

FORM 1

SPRUSON & FERGUSON

APPLICATION ACCEPTED AND AMENDMENTS
ALLOWED 15.1.91

COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952

608834

APPLICATION FOR A STANDARD PATENT

Pilot Ink Co., Ltd., of No. 3-17, Midori-machi, Showa-ku, Nagoya-shi, Aichi, JAPAN, hereby apply for the grant of a standard patent for an invention entitled:

Color Memory Toy

which is described in the accompanying complete specification.

Details of basic application(s):-

Basic Applic. No: Country:

64564/87 JP
144969/87 JP
19593/88 JP

Application Date:

29 April 1987
22 September 1987
17 February 1988

The address for service is:-

Spruson & Ferguson
Patent Attorneys
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1988 ATTACHED
MAIL OFFICER

DATED this TWENTY SEVENTH day of APRIL 1988

Pilot Ink Co., Ltd.

By: *[Signature]*

Registered Patent Attorney

LODGED AT SUB-OFFICE
28 APR 1988
Sydney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 57377
S&F CODE: 59080

5845/2



COMMONWEALTH OF AUSTRALIA

THE PATENTS ACT 1952

DECLARATION IN SUPPORT OF A
CONVENTION APPLICATION FOR A PATENT

In support of the Convention Application made for a
patent for an invention entitled:

Ferguson & Ferguson

Title of Invention

COLOR MEMORY TOY

Full name(s) and
address(es) of
Declarant(s)

I/We Ken Asai, Manager
of Pilot Ink Co., Ltd., No. 3-17, Midori-machi, Showa-ku,
Nagoya-shi, Aichi, Japan

do solemnly and sincerely declare as follows:-

Full name(s) of
Applicant(s)

- 1. ~~I am/We are the applicant(s) for the patent~~
(or, in the case of an application by a body corporate)
- 1. I am/We are authorised by Pilot Ink Co., Ltd.

- the applicant(s) for the patent to make this declaration on
its/their behalf.
- 2. The basic application(s) as defined by Section 141 of the
Act ~~was/were~~ made

Basic Country(ies)

in Japan

Priority Date(s)

on April 29, 1987, September 22, 1987 and February 17, 1988

Basic Applicant(s)

All by Pilot Ink Co., Ltd.

Full name(s) and
address(es) of
inventor(s)

- 3. ~~XXXX/We are the actual inventor(s) of the invention referred
to in the basic application(s)~~
(or where a person other than the inventor is the applicant)
Yutaka Shibahashi, Norikazu Nakasuji, Tsutomu Kito, Michiyuki Yasuda and
3. Kuniyuki Senga of
No. 43-1, Aza Sunada, Narumi-cho, Midori-ku, Nagoya-shi, Aichi, Japan;
No. 1-496, Aza Shiratsuchi, Haruki, Togo-cho, Aichi-gun, Aichi, Japan;
of No. 13-83-392, Ichinokura, Tajimi-shi, Gifu, Japan; No. 1559, Ryoshita,
Gifu-shi, Gifu, Japan and No. 323, Hirakaito, Kani-shi, Gifu, Japan

(respectively)
is/are the actual inventor(s) of the invention and the facts upon
which the applicant(s) is/are entitled to make the application are
as follows:

Set out how Applicant(s)
derive title from actual
inventor(s) e.g. The
Applicant(s) is/are the
assignee(s) of the
invention from the
inventor(s)

The Applicant is the assignee of the
invention from the inventors.

- 4. The basic application(s) referred to in paragraph 2 of this
Declaration ~~was/were~~ the first application(s) made in a Convention
country in respect of the invention(s) the subject of the application.

Declared at Tokyo, Japan this 13rd day of May 1988

.....
Ken Asai
Signature of Declarant(s) Ken Asai 11/81
Manager

(12) PATENT ABRIDGMENT (11) Document No. AU-B-15248/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 608834

(54) Title
COLOR MEMORY TOY

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(56) Prior Art Documents
US 4215208
US 3831165

(57) Claim

1. A color memory toy, comprising:

a toy body having an outer surface; and a quasi-reversible thermochromic coloring material applied to said surface and having a temperature hysteresis characteristic for changing between a first and second colored state, wherein said material exhibits a complete change of color from said first colored state to said second colored state at an upper temperature T_B above a first temperature when said material is heated, maintains a present one of said first and second colored states within a two-color holding temperature range between said first temperature and a second temperature lower than said first temperature, said first and second colored states being able to alternately appear within said two-color holding temperature range, and exhibits a complete change of color from said second colored state to said first colored state at a lower temperature T_A below said second temperature when said material is cooled, wherein said two-color holding temperature range is from about 10°C to about 35°C.

