Jan. 23, 1973 YOSHINOBU MURAKAMI ET AL 3,712,811

ELECTROPHOTOGRAPHIC MATERIAL

Filed March 5, 1971

3 Sheets-Sheet 1

FIG. 1

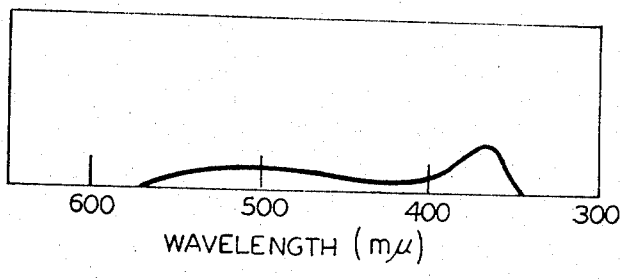


FIG. 2

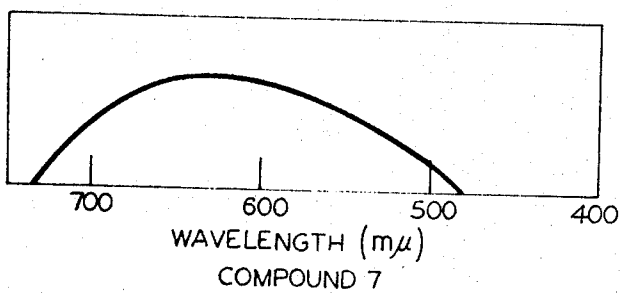
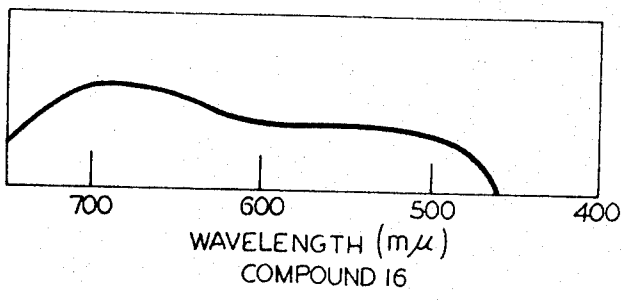


FIG. 3



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FIG. 4

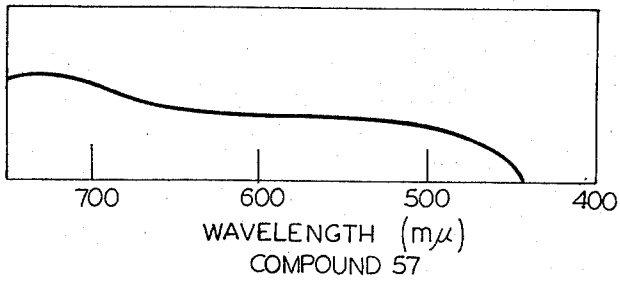


FIG. 5

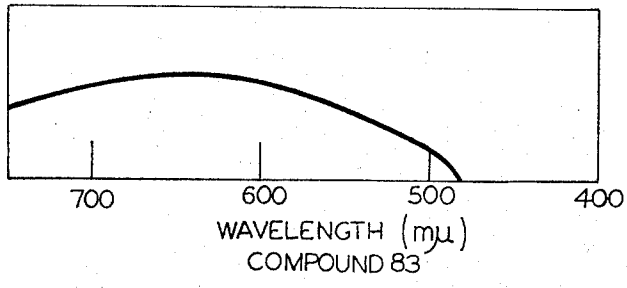
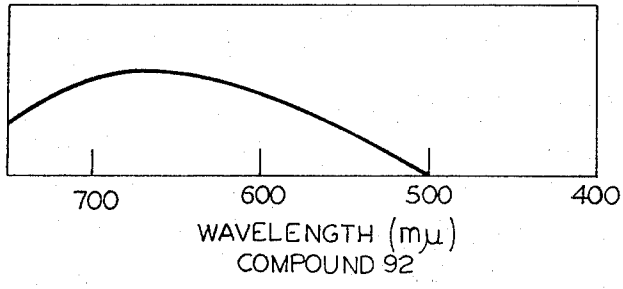


FIG. 6



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FIG. 7

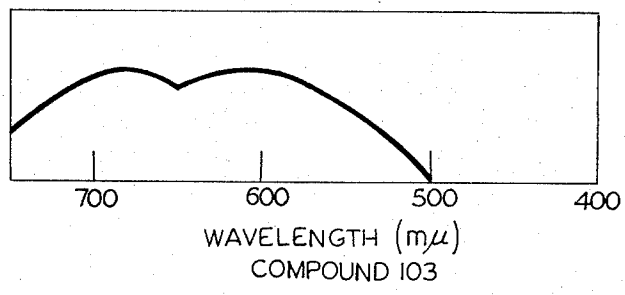


FIG. 8

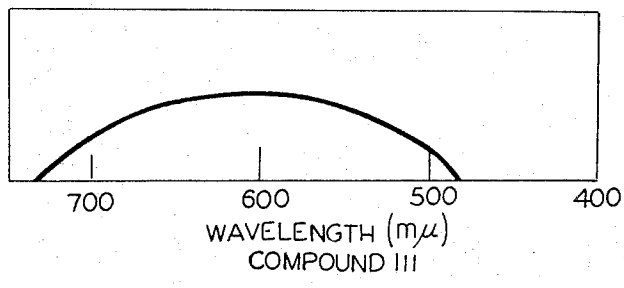
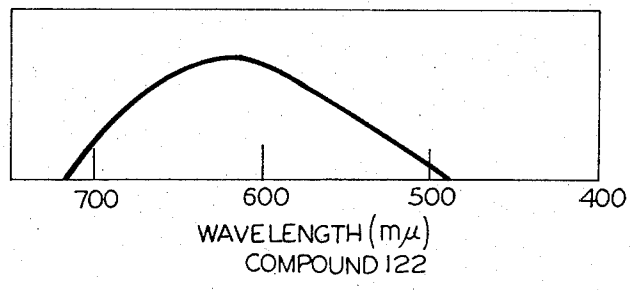


FIG. 9



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United States Patent Office 3,712,811
Patented Jan. 23, 1973

3,712,811

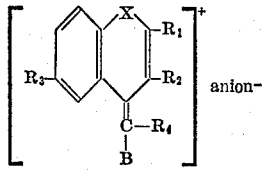
ELECTROPHOTOGRAPHIC MATERIAL

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Filed Mar. 5, 1971, Ser. No. 121,508
Claims priority, application Japan, Mar. 13, 1970, 45/21,766, 45/21,767
Int. Cl. G03g 5/06
U.S. Cl. 96—1.6 3 Claims

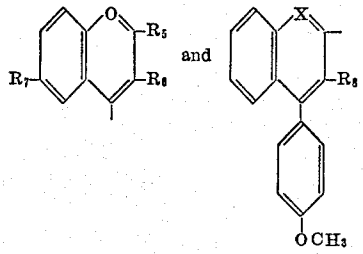
ABSTRACT OF THE DISCLOSURE

An electrophotographic material is provided herein which comprises a conductive support layer and a photoconductive insulating layer, the latter layer comprising a photoconductive polymeric compound such as poly-N-vinylcarbazole, and a sensitizer having the following general formula



wherein

B represents a radical selected from the group consisting of



Compounds falling under the latter general formula include such compounds as 2-phenyl-4-[(2'-phenyl-4'-benzopyranylidene)benzyl]-benzopyrylium perchlorate and 2,3-phenyl - 4 - [(2'-phenyl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate.

This invention relates to novel light-sensitive layers and more particularly to electrophotographic light-sensitive polymer layers.

