

Jan. 26, 1971

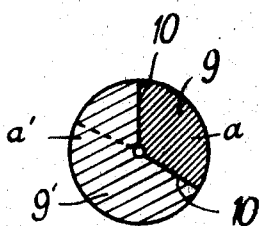
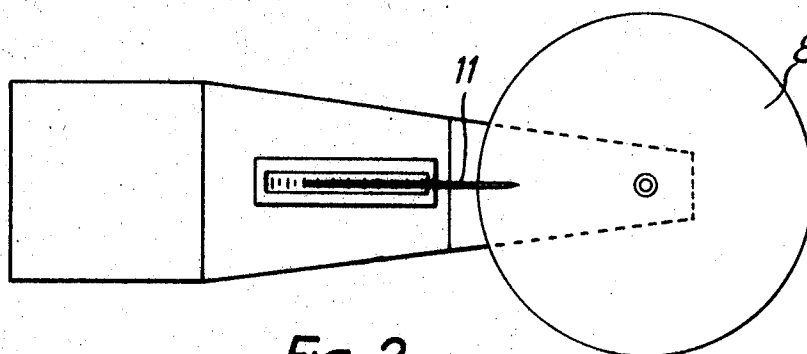
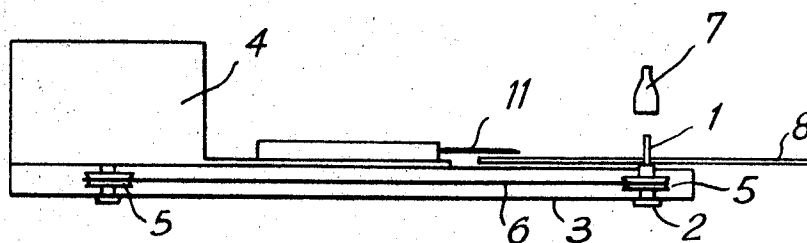
J. FILLACIER ET AL

3,557,472

METHOD AND APPARATUS FOR SELECTING AND REPRODUCING COLOURS

Filed Dec. 9, 1968

4 Sheets-Sheet 1



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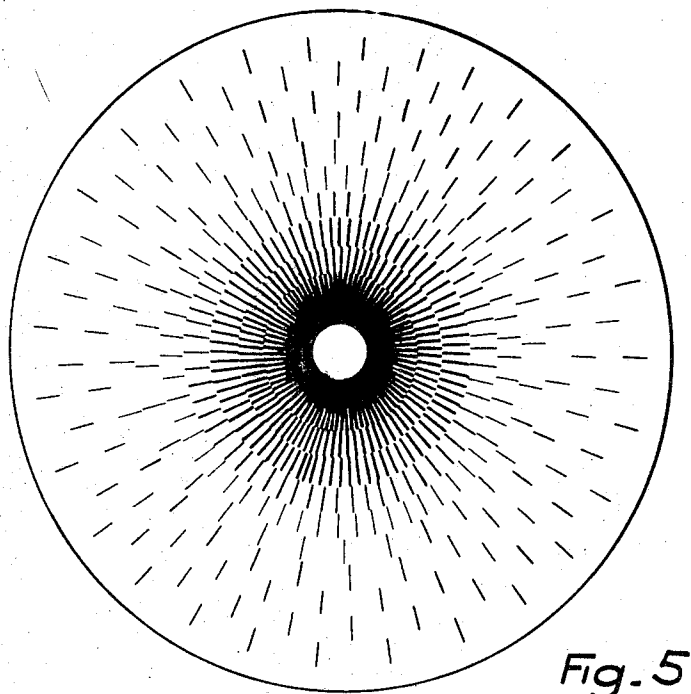
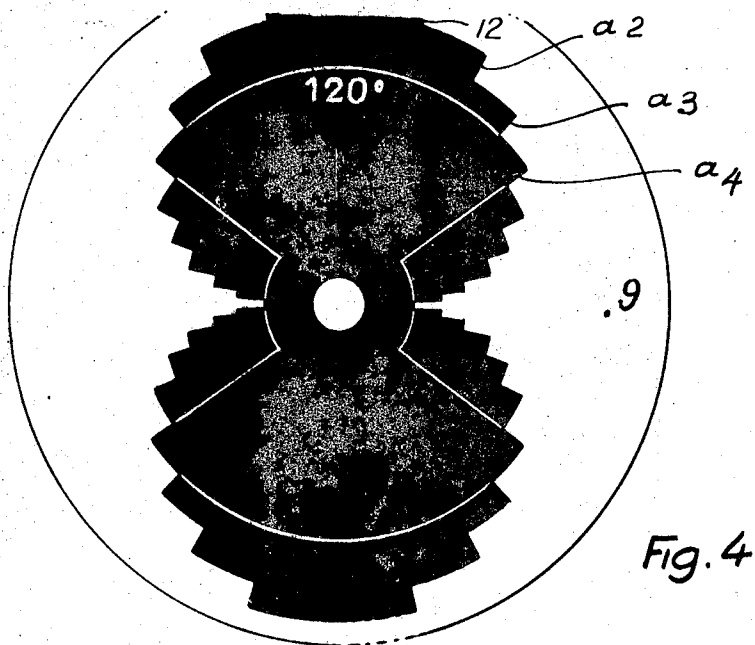
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METHOD AND APPARATUS FOR SELECTING AND REPRODUCING COLOURS