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(10) 608834

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9. A color memory toy as recited in claim 1, further comprising a breath blowing means separate from said toy body, said breath blowing means comprising a shaped body, a funnel-shaped mouthpiece on an outside of said shaped body, and a pipe portion connected to said mouthpiece through said shaped body, said pipe portion having an open end to be faced to said toy body such that breath blown through the breath blowing means onto said toy body causes it to change color.

FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

60 883 4

(ORIGINAL)

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

This document contains the amendments made under Section 49 and is correct for printing.

Name and Address
of Applicant:

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Complete Specification for the invention entitled:

Color Memory Toy

The following statement is a full description of this invention, including the best method of performing it known to me/us

ABSTRACT OF THE DISCLOSURE

A color-changeable toy having a toy body to which a quasi-reversible thermochromic material is applied in a pattern. This material stably holds either of two colored states in a range of ordinary room temperatures. However, the material reversibly changes to one of the states above this range and to the other below this range. Thereby, by using commonly available heat and chilling sources such as ice, hot water or breath, one of the colors can be selected. A breath blow pipe can be used in conjunction with the toy and have an external appearance associated with that of the toy, e.g., gun and soldier.

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COLOR MEMORY TOY
DESCRIPTION OF THE INVENTION
BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to color changing toys. It particularly relates to a toy having two colored configurations in which a user can change between the two configurations of the toy by use of suitable heating or cooling. Further, the user can select one of the two configurations and hold the selected configuration in the range of ordinary
10 temperatures.

Background Art

 In order to provide such a toy in which two visual configurations are exhibited depending on a change in temperature, there has been proposed a toy which is colored so that the surface of the toy changes in color at a
15 predetermined threshold temperature. However, only a specific one of the two states before and after the change can exist in the range of ordinary temperature. That is, although the non-ambient state is maintained during the application of heat or chilling required to present the non-ambient state, the toy returns to the ambient state (determined by the range of ordinary
20 temperature) when the application of heat or chilling is removed.

SUMMARY OF THE INVENTION

 It is an object of the present invention to provide a toy having two visual configurations in which the color of its surface changes depending on the temperature but either one of the configurations before and after the
25 change in surface color can be selected as desired and can be maintained in the range of ordinary temperature.

 According to the present invention there is provided a color memory toy, comprising:

 a toy body having an outer surface; and a quasi-reversible thermochromic
30 coloring material applied to said surface and having a temperature hysteresis characteristic for changing between a first and second colored state, wherein said material exhibits a complete change of color from said first colored state to said second colored state at an upper temperature above a first temperature when said material is heated, maintains a present one of said
35 first and second colored states within a two-color holding temperature range between said first temperature and a second temperature lower than said first temperature, said first and second colored states being able to alternately appear within said two-color holding temperature range, and exhibits a



complete change of color from said second colored state to said first colored state at a lower temperature below said second temperature when said material is cooled, wherein said two-color holding temperature range is from about 10°C to about 35°C.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1 and 2 are perspective views of a miniature car of an embodiment of the invention in which Figure 1 shows an aspect in which a whole body is yellow, and Figure 2 shows an aspect of a two-tone color in which a roof is yellow and the rest is red.

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Figures 3 and 4 are views illustrating respective aspects of duality of a doll of another embodiment of the invention.

Figure 5 is an enlarged sectional view of an eye portion of the doll of Figures 3 and 4.

Figure 6 is an enlarged sectional view of an eyebrow portion of the doll of Figures 3 and 4.

Figure 7 is an enlarged sectional view of a mark portion of a miniature car of yet another embodiment.

10 Figure 8 is an enlarged sectional view of an instant photograph of a further embodiment.

Figures 9 and 10 are views for explaining the manner how to play with combination of a color memory soldier doll and a blowpipe according to the present invention.

Figure 11 is a view showing the hysteresis characteristic of the reversible recoloring composition.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The reversible thermochromic recording composition proposed by the present inventor in U.S. Patent 4,720,301 is preferably used as the above-mentioned quasi-reversible thermochromic coloring.