Various light-sensitive layers are well known in the electrophotographic art for making copies of documents, drawings, transparencies, etc. These layers contain organic photoconductive compounds, such as poly-N-vinylcarbazole, brominated poly-N-vinylcarbazoles, polyacenaphthylene, etc. These layers are non-conductors of electricity before exposure and become electrical conductors upon exposure.

It is necessary for the electrophotographic art that the photoconductive material has a high photoconductivity in the long wavelength region of the visible spectrum. Such a photoconductive material makes it possible for the electrophotograph art to employ inexpensive and convenient light sources such as incandescent lamps in a reduced exposure time and to reproduce colored pictures. The photoconductive materials mentioned above, however, have usually a low photoconductivity and spectrum characteristics sensitive to the short wavelength region of the exposure light and do not satisfy entirely the above requirement.

It is known that an addition of a so-called sensitizer can improve photoconductivity and spectrum characteristics of the above photoconductive compounds. Conventional sensitizers are dyestuff compounds, such as triarylmethane dyes, xanthene dyes, triazine dyes or acridine dyes, but the conventional sensitizers are not entirely satisfactory to improve the photoconductivity and the spectrum characteristics of the available photoconductive compounds.

In addition to the high photoconductivity and spectrum characteristics sensitive to visible light, the electrophotographic art requires a high electric resistance of photoconductive materials in the dark. Conventional sensitizers are apt to increase the dark conductivity whereas they promote the photoconductivity. A high dark conductivity of photoconductive materials is not desirable because it results in a loss of the applied electrostatic charge in the dark.

An object of the invention is to provide electrophotographic materials having a high photoconductivity and spectrum characteristics sensitive to a long wavelength region of the visible spectrum.

Another object of the invention is to provide electrophotographic materials having a high electric resistance in the dark.

These and other objects are accomplished by adding a new sensitizer shown hereinafter to a photoconductive polymeric compound such as poly-N-vinylcarbazole, brominated poly-N-vinyl-carbazole or polyacenaphthylene, as a light-sensitive film-forming composition.

The invention is further explained in the following description with reference to the accompanying drawings wherein:

FIG. 1 represents the wedge spectrogram for an electrophotographic material coated with an unsensitized solution of 10 weight percent of brominated poly-N-vinylcarbazole in chlorobenzene.

FIG. 2 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-(α-phenyl-p-methoxystyryl) - 4-[(2'-phenyl-4'-benzopyranylidene)-methyl] benzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

FIG. 3 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-styryl-3-phenyl-4-[(2'-styryl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

FIG. 4 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-p-methoxystyryl-4-[(2' - α - phenyl-p-methoxystyryl-4'-benzopyranylidene) methyl]benzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

FIG. 5 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-p-methoxystyryl-4-[(2'-phenyl-4'-benzothiopyranylidene)-methyl]benzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

FIG. 6 represents the wedge spectrogram for an electrophotograph material coated with a solution containing 10 weight percent of brominated poly-N-vinyl carbazole sensi-

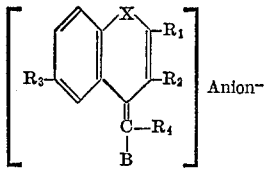
tized with 0.04 weight percent of 2-[2'-phenyl-4'-benzopyranylidene)methyl]3-phenylbenzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four parts of chlorobenzene and one weight part of dichloroethane.

FIG. 7 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-[(4'-benzothiopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

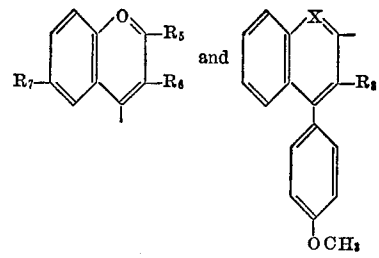
FIG. 8 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-[2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl] - 3 - phenylbenzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

FIG. 9 represents the wedge spectrogram for an electrophotographic material coated with a solution containing 10 weight percent of brominated poly-N-vinylcarbazole sensitized with 0.04 weight percent of 2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-3-phenyl - benzopyrylium perchlorate, the brominated poly-N-vinylcarbazole being dissolved in a solvent of four weight parts of chlorobenzene and one weight part of dichloroethane.

The new sensitizer, according to the present invention has the following formula:



where B represents a radical selected from the group consisting of,



R_1 is hydrogen, phenyl or an ethenyl or an ethenyl radical selected from the group consisting of styryl, p-methoxystyryl, 3,4-dimethoxystyryl, α-phenylstyryl, α-phenyl-p-methoxystyryl, β-furyl(α')ethenyl and α-phenyl-β-furyl(α')ethenyl;

R_2 is hydrogen or phenyl;

R_3 is hydrogen, methyl or phenyl;

R_4 is hydrogen or phenyl;

R_5 is hydrogen, phenyl or an ethenyl radical selected from the group consisting of styryl, p-methoxystyryl, 3,4-dimethoxystyryl, α-phenyl-p-methoxystyryl, β-furyl(α')ethenyl and α-phenyl-β-furyl(α')ethenyl;

R_6 is hydrogen or phenyl;

R_7 is hydrogen, methyl or phenyl;

R_8 is hydrogen or phenyl;

the anion is anionic function selected from the group consisting of perchlorate, fluoroborate, chloroferrate, chlorozincate and nitrate; and

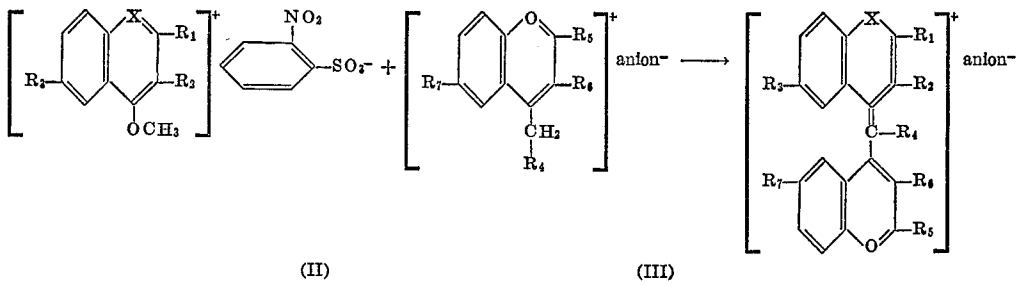
X is oxygen or sulfur atom.

The sensitizers having the formula above mentioned are prepared by the following chemical Equation A or B.

In the case of Equation A, 4-[(4'-benzopyranylidene)-methyl]benzopyrylium derivative (III) is obtained by an addition reaction of 4-methoxybenzopyrylium o-nitrobenzene sulfonate (I) with a benzopyrylium salt (II) in an acetic anhydride solution. The benzopyrylium salt has an active methyl or methylene radical.

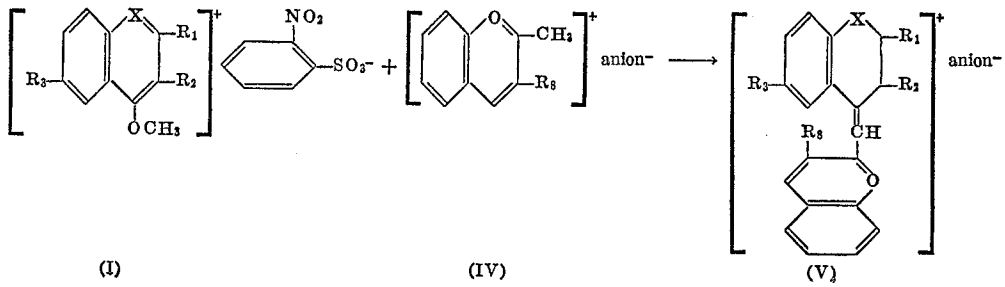
In the case of Equation B, 2-[(4'-benzopyranylidene)-methyl]benzopyrylium derivative (V) is obtained by an addition reaction of 4-methoxybenzopyrylium o-nitrobenzene sulfonate (I) with a benzopyrylium salt (IV) in an acetic anhydride solution. The benzopyrylium salt has an active methyl radical.

