PATENT SPECIFICATION

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G2C C8B4A1A C8B4D C8B4G10 C8B4G11 C8B4G12 C8B4G13 C8B4G14 C8B4G17 C8B4G1 C8B4G22 C8B4G23 C8B4G2 C8B4G3 C8B4G4 C8B4G5 C8B4G6 C8B4G7

(54) BIS-AMIDO BENZINE DERIVATIVES AND THEIR USE AS COLOUR COUPLERS IN MATERIAL FOR COLOUR PHOTOGRAPHY

(71) We, CIBA-GEIGY AG, a body corporate organised according to the laws of Switzerland, of Basle, Switzerland, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In order to produce coloured photographic images, exposed silver halide emulsion layers which at the same time contain colour couplers are, as is known, developed with a developing agent which contains aromatic primary amino groups. The oxidised developing agent reacts with the colour coupler with the formation of an image dye, the amount of this dye being dependent on the amount of silver developed.

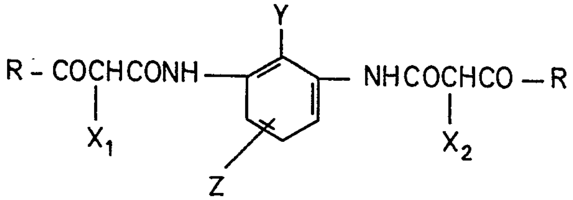
In general, a light-sensitive photographic multi-layer material which consists of a red-sensitive layer, which contains the cyan coupler, a green-sensitive layer, which contains the magenta coupler, and a blue-sensitive layer, which, in turn, contains the yellow coupler, is used. On colour development, the corresponding dyes, which are cyan, magenta and yellow in colour, then form.

Usually, phenols or α-naphthols are employed as cyan couplers, pyrazolones are employed as magenta couplers and acylacetylamides are employed as yellow couplers. The dyes formed after development are then indophenols, indamines or azomethines.

A structural characteristic of the conventional yellow couplers is an active methylene group, it being possible, in some cases, for one hydrogen atom to be replaced by a group which is detachable during the coupling reaction. In the former case, the couplers are termed four-equivalent couplers since four equivalents of silver halide are required in order to form the image dye. In the second case, only two equivalents of silver halide are used to produce the corresponding image dye (two-equivalent couplers). These known couplers result in image dyes which in each case contain a chromogenic grouping (azomethine grouping) and a ballast group. Although the ballast groups are important inasmuch as they are responsible, for example, on the one hand for the solubility of the coupler and on the other hand also for the resistance of the dyes to diffusion, they can, however, also have an adverse influence (for example as a result of undesired light absorption) on the photographic properties of the recording material for colour photography; moreover, they make no contribution towards increasing the colour yield of the image dye to be formed. In order to overcome these disadvantages either the size of the ballast groups can be reduced (which, however, because of the demands made on these groups hardly promises success) or the number of the chromogenic groupings per molecule is increased, i.e. the 1:1 ratio (chromogenic group: ballast group) is changed to, for example, 2:1. By means of this measure, the molar colour-forming capacity of the couplers is increased and a greater colour density is achieved, so that the amount of coupler employed can be reduced and, as a result, at the same time the amount of ballast groups and, thus, their possible adverse influence on the photographic material can be reduced. Colour couplers of this type are known, for example, from U.S. Patent Specification 3,077,403 and German Offenlegungsschrift 2,408,168. However, the characteristics of these couplers in use are still not entirely satisfactory. The object of the present invention is, therefore, to provide novel colour couplers and materials for colour photography which have improved characteristics and in which compounds which contain, per molecule, two chromogenic groupings but only one ballast group are employed as the yellow coupler.

The colour couplers employed according to the invention can be either so-called twice 2-equivalent couplers or twice 4-equivalent couplers, i.e. compounds which possess, per molecule, two reactive positions capable of forming a colour with the oxidised developer, 2 or 4 equivalents of silver halide being consumed in each case.

The subject of the present invention is a yellow coupler of the formula

(1) 

in which R is alkyl, cycloalkyl or aryl and X_1 and X_2 are radicals which are detachable during the coupling reaction, Y is halogen, alkyl, alkoxy, alkylmercapto, —CN, —COOH, carbalkoxy, $—NH_2$, $—NHR_1$, $—NR_1R_2$ or $—NHCOR_1$, in which R_1 and R_2 are alkyl or phenyl, Z is alkyl having 5 to 40 carbon atoms, alkoxy having 5 to 40 carbon atoms, cycloalkoxy having 5 to 12 carbon atoms or aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkylmercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl, in which radicals the sum of the carbon atoms in each case is 6 to 40; or $—COOR_3$, $—COR_3$, $—NR_3R_4$, $—CONR_3R_4$, $—NR_4COR_3$, $—SO_2R_3$, $—SO_2NR_3R_4$ or $—NR_4SO_2R_3$, R_3 is substituted or unsubstituted alkyl having 1 to 40 carbon atoms, substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms.

The invention also relates to photographic material which contains in at least one silver halide emulsion layer, the yellow colour coupler of formula I and to a process, for colour photography, for the production of a yellow image by colour development of an exposed recording material which contains a compound of the formula (1) as the yellow coupler, and the use of compounds of the formula (1) as yellow couplers in light-sensitive recording materials for colour photography.

Suitable alkyl radicals R in formula (1) can contain 1 to 18 carbon atoms and can be straight-chain or branched, for example methyl, ethyl, propyl, i-propyl, butyl, isobutyl, tert.-butyl, amyl, tert.-amyl (1,1-dimethylpropyl), 1,1,3,3-tetramethylbutyl, 1-methyl-1-ethylpentyl, hexyl, 1-methylpentyl, neopentyl, 1-, 2- or 3-methylhexyl, heptyl, n-octyl, tert.-octyl, 2-ethoxyhexyl, n-nonyl, isononyl, tert.-nonyl, decyl, tert.-decyl and undecyl; and also dodecyl, tetradecyl, hexadecyl and octadecyl as well as the corresponding isomers. Straight-chain or branched alkyl radicals having 3 to 10 carbon atoms are particularly suitable and amongst these tert.-alkyl radicals having 4 to 8 carbon atoms are preferred. tert.-Butyl, 1,1,3,3-

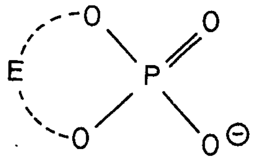
tetramethylbutyl, 1-methyl-1-ethylpentyl and 1,1-dimethylpropyl are particularly preferred tertiary alkyl radicals.

Examples of cycloalkyl are those having 3 to 12 ring carbon atoms, for example cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl, which can be unsubstituted or substituted. Cycloalkyl also includes bicycloalkyl and tricycloalkyl, for example norbornyl and adamantyl. Cyclopentyl, cyclohexyl and adamantyl are preferred.

Aryl radicals are especially phenyl or substituted phenyl, possible substituents being halogen, for example fluorine, chlorine or bromine, and alkyl or alkoxy, preferably each having 1 to 4 carbon atoms, for example methyl, ethyl, propyl, i-propyl, butyl, tert.-butyl, methoxy, ethoxy, propoxy and butoxy, and also amino (—NH_2), sulphonyl (—SO_3H), alkylsulphonyl and acylamino, the latter two of which can be represented by the formulae —SO_2R_6 and —$NHCOR_7$, in which R_6 is alkyl having 1 to 5 carbon atoms, for example methyl, ethyl, propyl, i-propyl, butyl or amyl, and R_7 is also alkyl having 1 to 5 carbon atoms, particular radicals again being those mentioned for R_6.

A preferred aryl radical is phenyl substituted by halogen and alkyl or alkoxy each having 1 to 4 carbon atoms.

Possible radicals X_1 and X_2, which are detachable during the coupling reaction, are hydrogen (in 4-equivalent couplers), halogen, alkoxy and phenoxy, substituted or unsubstituted, nitrogen-containing 5-membered or 6-membered heterocyclic structures, which are bonded to the coupling point via a nitrogen atom, the radicals —S—R_8 and $OPO(OR_9)_2$, in which R_8 is alkyl, substituted phenyl or a heterocyclic structure and R_9 is alkyl or phenyl, and also a radical of the formula



in which E is the complement to a radical containing the ring consisting of the phosphorus atom, the two oxygen atoms and 3 carbon atoms. A suitable detachable halogen is bromine and especially chlorine. The alkoxy radical can contain 1 to 4 carbon atoms and the phenoxy radical can be substituted by nitro, carboxyl or carboxyl-ester, in which the alcohol component of the ester can contain 1 to 4 carbon atoms. Specific examples of carboxyl-ester substituents are methyl, ethyl, propyl and butyl ester groups.

The 5-membered or 6-membered heterocyclic structures which are bonded to the coupling point via a nitrogen atom are, for example, heterocyclic structures which contain one or more nitrogen, sulphur and/or oxygen atoms and, if desired, can be fused to a further ring. Examples which may be mentioned are the radicals of pyrazole, imidazole, triazoles (1,2,3 and 1,2,4), tetrazoles, benztriazole, pyrimidine, pyridazine, thiazole, oxazole and oxazine; and also cyclic imides. The said heterocyclic structures can be in the unsubstituted or substituted form.

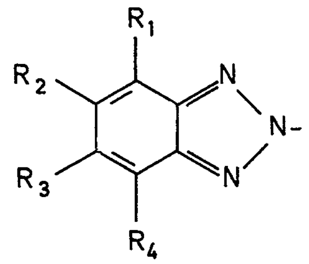
Attention is drawn to the following publications with regard to further details relating to leaving groups in two-equivalent yellow couplers:

halogen atoms, such as are described, for example, in German Offenlegungsschrift 2,114,577, French Patent Specifications 991,453 and 869,169 or U.S. Patent Specifications 2,728,658 and 3,277,155;

the group —OR, in which R is alkyl, aryl, a heterocyclic radical or acyl, such as are described, for example, in British Patent Specification 1,092,506; French Patent Specifications 1,411,385 and 1,385,696 or U.S. Patent Specifications 3,447,928 and 3,408,194;

the —SR″ group which is described in British Patent Specification 953,454 or U.S. Patent Specification 3,265,506;

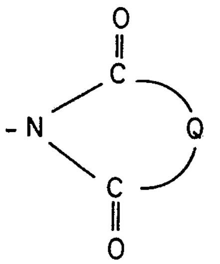
the 1,2,3-benztriazolyl group of the formula



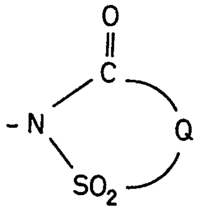
(German Offenlegungsschrift 1,800,420)

the radicals $—SO_3H$ and —SCN (British Patent Specification 638,039 and U.S. Patent Specification 3,253,924)

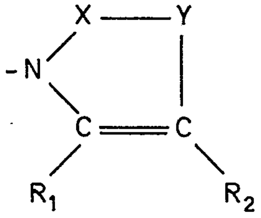
imide groups of the formulae



and

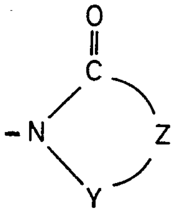


(German Offenlegungsschriften 2,163,812, 2,213,461 and 2,057,941); radicals of the formula



(German Offenlegungsschrift 2,329,587)

leaving groups of the formula

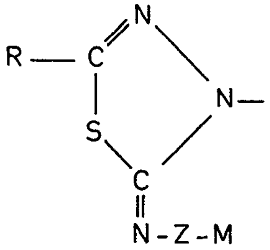


(German Offenlegungsschrift 2,433,812)

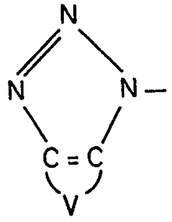
1,2,4-triazolyl or 1,2,3-benzotriazin-4-(3)-one radicals as leaving groups (German Offenlegungsschrift 2,528,638);

1,2,4-triazolyl or tetrazolyl radicals as leaving groups (German Offenlegungsschrift 2,442,703),

open-chain or cyclic sulphonamidyl radicals as leaving groups (German Offenlegunggschrift 2,454,741), leaving groups of the formula



(German Offenlegungsschrift 2,716,204) and
leaving groups of the formula



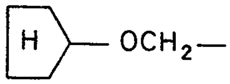
in which V, together with the —C=C— grouping, forms an aromatic ring of the benzene series or a heterocyclic ring containing at least one nitrogen atom (German Offenlegungsschrift 2,414,006).

The substituent Y can be halogen, for example fluorine, chlorine or bromine, or alkyl, alkoxy or alkylmercapto, each having, preferably, 1 to 12 carbon atoms, for example methyl, ethyl, propyl, butyl, amyl, hexyl, octyl, nonyl, decyl, undecyl or dodecyl, and the corresponding isomers, and also the analogous alkoxy or alkylmercapto radicals. Further suitable substituents Y are —CN, —COOH, carbalkoxy having up to 12 carbon atoms in the alkoxy part, —NH_2 and alkyl-, phenyl-, dialkyl- and diphenyl-amino, in which alkyl preferably contains 1 to 5 carbon atoms, or acylamino, in which the acyl radical contains 2 to 13 carbon atoms and as a rule is derived from alkylcarboxylic acids having the corresponding number of carbon atoms or from benzoic acid (C_6H_5COOH).

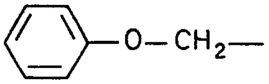
The radical —$NHCOR_{12}$, in which R_{12} is alkyl having 1 to 12 carbon atoms and especially chlorine, are preferred meanings of Y.

The substituent Z, which may be in the meta-position, but preferably in the para-position, relative to the substituent Y, can be a straight-chain or branched alkyl radical having 5 to 40 carbon atoms. Possible straight-chain alkyl radicals are thus, for example: pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hentriacontyl, dotriacontyl, tritriacontyl, tetratriacontyl, pentatriacontyl, hexatriacontyl, heptatriacontyl, octatriacontyl, nonatriacontyl and tetracontyl. The corresponding isomers are also suitable.

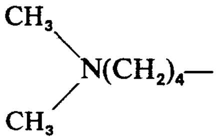
Z can also be one of the following radicals, in which the sum of the carbon atoms in each case should be in the range of 6 to 40: aralkyl, for example benzyl, alkoxyalkyl, for example $CH_3(CH_2)_4$—OCH_2— or $CH_3O(CH_2)_5$— are homologues, alkoxycycloalkyl, for example $CH_3O(cyc)C_5H_8$— and homologues, cycloalkoxyalkyl, for example



and homologues, phenoxyalkyl, for example

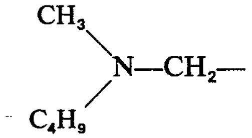


and homologues, which is unsubstituted or substituted by halogen (F, Cl or Br), alkyl or alkoxy (C_1—C_4); alkyl- and dialkyl-aminoalkyl, for example $CH_3NH(CH_2)_9$—, $C_5H_{11}NHCH_2$—,



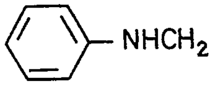
$$\begin{matrix} CH_3 \\ N(CH_2)_4\text{—} \\ CH_3 \end{matrix}$$

or

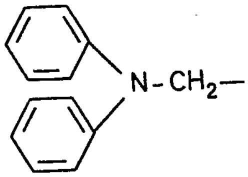


$$\begin{matrix} CH_3 \\ N\text{—}CH_2\text{—} \\ C_4H_9 \end{matrix}$$

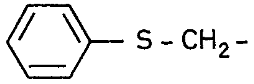
and the corresponding homologues; aryl- and diaryl-aminoalkyl, for example



or

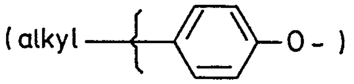


and homologues, which are unsubstituted or substituted in the aryl part by halogen (Cl, Br or I), alkyl or alkoxy (C_1—C_4), and arylmercaptoalkyl, for example



and homologues, which is unsubstituted or substituted as indicated for aryl- and diaryl-aminoalkyl.