20 The meaning of the above-mentioned hysteresis characteristic is as follows. The shape of the curve obtained by plotting the color density as a function of temperature depends on whether the temperature is changing from below to above the range of color changing temperature or from above to below the same range. Therefore, the curves in the foregoing two cases form a loop when they are combined as shown in Fig. 11. Assuming that the temperatures at the junctions between the two curves at the opposite ends of the loop at the lower and higher sides are represented by T_A and T_B respectively, the quasi-reversible thermochromic coloring used according to the present invention is characterized in that the lower temperature T_A
30 is a temperature to be obtained in a human environment, for example, produced by ice or cold water, that is, a temperature within a range of from about 0°C to about 15°C, and the higher temperature T_B is a temperature obtainable in a human environment, for example, produced by a human body, a hot water bath, a hair dryer, or the like. That is, the higher temperature T_B is within a range of from about 27°C to about 90°C. With this quasi-reversible thermochromic coloring, the range of temperature in which both the colored state and the colorless state (both the first and second colored states) can co-exist extends over the range of ordinary temperature. This range will hereinafter be referred to as the

"two-color holding temperature range". Particularly, the quasi-reversible thermochromic color in which the two-color holding temperature range exists within the range of ordinary temperatures of from about 10°C to about 35°C is preferably selected.

There are various combinations of different quasi-reversible thermochromic coloring, for example, the combination of quasi-reversible thermochromic colorings having different colors, or the combination of those having two-color holding temperature ranges which are different from each other while both extend within the range of ordinary temperature. A special example of the latter combination is the combination of those colorings having the relationship that the two-color holding temperature range of one quasi-reversible thermochromic color is wider than and includes that of the other quasi-reversible thermochromic color. Any of these combinations may give a toy changeability between a variety of patterns or a variety of designs when such a combination is applied to various surface portions of the toy.

The quasi-reversible thermochromic color is dispersed in a suitable medium so as to be used as a coloring material in the form of ink, pigment or paint to thereby color a desired portion of the surface of a shaped toy. Needless to say, the above-mentioned treatment may be performed on the surface of members of a toy before assembly.

In a shaped toy in which the portion coated with the quasi-reversible thermochromic coloring is in the colorless state at an ordinary temperature, it thereby produces the configuration that the color of a substrate appears. If the surface of this colorless portion is first cooled below the above-described lower temperature T_A so as to make the portion be in the colored state and the temperature of the portion is then returned to the ordinary temperature the configuration of the lower temperature colored state is held within the range of ordinary temperature.

On the other hand, if the temperature of the same surface portion is returned to the ordinary temperature after it is once heated above the above-described higher temperature T_B so as to make the portion be in the colorless state, the higher temperature colorless state is held within the range of ordinary temperature. The same explanation applies to the interchangeability between the respective configurations of the switchable first and second colors.

Thus, the toy of the present invention is constructed such that one of two visual configurations can be selected and held according to user's desire. The selected configuration can be further varied into the other

configuration at will and the thus obtained other configuration remains stable. At that time, if heat or cooling is applied to only a part of the painted portion, the configuration of only that part is varied.

If different kinds of quasi-reversible thermochromic coloring are painted on respective surface portions of the toy of the present invention, the toy exhibits an overall pattern or design which varies whenever any of the respective surface portions are varied in color.

The example of applications of the above functions may include: a change between two appearances of painted and an unpainted face, or between the appearances of an ordinarily painted face and a thickly painted face in a doll. In a general sense, a shaped toy of the invention such as a vehicle, an animal, a monster, a dinosaur, etc., a dress for a doll, and so on, has surfaces which exhibit interchangeability between patterns, for example, between a uniform color and a camouflage color, between different designs, between a plain design and a fancy design, between two colors, or between one of the colors and a combination of two colors. Even more particularly, an animal toy may be interchangeable between two types, for example, between a horse and a zebra, between a white bear and a panda, and the respective animal type is stably held in the range of ordinary temperature.

The color of the surface of the above-mentioned toy may be partially changed by, for example, a brush a writing-brush, a sponge, a cloth and the like which have been soaked with cold or hot water. It is, however, preferable to use a breath blowing means (blowpipe) constituted by a shaped object externally having a funnel-shaped mouthpiece and a pipe portion which is connected to the mouthpiece through the shaped object. The pipe portion is externally projected and opened at its end. If the shaped object of the blowpipe is made to have a shape associated with the toy itself, for example, if the toy and blowpipe have respective shapes of a soldier and a gun or a trumpet or a wizard and a staff, playing with such a set of the toy and the blowpipe has redoubled interest, and there is an advantage in that user's breath is used as a heating source.