EQUATION A



(I) (II) (III)

EQUATION B



(I) (IV) (V)

In both cases, methyl 2,4-dinitrobenzene sulfonate, dimethyl sulfate or methyl iodide can be used instead of methyl o-nitrobenzene sulfonate.

Representative examples of the benzopyranylidene-methylbenzopyrylium salts and benzothiopyranylidene-methylbenzopyrylium salts according to the invention are listed in Table I.

TABLE I

Compound number:	Name of Compound
1.	2-phenyl-4-[(2'-phenyl-4'-benzopyranaylidene) benzyl]benzopyrylium perchlorate
2.	2,3-diphenyl-4-[(2'-phenyl-4'-benzopyranylidene) benzyl]-6-methylbenzopyrylium perchlorate
3.	2,3-diphenyl-4-[(2'-phenyl-4'-benzopyranylidene) methyl]-6-methylbenzopyrylium perchlorate
4.	2,3-diphenyl-4-[(2'-phenyl-4'-benzopyranylidene) methyl]-6-phenylbenzopyrylium perchlorate
5.	2-p-methoxystyryl-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
6.	2-β-furyl(α')ethenyl-4-[(2'-phenyl-4'-benzopyranylidene-methyl]benzopyrylium perchlorate
7.	2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
8.	2-styryl-3-phenyl-4-[(2'-phenyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
9.	2-p-methoxystyryl-3-phenyl-4-[(2'-phenyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
10.	9-[(2'-phenyl-4'-benzopyranylidene)methyl] xanthylium perchlorate
11.	2-β furyl(α')ethenyl-3-phenyl-4-[(2'-phenyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
12.	2,3-diphenyl-4-[(2'-styryl-4'-benzopyranylidene) benzyl]-6-methylbenzopyrylium perchlorate
13.	2-phenyl-4-[(2'-styryl-4'-benzopyranylidene) benzyl]benzopyrylium perchlorate
14.	2,3-diphenyl-4-[(2'-styryl-4'-benzopyranylidene) methyl]-6-methylbenzopyrylium perchlorate
15.	2-(α-phenyl-p-methoxystyryl)-4-[(2'-styryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
16	2-styryl.-3-phenyl-4-[(2'-styryl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
17.	9-[(2'-styryl-4'-benzopyranylidene)methyl] xanthylium perchlorate
18.	2-p-methoxystyryl-3-phenyl-4-[2'-styryl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
19.	2,3-diphenyl-4-[(4'-benzopyranylidene)benzyl] benzopyrylium perchlorate
20.	2-phenyl-4-[(4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
21.	2,3-diphenyl-4 [(4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
22.	2-α-phenyl-p-methoxystyryl)-4-[(4'-benzopyranylidene)methyl]benzopyrylium perchlorate
23.	2-styryl-3-phenyl-4-[(4'-benzopyranylidene) methyl]-6-methylbenzopyrylium perchlorate
24.	2-p-methoxystyryl-3-phenyl-4-[(4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
25.	9-[(4'-benzopyranylidene)methyl]xanthylium perchlorate
26.	2-p-methoxystyryl-4-[(4'-benzopyranylidene) methyl]benzopyrylium perchlorate
27.	2-p-methoxystyryl-4-[(2'-p-methoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
28.	2-(α-phenyl-p-methoxystyryl)-4-[(2'-p-methoxy-

TABLE I—Continued

Compound number:	Name of Compound
	styryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
29.	2-styryl-3-phenyl-4-[(2'-p-methoxystyryl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
30.	2,3-diphenyl-4-[(2'-p-methoxystyryl-4'-benzopyranylidene)-methyl]-6-methylbenzopyrylium perchlorate
31.	2,3-diphenyl-4-[(2'-p-methoxystyryl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
32.	2-phenyl-4-[(2'-p-methoxystyryl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
33.	9-[(2'-p-methoxystyryl-4'-benzopyranylidene) methyl]xanthylium perchlorate
34.	2-p-methoxystyryl-4-[(4'-benzothiopyranylidene) methyl]benzopyrylium perchlorate
35.	2-(α-phenyl-p-methoxystyryl)-4-[(4'-benzothiopyranylidene)-methyl]benzopyrylium perchlorate
36.	2-styryl-3-phenyl-4-[(4'-benzothiopyranylidene) methyl]-6-methylbenzopyrylium perchlorate
37.	2,3-diphenyl-4-[(4'-benzothiopyranylidene) methyl]-6-methylbenzopyrylium perchlorate
38.	2,3-diphenyl-4-[(4'-benzothiopyranylidene) benzyl]-6-methylbenzopyrylium perchlorate
39.	2-phenyl-4-[(4'-benzothiopyranylidene)benzyl] benzopyrylium perchlorate
40.	9-[(4'-benzothiopyranylidene)methyl]xanthylium perchlorate
41.	2-p-methoxystyryl-3-phenyl-4-[(4'-benzothiopyranylidene)-methyl]-6-methylbenzopyrylium perchlorate
42.	2-p-methoxystyryl-4-[(2'-3'',4''-dimethoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
43.	2-styryl-3-phenyl-4-[(2'-3'',4''-dimethoxystyryl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
44.	9-[(2'-3'',4''-dimethoxystyryl-4'-benzopyranylidene)methyl]xanthylium perchlorate
45.	2-phenyl-4-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
46.	2,3-diphenyl-4-[2'-β-furyl(α')ethenyl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
47.	2,3-diphenyl-4-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
48.	2-p-methoxystyryl-4-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
49.	2-(α-phenyl-p-methoxystyryl)-4-[(2'-β-furyl(α') ethenyl-4'-benzopyranylidene)methyl]benzopyrylium percholrate
50.	9-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene) methyl]xanthylium perchlorate
51.	2-phenyl-4-[(2'-α-phenylstyryl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
52.	2-p-methoxystyryl-4-[(2'-α-phenylstyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
53.	2-(α-phenyl-p-methoxystyryl)-4-[(2'-α-phenylstyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
54.	2-phenyl-4-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
55.	2,3-diphenyl-4-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
56.	2,3-diphenyl-4-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]-6-methylbenzo pyrylium perchlorate

TABLE I—Continued

Compound number: Name of Compound

57. 2-p-methoxystyryl-4-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
58. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
59. 9-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]xanthylium perchlorate
60. 2-p-methoxystyryl-4-[(2'-α-phenyl-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
61. 9-[(2'-α-phenyl-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]xanthylium perchlorate
62. 2-phenyl-4-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
63. 2,3-diphenyl-4-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
64. 2,3-diphenyl-4-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
65. 2-p-methoxystyryl-4-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
66. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
67. 9[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]xanthylium perchlorate
68. 2-phenyl-4-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
69. 2,3-diphenyl-4-[(2'-3''-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
70. 2,3-diphenyl-4-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
71. 2-p-methoxystyryl-4-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
72. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'benzopyranylidene)methyl]benzopyrylium perchlorate
73. 9-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]xanthylium perchlorate
74. 2-phenyl-4-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]benzopyrylium perchlorate
75. 2,3-diphenyl-4-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate
76. 2,3-diphenyl-4-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
77. 2-p-methoxystyryl-4-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
78. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-benzopyrylium perchlorate
79. 9-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]xanthylium perchlorate
80. 2-phenyl-4-[(2'-phenyl-4'-benzothiopyranylidene)benzyl]benzopyrylium perchlorate
81. 2,3-diphenyl-4-[(2'-phenyl-4'-benzothiopyranylidene)benzyl]-6-methylbenzopyrylium perchlorate