Furthermore, Z can be one of the radicals —$COOR_3$, —COR_3, —OR_3, NR_3R_4, —$CONR_3R_4$, —NR_4COR_3, —SO_2R_3, —$SO_2NR_3R_4$ or —$NR_4SO_2R_3$, in which R_3 is substituted or unsubstituted alkyl having 1 to 40 carbon atoms. Examples of alkyl are methyl, ethyl, propyl and butyl and also the radicals having 5 to 40 carbon atoms mentioned for Z as alkyl. The alkyl groups can also be branched. Possible substituents of the alkyl radicals are phenyl, which is unsubstituted or substituted by alkyl having 1 to 5 carbon atoms, or alkylphenoxy



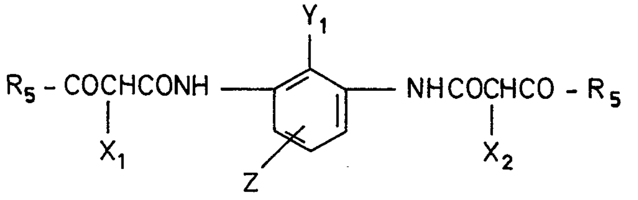
in which the phenyl ring can contain one or more alkyl substituents having, in each case, 1 to 5 carbon atoms. If R_3 is cycloalkyl having 5 to 12 carbon atoms, possible radicals are, for example, cyclopentyl, cyclooctyl or cyclododecyl and especially cyclohexyl, which, in turn, can be substituted by alkyl. The alkyl groups can contain 1 to 4 carbon atoms (methyl, ethyl, propyl, isopropyl, butyl, isobutyl or tert.-butyl) and there can be 1 or more, for example 2, of the alkyl substituents on cyclohexyl. Phenyl and phenyl substituted by alkyl are further meanings of R_3 and alkyl can contain 1 to 5 carbon atoms (methyl, ethyl, propyl, isopropyl, butyl, isobutyl, tert.-butyl, amyl, isoamyl or tert.-amyl) and one or more alkyl substituents, for example 1 or 2, can be present per phenyl.

R_4 is hydrogen or alkyl having 1 to 12 carbon atoms and can be, for example, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl or dodecyl or a corresponding isomer (branched alkyl). The radicals —$COOR_3$, —$CONR_3R_4$, —NR_4COR_3 and —$SO_2NR_3R_4$ are preferred.

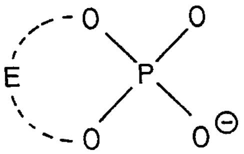
The substituent Z in compounds of the formula (1) can thus have the following meanings: Z is alkyl having 5 to 40 carbon atoms, alkoxy having 5 to 40 carbon atoms, cycloalkoxy having 5 to 12 carbon atoms or aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkylmercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl in which radicals the sum of the carbon atoms in each case is 6 to 40; or —$COOR_3$, —COR_3, —NR_3R_4, —$CONR_3R_4$, —NR_4COR_3, —SO_2R_{33}, —$SO_2NR_{33}R_4$ or $NR_4SO_2R_{33}$, in which R_3 is substituted or unsubstituted alkyl having 1 to 20 carbon atoms substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl, R_{33} is alkyl having 1 to 20 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms; or Z is alkyl having 5 to 40 carbon atoms; aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkylmercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl, in which radical the sum of the carbon atoms in each case is 6 to 40; or $-COOR_3$, $-COR_3$, $-OR_3$, $-NR_3R_4$, $-CONR_3R_4$, $-NR_4COR_3$, $-SO_2R_3$, $-SO_2NR_3R_4$ or $-NR_4SO_2R_3$, in which R_3 is straight-chain or branched alkyl having 5 to 40 carbon atoms or cycloalkyl having 5 to 12 carbon atoms and R_4 is hydrogen or straight-chain or branched alkyl having 1 to 12 carbon atoms.

The preferred yellow coupler is a compound of the formula

(2)



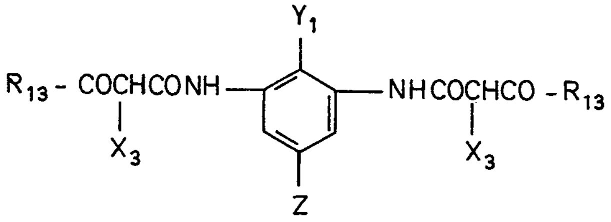
in which R_5 is straight-chain or branched alkyl having 1 to 18 carbon atoms, cycloalkyl, bicyclo- or tricyclo-alkyl having 3 to 12 ring carbon atoms, phenyl or phenyl substituted by halogen, alkyl or alkoxy each having 1 to 4 carbon atoms, $-NH_2$, $-SO_2R_8$ or $-NHCOR_7$, in which R_8 is alkyl having 1 to 5 carbon atoms and R_7 is alkyl having 1 to 5 carbon atoms, X_1 and X_2 are hydrogen, halogen, substituted or unsubstituted alkoxy and phenoxy, nitrogen-containing 5-membered or 6-membered heterocyclic structures which are bonded to the coupling point via a nitrogen atom, $-S-R_8$ in which R_8 is alkyl, substituted phenyl or a heterocyclic structure, $-OPO(OR_9)_2$, in which R_9 is alkyl or phenyl, or a radical of the formula



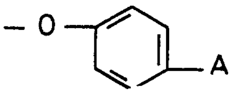
in which E is the complement to a radical containing the six-membered ring consisting of the phosphorus atom, the two oxygen atoms and 3 carbon atoms, Y_1 is fluorine, chlorine, bromine, alkyl, alkoxy and alkylmercapto, each having 1 to 12 carbon atoms, $-CN$, $-COOH$, $-COOR_{12}$, $-NH_2$, NHR_{10}, $-NR_{10}R_{11}$ or $-NHCOR_{12}$, in which R_{10} and R_{11} are alkyl having 1 to 5 carbon atoms or phenyl and R_{12} is alkyl having 1 to 12 carbon atoms, and Z is as defined.

Further preferred yellow coupler are the compounds of the formula

(4)



in which R_{13} is straight-chain or branched alkyl having 3 to 10 carbon atoms, cyclopentyl, cyclohexyl, adamantyl, phenyl or phenyl substituted by fluorine, chlorine or bromine or alkyl or alkoxy each having 1 to 4 carbon atoms, X_3 is hydrogen, chlorine or a radical of the formulae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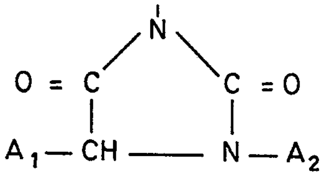
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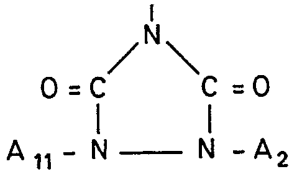
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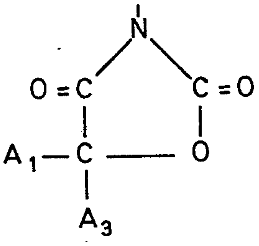
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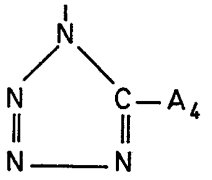
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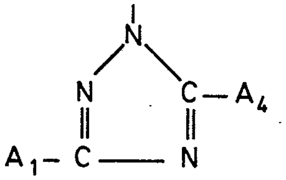
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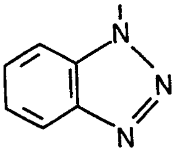
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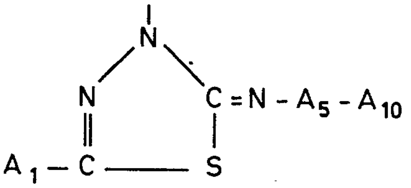
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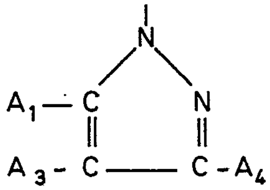
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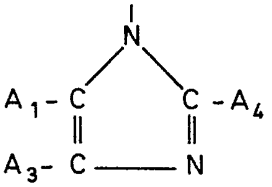
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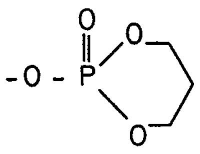
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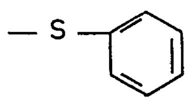
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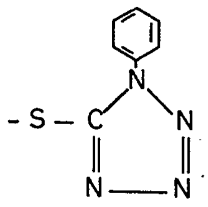
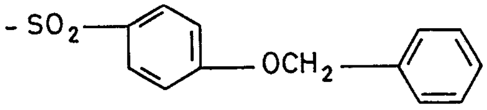
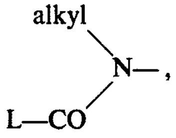


in which A is COOH, NO_2, $COOR_{14}$, in which R_{14} is alkyl having 1 to 4 carbon atoms, or the radical of the formula

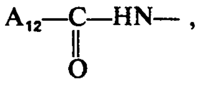


A_1 is hydrogen, alkyl having 1 to 18, and preferably 1 to 4, carbon atoms (methyl, ethyl, propyl, isopropyl, butyl, isobutyl or tert.-butyl), aralkyl, preferably benzyl, aryl, preferably phenyl, cycloalkyl having one to four cycloalkyl rings, alkoxy having 1 to 18 carbon atoms, aryloxy, preferably phenoxy, alkylmercapto having 1 to 18 carbon atoms, arylmercapto, preferably phenylmercapto, halogen, trifluoromethyl, cyano, $—NH_2$, mono- or di-alkylamino, in which the alkyl radicals each contain 1 to 18 carbon atoms,



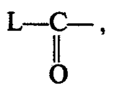
$$\text{(alkyl)(L—CO)N—},$$

in which alkyl contains 1 to 5 carbon atoms,



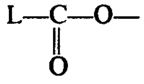
$$A_{12}—\underset{\overset{\|}{O}}{C}—HN— ,$$

$A_3—SO_2—HN—$,



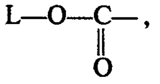
$$L—\underset{\overset{\|}{O}}{C}— ,$$

$L—SO_2—$,



$$L—\underset{\overset{\|}{O}}{C}—O—$$

or

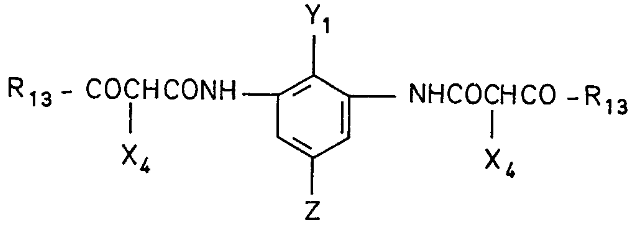


$$L—O—\underset{\overset{\|}{O}}{C}— ,$$

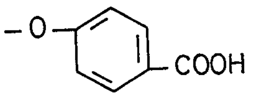
A_2 is straight-chain or branched alkyl having 1 to 18 carbon atoms, aralkyl, preferably benzyl, or phenyl substituted by alkyl, alkoxy, halogen, —NH_2, alkylamino, dialkylamino, acylamino, —COOH, carbalkoxy, carboxamido, sulphonyl, sulphonamido or alkylmercapto, in which alkyl, alkoxy and acyl preferably each contain 1 to 5 carbon atoms, A_3 is non-branched or branched alkyl having 1 to 18 carbon atoms which is unsubstituted or substituted by halogen, nitro, cyano, alkoxy (C_1—C_4) or primary, secondary or tertiary amino groups, aralkyl, preferably benzyl, or cyloalkyl having one to four cycloalkyl rings; aryl, preferably phenyl, which is unsubstituted or substituted by alkyl or alkoxy each having 1 to 4 carbon atoms, halogen, acylamino (C_1—C_4), —SO_3H, —COOH, sulphonamide or carboxamide, N- or N,N-substituted sulphonamide or carboxamide, preferably alkyl-substituted (C_1—C_4), carboxylic acid ester, hydroxyl, nitro, primary, secondary or tertiary amine, mercapto, alkylmercapto (C_1—C_4), —SO_2—L— or —COL—; pyridyl, furyl, thienyl, perfluoroalkyl (C_1—C_{12}), acyl, dialkylamino having, in each case, 1 to 5 carbon atoms in the alkyl part, alkoxy having 1 to 18 carbon atoms or phenoxy, A_4 is hydrogen, substituted or unsubstituted alkyl having 1 to 18 carbon atoms, cycloalkyl, preferably cyclohexyl, cycloalkenyl, preferably cyclohexenyl, alkenyl (C_2—C_5), aryl, preferably phenyl, aralkyl, preferably benzyl, a heterocyclic radical, alkoxy (C_1—C_4), aryloxy, preferably phenoxy, alkylmercapto (C_1—C_4), amino which is unsubstituted or substituted by alkyl (C_1—C_4), aryl, preferably phenyl, or acyl, alkylsulphonyl (C_1—C_4), arylsulphonyl, acyloxy, aminosulphonyl, carboxamide, sulphonamide, alkyl carboxylate (C_1—C_4) in the alkyl radical), nitro, cyano, halogen, substituted or unsubstituted ureido or substituted or unsubstituted aminosulphonylamino, A_5 is —CO— or —SO_2— and A_{10} is hydrogen, if A_5 is —CO—, and has the meaning defined for A_3, A_{11} is alkyl having 1 to 18 carbon atoms which is unsubstituted or substituted by halogen, amino, cyano or alkoxy (C_1—C_4), and also cycloalkyl, especially cyclohexyl, aryl, especially phenyl, or aralkyl, especially benzyl, A_{12} is hydrogen and has the meaning defined for A_3 and L is alkyl having 1 to 18 carbon atoms, which is unsubstituted or substituted by halogen, amino, cyano or alkoxy (C_1—C_4), cycloalkyl, preferably cyclohexyl, aryl, preferably phenyl, pyridyl, pyrimidyl, furyl or thienyl and Y_1 and Z are as defined.

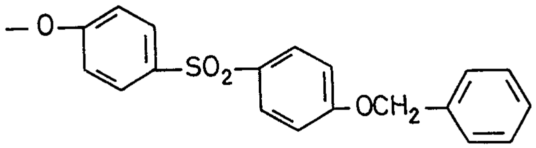
Finally, particularly preferred yellow couplers and of the formula

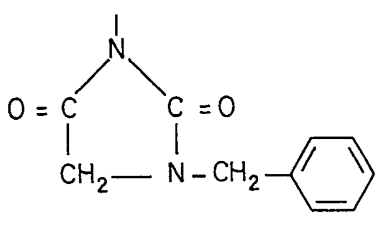
(5)

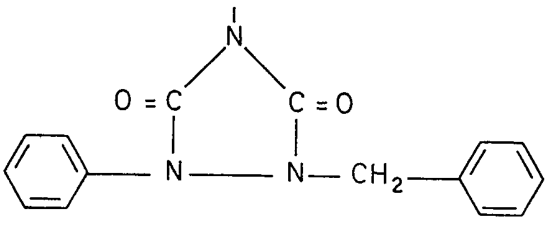


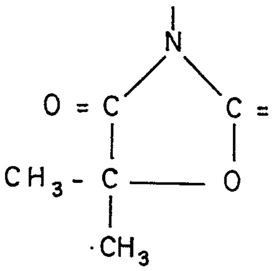
in which X_4 is hydrogen, chlorine or a radical of the formulae