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4 Sheets-Sheet 2



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METHOD AND APPARATUS FOR SELECTING AND REPRODUCING COLOURS

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4 Sheets-Sheet 3

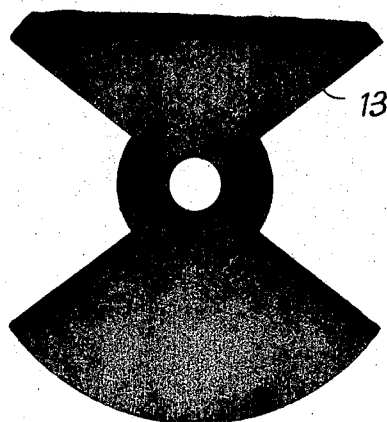


Fig. 6

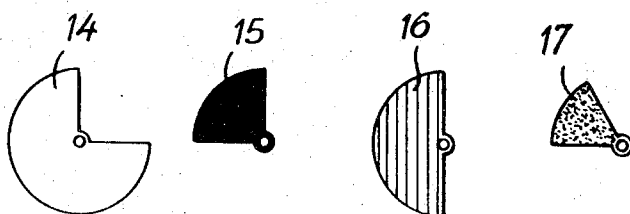


Fig. 7

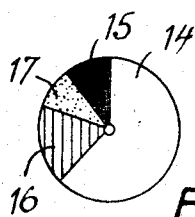


Fig. 8

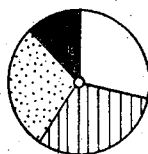


Fig. 9

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3,557,472

METHOD AND APPARATUS FOR SELECTING AND REPRODUCING COLOURS

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131,344

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5 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for selecting and reproducing colour tones by arranging coloured sectors of slit discs on a turn-table in accordance with a code so that when the turn-table is rotated, a colour or colour tone is reproduced corresponding to the colour or colour tone originally produced by means of a like set of coded discs.

BACKGROUND OF THE INVENTION

The sensation resulting from the perception of a colour is a subjective phenomenon, particularly as regards the "tone" (i.e., the exact shade of a colour).

For the definition and the accurate reproduction of a "tone," there are at present various empirical methods: verbal description, and approximate representation thereof by an existing specimen produced, for example, by painting.

But colour and shade atlases never cover all the tones selectively perceptible, and the various specimens which one endeavours to produce thereof can rarely be provided adjacent to one another.

The data of the exploration of a tone by the photocolorimetric method are precise but too abstract to be adopted by the average user.

The purpose of the present invention is therefore to provide means enabling:

(a) A decorator to obtain, by a simple apparatus, a representation of any one of the 50,000 or so tones capable of being identified by the human eye, and to identify it by an index corresponding to the settings which he has had to select for the apparatus in order to obtain it;

(b) An artisan entrusted with the material task of decoration (e.g., the painting of the various elements of a scheme) to produce on the spot, on the basis of indices with which he has been provided, and by means of the same apparatus, visual specimens which he can use as a model for the execution of his work;

(c) Finally, the same apparatus serves to verify whether the work performed is in accordance with the coded indications received.

The invention is based on the use of a principle which has been known since Newton, i.e., the use of a turntable on which can be placed a disc divided into sectors of different colours and of a width depending on the part which each basic colour is to play in the required "tone." In practice, these sectors of variable width can be obtained by a series of superimposed discs with slits enabling them to be imbricated into one another.