TABLE I—Continued

Compound number: Name of Compound

82. 2,3-diphenyl-4-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
83. 2-p-methoxystyryl-4-[(2'-phenyl-4'-benzothiopyranylidene)methyl]benzopyrylium perchlorate
84. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl-4'-benzothiopyranylidene)methyl]benzopyrylium perchlorate
85. 2-p-methoxystyryl-3-phenyl-4-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
86. 2-styryl-3-phenyl-4-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-6-methylbenzopyrylium perchlorate
87. 9-[(2'-phenyl-4'-benzothiopyranylidene)methyl]xanthylium perchlorate
88. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium fluoborate
89. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium chloroferrate
90. 2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium chlorozincate
91. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-benzopyrylium perchlorate
92. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenyl-benzopyrylium perchlorate
93. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenyl-benzopyrylium fluoborate
94. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium chloroferrate
95. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium nitrate
96. 2-[(2'-styryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
97. 2-[(2'-styryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
98. 2-[(4'-benzopyranylidene)methyl]benzopyrylium perchlorate
99. 2-[(4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
100. 2-[(2'-p-methoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
101. 2-[(2'-p-methoxystyryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium percholate
102. 2-[(4'-benzothiopyranylidene)methyl]benzopyrylium perchlorate
103. 2-[(4'-benzothiopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
104. 2-[(2'-3'',4''-dimethoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
105. 2-[(2'-3'',4''-dimethoxystyryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
106. 2-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
107. 2-[(2'-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
108. 2-[(2'-α-phenylstyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
109. 2-[(2'-α-phenylstyryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
110. 2-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate
111. 2-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate
112. 2-[(2'-α-phenyl-β-furyl(α')ethenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

TABLE I—Continued

Compound number: Name of Compound

113. 2-[(2'-p-methoxystyryl-3',6'-diphenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

114. 2-[(2'-3'',4''-dimethoxystyryl-3',6'-diphenyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

115. 2-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate

116. 2-[(2'-p-methoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

117. 2-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate

118. 2-[(2'-3'',4''-dimethoxystyryl-3'-phenyl-6'-methyl-4--benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

119. 2-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate

120. 2-[(2'-β-furyl(α')ethenyl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

121. 2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]benzopyrylium perchlorate

122. 2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate

123. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-4-p-methoxyphenylbenzothiopyrylium perchlorate

124. 2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenyl-4-p-methoxyphenylbenzopyrylium perchlorate

125. 2-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]-4-p-methoxyphenylbenzothiopyrylium perchlorate

126. 2-[(2'-α-phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]-3-phenyl-4-p-methoxyphenylbenzothiopyrylium perchlorate

127. 2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-4-p-methoxyphenylbenzothiopyrylium perchlorate

128. 2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-3-phenyl-4-p-methoxyphenylbenzothiopyrylium perchlorate

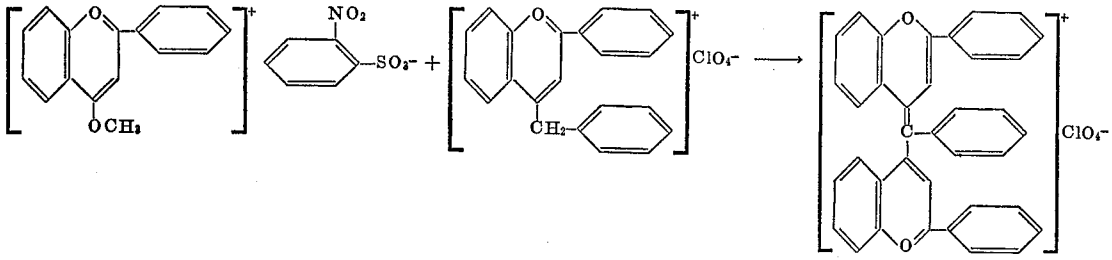
Table 2 lists additional information on the absorption maximum in dichloroethane and melting point of the novel compounds according to the invention.

TABLE 2

Compound number	Melting point	Absorption maximum in dichloroethane (mμ)
1	135–139	415 and 710.
2	130–132	430 and 720.
3	182–187	410 and 630.
4	164–170	635.
5	163–172	490 and 575.
6	>300	575 and 660.
7	162–169	500 and 610.
8	180–187	490 and 670.
9	157–160	550 and 670.
10	103–105	610.
11	120–126	595.
12	176–180	430 and 700.
13	122–126	420 and 730.
14	163–170	420 and 650.
15	160–164	500 and 600.
16	166–169	495 and 710.
17	135–140	580.
18	159–162	555.
19	179–181	420 and 730.
20	140–142	415 and 730.
21	165–172	410 and 700.
22	174–178	500 and 600.
23	176–179	485.
24	170–175	505.
25	>300	630.
26	>300	560.
27	191–197	560.
28	201–203	500 and 590.
29	200–204	660 and 710.
30	185–189	410 and 650.
31	178–183	430 and 690.
32	181–188	420 and 700.
33	117–123	550 and 650.
34	185–189	590.
35	159–164	495 and 600.
36	185–188	610, 650 and 700.
37	160–165	415 and 650.
38	204–206	425 and 700.
39	166–169	415 and 730.
40	>300	660.
41	173–180	555.
42	175–181	540 and 600.
43	167–173	660 and 710.
44	161–164	580 and 720.
45	145–150	415 and 720.
46	188–190	425 and 720.
47	168–175	670.
48	171–176	490 and 580.
49	179–186	600 and 720.
50	171–175	610 and 660.
51	151–155	480 and 740.
52	171–176	495 and 580.
53	173–177	590 and 700.
54	140–147	550 and 750.
55	203–207	420 and 680.
56	138–142	555 and 680.
57	170–175	570.
58	154–157	585 and 690.
59	168–174	570.
60	206–209	600.
61	>300	650.
62	193–146	550.
63	202–204	425 and 700.
64	173–177	530 and 690.
65	190–194	590.
66	190–193	500 and 600.
67	192–195	620.
68	112–118	570 and 760.
69	190–192	495.
70	154–159	650 and 700.
71	177–182	500 and 710.
72	176–181	590.
73	195–199	495 and 640.
74	189–195	550.
75	184–187	415 and 720.
76	192–196	640 and 700.
77	>300	550.
78	219–222	550.
79	226–230	630.
80	127–134	410 and 745.
81	190–192	425 and 730.
82	156–159	665.
83	164–169	600 and 680.
84	175–178	600 and 720.
85	170–177	550 and 700.
86	157–166	650 and 695.
87	169–172	635.
88	137–140	500 and 610.
89	167–172	500 and 610.
90	160–163	500 and 610.
91	>300	575.
92	128–134	575 and 675.
93	133–136	575 and 675.
94	152–158	575 and 675.
95	133–138	575.
96	190–195	575.
97	156–158	620 and 690.
98	225–229	565.
99	183–187	525 and 560.
100	208–212	570.
101	170–176	630 and 690.
102	225–228	610.
103	163–168	610 and 690.
104	178–184	510.
105	172–175	580 and 690.
106	167–171	565 and 620.
107	190–194	560 and 635.
108	211–214	570 and 610.
190	175–179	570 and 610.
110	198–201	570 and 610.
111	158–163	580 and 630.
112	>300	600 and 645.
113	185–188	570 and 620.
114	199–204	600.
115	211–215	565 and 600.
116	177–181	570 and 610.
117	205–207	570.
118	190–194	590.
119	237–241	560.
120	>300	590.
121	207–210	565 and 605.
122	155–158	615 and 675.
123	143–145	615.
124	126–131	619.
125	144–148	559 and 657.
126	140–142	589 and 663.
127	149–153	656.
128	141–145	660.