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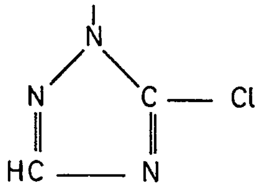
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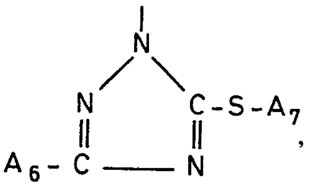
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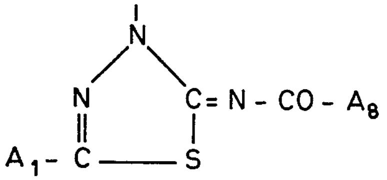
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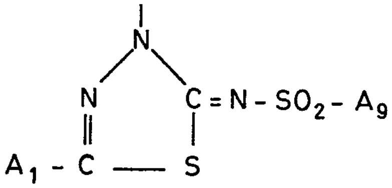
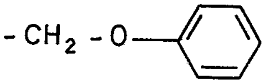


in which A_6 is hydrogen or alkyl having 1 to 4 carbon atoms, A_7 is alkyl having 1 to 12, and preferably 1 to 9, carbon atoms, A_8 is straight-chain or branched alkyl having 1 to 18, and preferably 1 to 4, carbon atoms, $-CH_2Cl$, $-CCl_3$,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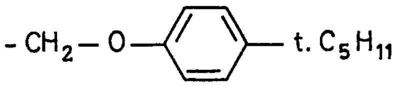
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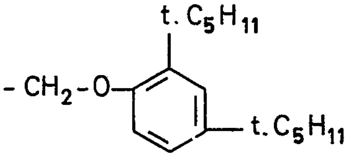
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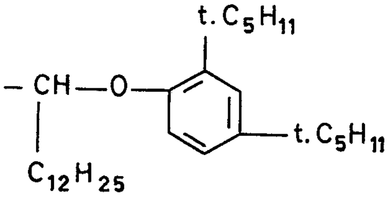
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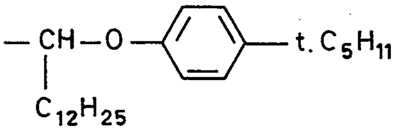
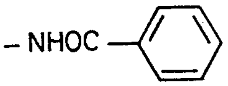
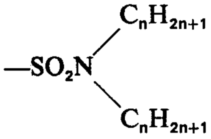
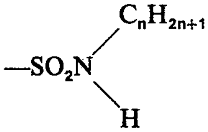
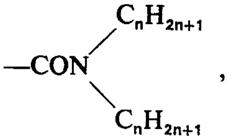
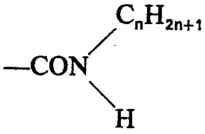
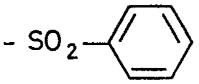

, $-CH_2-O-C_nH_{2n+1}$,

aralkyl, cycloalkyl, phenyl or phenyl substituted by $-C_nH_{2n+1}$, $-OC_nH_{2n+1}$, $-Cl$, $-Br$, $-NHOCC_nH_{2n+1}$,


, $-SO_2NH_2$,

$-SO_2N(C_nH_{2n+1})_2$,

$-SO_2N(C_nH_{2n+1})H$,

$-CONH_2$,

$-CON(C_nH_{2n+1})_2$,

$-CON(C_nH_{2n+1})H$, $-SO_2CH_3$,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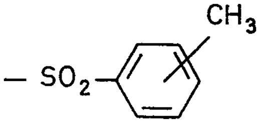
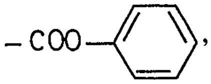
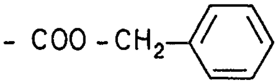
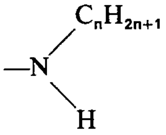
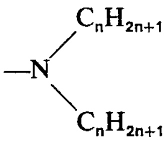

, $-COOH$, $-COOC_nH_{2n+1}$,

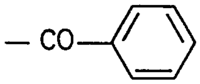
, $—COO—C_nH_{2n+1}$, , $—OH$, $—NH_2$,

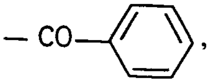
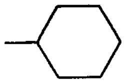
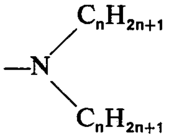


$—N(C_nH_{2n+1})(H)$,

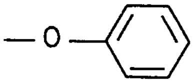


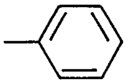
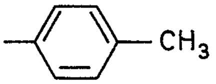
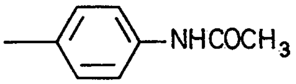
$—N(C_nH_{2n+1})_2$, $—SC_nH_{2n+1}$, $—SO_3H$, COC_nH_{2n+1} or

, pyridyl, furyl, thienyl, $—C_nF_{2n+1}$, $—COC_nH_{2n+1}$,

, , norbornyl, adamantyl, 

$—N(C_nH_{2n+1})_2$,

$—O—C_mH_{2m+1}$ or  and n is a number from 1 to 5, A_9 is $—CH_3$,

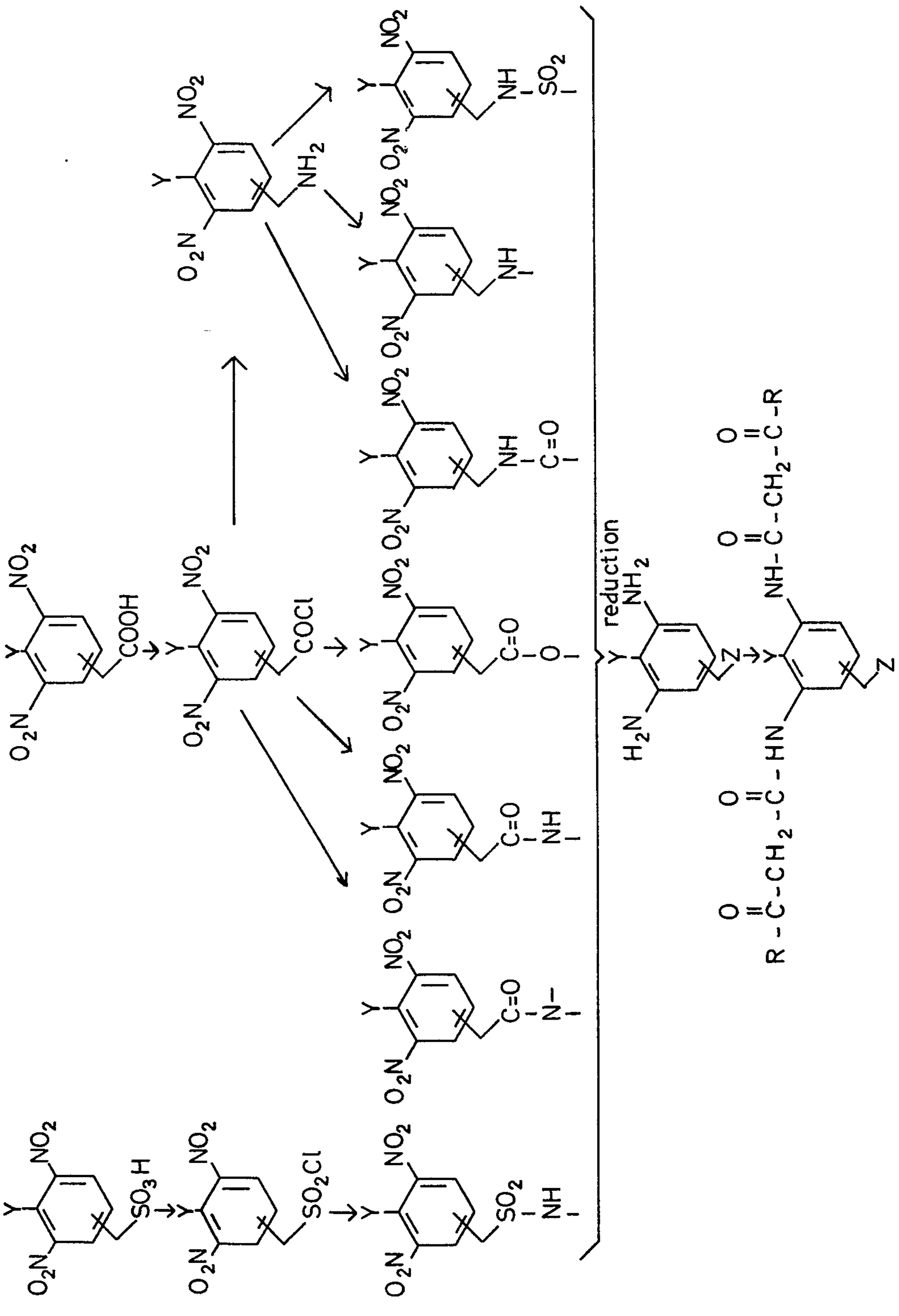
,  or 

and R_{13}, Y_1, Z and A_1 are as defined.

The compounds of the formulae (1) to (5) are also a subject of the present invention.

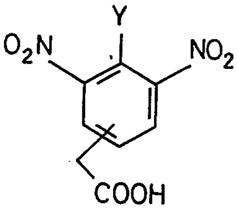
The preparation of the compounds of the formulae (1) to (5) can be carried out in accordance with the following reaction scheme.

Reaction scheme for the preparation of the couplers

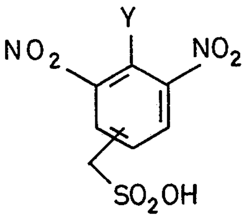


The dinitrobenzoic acids, dinitrosulphonic acids, dinitroamines or dinitrophenols of the formulae

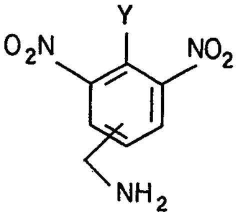
(6)



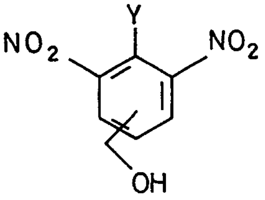
(7)



(8)



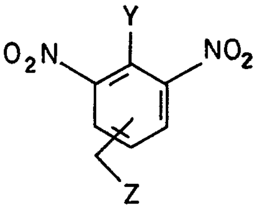
(9)



which are required as starting materials are known from the literature. They can be prepared by various methods, such as those described, for example, in Org. Synth. Coll. Vol. *4* 364; Ann. *366*, 95; Ann. *274*, 349; J. Am. Chem. Soc. *49*, 497, (1927); Ber. *42*, 1729; Ber. *10*, 1696 and Ber. *58*, 1221.

The dinitrobenzoic acids and dinitrosulphonic acids can be converted via the corresponding acid chlorides, in accordance with the reaction scheme, into the corresponding esters, amides or amines, sulphonates or sulphonamides of the formula

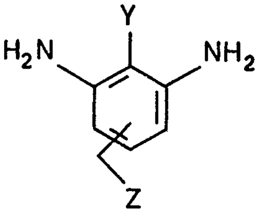
(10)



These, in turn, can be reduced by known methods to the corresponding diamines.

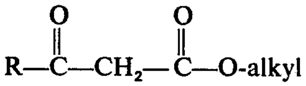
Diamines of the formula

(11)



are reacted with at least two mol equivalents of an ester of the formula

(12)

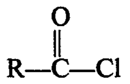


$$R-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-O\text{-alkyl}$$

R, Y, and Z are as defined. Esters of the formula (12) are known from the literature (for example U.S. Patent Specifications, 3,245,506 and 27,848, Org. Reactions, *1*, 266 et seq. — Wiley New York — and J.A.C.S. *70*, 497 (1948)).

They are obtained, for example, by a condensation reaction of an acid chloride of the formula

(13)

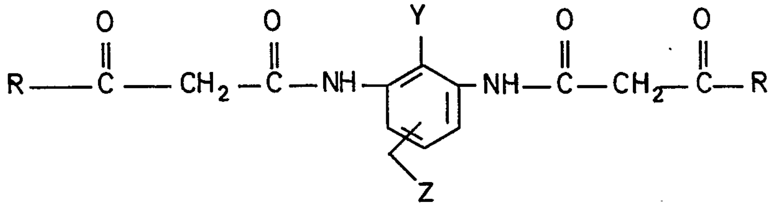


$$R-\overset{\overset{O}{\|}}{C}-Cl$$

with the sodium compound of an alkyl acetoacetate and subsequent scission of the reaction product with a base (c.f., for example, German Offenlegungsschriften 2,503,099 and 2,114,577, Org. Synth. Coll. Vol. II, 266 and J. Am. Chem. Soc. *67*, 2197 (1945)).

The bis-coupler of the formula

(14)

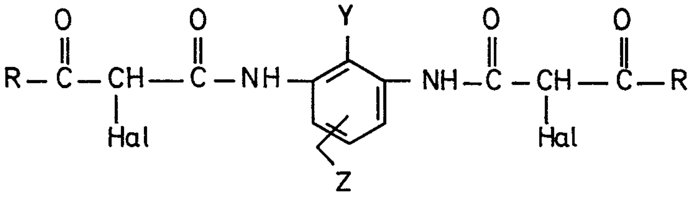


are obtained from the reaction of the keto-esters of the formula (12) with diamines of the type indicated as examples in Table I.

The four-equivalent couplers of the formula (14) obtained by the preparation process described can be modified by replacing one hydrogen of the —CH_2— group by a halogen atom in a manner which is known per se. (c.f. German Offenlegungsschriften 2,263,875, 2,402,220 and 2,329,587 and U.S. Patent Specification 3,265,506).

These two-equivalent couplers of the formula

(15)



in which Hal is Cl or Br and R, Y and Z are as defined.

The two-equivalent couplers of the formula (15) can preferably be further reacted with salts of the formula

$$X^{\ominus}M^{\oplus}$$

X is a radical which is detachable during the coupling reaction and M is, for example, Na, K or Ag.

The yellow couplers of the formulae (1) to (5) can be incorporated, in a known manner, in a silver halide emulsion containing gelatine or another binder. Corresponding application possibilities are described, for example, in U.S. Patent Specifications 2,304,939, 2,304,940, 2,322,027, 2,284,879, 2,801,170, 2,801,171, 2,749,360 and 2,825,382.

If desired, they can also be employed in the developing bath.

The yellow couplers of the formulae (1) to (5) can be used on their own or as a mixture and in some cases even as a mixture with other couplers.

Carrier materials for the light-sensitive recording material, for colour photography, according to the invention having at least one silver halide emulsion layer can be the conventional carriers suitable for this purpose, for example cellulose acetate, polystyrene, polyester(polyethylene terephthalate) or polycarbonate films and also papers, which can be coated, and glass.

The couplers used according to the invention have a high coupling reactivity towards the oxidation product of the aromatic primary amine (developer), so that the developing of the silver halide emulsion proceeds rapidly.

Furthermore, an adequate colour density is achieved, although the molar amount of coupler employed can be markedly reduced compared with that of known couplers. Since, at the same time, the amount of solvent for the coupler can be reduced, it is possible to reduce the total layer thickness of the emulsion layer.

If two-equivalent couplers are used, it is also possible to reduce the amount of silver halide. All of the measures lower the production costs for the photographic material.

The layer sensitive to blue light can be kept thinner and by this means the sharpness and the resolution of the resulting colour image are improved.

The coloured photographic image obtained with the yellow couplers employed according to the invention displays a good resistance to light and moisture and a stability sufficiently great to enable it to be stored for a prolonged period without any impairment.

Preparation instructions for the preparation of the diamines

Preparation Instructions 1

Stage 1

13.25 g of 4-chloro-3,5-dinitro-benzoyl chloride and 10.25 g of dodecan-1-ol are dissolved in 150 ml of benzene and the solution is stirred in the presence of 4.5 g of pyridine for one hour at 20°C. The mixture is then washed with water and subsequently dried. After evaporating off the benzene, the resulting crude product is recrystallised from methanol. This gives 18.5 g of a white product. Melting point 49 to 52°C.

Stage 2

20 g of iron powder, 25 ml of water and 5 ml of hydrochloric acid are refluxed for 90 minutes. The mixture is cooled to about 40°C. A solution of 10 g of dodecyl 4-chloro-3,5-dinitro-benzoate in methanol is then added. The mixture is refluxed for 4 hours and then filtered hot. Water is added to the filtrate until it becomes turbid; the mixture is then cooled with ice and filtered. This gives 7.5 g of a light brown powder. Melting point: 70 to 73°C (diamine 101 in Table I).

Preparation Instructions 2

Stage 1

14.5 g of 4-chloro-3,5-dinitro-benzoyl chloride are dissolved in 200 ml of diethyl ether and the solution is cooled to −10°C. A solution of 10 g of dodecylamine and 5,5 g of triethylamine, dissolved in 200 ml of ether, is added dropwise to this solution in the course of 3 hours. The mixture is stirred for a further one hour, during which time the temperature rises to about 20°C. The mixture is washed with water and then dried and the solvent is then removed. The product is recrystallised from ethyl acetate/hexane. This gives 18 g of a light yellow product. Melting point: 87 to 90°C.

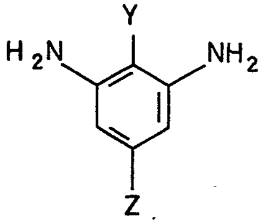
Stage 2

The product obtained from Stage 1 is reduced analogously to Stage 2 in Preparation Instructions 1. This gives 4-chloro-3,5-diamino-benzoic acid dodecylamide. Melting point: 102 to 105°C. (Diamine 108 in Table I).

The other diamines listed in Table I are prepared analogously from the corresponding starting materials.