Example 1

The first example is a doll made of polyvinyl chloride resin and having a configuration in which its face had been ordinarily painted, that is, its lips, cheeks and eyelids had been painted in light pink, light cinnabar and light purple respectively. Paints L', M' and N' including quasi-reversible thermochromic colors L, M and N respectively were spray-painted upon the lips, the cheeks and the eyelids respectively. These

quasi-reversible thermochromic colorings L, M and N were thermally reversibly changeable respectively between blue and colorless, between purple and colorless and between pink and colorless. For all three colorings, the point T_A was 10°C and the point T_B was 32°C . The face was dried so that the doll was made to be a color memory doll which could exhibit a dual configuration in its face.

10 After the face of this doll was warmed by hands it showed the aspect of an ordinarily painted face. When the face was cooled by cold water of about 10°C below room temperature of about 25°C , the lips, the cheeks and the eyelids respectively turned dark blue, dark purple and dark pink so that the doll exhibited the appearance aspect of a psychedelically painted face. This aspect was stably held in the range of temperature of from 14°C to 29°C .

Next, when the face was warmed again by hands, the psychedelic paint was erased from the face so that the face was changed to exhibit the appearance of the ordinarily painted face. Whenever this operation was repeated, the doll exhibited changeability between the psychedelically painted appearance and the ordinarily painted appearance, and it was possible to play with the change repeatedly and many times. It was also possible to make only one of the lips, the cheeks and the eyelids be changed in the manner as mentioned above.

Example 2

30 On plain light blue cloth made of polyester, a spotted pattern was screen-printed with screen printing inks P', Q' and R' respectively including quasi-reversible thermochromic colorings P, Q and R which in response to the change of temperature were reversibly changeable respectively between green and colorless, between red and colorless and between orange and colorless. For all three colorings, the point T_A was 8°C and the point T_B was 35°C . Then, the cloth was made into a dress and the dress was put on a doll to provide a color memory doll with a dress exhibiting the two appearances.

The dress of the doll was heated by a hair dryer so that the doll was made to have the aspect of wearing a plain, light blue dress at room temperature of about 20°C . Next, when the doll was cooled in a refrigerator, the plain dress was changed into the appearance of a green, red and orange spotted pattern. This appearance was stably held in the range of temperature of from 15°C to 30°C .

Next, when the dress was heated again by a hair dryer, the above-mentioned spotted pattern was thereby erased so that the doll was changed

into the appearance of wearing the plain, light blue dress. Whenever this operation was repeated, the dress exhibited the duality between the plain appearance and the spotted pattern appearance and it was possible to play with the change repeatedly many times.

Example 3

The surface of a miniature car made of ABS resin was spray-coated with a paint including a quasi-reversible thermochromic color which was reversibly changeable in response to the change of temperature between red and yellow. The point T_A was 10°C and the point T_B was 32°C . The miniature car was dried producing a color memory miniature car having a body exhibiting a bistable appearance. This miniature car is shown in Figures 1 and 2.

The body of the miniature car was warmed by hand so that the car was changed to show the aspect of a yellow body (as shown in Figure 1) at room temperature of about 24°C . Next, when the body was cooled by a cold spray, the body turned red. This appearance was stably held in the range of temperature of from 15°C to 30°C .

Next, when only a roof of the car body was warmed by hands, only the roof turned yellow from red, and the car body exhibited the aspect of a yellow and red two-tone body, shown in Figure 2. Being further warmed, the body turned yellow from the two-tone yellow/red color combination. Whenever this operation was repeated, the car exhibited interchangeability among red, yellow, and the yellow/red two-tone color, and it was possible to play with the change repeatedly many times.

Example 4

With a doll made of polyvinyl chloride resin and having its face with the appearance shown in Figure 3, three paints were painted on portions corresponding to eye centers 3', the rest of the eyes 3 and eyebrows 3" of the doll. These three paints respectively included quasi-reversible thermochromic colors reversibly changeable in response to the change of temperature respectively between green and colorless, between dark brown and colorless and between brown and colorless. For all three paints, the point T_A was 10°C and the point T_B was 30°C . Thereby, a color memory doll with its face having two appearances was obtained, as shown separately in Figures 3 and 4. Figure 5 is an enlarged sectional view showing the above-mentioned eye portion, and Figure 6 is an enlarged sectional view showing the above-mentioned eyebrow portion. Figures 5 and 6 show a base material 1 of the face, unchangeable color marks 2 and 2', and quasi-reversible thermochromic color layers 3, 3' and 3".