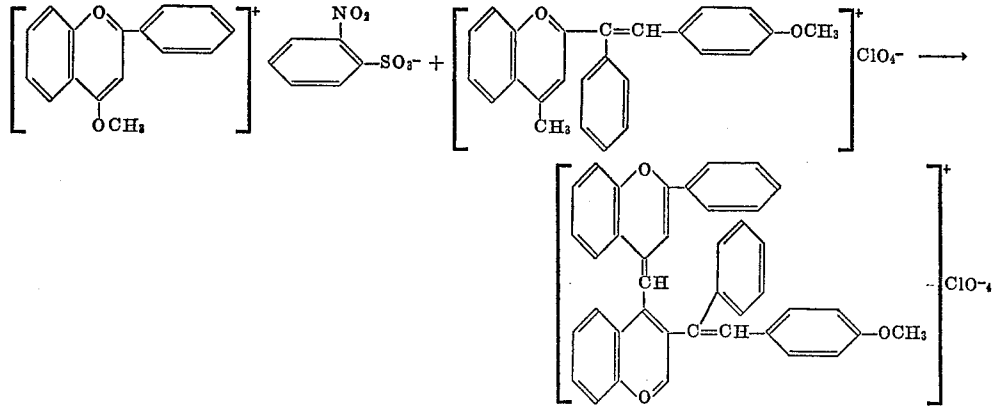
The following description will explain a practical method for making benzopyranylidene-methylbenzopyrylium salts or benzothiopyranylidene-methylbenzopyrylium salts with reference to exemplary compounds. The details of the preparation of other compounds will be apparent to the skilled in the art from the preceding disclosure and the following illustrative examples of preparation methods of various compounds according to the invention:

(a) 2-phenyl-4-[(2'-phenyl-4'-benzopyranylidene)benzyl] benzopyrylium perchlorate (compound number 1)



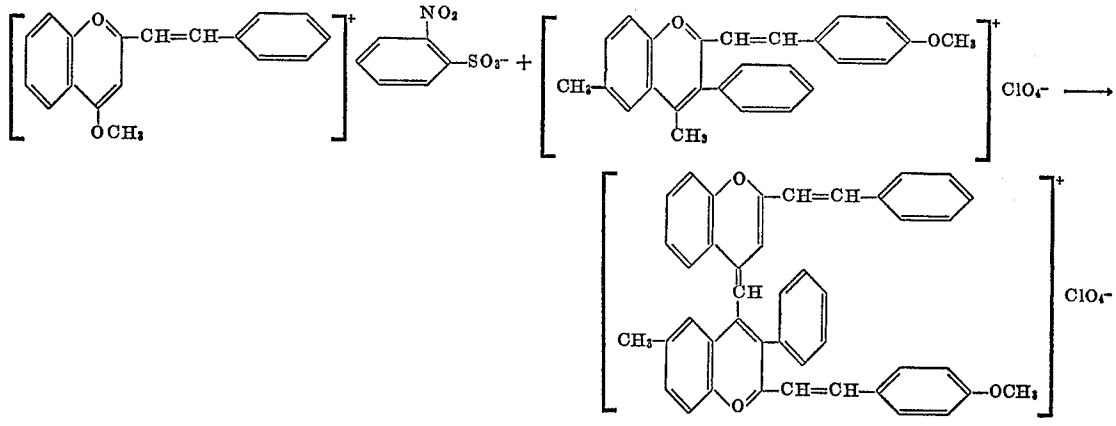
5.5 grams of 2-phenyl-4-methoxybenzopyrylium o-nitrobenzene sulfonate, which is obtained from flavone and methyl o-nitrobenzenesulfonate, and 5 grams of 2-phenyl-4-benzyl-benzopyrylium perchlorate are dissolved in 150 milliliters of acetic anhydride to a solution. The solution is then refluxed for 15 minutes and poured into 900 milliliters of 10 weight percent perchloric acid. The solution is filtered to obtain a precipitate. The precipitate is dried and dissolved again in dichloroethan to a solution. For purification the solution is poured into ether. Precipitated crystals are filtered off, washed with ether and dried to obtain 4 grams (theoretical yield 53%) of green crystals having a melting point of 135° to 139° C.

(b) 2 - (α - phenyl - p - methoxystyryl) - 4 - [(2'-phenyl-4' - benzopyranylidene)methyl]benzopyrylium perchlorate (compound number 7)



5.5 grams of 2 - (α - phenyl - p - methoxystyryl)-4-methylbenzopyrylium perchlorate and 5.5 grams of 2-phenyl-4-methoxybenzopyrylium o-nitrobenzene sulfonate are dissolved in 150 milliliters of acetic anhydride to a solution. The solution is then refluxed for 15 minutes and poured into 900 millilters of 10 weight percent perchloric acid. The solution is filtered to obtain a precipitate. The precipitate is reprecipitated with dichloroethane ether. Precipitated crystals are filtered off, washed with ether and dried to obtain 5.5 grams (theoretical yield 69%) of blue crystals having a melting point of 162° to 169° C. In the procedure above mentioned the solution is poured into an ether solution of $BF_3 \cdot O(C_2H_5)_2$ instead of 10 weight percent perchloric acid. In this case 2-(α-phenyl-p-methoxystyryl)-4-[(2'-phenyl - 4' - benzopyranylidene) methyl]benzopyrylium fluoroborate (compound number 88) is obtained. In the procedure when the solution is poured into a 10 weight percent zinc chloride aqueous solution, 2 - (α - phenyl-p-methoxystyryl)-4-[(2'-phenyl-4' - benzopyranylidene)methyl]benzopyrylium chlorozincate (compound number 90) is obtained.

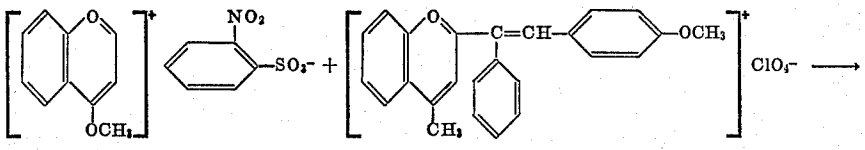
(c) 2 - p - methoxystyryl - 3 - phenyl-4-[(2'-styryl-4'-benzopyranylidene)methyl] - 6 - methylbenzopyrylium perchlorate (compound number 18)

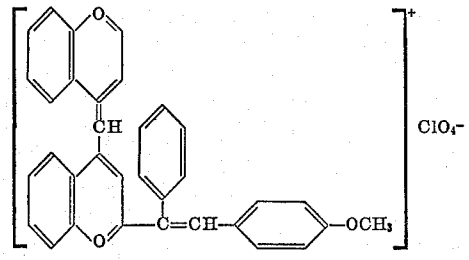


2 - styryl - 4 - methoxybenzopyrylium o - nitrobenzenesulfonate (melting point, 155° to 157° C.) is obtained by a reaction of 2-styrylchromone and methyl o-nitrobenzenesulfonate in dry benzene at 50° C. for 24 hours. According to the same reaction as shown in procedure (a), 2 - styryl - 4 - methoxybenzopyrylium o - nitrobenzenesulfonate reacts with 2-p-methoxystyryl-3-phenyl-4,6-dimethylbenzopyrylium perchlorate to obtain 2-p-methoxystyryl - 3 - phenyl - 4 - [(2' - styryl-4'-benzopyranylidene) methyl] - 6 - methylbenzopyrylium perchlorate crystals which have a color of reddish violet in dichloroethane and have a melting point of 159° to 162° C. The product is obtained in 73% yield.