TABLE I : Diamines of the formula

(100)



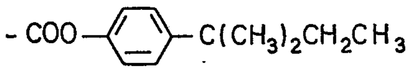
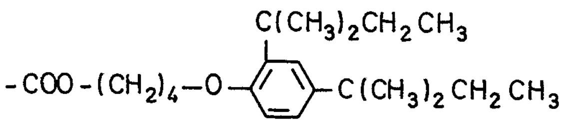
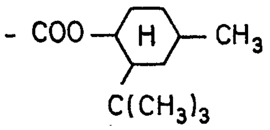
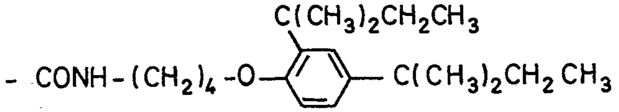
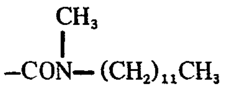
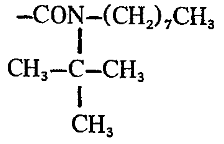
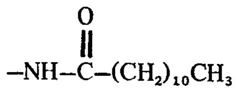
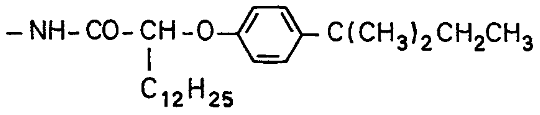
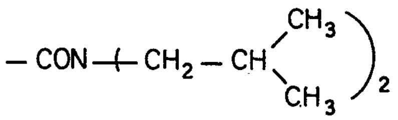
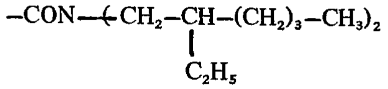
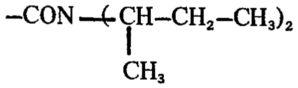
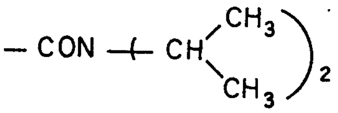
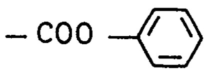
No.	Y	Z	Melting point °C
101	Cl	$-COO(CH_2)_{11}CH_3$	70 – 73
102	Cl	$-COOCH_2C(CH_3)_3$	108 – 110
103	CH_3-	$-COO(CH_2)_{11}CH_3$	67 – 70
104	CH_3O-	$-COO(CH_2)_{11}CH_3$	55 – 57
105	Cl		81 – 84
106	Cl		117 – 118
107	Cl		118 – 122
108	Cl	$-CONH(CH_2)_{11}CH_3$	102—105
109	Cl		120 – 122
111	Cl	$-CON\left[(CH_2)_5CH_3\right]_2$	67 – 68
112	Cl	$-CON\left[(CH_2)_7CH_3\right]_2$	32 – 33
113	Cl	 $-CON(CH_3)-(CH_2)_{11}CH_3$	41 – 42

TABLE I (Continuation)

No.	Y	Z	Melting point °C
114	Cl	 $-\underset{CH_3-\underset{CH_3}{C}-CH_3}{CON}-(CH_2)_7CH_3$	Oel
115	Cl	 $-NH-\overset{O}{\overset{\Vert}{C}}-(CH_2)_{10}CH_3$	110 – 112
116	Cl		42 – 43
117	CH_3	$-SO_2NH-(CH_2)_{11}CH_3$	61 – 64
118	Cl	$-CON-(CH_2-CH_2-CH_2-CH_3)_2$	128 – 130
119	Cl		119 – 122
120	Cl	 $-CON-(CH_2-\underset{C_2H_5}{CH}-(CH_2)_3-CH_3)_2$	67 – 71
121	Cl	 $-CON-(\underset{CH_3}{CH}-CH_2-CH_3)_2$	137 – 139
122	Cl	$-CON-(CH_2-CH_3)_2$	111 – 112
123	Cl		129 – 131
124	Cl		140 – 142

Preparation of the yellow couplers.

Example 1.

A solution of 10 g of dodecyl 4-chloro-3,5-diaminobenzoate (Diamine No. 101) and 10 g of methyl pivaloylacetate are heated in 150 ml of xylene to 140°C for 5 hours. During this period, the alcohol formed is continuously removed by distillation. After the reaction has ended, the xylene is evaporated; the residue is recrystallised from methanol.

A product which melts at 64 to 65°C is obtained. (Coupler No. 201 in Table II).

The D_{max} values for the dyes obtained from the couplers (c.f. Example 10) are also given in the tables which follow.

Example 2.

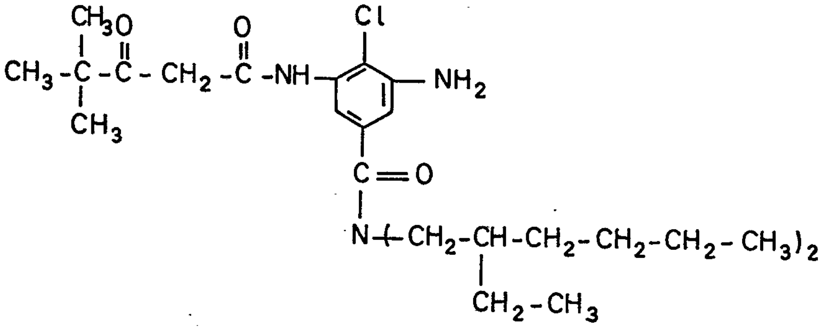
A solution of 8 g of isobutyl 4-chloro-3,5-diaminobenzoate (Diamine No. 102) and 28 g of ethyl o-ethoxybenzoylacetate in 300 ml of xylene are heated to 140°C for 3 hours, the ethanol formed being distilled off. After the reaction has ended, the xylene is evaporated and the residue is treated in methanol with active charcoal and the mixture is then filtered. After crystallisation from methanol/chloroform, 13.5 g of a product which melts at 142 to 145°C are obtained (Coupler No. 208 in Table II).

Example 3.

A solution of 67 g of 4-chloro-3,5-diamino-N,N-di-(2-ethylhexylamine)-benzoic acid amide (Diamine No. 120) and 77 g of methyl pivaloylacetate are refluxed in 1,000 ml of xylene for 5 hours. During this period the alcohol is removed continuously by distillation. The xylene is evaporated. The crude product is recrystallised from methanol. This gives a product which melts at 40 to 45°C. (Coupler No. 221 in Table II).

A further product which has a melting point of 84 to 87°C and is of the formula

(200)

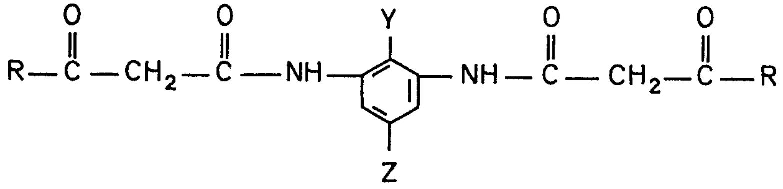


was obtained from the mother liquor.

The other couplers listed in Table II can also be prepared in an analogous manner.

TABLE II

Yellow couplers of the formula



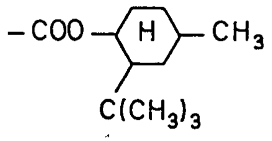
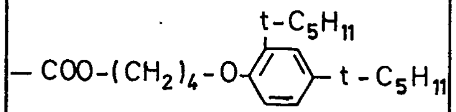
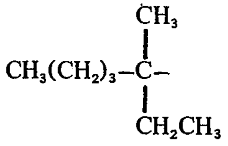
No.	R	Z	Y	Melting point °C	D_{max}
201	t-Butyl	$-COO-(CH_2)_{11}-CH_3$	Cl	64 – 65	1.33
202	t-Butyl	$-COO-(CH_2)_{11}-CH_3$	CH_3-	82 – 85	0.88
203	t-Butyl	$-COO-(CH_2)_{11}-CH_3$	CH_3O-	54 – 56	0.74
204	t-Butyl	$-COO-CH_2-C(CH_3)_3$	Cl	139 – 141	1.17
205	t-Butyl		Cl	94 – 96	0.99
206	t-Butyl		Cl	51 – 53	1.26
207	 $CH_3(CH_2)_3-\underset{CH_2CH_3}{\overset{CH_3}{C}}-$	$-COO-CH_2-C(CH_3)_3$	Cl	72 – 74	0.91

TABLE II (Continuation)

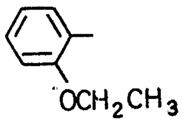
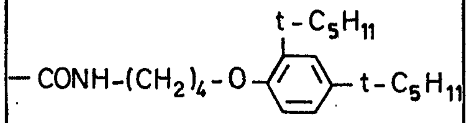
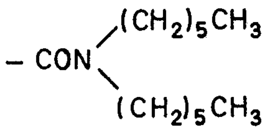
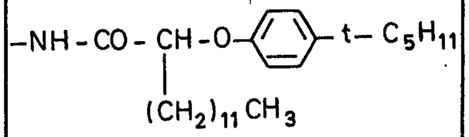
No.	R	Z	Y	Melting point °C	D_{max}
208		$-COO-CH_2-C(CH_3)_3$	Cl	142 – 145	0.99
209	t-Butyl	$-CONH-(CH_2)_{11}CH_3$	Cl	140 – 143	1.32
211	t-Butyl		Cl	173 – 175	1.17
212	t-Butyl	 $-CON\begin{array}{l}(CH_2)_5CH_3\\(CH_2)_5CH_3\end{array}$	Cl	124 – 126	1.54
213	t-Butyl		Cl	75 – 77	1.27
214	t-Butyl	$-SO_2-NH-(CH_2)_{11}CH_3$	CH_3-	101 – 103	1.15

TABLE II (Continuation)

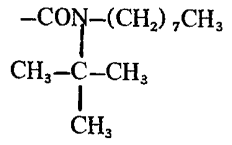
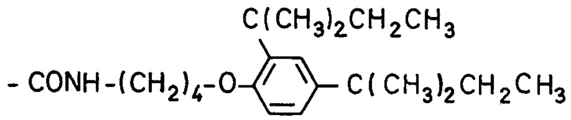
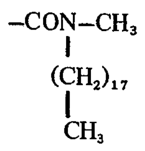
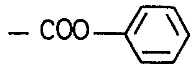
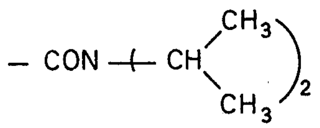
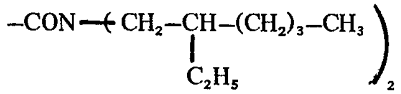
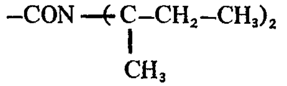
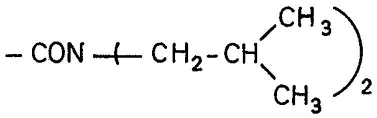
No.	R	Z	Y	Melting point °C	D_{max}
215	t-Butyl	 $-CON(C(CH_3)_3)-(CH_2)_7CH_3$	Cl	140 – 142	1.31
216	Adamantyl		Cl	175 – 178	0.61
217	t-Butyl	 $-CON(CH_3)-(CH_2)_{17}-CH_3$	Cl	Oil	1.12
218	t-Butyl		Cl	214 – 216	0.70
219	t-Butyl		Cl	204 – 206	1.27
220	t-Butyl	$-CON-(CH_2-CH_3)_2$	Cl	175 – 176	0.98

TABLE II (Continuation)

No.	R	Z	Y	Melting point °C	D_{max}
221	t-Butyl	 $-CON(CH_2-CH(C_2H_5)-(CH_2)_3-CH_3)_2$	Cl	40 – 45	1.20
222	t-Butyl	 $-CON(C(CH_3)-CH_2-CH_3)_2$	Cl	69 – 71	1.09
223	t-Butyl	$-CON(CH_2-CH_2-CH_2-CH_3)_2$	Cl	amorphous	1.11
224	t-Butyl	 $-CON(CH_2-CH(CH_3)(CH_3))_2$	Cl	110 – 113	1.08

Example 4.

Dodecyl 3,5-bis-[α-chloro-α-pivaloyl-acetamido]-4-chloro-1-benzoate

0.38 g of sulphuryl chloride was added dropwise at −10°C to a solution of 0.85 g of dodecyl 3,5-bis-[α-pivaloyl-acetamido]-4-chloro-1-benzoate (Coupler No. 201) in 30 ml of benzene/hexane. The mixture is stirred for a further half hour at −10°C. The reaction mixture is then warmed to room temperature and stirred for a further one hour. The solvent is distilled off and the residue is recrystallised from methanol. 820 mg of Coupler No. 301 are obtained. Melting point: 110 to 115°C.

Example 5.

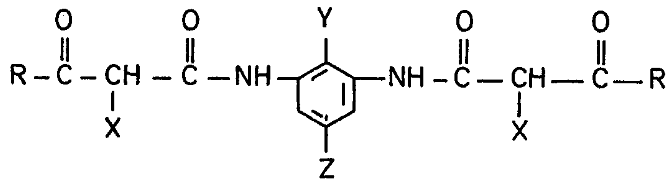
Dodecyl 3,5-bis-[α-bromo-α-pivaloyl-acetamido]-4-chloro-1-benzoate

118 g of bromine were added slowly dropwise at −5°C to a solution of 225 g of Coupler No. 201 in 600 ml of carbon tetrachloride. The icebath is then removed and, after warming to room temperature, the reaction mixture is stirred for a further one hour. The solution is washed, first with dilute sodium hydroxide solution and then with water, and dried. After removing the solvent, Coupler No. 302 is obtained in the form of a yellowish powder having a melting point of 102 to 107°C.

The other yellow couplers in Table III can be prepared in the same way.

TABLE III

Yellow couplers of the formula



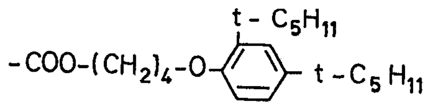
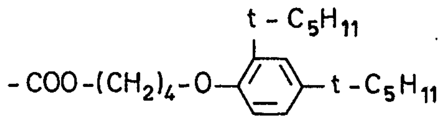
No.	R	Z	Y	X	Melting point °C	D_{max}
301	t-Butyl	$-COO-(CH_2)_{11}CH_3$	Cl	Cl	110 – 115	1.08
302	t-Butyl	$-COO-(CH_2)_{11}CH_3$	Cl	Br	100 – 102	1.05
303	t-Butyl	$-COO-(CH_2)_{11}CH_3$	CH_3O-	Cl	101 – 102	0.86
304	t-Butyl	$-COO-(CH_2)_{11}CH_3$	CH_3-	Cl	143 – 145	0.53
305	t-Butyl	$-COO-(CH_2)_{11}CH_3$	CH_3-	Br	124 – 126	0.75
306	t-Butyl		Cl	Cl	44 – 45	1.11
307	t-Butyl		Cl	Br	51 – 53	0.91
308	t-Butyl	$-COO-CH_2-C(CH_3)_3$	Cl	Cl	53 – 54	0.95
309	t-Butyl	$-COO-CH_2-C(CH_3)_3$	Cl	Br	55 – 59	0.96

TABLE III (Continuation)

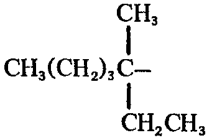
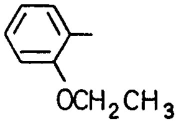
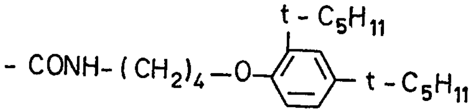
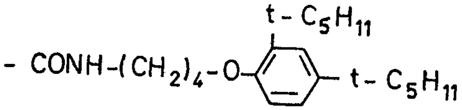
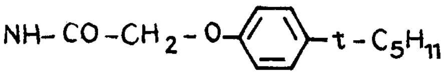
No.	R	Z	Y	X	Melting point °C	D_{max}
310	 $CH_3(CH_2)_3\overset{CH_3}{\underset{CH_2CH_3}{C}}-$	$-COO-CH_2-C(CH_3)_3$	Cl	Cl	30 – 32	0.85
311		$-COO-CH_2-C(CH_3)_3$	Cl	Cl	42 – 45	1.21
312	t-Butyl	$-CONH(CH_2)_{11}CH_3$	Cl	Cl	112 – 113	1.04
313	t-Butyl		Cl	Cl	136 – 138	1.37
314	t-Butyl		Cl	Br	138 – 140	1.21
316	t-Butyl		Cl	Cl	103 – 104	1.12