When the face of the doll was cooled to a temperature below 10°C, the face exhibited an appearance in which both the eyes were opened as shown in Figure 4. When a towel soaked with hot water of 30°C was pressed on one of the eyes, the face exhibited another appearance in which only one of the eyes was shut, that is, an appearance of winking. When the towel was pressed on the whole of the face, the face exhibited an appearance in which both the eyes were shut, that is, a sleeping appearance, as shown in Figure 3. The respective aspects were held in the range of ordinary temperature, and the change between the respective aspects could be reproduced repeatedly.

Example 5

On a side surface of a miniature car or truck, a mark I was drawn with a brush by use of multi-color paints which do not change with temperature. Then, a first reversible paint including a quasi-reversible thermochromic color reversibly changeable between pink and colorless (the point T_A was 10°C and the point T_B was 35°) was applied over the whole of the mark I. Then, a second reversible paint including a quasi-reversible thermochromic color reversible changeable between dark green and colorless (the point T_A was 10°C and the point T_B was 35°C) was applied to the surface of the first reversible color paint so that the portions coated with the two reversible paints partly overlapped on each other to thereby produce the miniature car having a mark which could exhibit two appearances.

Figure 7 is an enlarged sectional view showing the foregoing mark position. Figure 7 shows a base material 11 of the miniature car, paints 12 and 12' forming the mark I, and the two reversible paints 13 and 13'.

When the miniature car was exposed to a temperature not less than 35°C, the mark I was displayed, and the mark I was visually held even if the temperature was returned into the range of ordinary temperature. Next, when the miniature car was cooled to a temperature not higher than 10°C, another mark II different from the first mark I was displayed, and the mark II was held even if the temperature was returned into the range of ordinary temperature. It was possible to repeat the process many times.

Example 6

The sixth example imitates an instant photograph. A colorful design, corresponding to the photograph, was offset-printed with temperature invariant ink on the surface of art paper, and then screen-printing was performed over the whole face of the colorful design with ink including a quasi-reversible thermochromic color reversibly changeable between black

and colorless. The point T_A was 10°C and the point T_B was 30°C . There was thus produced an imitative instant photograph having a dual appearance was obtained.

Figure 8 is an enlarged sectional view showing the imitative instant photograph. Figure 8 shows a base material 14 of art paper, differently colored inks 15, 15' and 15" forming the design, and a quasi-reversible thermochromic color layer 16.

10 When the imitative instant photograph was cooled below 10°C , the whole surface of the imitative instant photograph turned black, and the black was held even if the temperature was returned into the range of ordinary temperature ($15^\circ\text{C} - 28^\circ\text{C}$). When the imitative instant photograph was exposed to a temperature not lower than 30°C , the black overlying color was erased so that the imitative instant photograph exhibited the underlying colorful design. The colorful design was held in the range of ordinary temperature and it was possible to repeat the change.

Example 7

A toy soldier 20, shown in Figure 9, was spray-painted at its surface portions corresponding to its helmet and uniform with a paint including a quasi-reversible thermochromatic coloring reversibly changeable between dark green and red. It was painted further at its surface portions corresponding to gloves and boots with another paint including a quasi-reversible thermochromatic coloring reversibly changeable between brown and red. The point T_A was 10°C and the point T_B was 32°C for both the colorings. Thereby, a color memory soldier doll was obtained.

30 Figures 9 and 10 show the manner how to play with the toy soldier 20. Portions 21 of the chest, a shoulder and a leg of the toy soldier presenting dark green and brown respectively were warmed by breath by use of a gun-shaped breath blowing means (blowpipe) 22, which has a mouthpiece 23 and a projecting pipe 24. Thereby, the portions 21 turned red as if the toy soldier 20 had been injured (Figure 10). This aspect was held at the room temperature of about 28°C .

Next, when the toy soldier 20 was cooled below 10°C , the red portions 21 were returned to the original colors, and this appearance was also held at room temperature. It was possible to repeatedly play with the change.

