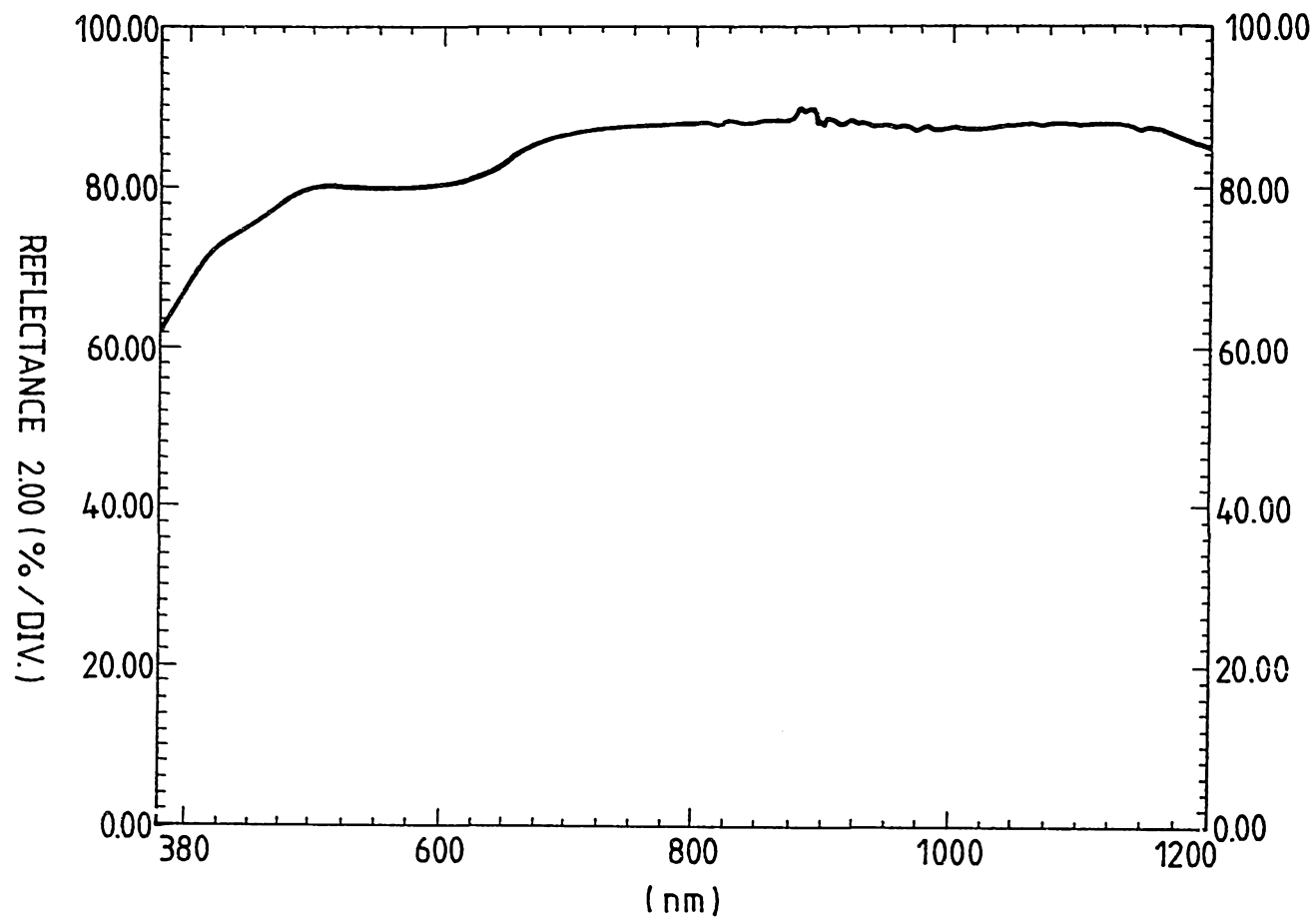


FIG. 20B



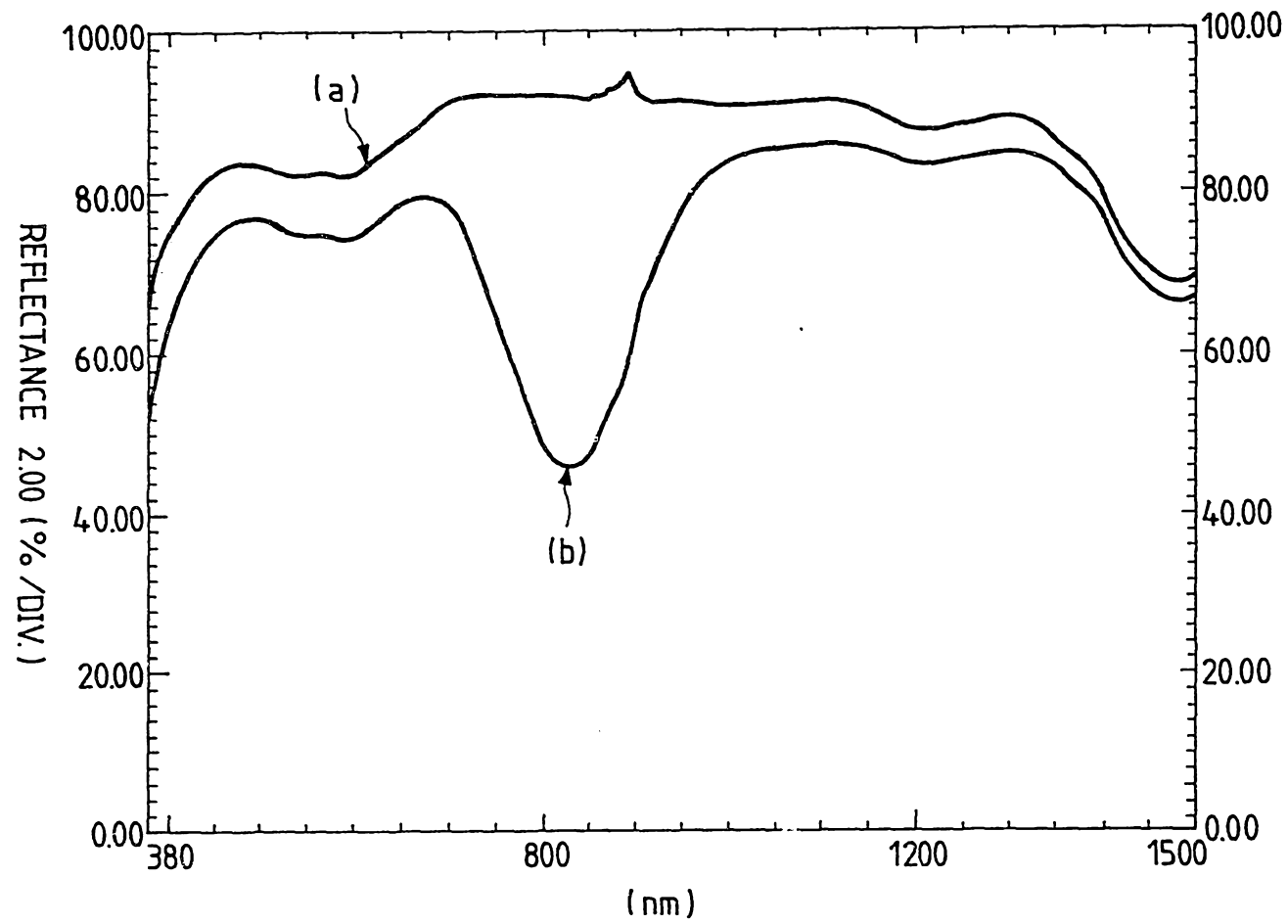
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FIG. 21



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FIG. 22



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FIG. 23