TABLE III (Continuation)

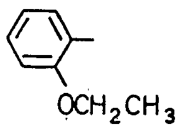
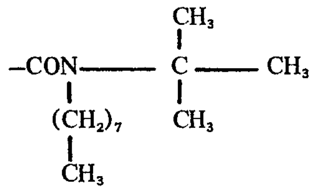
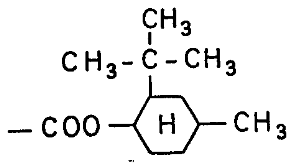
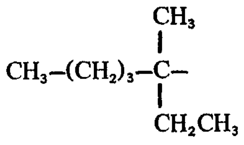
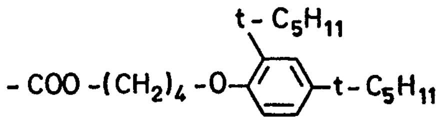
No.	R	Z	Y	X	Melting point °C	D_{max}
317	t-Butyl	$-SO_2-NH-(CH_2)_{11}CH_3$	CH_3-	Cl	77 – 80	0.89
318		$-COO-CH_2-C(CH_3)_3$	Cl	Br	55 – 58	0.93
319	t-Butyl	 $-\underset{\substack{\vert \\ (CH_2)_7 \\ \vert \\ CH_3}}{CON}-\overset{CH_3}{\underset{CH_3}{C}}-CH_3$	Cl	Cl	50 – 52	1.01
320	t-Butyl	,,	Cl	Br	193 – 195	0.98
321	t-Butyl	$-CON[(CH_2)_5-CH_3]_2$	Cl	Cl	Oil	1.15
322	t-Butyl		Cl	Cl	68 – 70	0.92
323	 $CH_3-(CH_2)_3-\overset{CH_3}{\underset{CH_2CH_3}{C}}-$		Cl	Cl	Oil	0.50

TABLE III (Continuation)

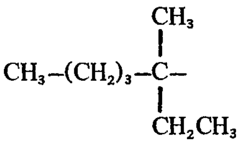
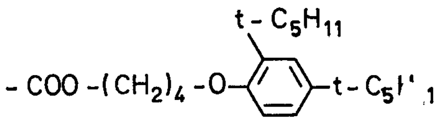
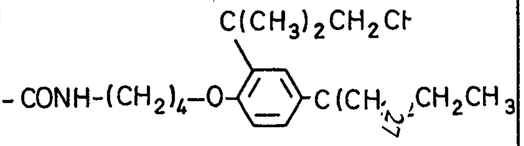
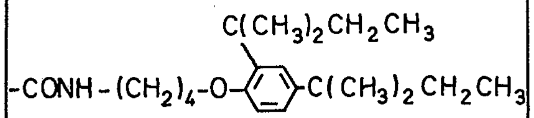
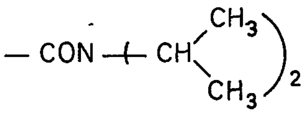
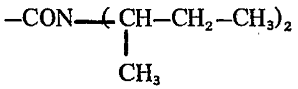
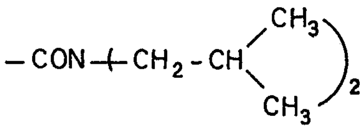
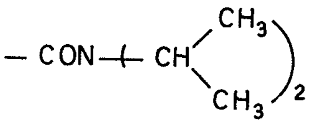
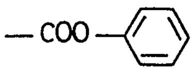
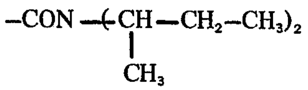
No.	R	Z	Y	X	Melting point °C	D_{max}
324	 $CH_3-(CH_2)_3-C(CH_3)(CH_2CH_3)-$		Cl	Br	48 – 50	0.42
325	Adamantyl		Cl	Cl	122 – 125	0.73
326	Adamantyl		Cl	Br	136 – 138	0.81
327	t-Butyl		Cl	Cl	240 – 242	1.09
328	t-Butyl	 $-CON(CH(CH_3)-CH_2-CH_3)_2$	Cl	Cl	52 – 55	0.68
329	t-Butyl	$-CON(CH_2-CH_2-CH_2-CH_3)_2$	Cl	Br	50 – 55	1.15

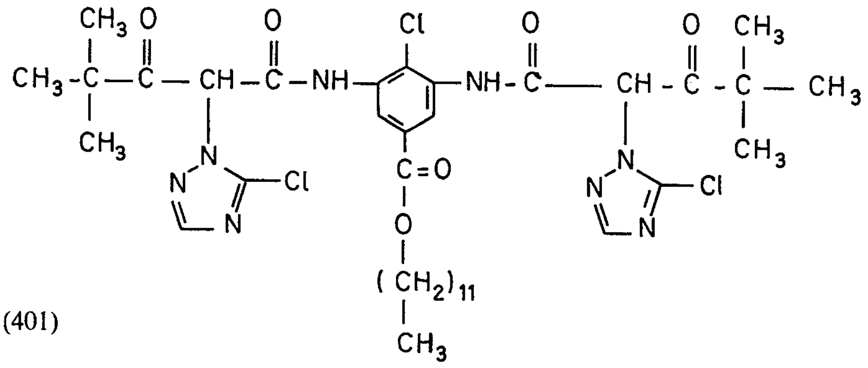
TABLE III (Continuation)

No.	R	Z	Y	X	Melting point °C	D_{max}
330	t-Butyl		Cl	Br	50 – 52	1.02
331	t-Butyl		Cl	Br	224 – 228	1.04
332	t-Butyl		Cl	Br	52 – 55	0.71
333	t-Butyl	 $-CON-(CH(CH_3)-CH_2-CH_3)_2$	Cl	Br	188 – 190	1.05
334	t-Butyl	$-CONH-(CH_2)_{11}-CH_3$	Cl	Br	160 – 163	1.01

Example 6.

Dodecyl 3,5-bis-[α-(5-chloro-1,2,4-triazolyl)-α-pivaloyl-acetamido]-4-chloro-1-benzoate

A mixture of 0.780 mg of the potassium salt of 5-chloro-1,2,4-triazole and 1.4 g of dodecyl 3,5-bis-(α-bromo-α-pivaloyl-acetamido)-4-chloro-1-benzoate is stirred in 50 ml of absolute acetonitrile for 6 hours at room temperature. The yellow suspension is poured into 500 ml of acidified water (pH value: 2.5); the resulting white precipitate is then filtered off. After recrystallisation from ethyl acetate/hexane, 1.1 g of the compound of the formula

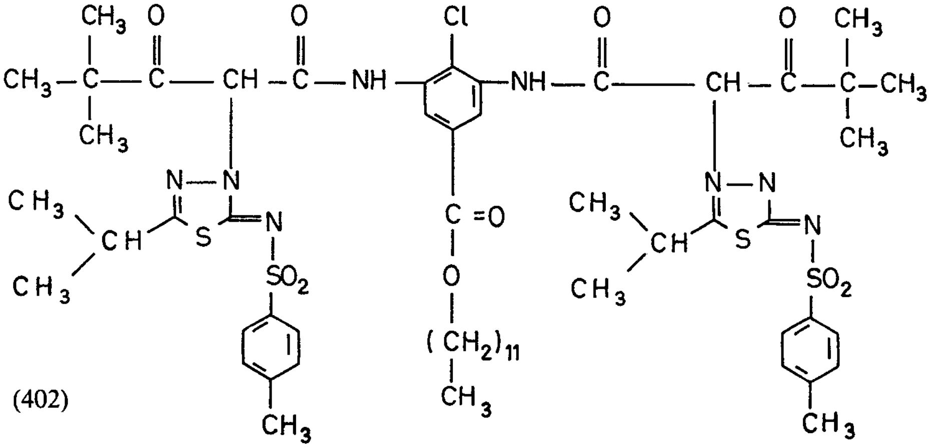


(401)

are obtained. Melting point: 148 to 150°C.

Example 7.

The potassium salt of 2-p-toluenesulphonylamino-5-isopropyl-1,3,4-thiadiazole is reacted, in accordance with Example 5, with the benzoate mentioned in Example 6. This gives the coupler of the formula

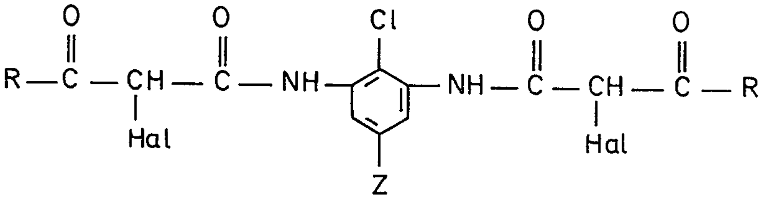


(402)

Melting point: 146 to 148°C.

The other compounds mentioned in Table IV can also be prepared in an analogous manner.

(Reaction of halogen-substituted couplers of the formula

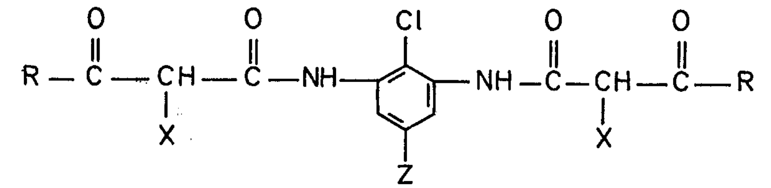


(400a)

in corresponding solvent with salts of the formula (400b) $X^{\ominus}M^{\oplus}$).

TABLE IV

Yellow couplers of the formula

(400) 

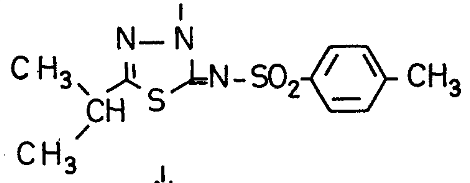
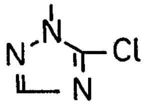
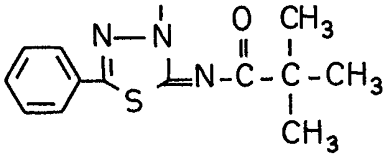
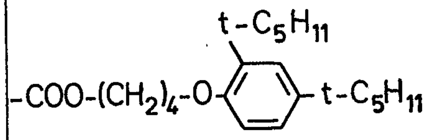
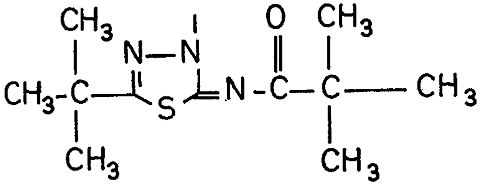
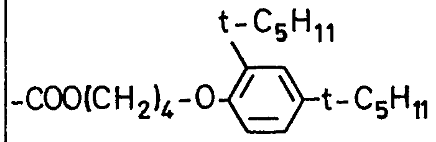
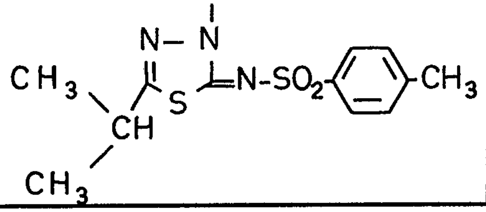
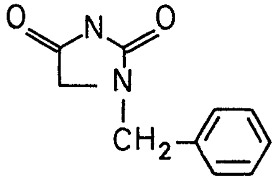
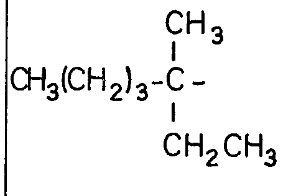
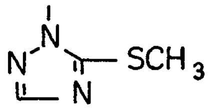
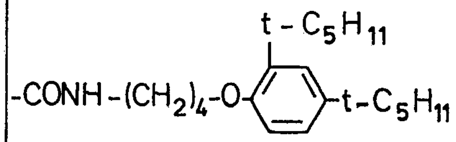
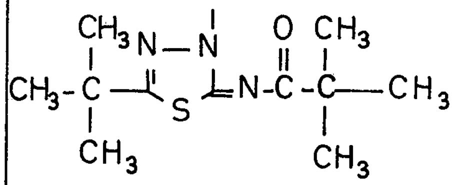
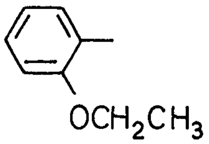
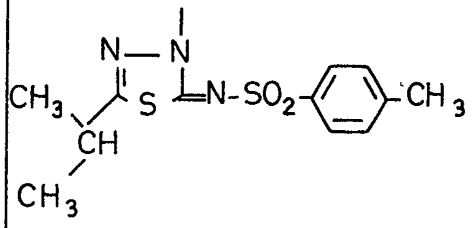
NO.	R	Z	X	melting point °C	D max
403	t-Butyl	$-COO-(CH_2)_{11}CH_3$		146-148	1.46
404	t-Butyl	$-COO-(CH_2)_{11}CH_3$		148-150	1.35
405	t-Butyl	$-COO-(CH_2)_{11}CH_3$		113-115	1.43
406	t-Butyl			163-164	1.45
407	t-Butyl			173-176	1.42

TABLE IV (CONTD)

NO.	R	Z	X'	melting point °C	D_{max}
408	t-Butyl	$-COO-CH_2-C(CH_3)_3$		193-195	0.91
409	 $CH_3(CH_2)_3-C(CH_3)(CH_2CH_3)-$	$-COO-CH_2-C(CH_3)_3$		62 - 65	1.18
410	t-Butyl			110 -112	1.42
411		$-COO-CH_2-C(CH_3)_3$		115-118	1.11

TABL IV (CONTD)

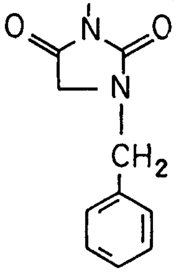
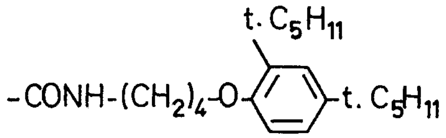
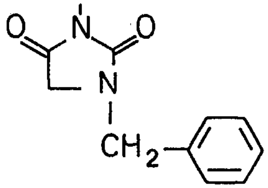
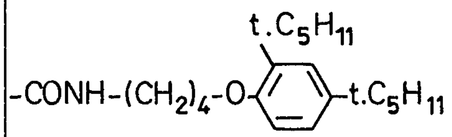
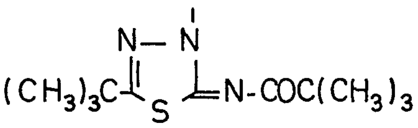
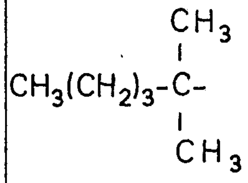
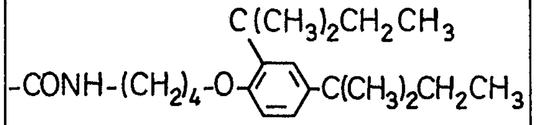
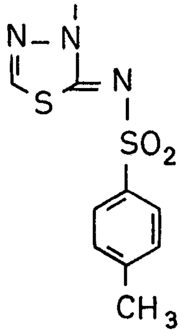
NO.	R	Z	X	melting point °C	D_{max}
412	t-Butyl	$-COO-(CH_2)_{11}CH_3$		141-143	1.21
413	t-Butyl			114-115	1.26
414	Adamantyl			185-188	0.96
415	 $CH_3(CH_2)_3-\overset{CH_3}{\underset{CH_3}{C}}-$			127-129	1.32

TABLE IV (CONTD)