According to the present invention, as described above with respect to the examples, it is possible to change the aspect of a part or all of the surface of a toy by use of a heating source or a cooling source commonly available. It is also possible to hold a desired appearance in

the range of ordinary temperature. Moreover, if each of the respective parts such as a face, hair, finger-nails (manicure), a dress & accessory, shoes, a hat, etc., of a doll is given a selective dual appearance, a single toy can be used which can exhibit a variety of appearances without exchanging those parts. The present invention can provide a variety of ways of playing with a single toy and can give a high additional value.

aims defining the invention are as follows:

1. A color memory toy, comprising:

a toy body having an outer surface; and a quasi-reversible thermochromic coloring material applied to said surface and having a temperature hysteresis characteristic for changing between a first and second colored state, wherein said material exhibits a complete change of color from said first colored state to said second colored state at an upper temperature^{T_B}_A above a first temperature when said material is heated, maintains a present one of said first and second colored states within a two-color holding temperature range between said first temperature and a second temperature lower than said first temperature, said first and second colored states being able to alternately appear within said two-color holding temperature range, and exhibits a complete change of color from said second colored state to said first colored state at a lower temperature^{T_A}_A below said second temperature when said material is cooled, wherein said two-color holding temperature range is from about 10°C to about 35°C.

2. A color memory toy as recited in claim 1, wherein both of said lower and upper temperatures are obtainable in human environment such as cold water, a human body, a hot water bottle and a hair dryer.

3. A color memory toy as recited in claim 2, wherein said lower temperature^{T_A}_A is within a range of from about 0°C to about 15°C and said upper temperature^{T_B}_A is within a range of from about 27°C to about 90°C.

4. A color memory toy as recited in claim 1, wherein said toy body has a 3-dimensional outer surface and said coloring material is applied to only a portion thereof.

5. A color memory toy as recited in claim 4, wherein said first and second colored states manifest different visible colors.

6. A color memory toy as recited in claim 4, wherein one of said first and second colored states manifest a visible color and the other of said first and second colored states is substantially colorless.

7. A color memory toy as recited in claim 4, further comprising a temperature invariant colored material applied between said thermochromic coloring material and said toy body.

8. A color memory toy as recited in claim 7, wherein said temperature invariant colored material is visibly patterned.

9. A color memory toy as recited in claim 1, further comprising a breath blowing means separate from said toy body, said breath blowing



means comprising a shaped body, a funnel-shaped mouthpiece on an outside of
said shaped body, and a pipe portion connected to said mouthpiece through said
shaped body, said pipe portion having an open end to be faced to said toy body
such that breath blown through the breath blowing means onto said toy body
causes it to change color.

10. A color memory toy substantially as hereinbefore described with
reference to the drawings.

DATED this FOURTH day of JANUARY 1991
Pilot Ink Co., Ltd.

Patent Attorneys for the Applicant
SPRUSON & FERGUSON



15248/88

FIG. 1

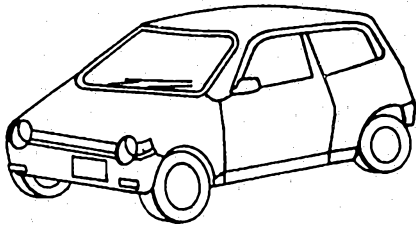


FIG. 2

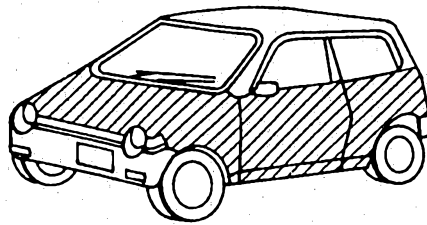


FIG. 3

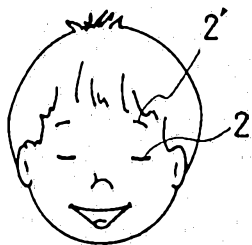


FIG. 4

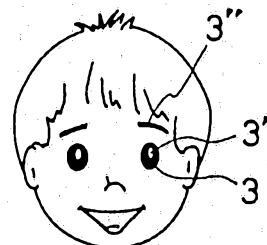


FIG. 5

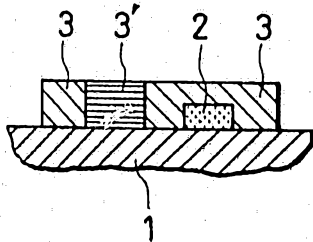
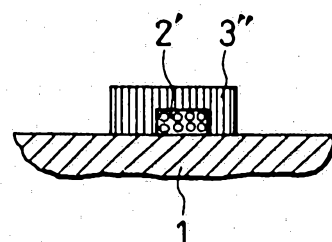