When about twenty slit coloured discs, capable of being superimposed in combinations of 2 and 2, 2 and 3, 2 and 4 or even more, and imbricated into one another, in sectors of variable width, are thus prepared in advance, a great variety of bold or pure colours can then be obtained by rotating the discs. It has also been proposed that in order to produce the thousands of darker or lighter "tones" of these pure colours, capable of being distinguished by the human eye, a black disc and a white disc with slits be

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likewise placed on the turntable to produce a white sector and a black sector of adjustable amplitude.

The inventor has found that the presence of a black sector on the gyroscope-type apparatus does impart to the colour obtained by the coloured sectors variable ranges of satisfactory darkened tones but that on the other hand, the presence of a white sector on the turntable does not lighten the colour resulting from the coloured sectors but introduces a grey tone into this colour, thus debasing it.

The inventor has thus found it desirable to consider providing, for each of the twenty or so basic colours, not one single disc but as many brightened discs as there are brightening shades or "tones" which the eye can perceive thereof, i.e., about forty. The result of this limitation would have been the provision of about $20 \times 40 = 800$ discs (darkening shades being obtained by the known method of the black sector, improved in accordance with the invention, as explained farther on). This number of discs, 800, would be somewhat excessive for practical use, as would also be the cost of the method for the selection and exact identification of all the tones desired.

Fortunately, the inventor found that to enable the 40 perceptible darkening shades or "tones" to be selected it was sufficient to construct discs corresponding to about ten thereof, evenly graduated and corresponding to the main shades. It has been found, in fact, that the intermediate tones between these ten main tones can be obtained by the superimposition of two discs corresponding to two of these main tones and by the imbrication of one in the other, in such a way as to produce sectors with a relative width of $\frac{1}{4}$ ", $\frac{1}{2}$ " or $\frac{1}{3}$ ". It has been found, in fact, that this imbrication or combination of two discs of which the tones are characterized by a different degree of darkening does not show the tendency of the tone towards grey unless it is limited to two discs corresponding to the two neighbouring principal shades or "tones."

SUMMARY OF THE INVENTION

According to the present invention there is provided a method of determining any desired colour and a lighter or darker of this colour comprising overlapping a plurality of slit discs bearing different colours so that the discs form a dial subdivided into sectors of different colours and of adjustable width, placing the discs on a turntable, rotating the turntable at high speed and observing the colour tone produced by the dial, the improvement comprising defining the various sectors of said dial by an exact numerical or alphabetical and numerical code whereby anyone provided with like discs and turntable and with the coded references the exact appearance of the colour tone selected.

BRIEF DESCRIPTION OF THE DRAWING

The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIGS. 1 and 2 are a sectional side elevation and plan view, respectively, of an apparatus used for carrying out the method according to this invention;

FIG. 3 illustrates the principle on which this apparatus is used;

FIGS. 4 to 6 show the equipment used in accordance with this invention;

FIG. 7 to 9 illustrate a special application of the invention; and

FIG. 10 illustrates a special device with the different parameters defining the tone selected.

As shown schematically in FIGS. 1 and 2, the apparatus, based on the known principle, used for the operation of the invention, comprises a shaft 1, mounted vertically on a stop 2, affixed to a horizontal stand 3, this

shaft being set in rotation by an electric motor 4, two pulleys 5 and a cable 6.

To this shaft is keyed a turntable 8 on which one or more discs 9 of one and the same diameter (FIG. 3) can be placed and affixed by means of a locking head 7, the discs having radial slits at 10, in such a manner that two superimposed discs 9 and 9', of different colours *a* and *a'*, can be imbricated into each other, producing on the surface of the turntable a sector of each of the discs, the relative widths of the sectors being adjustable as desired. By rotating the disc the user will thus be able to perceive a colour resulting from the combination of *a* and *a'* in the proportion corresponding to that between the widths of the sectors 9 and 9' (e.g. $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{1}{3}$ "). It is obvious that the sensation corresponding to a more complex colour could be obtained by placing three or four slit discs on the turntable.

The apparatus shown in FIGS. 1 and 2 also comprises a needle 11 capable of moving radially in respect of the turntable, opposite a scale or reference system, enabling the distance from its point to the shaft of the turntable to be measured. The function of this needle will be defined hereinafter when the method by which the darkened shades are regulated is elucidated.

In the example selected to illustrate the invention, it is assumed that 18 pure basic colours have been selected, enabling 72 pure colours to be obtained by combining them in pairs.

To obtain different shades or tones, ten discs of the same colour, but of a light or darker tone, ranging from the pure colour to white, are provided for each basic colour, in addition to the disc of the pure colour. If two discs of lightened shades or adjacent tones are imbricated on the rotating disc of the gyroscopic-type apparatus, in a proportion of $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{1}{3}$, the rotation of the turntable provides the operator with the sensation corresponding to the three intermediate tones between these tones of the two discs.