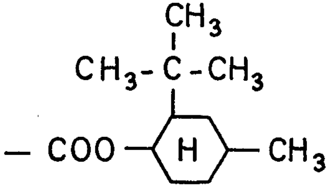
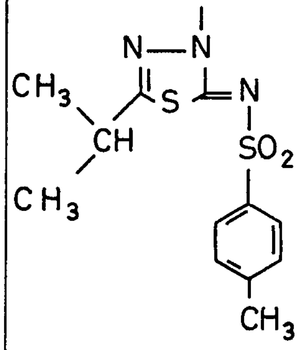
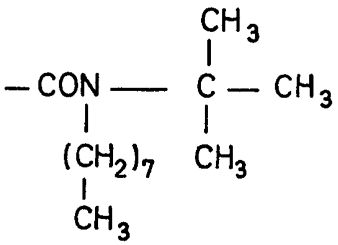
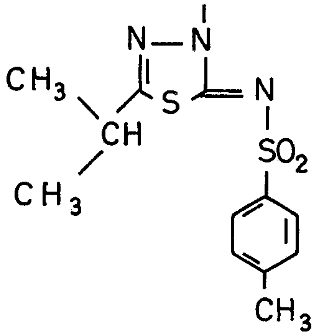
NO.	R	Z	X	melting point °C	D max
416	t - Butyl			122-125	1.57
417	t - Butyl	 $-\mathrm{CON}((\mathrm{CH_2})_7\mathrm{CH_3})-\mathrm{C}(\mathrm{CH_3})_3$		78 - 80	1.52

TABLE IV (CONTD)

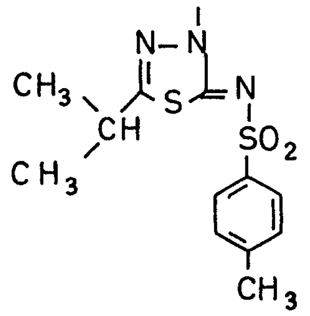
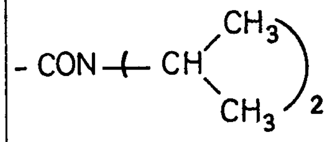
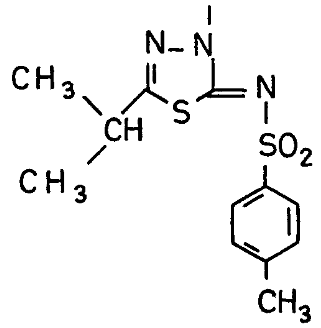
NO.	R	Z	X	melting point °C	D_{max}
418	t-Butyl	$-CON\!\left(CH_2-CH_3\right)_2$		157-160	1.40
419	t-Butyl	 $-CON\!\left(CH(CH_3)_2\right)_2$		148-150	1.39

TABLE IV (CONTD)

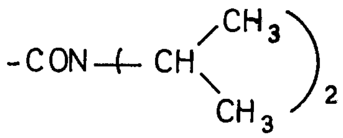
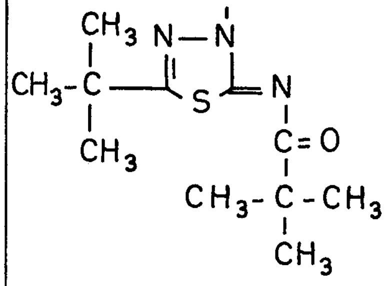
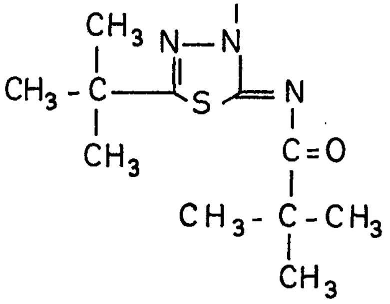
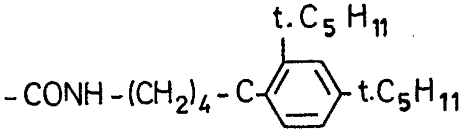
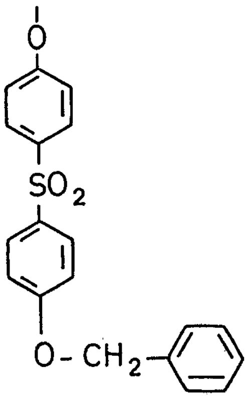
NO.	R	Z	X	melting point °C	D max
420	t-Butyl	 $-CON{\left(CH{\overset{CH_3}{\underset{CH_3}{}}}\right)}_2$		154-157	1·25
421	t-Butyl	$-CON(CH_2-CH_3)_2$		128-131	1·11
422	t-Butyl			114-116	1·33

TABLE IV (CONTD)

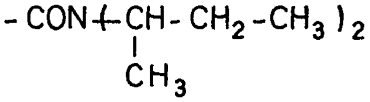
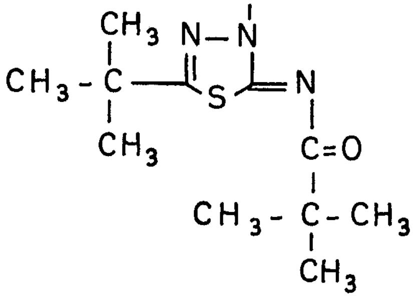
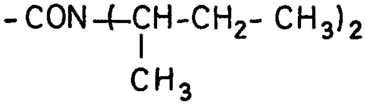
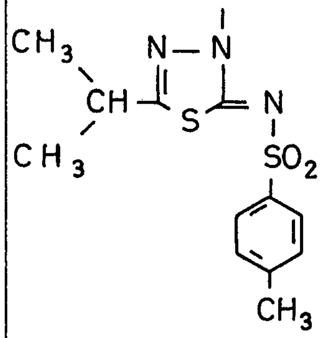
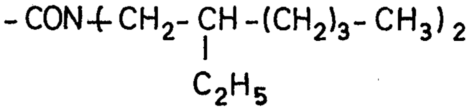
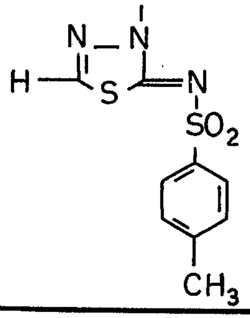
NO.	R	Z	X	melting point °C	D max
423	t-Butyl	 $-CON(\underset{\displaystyle CH_3}{CH}-CH_2-CH_3)_2$		175-180	1.42
424	t-Butyl	 $-CON(\underset{\displaystyle CH_3}{CH}-CH_2-CH_3)_2$		218-221	1.46
425	t-Butyl	 $-CON(CH_2-\underset{\displaystyle C_2H_5}{CH}-(CH_2)_3-CH_3)_2$		108-110	1.14

TABLE IV (CONTD)

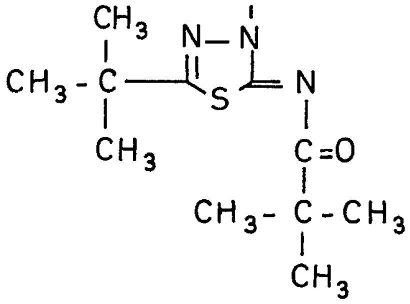
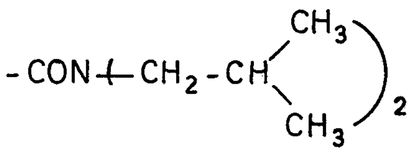
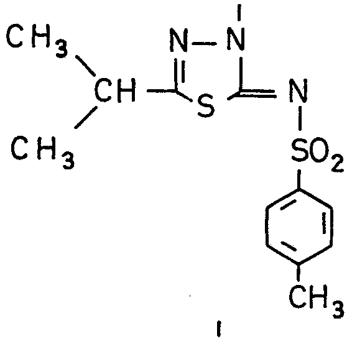
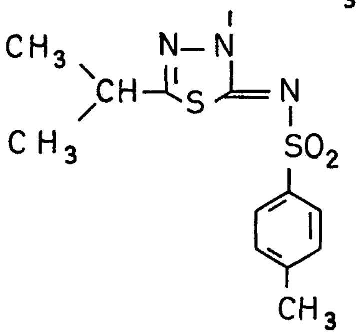
NO.	R	Z	X	melting point °C	D_{max}
426	t- Butyl	$-CONH-(CH_2)_{11}-CH_3$		93 - 95	1.28
427	t - Butyl	 $-CON\left(CH_2-CH(CH_3)_2\right)_2$		140-142	1.35
428	t - Butyl	$-CON\left(CH_2-CH_2-CH_2-CH_3\right)_2$		193-195	1.32

TABLE IV (CONTD)

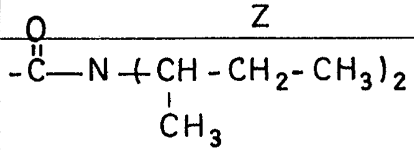
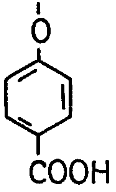
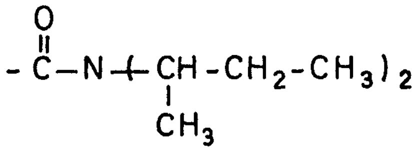
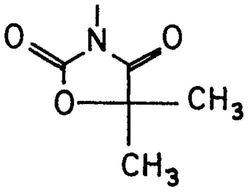
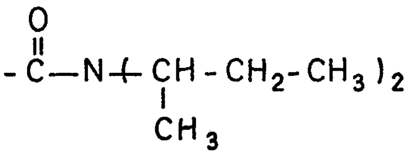
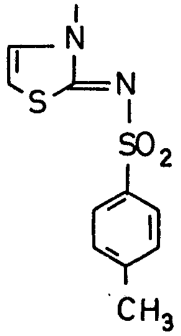
NO.	R	Z	X	melting point °C	D_{max}
429	t-Butyl	 $-\overset{O}{\overset{\|}{C}}-N\left(\underset{CH_3}{\underset{\|}{CH}}-CH_2-CH_3\right)_2$		108-110	0.44
430	t-Butyl	 $-\overset{O}{\overset{\|}{C}}-N\left(\underset{CH_3}{\underset{\|}{CH}}-CH_2-CH_3\right)_2$		149-151	0.45
431	t-Butyl	 $-\overset{O}{\overset{\|}{C}}-N\left(\underset{CH_3}{\underset{\|}{CH}}-CH_2-CH_3\right)_2$		165-168	1.11

TABLE IV (CONTD)

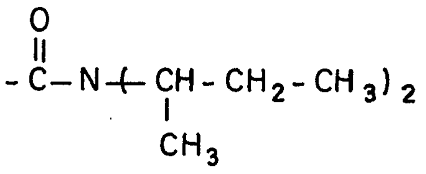
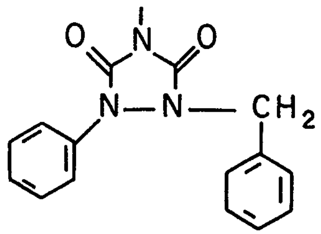
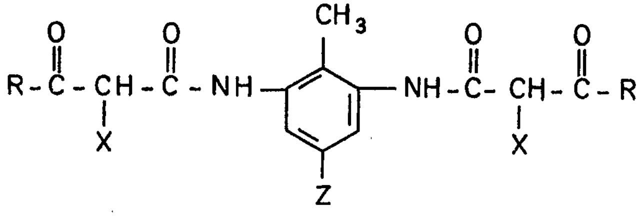
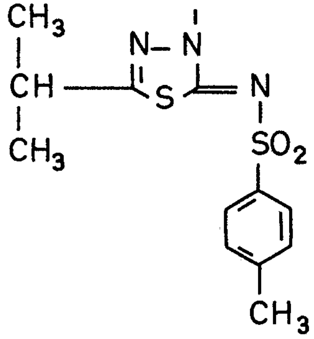
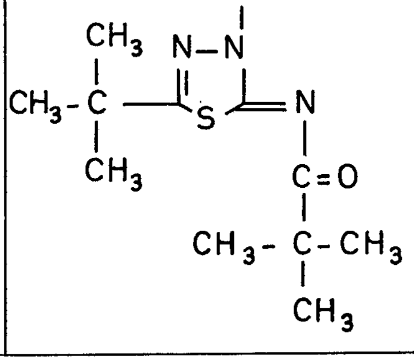
NO.	R	Z	X	melting point °C	D_{max}
432	t-Butyl	 $-\overset{\overset{O}{\|\|}}{C}-N\left(\underset{CH_3}{CH}-CH_2-CH_3\right)_2$		218-220	1.05

TABLE V

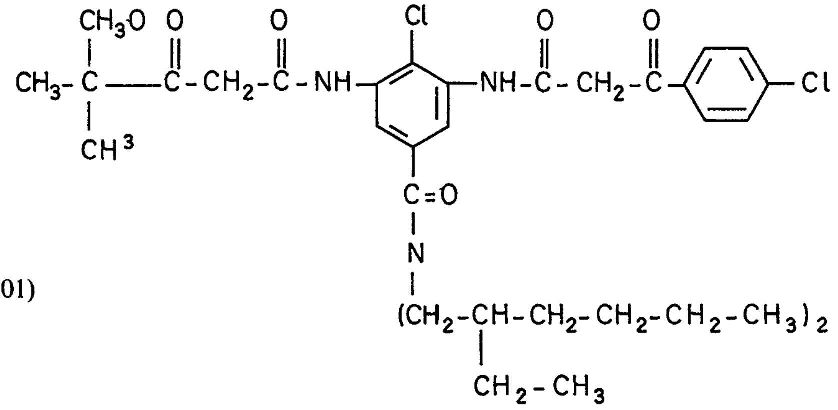
Yellow couplers of the formula



NO.	R	Z	X	melting point °C	D_{max}
500	t - Butyl	$-SO_2-NH-(CH_2)_{11}-CH_3$		188 -190	1.15
501	t - Butyl	$-SO_2-NH-(CH_2)_{11}-CH_3$		104 -107	1.22

Example 8.

A solution of 8 g of α-pivaloyl-2-chloro-3-amino-5-[(N,N-di-2-ethylhexylamine)-carbamido]-acetanilide (obtained as in Example 3) and 4.2 g of ethyl p-chlorobenzoylacetate in 300 ml of xylene were reacted in a manner analogous to that in Example 1. The resulting product was crystallised from methanol/water. This gives a product which melts at 62 to 64°C and is of the following formula:

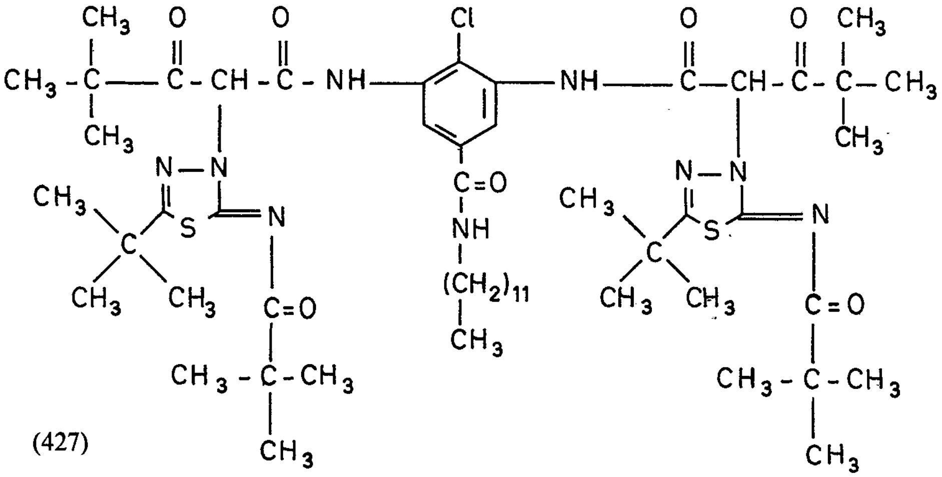


(701)

Example 9.

The potassium salt of 2-pivaloylamino-5-tert.-butyl-1,3,4-thiadiazole is reacted, in accordance with Example 6, with the coupler of the formula (334).

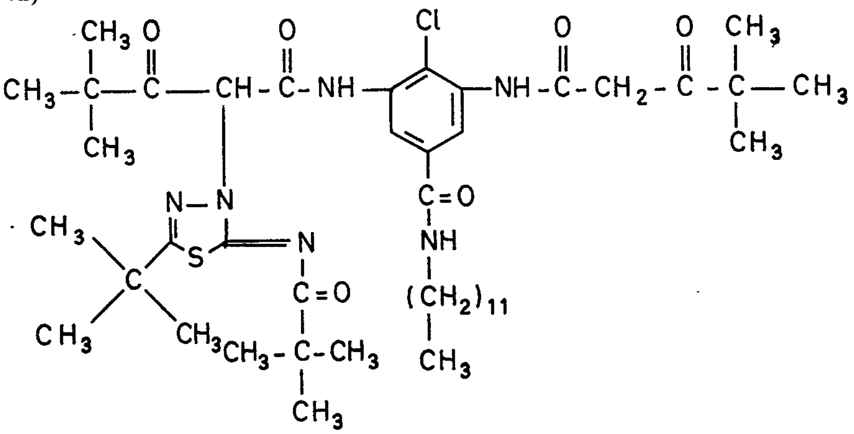
After separation of the resulting crude product by chromatography, two products in the pure form are obtained, which are of the formulae given below.