(d) 2 - (α - phenyl - p - methoxystyryl)-4-[(4'-benzopyranylidene)methyl]benzopyrylium perchlorate (compound number 22)

2-(3',4' - dimethoxystyryl) - 4 - methoxybenzopyrylium o-nitrobenzenesulfonate (melting point 211° to 213° C.) is obtained from a reaction of 2-(3',4'-dimethoxystyryl) chromone and methyl o-nitrobenzene sulfonate. 6.5 grams of 2 - (3',4' - dimethoxystyryl)-4-methoxybenzopyrylium o-nitrobenzenesulfonate and 4.5 grams of 2-p-methoxystyryl-4-methylbenzopyrylium perchlorate are dissolved in 150 milliliters of acetic anhydride to a solution. The solution is heated at 100° C. for 100 minutes. After cooling the solution is poured into 900 milliliters of 10 weight percent perchloric acid. Precipitates are filtered off and dried. For purification, reprecipitation is made using dichloroethane and ether. 3.2 grams of product is obtained in 41% yield. The product has a color of dark violet in dichloroethane and a melting point of 175° to 181° C.

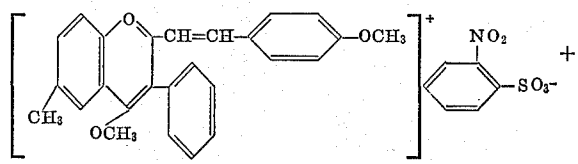


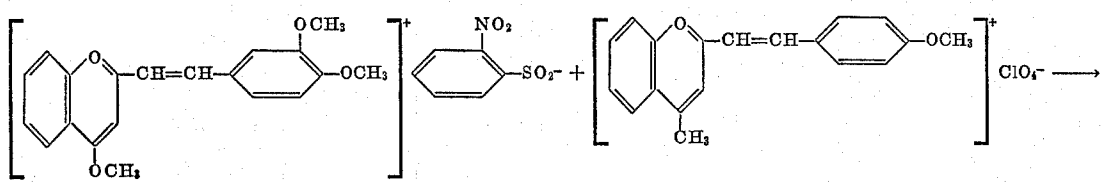


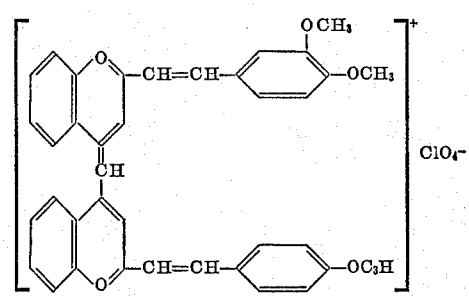
4 - methoxybenzopyrylium o - nitrobenzenesulfonate reacts with 2 - (α - phenyl - p - methoxystyryl)-4-methyl] benzopyrylium perchlorate to 2 - (α - phenyl - p - methoxystyryl) - 4 - [(4'-benzopyranylidene)methyl]-benzopyrylium perchlorate in the same procedure as the procedure (a). The crystals have a color of violet in dichloroethane and a melting point of 174° to 178° C. The product is obtained in 95% yield.

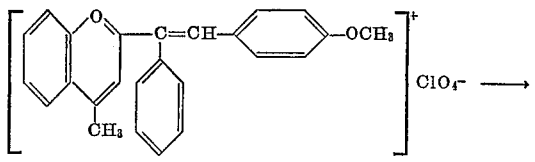
(e) 2 - p - methoxystyryl - 4 - [(2' - 3'',4'' - dimethoxystyryl - 4' - benzopyranylidene)methyl]benzopyrylium perchlorate (compound number 42)

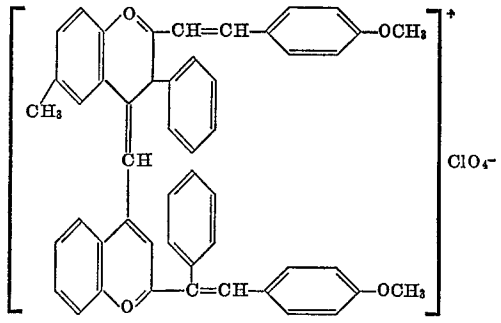
(f) 2 - (α - phenyl - p - methoxystyryl)-4-[(2'-p-methoxystyryl - 3' - phenyl - 6' - methyl - 4'-benzopyranylidene) methyl]benzopyrylium perchlorate (compound number 66)





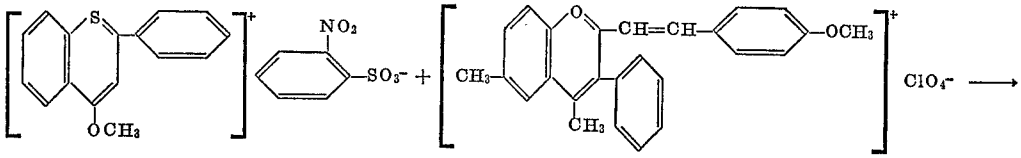






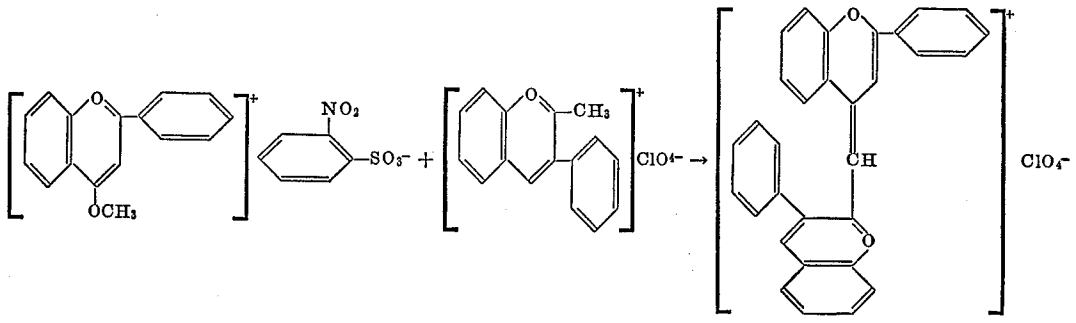
2 - p - methoxystyryl - 3 - phenyl - 4-methoxy-6-methylbenzopyrylium o-nitrobenzenesulfonate (melting point 141° to 144° C.) is obtained from 2-p-methoxystyryl-3-phenyl-6-methylchromone and methyl o-nitrobenzenesulfonate. 2-p-methoxystyryl-3-phenyl-4-methoxy-6-methylbenzopyrylium o-nitrobenzenesulfonate reacts with 2-(α-phenyl - p - methoxystyryl) - 4-methylbenzopyrylium perchlorate in the same procedure as the procedure (e). The product has a color of violet in dichloroethane and a melting point of 190° to 193° C.

(g) 2 - p - methoxystyryl - 3 - phenyl - 4 - [(2'-phenyl-4'-benzothiopyranylidene)methyl] - 6 - methyl]benzopyrylium perchlorate (compound number 85)



2-phenyl-4-methoxybenzothiopyrylium o-nitrobenzenesulfonate is obtained from thioflavone and methyl o-nitrobenzenesulfonate. As the same procedure as procedure (e), the product is obtained in 62% yield. The product has a color of reddish violet in dichloroethane and melting point of 170° to 177° C.