FIG. 6



15248/88

FIG. 7

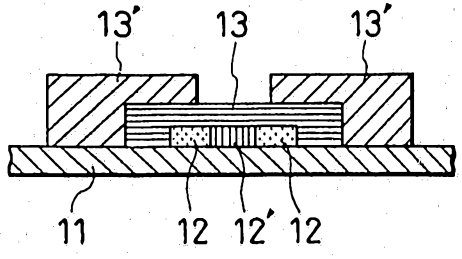


FIG. 8

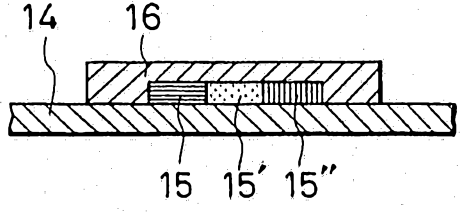


FIG. 11

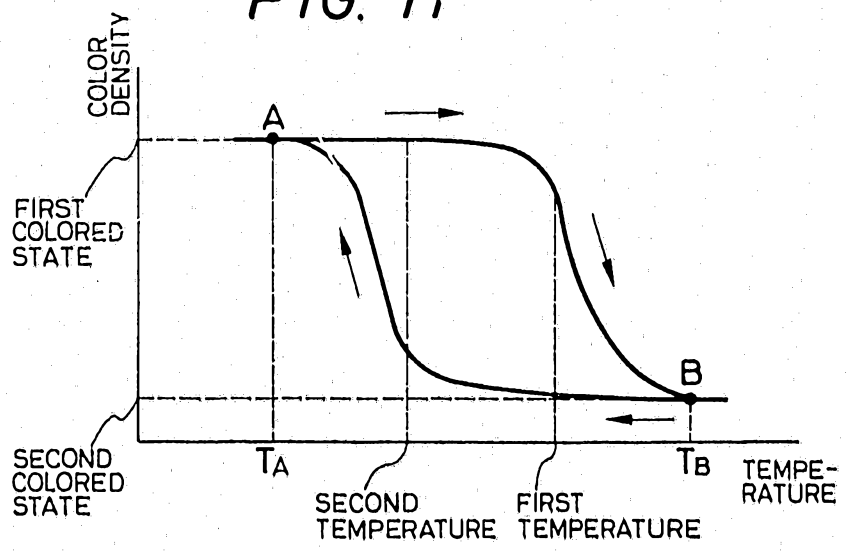


FIG. 9

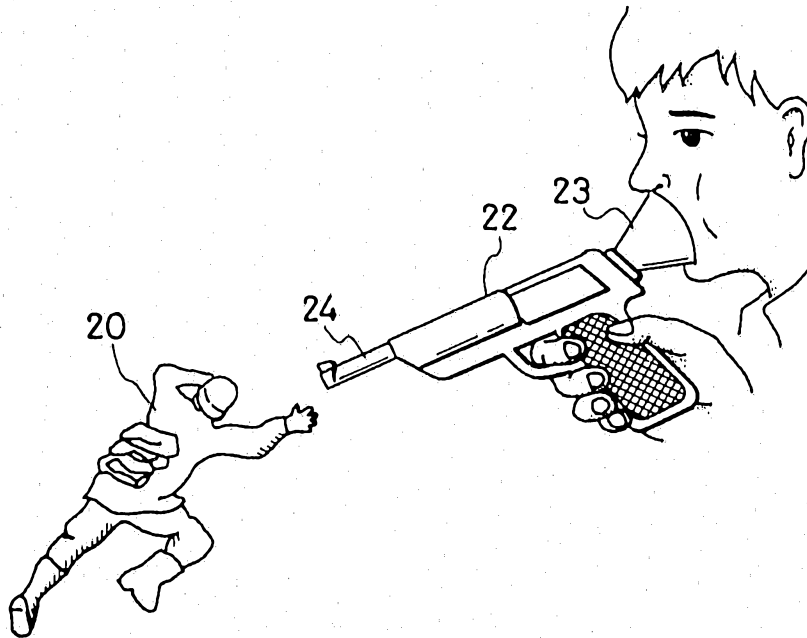


FIG. 10