(427)

Melting point: 93—95°C and

(702)



Melting point: 104 to 106°C, D_{max} 1.08.

Use Examples

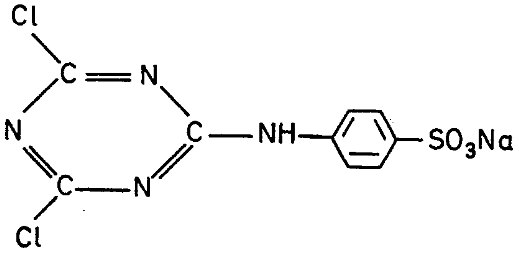
Example 10.

Coupler Emulsion

0.05 mmol of the yellow coupler of the formula (402) are dissolved in 2.0 ml of tricresyl phosphate/methylene chloride (1:9). The methylene chloride is evaporated off, 6.6 ml of a 6% strength gelatine solution, 1.2 ml of water and 2.0 ml of an 8% strength aqueous solution of sodium isopropylnaphthalenesulphonate are added, the pH of the mixture is adjusted to a value of 6.5 and the mixture is emulsified for 5 minutes with the aid of an ultrasonic device with an output of 100 watts.

Coating

2.5 ml of the coupler emulsion, freshly exposed to ultrasonic waves, 1.6 ml of silver bromide emulsion which has a pH of 6.5 and contains 1.4% of silver and 6.0% of gelatine, 1.0 ml of a 1% strength aqueous solution of the hardener of the formula



and 5.0 ml of water are mixed together and coated, at 40°C, onto a subbed 13 cm x 18 cm glass plate.

After the mixture has solidified at 10°C, the plate is dried in a circulating air drying cabinet at room temperature.

Photographic exposure and processing

A strip cut to 4.0 cm x 6.5 cm is exposed, at 500 Lux/cm², under a step wedge for 2 seconds and then treated at 24°C in the following way:

	Minutes
1. Colour development	5
2. Washing	5
3. First fixing	2
4. Washing	2
5. Silver bleaching	2
6. Washing	2
7. Second fixing	4
8. Washing	10
9. Drying	10

The processing solutions are of the following composition:

I. Colour development solution (pH = 10.7)

4-amino-3-methyl-N-ethyl-N-β-(methyl-sulphonamido)-ethyl-aniline; $1\frac{1}{2}$ $H_2SO_4 \times H_2O$		10 mmols
anhydrous sodium sulphite		2.0 g
potassium bromide		0.5 g
potassium carbonate		40.0 g
benzyl alcohol		10.0 g
water	to make up to	1,000 ml

II. Fixing solution (pH = 4.5)

sodium thiosulphate .6 H_2O		80.0 g
anhydrous sodium sulphite		5.0 g
sodium borate (Borax)		6.0 g
potassium alum		7.0 g
acetic acid		4.0 g
water	to make up to	1,000 ml

III. Silver bleaching bath (pH = 7.2)

potassium ferrycyanide (III)		100.0 g
boric acid		10.0 g
sodium borate (Borax)		5.0 g
water	to make up to	1,000 ml

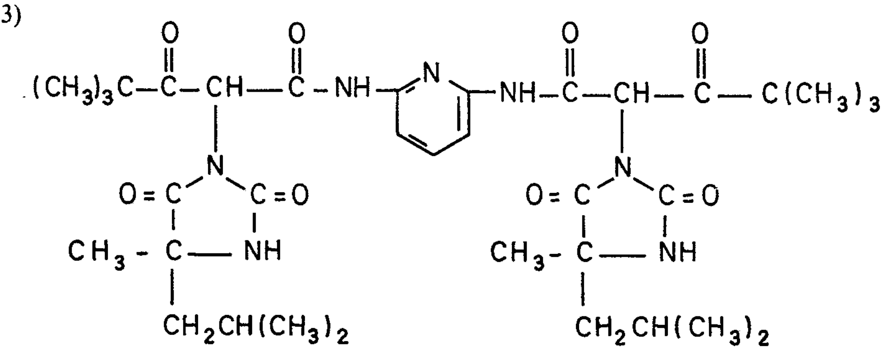
A clear, sharp yellow wedge which has an absorption maximum at 443 nm and a colour density of 1.46 is obtained.

Photographic materials can also be produced, and processed, in the same way with the other yellow couplers described in Examples 1 to 9, including the Tables.

For comparison, the following yellow couplers are also employed in a photographic material, which is processed as described above:

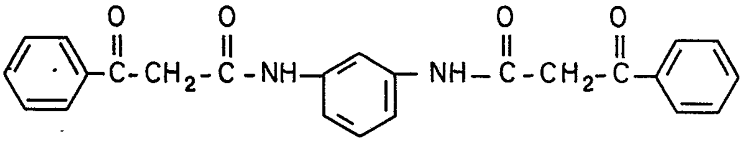
The yellow coupler of the formula

(703)



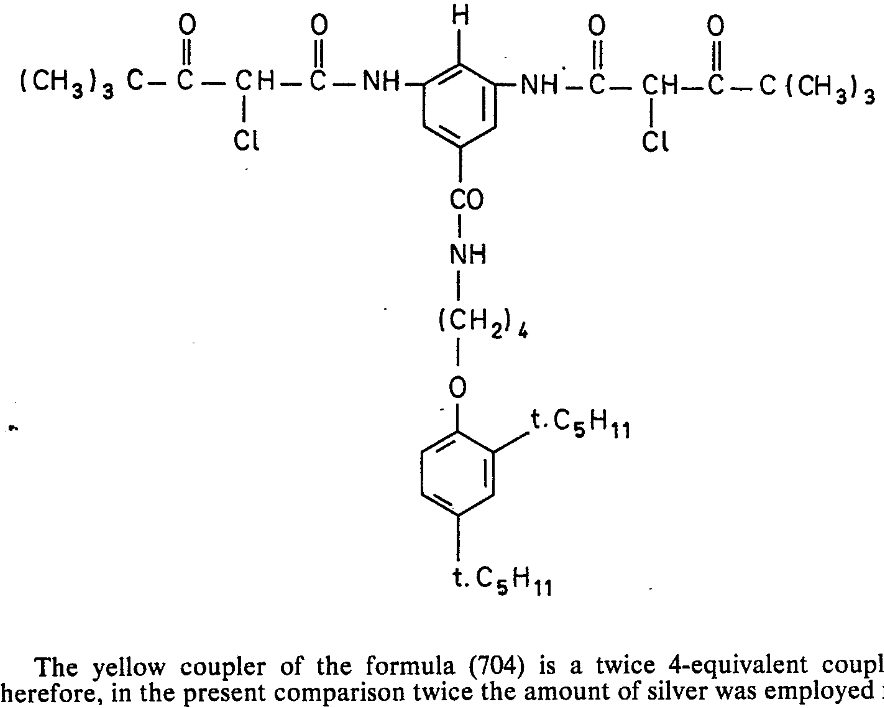
(Compound No. 50 in German Offenlegungsschrift 2,408,168); the yellow coupler of the formula

(704)



(U.S. Patent Specification 3,077,403) and (705) = (315)

(705) = (315)



The yellow coupler of the formula (704) is a twice 4-equivalent coupler. Therefore, in the present comparison twice the amount of silver was employed for this coupler.

Results

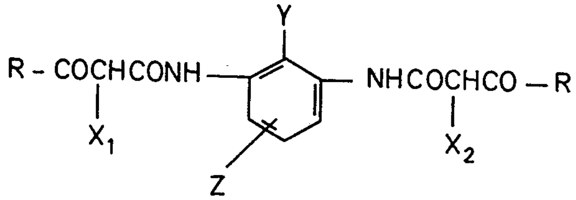
Compound of the formula	λ_{max} [nm]	D_{max}
(402)	443	1.46
(703)	440	0.11
(704)	441	1.03
(705)	440	0.21

The maximum densities of the yellow dyes which are obtained from the comparison couplers of the formulae (703) to (705) are markedly lower than the corresponding colour density which is obtained using the colour coupler of the formula (402).

WHAT WE CLAIM IS:—

1. A yellow coupler of the formula

1)



in which R is alkyl, cycloalkyl or aryl and X_1 and X_2 are radicals which are detachable during the coupling reaction, Y is halogen, alkyl, alkoxy, alkylmercapto, —CN, —COOH, carbalkoxy, $—NH_2$, $—NHR_1$, $—NR_1R_2$ or $—NHCOR_1$, in which R_1 and R_2 are alkyl or phenyl, Z is alkyl having 5 to 40 carbon atoms, alkoxy having 5 to 40 carbon atoms, cycloalkoxy having 5 to 12 carbon atoms or aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkylmercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl, in which radicals the sum of the carbon atoms in each case is 6 to 40; or $—COOR_3$, $—COR_3$, $—NR_3R_4$, $—CONR_3R_4$, $—NR_4COR_3$, $—SO_2R_3$, $—SO_2NR_3R_4$ or $—NR_4SO_2R_3$, R_3 is substituted or unsubstituted alkyl having 1 to 40 carbon atoms, substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms.

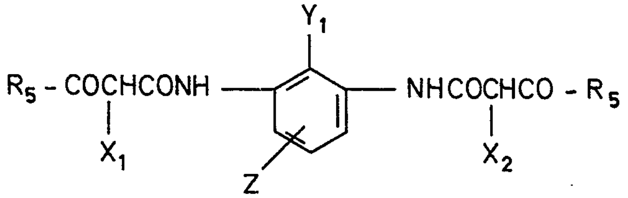
2. A yellow colour coupler according to claim 1, wherein Z is alkyl having 5 to 40 carbon atoms, alkoxy having 5 to 40 carbon atoms, cycloalkoxy having 5 to 12 carbon atoms or aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkyl-mercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl, in which radicals the sum of the carbon atoms in each case is 6 to 40; or$—COOR_3$, $—COR_3$, $—NR_3R_4$, $—CONR_3R_4$, $—NR_4COR_3$, $—SO_2R_{33}$, $—SO_2NR_{33}R_4$ or $NR_4SO_2R_{33}$, in which R_3 is substituted or unsubstituted alkyl having 1 to 20 carbon atoms, substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl, R_{33} is alkyl having 1 to 20 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms, and R, R′, X_1, X_2 and Y are as defined in claim 1.

3. A yellow colour coupler according to claim 1, wherein Z is alkyl having 5 to 40 carbon atoms; aralkyl; alkoxyalkyl, alkoxycycloalkyl, cycloalkoxyalkyl, substituted or unsubstituted phenoxyalkyl, alkylamino- and dialkylamino-alkyl, substituted or unsubstituted arylamino- and diarylamino-alkyl, alkylmercaptoalkyl or substituted or unsubstituted arylmercaptoalkyl, in which radical the sum of the carbon atoms in each case is 6 to 40; or $—COOR_3$, $—COR_3$, $—NR_3R_4$, $—CONR_3R_4$, $—NR_4COR_3$, $—OR_3$, $—SO_2R_3$, $—SO_2NR_3R_4$ or $—NR_4SO_2R_3$, in which R_3 is straight-chain or branched alkyl having 5 to 40 carbon atoms or

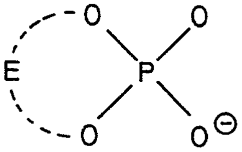
cycloalkyl having 5 to 12 carbon atoms and R_4 is hydrogen or straight-chain or branched alkyl having 1 to 12 carbon atoms, and R, R′, X_1, X_2 and Y are as defined in claim 1.

4. A yellow colour coupler according to claim 3 of the formula

(2)



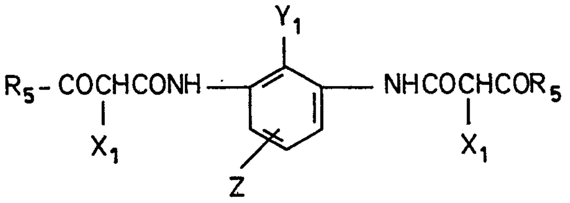
in which R_5 is straight-chain or branched alkyl having 1 to 18 carbon atoms, cycloalkyl, bicycloalkyl or tricycloalkyl having 3 to 12 ring carbon atoms, phenyl or phenyl substituted by halogen, alkyl or alkoxy each having 1 to 4 carbon atoms, $—NH_2$, $—SO_2R_8$ or $—NHCOR_7$, in which R_8 is alkyl having 1 to 5 carbon atoms and R_7 is alkyl having 1 to 5 carbon atoms, X_1 and X_2 are hydrogen, halogen, substituted or unsubstituted alkoxy and phenoxy, nitrogen-containing 5-membered or 6-membered heterocyclic structures which are bonded to the coupling point via a nitrogen atom, $—S—R_8$ in which R_8 is alkyl, substituted phenyl or a heterocyclic structure, $—OPO(OR_9)_2$, in which R_9 is alkyl or phenyl, or a radical of the formula



in which E is the complement to a radical containing the six-membered ring consisting of the phosphorus atom, the two oxygen atoms and 3 carbon atoms, Y_1 is fluorine, chlorine, bromine, alkyl, alkoxy and alkylmercapto, each having 1 to 12 carbon atoms, —CN, —COOH, $—COOR_{12}$, $—NH_2$, NHR_{10}, $—NR_{10}R_{11}$ or $—NHCOR_{12}$, in which R_{10} and R_{11} are alkyl having 1 to 5 carbon atoms or phenyl and R_{12} is alkyl having 1 to 12 carbon atoms, and Z is as defined in claim 3.

5. A yellow colour coupler according to claim 4 of the formula

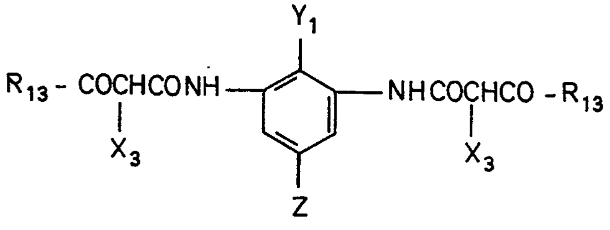
(3)



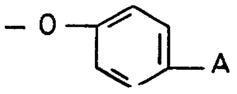
in which R_5, X_1, Y_1 and Z are as defined in claim 4.