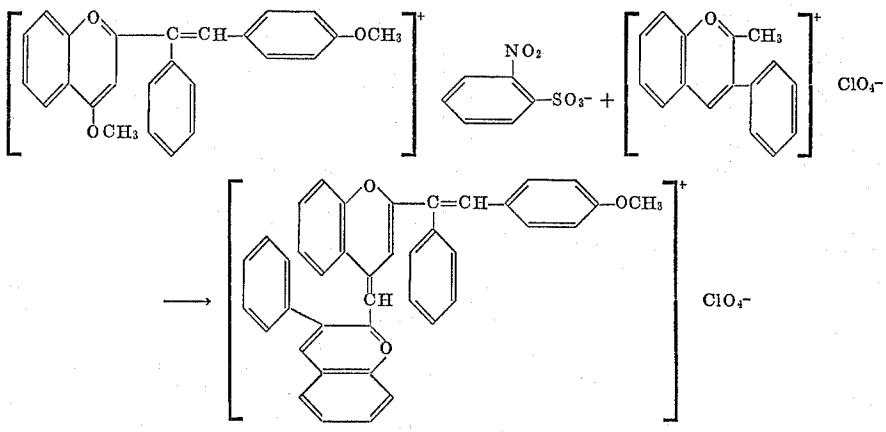
(h) 2 - [(2' - phenyl - 4' - benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate (compound number 92)



5.5 grams of 2 - phenyl - 4 - methoxybenzopyrylium o-nitrobenzenesulfonate, which is obtained from flavone and methyl o-nitrobenzenesulfonate, and 4 grams of 2-methyl-3-phenylbenzopyrylium perchlorate are dissolved in 150 milliliters of acetic anhydride to a solution. The solution is heated at 100° C. for 15 minutes. After cooling the solution is poured into 900 milliliters of 10 weight percent perchloric acid. Precipitated product is filtered off and dried. For purification, reprecipitation is made using dichloroethane and ether. The product has a color of blue in dichloroethane and a melting point of 128° to 134° C. The product yields 3 grams (theoretical yield 46%). Compound number 93 (fluoborate), compound number 94 (chloroferrate) or compound number 95 (nitrate) is obtained using either solution of boron-trifluoride etherate, aqueous solution of ferric chloride or diluted nitric acid respectively instead of 10 weight percent perchloriic acid.

(i) 2 - [(2' - 4 - phenyl-p-methoxystyryl-4'-benzopyranylidene)methyl]-3-phenylbenzopyrylium perchlorate compound number 11)

troconductive support in per se usual manner, for example, by spraying, by means of bladed coating, by means of whirler coating, etc., and then dried so as to produce



2 - (α-phenyl-p-methoxystyryl) - 4 - methoxybenzopyrylium o-nitrobenzenesulfonate, which is obtained from 2 - (α - phenyl - p - methoxystyryl)chromone and methyl o-nitrobenzenesulfonate, reacts with 2-methyl-3-phenylbenzopyrylium perchlorate in the same procedure as procedure (h). The reaction product yields in 43%. The product has a color of violet in dichloroethane and a melting point of 158° to 163° C.

It has been discovered according to the invention the compounds listed in Table 1 are sensitizing agents which can improve the photoconductivity and the spectrum characteristics of photoconductive polymeric compounds such as poly-N-vinylcarbazole, brominated poly-N-vinylcarbazoles, polyacenaphthylene, etc. These polymers, except brominated poly-N-vinylcarbazoles, are prepared in a per se well known method. The brominated poly-N-vinylcarbazole can be prepared by the following method: To the solution of 20 grams of poly-N-vinylcarbazole in 450 milliliters of chlorobenzene, there are added 18.44 grams of N-bromosuccinimide and 0.173 gram of benzoyl peroxide. The mixture is heated at 80° C. for 2 hours while being stirred thoroughly and is poured into methanol to obtain a white polymer. The polymer is dissolved in chlorobenzene and again poured into methanol for purification. The pure polymer thus obtained as a precipitate exhibits upon elementary analysis a halogen content of 29.87 weight percent which approximates the value calculated, i.e. 29.44 weight percent of the monobromosubstituted product from poly-N-vinylcarbazole. This indicates that the polymer obtained is a monobromosubstituted product. The degree of bromination varies from 50 mole percent to 200 mole percent according to reaction conditions.

The novel sensitizer comprising at least one compound from the group listed in Table 1 is dissolved in a suitable solvent, such as dichloroethane, methylene chloride, chloroform, or a combination thereof, and is added to the solution of the photoconductive polymer described above. The preferable amount of the sensitizer added is from 0.01 to 3.0 weight parts in connection with 100 weight parts of the photoconductive polymer. Advantageously, the amount thereof is from 0.1 to 2.0 weight parts in connection with 100 weight parts of the photoconductive polymer.

For the preparation of the photoconductive insulating layer, a said solution of the photoconductive polymer and the sensitizer in a suitable solvent is applied to the electroconductive support. Operable solvents are benzene, toluene, chlorobenzene, dioxane, methylene chloride, dichloroethane and combinations thereof. Said solution may be incorporated with suitable plasticizers and/or organic colloids for improving the flexibility and strength of the photoconductive polymer. Operable plasticizers are as follows: chlorinated diphenyl, dimethyl phthalate, diethyl phthalate and octyl phthalate. Operable organic colloids are as follows: natural and synthetic resins, e.g. phenol resin, phenol resin modified with resin, polyvinyl acetal, polyvinyl butyral, polyvinyl cinnamate, polycarbonate resin. Operable materials for electroconductive supports may be made of any materials which satisfy the requirement of the electrophotographic art, e.g. metal plate or glass plate having NESA coating, plate or foil made of electrically conductive resin or coated with evaporated thin metal layer. If paper is to be used as a support for the photoconductive layer, pretreatment of the paper against penetration of the coating solution is advisable. The transparent support can produce a transparent electrophotographic plate, foil or film. After an electrostatic charge has been applied, i.e. after the layer has been charged positively or negatively by means of a corona discharge, the layer becomes light sensitive.

The reproducton of images by the electrophotographic method is carried out as follows: when the photoconductive layer has been charged by means of a corona discharge apparatus, the support with the sensitized layer is exposed to light under a master and is then dusted over in a per se known manner with a resin powder colored with carbon black. The image that now becomes visible can easily be wiped off. It can also be fixed by heating at about 120° C. From positive masters, positive images characterized by good contrast are produced.

This invention is still further illustrated with reference to the following illustrative examples.

EXAMPLE 1

1 gram of polyacenaphthylene and 0.6 gram of, as a plasticiser, chlorinated diphenyl (commercially available as "Kanechlor"), are dissolved in 8 milliliters of chlorobenzene. To the solution are added 0.5 milliliter of dichloroethane containing 0.006 gram of a sensitizer corresponding to compound number listed in Table 1. The solution is applied to an aluminum plate by means of whirler coating and is dried to form a layer of 7μ in

thickness. After said aluminum plate provided with the layer is charged negatively by means of corona discharge with a charging device maintained at approximately 6000 volts in the dark, it is placed under a positive master and is exposed to a 100 w. tungsten lamp at an illumination of 50 luxes, and the said plate is powdered over with a developer in a per se known manner. This developer consists of toner and carrier. The toner consists of low melting point polystyrene, colophony and carbon black. The toner is mixed with a carrier substance such that the toner becomes triboelectrically charged with a charge opposite to that produced on the plate. A positive image is produced and is fixed by slight heating. In Table 2, there are shown the optimum amounts of exposure in lux-second units.