Hitherto, therefore, the advance selection is confined to the choice:

(a) Of the two discs of pure colour, to be imbricated on the disc, and to the proportion in which they are imbricated thereon (i.e. the relative width of their two sectors), in order to produce the colour required;

(b) Of the lighter or darker tone of this colour, by selecting, from the range of tones of the pure colours chosen, the disc or combination of two adjacent discs corresponding to the lightened tone required.

As explained at the beginning, it is obvious that in order to determine the darkened tone, one could operate in accordance with the known principle, by superimposing on the turntable a slit black disc *a* and adjusting (as shown in FIG. 3) the amplitude of the visible sector in relation to that of the coloured disc. But this method offers no practical means for mutual comparisons of the different tones appearing during the rotation of the turntable for each particular position to which the black sector has been regulated.

The special device provided by the invention enables the user to observe the turntable, when placed in rotation, by means of a sort of palette on which the different tones, which can be obtained by a greater or smaller degree of darkening of the more or less lightened colour resulting from his first choice, are graduated in a series of rings.

For this purpose, a special black disc 12 (FIG. 4) is provided, to be mounted on the turntable, above the coloured disc 9 selected in advance and of which it is proposed to study the changes of tone as a function of the darkening.

The contour of this black disc 12 is subdivided into a series of arcs (9 in the example shown) of which the angular width increases from the periphery towards the centre.

It follows that the rotation of the turntable bearing the coloured disc and the special disc 12, will cause 9 rings

of different colour (FIG. 5) to appear, varying from the periphery to the centre, from the lightened tone, resulting from the disc or discs of the turntable of the first setting, to total blackening.

If the needle 11 of the apparatus shown in FIG. 1 and 2 is displaced radially, as far as the circle corresponding to the selected tone, the darkened tone selected can be located.

For increased convenience of operation, this notched disc 12 is supplemented by a series of black discs arranged star-wise, as shown at 13, in FIG. 6, the black part corresponding over its entire radius to the peripheral blackening of a notch of the disc 12. This will enable the effect of the tone selected to be seen more easily, over a relatively large surface.

The disc 13, of FIG. 6, which corresponds to the black part at 120° , thus corresponds to the notch *a4* of the disc 12.

A finer selection of the tone chosen can also be effected by providing, for each notch of the disc 12, four star-wise discs of the type 13 (FIG. 6), of which the orientation corresponds to quarter-intervals between the widths of two successive discs *a4* and *a3* arranged star-wise.

If the disc 12 has nine notches, the material of the apparatus will comprise $9 \times 4 = 36$ black discs 13 arranged star-wise.

An explanation will now be given of the task of the decorator and of the material which he requires in order to determine the colour and the lightened or darkened tone which he needs in order to obtain an exact visual representation of the tone which he has been asked to produce.

The artisan entrusted with the reproduction of the selected tone will only require the following equipment:

- a turntable of some kind or other;
- a set of discs of pure colours;
- a set of discs with the lightened tones of each of these pure colours;
- a set of black discs 13 arranged in star-fashion and determining the darkened tones.

He also requires, however, an accurate knowledge of the manner in which this material must be arranged, in order to ensure that when the turntable is set in rotation, the tone selected by the decorator will be reproduced.

He must thus have an exact knowledge of the following:

The reference of the pure-colour disc selected, or of the two pure-colour discs and the proportion in which one is imbricated into the other ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{3}$);

The reference of the lightening tone chosen for each of them, or of the two tones chosen, and the proportion in which they are imbricated;

The reference of the black disc, arranged star-wise, corresponding to the darkened tone chosen.

One could conceive of numerous codes enabling this location by reference marks to be effected without errors.

In the case of 18 pure-colour discs capable of being combined in pairs, 10 lightening tones for each of them, and 36 discs arranged star-wise, corresponding to the 9 notches of the disc 12 of FIG. 4, the following code could be adopted:

- the pure-colour discs are marked 1-18;
- the ten main lightened tones of each of these pure colours are marked A-J;
- the thirty six black blades are numbered 0-9, each one being subdivided into *a-d*;
- the proportion in which two pure-colour discs (such as 16 and 17), or two discs of a tone lightened by E and D, i.e. $\frac{1}{4}$, $\frac{1}{3}$ or $\frac{1}{2}$, are imbricated into one another, is identified by the figures (4), (3), (2).