6. A yellow coupler according to claim 5 of the formula

(4)



in which R_{13} is straight-chain or branched alkyl having 3 to 10 carbon atoms, cyclopentyl, cyclohexyl, adamantyl, phenyl or phenyl substituted by fluorine, chlorine or bromine or alkyl or alkoxy each having 1 to 4 carbon atoms, X_3 is hydrogen, chlorine or a radical of the formulae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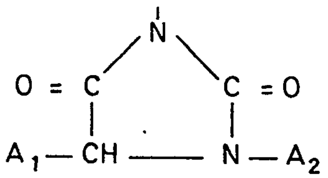
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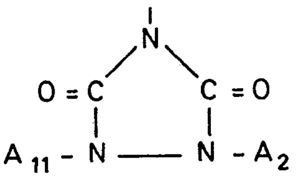
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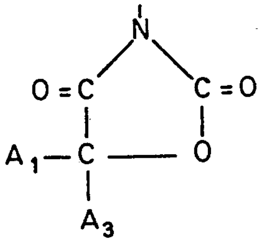
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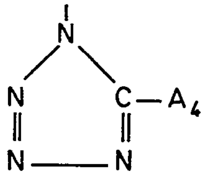
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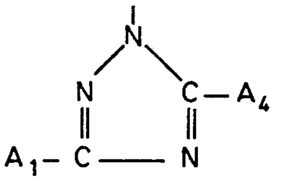
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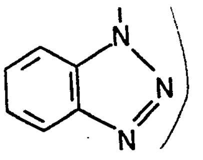
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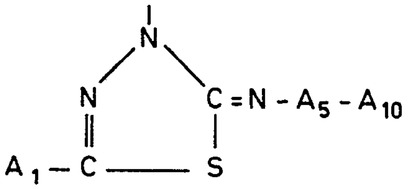
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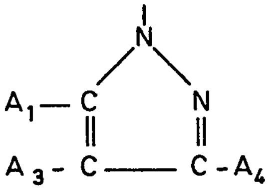
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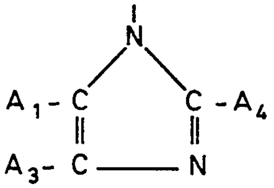
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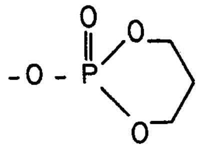
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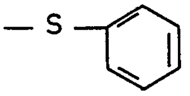
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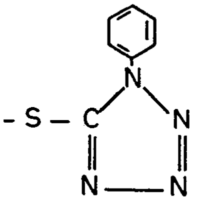
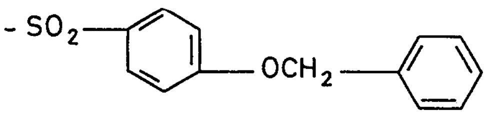
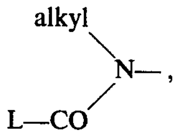


in which A is COOH, NO_2, $COOR_{14}$, in which R_{14} is alkyl having 1 to 4 carbon atoms, or the radical of the formula

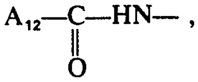


A_1 is hydrogen, alkyl having 1 to 18 carbon atoms, aralkyl, aryl, cycloalkyl having one to four cycloalkyl rings, alkoxy having 1 to 18 carbon atoms, aryloxy, alkylmercapto having 1 to 18 carbon atoms, arylmercapto, halogen, trifluoromethyl, cyano, $-NH_2$, mono- or di-alkylamino, in which the alkyl radicals each contain 1 to 18 carbon atoms,



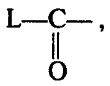
$$\begin{matrix}\text{alkyl}\diagdown & \\ & N-, \\ L-CO\diagup & \end{matrix}$$

in which alkyl contains 1 to 5 carbon atoms,



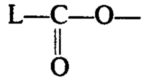
$$A_{12}-\underset{\underset{O}{\|}}{C}-HN-,$$

A_3-SO_2-HN- ,



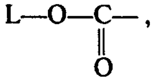
$$L-\underset{\underset{O}{\|}}{C}-,$$

$L-SO_2-$,



$$L-\underset{\underset{O}{\|}}{C}-O-$$

or

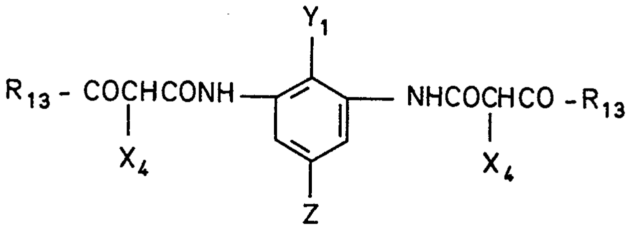


$$L-O-\underset{\underset{O}{\|}}{C}-,$$

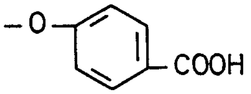
A_2 is straight-chain or branched alkyl having 1 to 18 carbon atoms, aralkyl, or phenyl substituted by alkyl, alkoxy, halogen, —NH_2, alkylamino, dialkylamino, acylamino, —COOH, carbalkoxy, carboxamido, sulphonyl, sulphonamido or alkylmercapto, A_3 is non-branched or branched alkyl having 1 to 18 carbon atoms which is unsubstituted or substituted by halogen, nitro, cyano, alkoxy or primary, secondary or tertiary amino groups, aralkyl, or cyloalkyl having one to four cycloalkyl rings; aryl which is unsubstituted or substituted by alkyl or alkoxy each having 1 to 4 carbon atoms, halogen, acylamino —SO_3H, —COOH, sulphonamide or carboxamide, N- or N,N-substituted sulphonamide or carboxamide, carboxylic acid ester, hydroxyl, nitro, primary, secondary or tertiary amine, mercapto, alkylmercapto —SO_2—L— or —CO—L; pyridyl, furyl, thienyl, perfluoroalkyl, acyl, dialkylamino having, in each case, 1 to 5 carbon atoms in the alkyl part, alkoxy having 1 to 18 carbon atoms or phenoxy, A_4 is hydrogen, substituted or unsubstituted alkyl having 1 to 18 carbon atoms, cycloalkyl, cycloalkenyl, alkenyl, aryl, aralkyl, a heterocyclic radical, alkoxy, aryloxy, alkylmercapto, amino which is unsubstituted or substituted by alkyl, aryl, or acyl, alkylsulphonyl, arylsulphonyl, acyloxy, aminosulphonyl, carboxamide, sulphonamide, alkyl carboxylate, nitro, cyano, halogen, substituted or unsubstituted ureido or substituted or unsubstituted aminosulphonylamino, A_5 is —CO— or —SO_2— and A_{10} is hydrogen, if A_5 is —CO—, and has the meaning defined for A_3, A_{11} is alkyl having 1 to 18 carbon atoms which is unsubstituted or substituted by halogen, amino, cyano or alkoxy, cycloalkyl, aryl or aralkyl, A_{12} is hydrogen and has the meaning defined for A_3 and L is alkyl having 1 to 18 carbon atoms, which is unsubstituted or substituted by halogen, amino, cyano or alkoxy, cycloalkyl, aryl, pyridyl, pyrimidyl, furyl or thienyl and Y_1 and Z are as defined in claim 5.

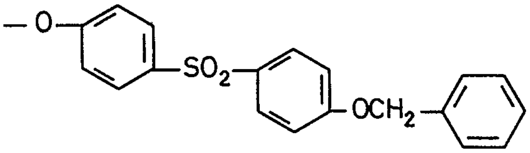
7. A yellow colour coupler according to claim 6 of the formula

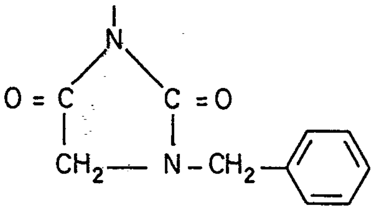
(5)

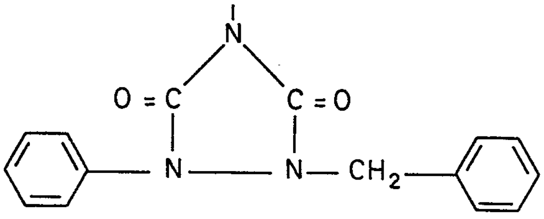


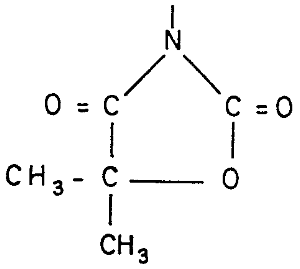
in which X_4 is hydrogen, chlorine or a radical of the formulae







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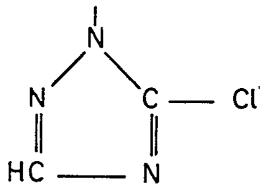
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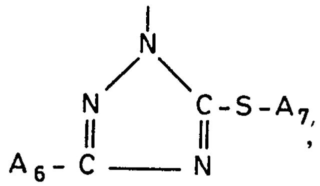
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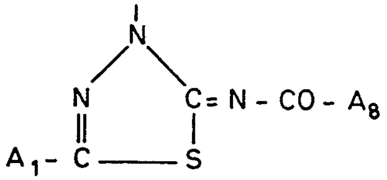
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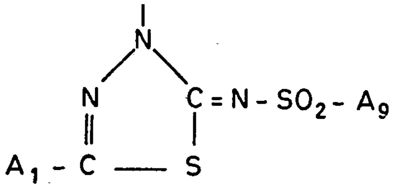
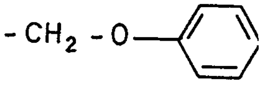


in which A_6 is hydrogen or alkyl having 1 to 4 carbon atoms, A_7 is alkyl having 1 to 12 carbon atoms, A_8 is straight-chain or branched alkyl having 1 to 18 carbon atoms, $—CH_2Cl$, $—CCl_3$,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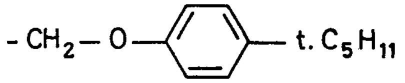
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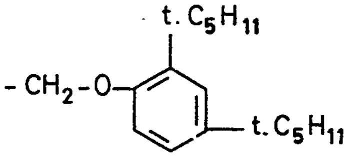
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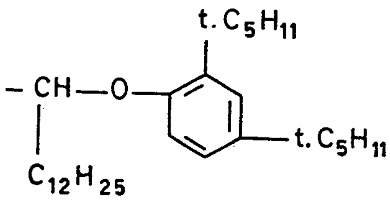
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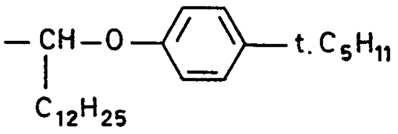
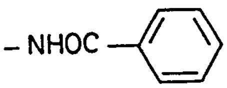
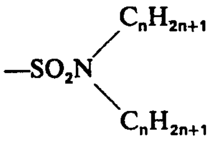
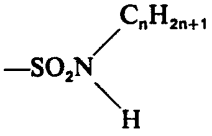
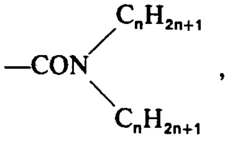
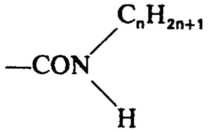
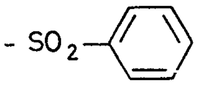

, $—CH_2—O—C_nH_{2n+1}$,

aralkyl, cycloalkyl, phenyl or phenyl substituted by $—C_nH_{2n+1}$, $—OC_nH_{2n+1}$, —Cl, —Br, $—NHOCC_nH_{2n+1}$,


, $—SO_2NH_2$,

$—SO_2N(C_nH_{2n+1})_2$
,

$—SO_2N(H)C_nH_{2n+1}$
,

$—CONH_2$,

$—CON(C_nH_{2n+1})_2$
,

$—CON(H)C_nH_{2n+1}$
, $—SO_2CH_3$,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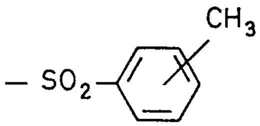
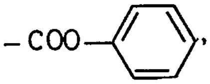
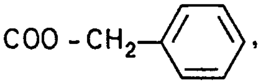
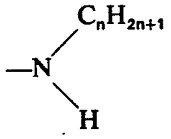
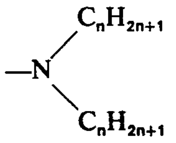
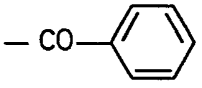
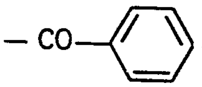
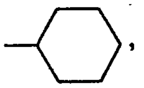
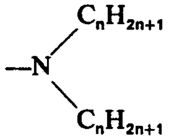
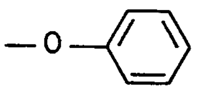

, —COOH, $—COOC_nH_{2n+1}$,

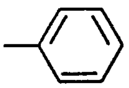
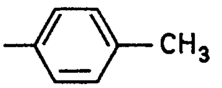
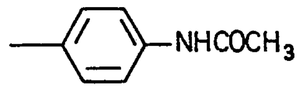
, —COO—C_nH_{2n+1}, , —OH, —NH_2,

 $-N(C_nH_{2n+1})(H)$,  $-N(C_nH_{2n+1})_2$, —SC_nH_{2n+1}, —SO_3H, COC_nH_{2n+1} or

, pyridyl, furyl, thienyl, —C_nF_{2n+1}, —COC_nH_{2n+1},

, , norbornyl, adamantyl,  $-N(C_nH_{2n+1})_2$,

—O—C_mH_{2m+1} or  and n is a number from 1 to 5, A_9 is —CH_3,

,  or 

and R_{13}, Y_1, Z and A_1 are as defined in claim 4.

8. A yellow colour coupler according to claim 7, wherein R_{13} is tert.-alkyl having 4 to 8 carbon atoms.

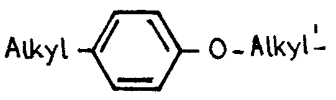
9. A yellow colour coupler according to claim 8, wherein R_{13} is tert.-butyl, 1,1,3,3-tetramethylbutyl, 1-methyl-1-ethyl-pentyl or 1,1-dimethylpropyl.

10. A yellow colour coupler according to claim 7, wherein Y_1 is chlorine or —$NHCOR_{12}$, in which R_{12} is alkyl having 1 to 12 carbon atoms.

11. A yellow colour coupler according to claim 1, wherein Z is —$COOR_3$, —$CONR_3R_4$, —$SO_2NR_3R_4$ or —NR_4COR_3, in which R_3 is substituted or unsubstituted alkyl having 1 to 40 carbon atoms, substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms.

12. A yellow colour coupler according to claim 2, wherein Z is —$COOR_3$, —$CONR_3R_4$, —$SO_2NR_{33}R_4$ or —NR_4COR_3, in which R_3 is substituted or unsubstituted alkyl having 1 to 20 carbon atoms or substituted or unsubstituted cycloalkyl having 5 to 12 carbon atoms or substituted or unsubstituted phenyl, R_{33} is alkyl having 1 to 20 carbon atoms or substituted or unsubstituted phenyl and R_4 is hydrogen or alkyl having 1 to 12 carbon atoms.

13. A yellow colour coupler according to claim 12, wherein Z is —$COOR_3$, —$CONR_3R_4$, —$SO_2NR_{33}R_4$ or —NR_4COR_3, in which R_3 is alkyl having 1 to 18 carbon atoms,

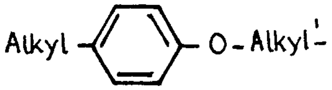


in which alkyl contains 1 to 5 and alkyl contains 4 to 14 carbon atoms, cyclohexyl, alkylcyclohexyl having 1 to 4 carbon atoms in the alkyl part, phenyl or alkylphenyl having 1 to 5 carbon atoms in the alkyl part, R_4 is hydrogen or alkyl having 1 to 8 carbon atoms and R_{33} is as defined in claim 12.

14. A yellow colour coupler according to claim 3, wherein Z is —$COOR_3$, —$CONR_3R_4$, —$SO_2NR_3R_4$ or —NR_4COR_3, in which R_3 is straight-chain or

branched alkyl having 5 to 40 carbon atoms or cycloalkyl having 5 to 12 carbon atoms and R_4 is hydrogen or straight-chain or branched alkyl having 1 to 12 carbon atoms.

15. A yellow colour coupler according to claim 1, wherein Z is $—COOR_3$, $—CONR_3R_4$, $—SO_2NR_3R_4$ or $—NR_4COR_3$, in which R_3 is straight-chain or branched alkyl having 5 to 18 carbon atoms,



in which alkyl contains 1 to 5 and alkyl' contains 4 to 14 carbon atoms, cyclohexyl, alkylcyclohexyl having 1 to 4 carbon atoms in the alkyl part or alkylphenyl having 1 to 5 carbon atoms in the alkyl part and R_4 is hydrogen or alkyl having 1 to 8 carbon atoms.

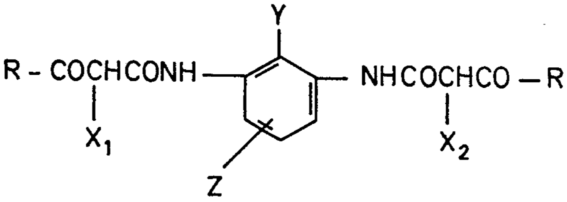
16. A yellow colour coupler which is one of the compounds 201 to 209, 211 to 224, 301 to 314, 316 to 334, 403 to 432 and 500 and 501 as hereinbefore set forth.

17. A light sensitive recording material for colour photography which contains in at least one silver halide emulsion layer a yellow colour coupler as claimed in any one of claims 1 to 16.

18. A colour photographic process for the production of a yellow image by colour development of a recording material as claimed in claim 17 which has been exposed imagewise.

19. The use of a compound of the formula:—

1)



in which R, X_1, X_2, Y and Z have the meanings given to them in claim 1 as a yellow colour coupler in a light-sensitive recording material for colour photography.

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