TABLE 2

Compound number:	Optimum exposure (lux-sec.)
None	200000
5	320
7	300
9	75
15	180
16	110
18	65
33	135
35	480
41	105
42	320
51	380
52	140
53	290
54	140
58	130
60	175
65	140
71	180
92	70
97	150
103	100
105	120
109	130
110	180
111	70
112	170
113	120
116	115

EXAMPLE 2

1 gram of poly-N-vinylcarbazole, chlorinated diphenyl (commercially available as "Kanechlor") and 0.006 gram of a sensitizer, corresponding to compound number listed in Table 1, in 10 milliliters of dichloroethane to a solution. The solution is applied to an aluminum plate by means of blade coating and is dried to form a layer of 10μ in thickness. An electrophotographic image is produced in the same way as that described in Example 1. In Table 3, there are shown the optimum amounts of exposure in lux-second units to produce exactly the original images.

TABLE 3

Compound number:	Optimum exposure (lux-sec.)
None	20000
1	50
2	220
3	60
4	70
5	22
6	44
7	26
8	62
9	44
10	48
11	160
12	220
13	90
14	75
15	28
16	36
17	115
18	22
23	180
26	110
27	44
28	36
29	40
30	60
32	120
33	36
34	50
35	30
36	46
37	90
41	52
42	44
43	48
45	75
47	58
48	34
49	35
50	70
51	30
53	26
54	28
56	28
57	20
58	24
59	36
60	44
61	44
62	100
64	54
65	44
66	22
67	74
70	56
71	20
72	22
76	60
78	38
80	46
82	50
83	24
84	19
85	17
86	54
87	42
88	25
89	28
90	30
91	140
92	18
93	20
34	23
95	40
96	66
29	24
98	230
99	460
100	50
101	36
102	115
103	36
104	68
105	19
106	120
107	58

TABLE 3—Continued

Compound number:	Optimum exposure (lux-sec.)
108	76
109	46
110	36
111	20
112	42
113	48
114	54
115	54
116	52
117	64
118	50
119	135
120	90
121	30
122	28

It is clear from Table 3 that the novel sensitizers improve the photoconductivity of poly-N-vinylcarbazole.

EXAMPLE 3

1 gram of brominated poly-N-vinylcarbazole (monobromo-substituted product), 0.5 gram of polycarbonate resin (commercially available as "Panlite-C"), 0.3 gram of chlorinated diphenyl (commercially available as "Kanechlor") and 0.002 gram of sensitizer listed in Table 1 are dissolved in a mixed-solvent of 8 milliliters of chlorobenzene and 2 milliliters of dichloroethane. This solution is applied to an aluminum plate by means of a blade coating and dried to form a layer of 14μ in thickness. On this support, electrophotographic images are produced in the same way as that described in Example 1. Table 4 shows the optimum amounts of exposure in lux-second units to reproduce exactly the original images.

TABLE 4

Compound number:	Optimum exposure (lux-sec.)
None	80000
1	75
2	280
3	67
4	44
5	20
6	26
7	18
8	30
9	22
10	40
11	120
12	400
13	110
14	75
15	25
16	28
17	135
18	23
19	410
20	340
21	180
22	40
23	130
24	60
25	300
26	100
27	52
28	52
29	48
30	110
31	320
32	270
33	27
34	30
35	26

TABLE 4—Continued

Compound number:	Optimum exposure (lux-sec.)
37	52
38	440
39	110
40	125
41	22
42	28
43	32
44	75
45	105
46	170
47	42
48	32
49	35
50	50
51	48
52	20
53	19
54	42
55	230
56	26
57	22
58	24
59	23
60	26
61	36
62	130
63	190
64	44
65	26
66	20
67	46
68	75
69	115
70	42
71	18
72	20
73	48
74	110
75	115
76	70
77	44
78	35
79	75
80	50
81	145
82	35
83	20
84	19
85	17
86	34
87	34
88	20
89	20
90	25
91	100
92	15
93	17
94	16
95	40
96	52
97	26
98	180
99	140
100	46
101	36
102	58
103	20
104	34
105	21
106	80
107	44
108	40

TABLE 4—Continued

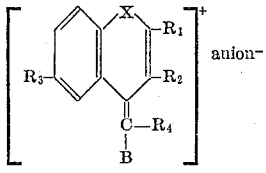
Compound number:	Optimum exposure (lux-sec.)
109	23
110	26
111	17
112	26
113	28
114	40
115	44
116	28
117	44
118	36
119	105
120	52
121	26
122	21
123	15
124	25
125	17
126	14
127	11
128	13

It is clear from Table 4 and FIGS. 1 to 9 that the novel sensitizers improve the photoconductivity and the spectrum characteristics of brominated poly-N-vinylcarbazole.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

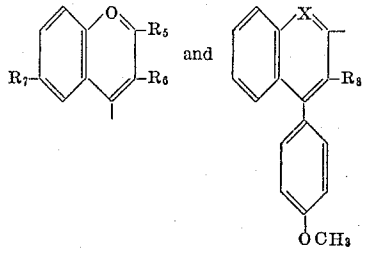
What we claim is:

1. An electrophotographic material comprising a conductive support layer and photoconductive insulating layer, the latter comprising a combination of a photoconductive polymeric compound and a sensitizing amount of a sensitizer having the following formula:



wherein

B represents a radical selected from the group consisting of



R_1 is hydrogen, phenyl or an ethenyl radical selected from the group consisting of styryl, p-methoxystyryl, 3,4-dimethoxy-styryl, α-phenylstyryl, α - phenyl - p-methoxystyryl, β-furyl (α')ethenyl and α-phenyl-β furyl(α') ethenyl;

R_2 is hydrogen or phenyl;

R_3 is hydrogen, methyl or phenyl;

R_4 is hydrogen or phenyl;

R_5 is hydrogen, phenyl or an ethenyl radical selected from the group consisting of styryl, p-methoxystyryl, 3,4-dimethoxy-styryl, α-phenyl-p-methoxystyryl, β-furyl(α')ethenyl and α-phenyl-β-furyl(α')ethenyl;

R_6 is hydrogen or phenyl;

R_7 is hydrogen or phenyl;

the anion is an anionic function selected from the group consisting of perchlorate, fluoroborate, chloroferrate, chlorozincate and nitrate; and

X is oxygen or a sulfur atom;

said photoconductive polymeric compound comprising at least one compound selected from the group consisting of poly-N-vinylcarbazole, brominated poly-N-vinylcarbazole and polyacenaphthylene.

2. An electrophotographic material according to claim 1, wherein said sensitizer comprises at least one compound selected from the group consisting of

2-(α-phenyl-p-methoxystryl)-4-[(2'-phenyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate,

2-p-methoxystyryl-4-[(2'-3'',4''-dimethoxystryl-3'-phenyl-6'-methyl-4'-benzopyranylidene)methyl]benzopyrylium perchlorate,

2-[(2'-phenyl-4'-benzopyranylidene)methyl]-3-phenyl benzopyrylium fluoroborate,

2-[(2'-phenyl-4'-benzopyranylidene)methyl]-4-p-methoxyphenyl benzothiopyrylium perchlorate, and

2-[(2'-phenyl-4'-benzothiopyranylidene)methyl]-4-p-methoxyphenyl benzothiopyrylium perchlorate.

3. An electrophotographic material according to claim 1, wherein said combination comprises 100 weight parts of photoconductive polymeric compound and 0.01 to 3.0 weight parts of sensitizer.

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U.S. Cl. X.R.

260—327 R, 345.2