Any one of the approximately one hundred thousand possible tones of different colours and degrees of light

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or dark, capable of being produced, can be accurately identified by a fixed reference, such as

16ED(2)4d

which will tell the artisan that to obtain the tone for which he is asked he must place on his turntable a disc 16E and a disc 16D, imbricated in a proportion of $\frac{1}{2}$, and superimpose on them the disc 4d arranged star-wise.

Numerous alternative codes would nevertheless be possible. FIG. 10 illustrates a more mathematical code for the colours and the tones, by the aid of a graph on which the various pure colours resulting from the mixture of two of the 18 adjacent basic colours, in a relative proportion of $\frac{1}{4}$ to $\frac{1}{3}$, $\frac{1}{2}$, are given along the abscissa, while the different degrees of lightening of these basic colours are given along the ordinates.

On this table the 18 basic colours corresponding to a material disc are marked in intervals of 4, i.e. 4, 8, 12 . . . 72; one of the points on the abscissa of the graph 21, corresponds to the superimposition of the discs 20 and 24 in the relative proportion of $\frac{1}{4}$. Similarly, the ten discs which correspond, for each basic colour, to the main degrees of lightening, are referenced in multiples of 4, starting with the white, i.e. 4, 8, 10, 12, up to 40, corresponding to the pure zone. A point on the ordinate of the graph, 22, corresponds to the superimposition of the lightening discs 20 and 24 imbricated in a proportion of $\frac{1}{2}$.

Each of the 70×40 tones, corresponding to 72 pure colours lightened in various degrees, is thus referenced by its abscissa, defining the basic-colour disc or discs by which it can be obtained, and by its ordinate, which locates that one of the discs of the colour selected which can be used in order to obtain the required tone. The darkened tones are also referenced as in the foregoing, by the number of the corresponding blade.

The invention also relates to a particular application of the definition of the colours by the imbrication of a number of discs of different colours on a turntable.

It often happens, particularly in the public sector, that the municipality does not impose on the architects and on the users one uniform tone for the plastering of the houses and their parts (roof, shutters, etc.) and merely asks that they remain within a certain range of tones. The municipality thus leaves the builders a certain freedom of choice in the mixture of two or three pure colours and a certain addition of black or white.

The limit of this freedom of choice will be defined by the larger or smaller width of the circular sectors to be placed on the turntable. The local authority will thus supply the builder with a set of sectors 14, 15, 16 and 17 (FIG. 7), which are white, black, yellow and green respectively, and of 270°, 90°, 180° and 60°, and which he can use as he wishes, in combination, by imbricating them into one another, in order to obtain the tone cor-

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responding, for example, to the rotation of the dial shown in FIG. 7.

On the other hand, he cannot use a tone corresponding to the rotation of the dial shown in FIG. 9, as this would require a green sector more than 60° wide.

The invention is not confined to the construction of the apparatus described in the foregoing.

In a simpler version, which can be used as a game for teaching purposes, the discs with slits enabling them to be imbricated into one another can be replaced by cubes of different colours capable of being placed side by side on the turntable. All six sides of each cube of a given basic colour are of this same colour but graduated in six different tones, ranging to white.

As a variant, a set of black masks can be provided, for superimposition on the coloured cubes and having radial openings of larger or smaller size, to enable the darkening of the resulting tones to be varied.

We claim:

1. The method of identifying and reproducing colors, including tints and shades thereof, comprising: providing sets of discs colored with basic colors and mixtures of said basic colors with white; selecting at least two of said discs; interleaving said selected discs to a predetermined degree and simultaneously rotating said interleaved discs while observing the same to thereby produce a resultant visible tint of said basic color; and rendering said visible color a darker shade by simultaneously spinning, with said interleaved discs, a black disc comprising opposed sectors of predetermined angular extent.

2. The method of claim 1 wherein said basic colors are saturated colors selected from regular intervals along a conventional chromatic range.

3. The method of claim 2 wherein said sets of discs bearing said saturated colors number about a dozen sets.

4. The method of claim 3 wherein each set of discs of each pure color comprises about ten discs, colored with a mixture of said pure color and different amounts of white.

5. The method of claim 1 including providing a set of about forty of said sectored black discs, on each of which the black sectors are of different angular extent from the others.

References Cited

UNITED STATES PATENTS

280,665	7/1883	Pittiot	356—193
824,374	6/1906	Munsell	35—28.5
2,101,741	12/1937	Ketcham	356—174
1,151,395	8/1915	Roberts	356—192X

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U.S. Cl. X.R.

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