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LIGHT, AUDIO AND CURRENT RELATED ASSEMBLIES, ATTACHMENTS AND DEVICES WITH CONDUCTIVE COMPOSITIONS

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(57) Claim

1. An electrical system for use on an object, said electrical system comprising, at least one current operated module having means for affixing the module in a predetermined position on said object, battery pack means to provide the current for operating said at least one current operated module, and conductive composition means connecting said battery pack means to said at least one current operated module for delivering current to said current operated module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

8. A light illuminating assembly comprising:

- a. at least one LED module including, means for affixing said LED module in a predetermined position on an object,
- b. battery pack means to provide electrical power for illuminating said at least one LED module, and
- c. conductive composition means between the at least one LED module and the battery pack means for transmitting current to the at least one LED

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module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

13. A combination of an electrical system and objects, including:

- a. at least one current operated module with means for affixing said at least one current operated module in a predetermined position on at least one of the objects,
- b. battery pack means to provide electrical power for illuminating said at least one current operated module, and
- c. conductive composition means formed on said objects so when said objects are interconnected communication between the at least one current operated module and the battery pack means is established for transmitting current to the at least one current operated module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

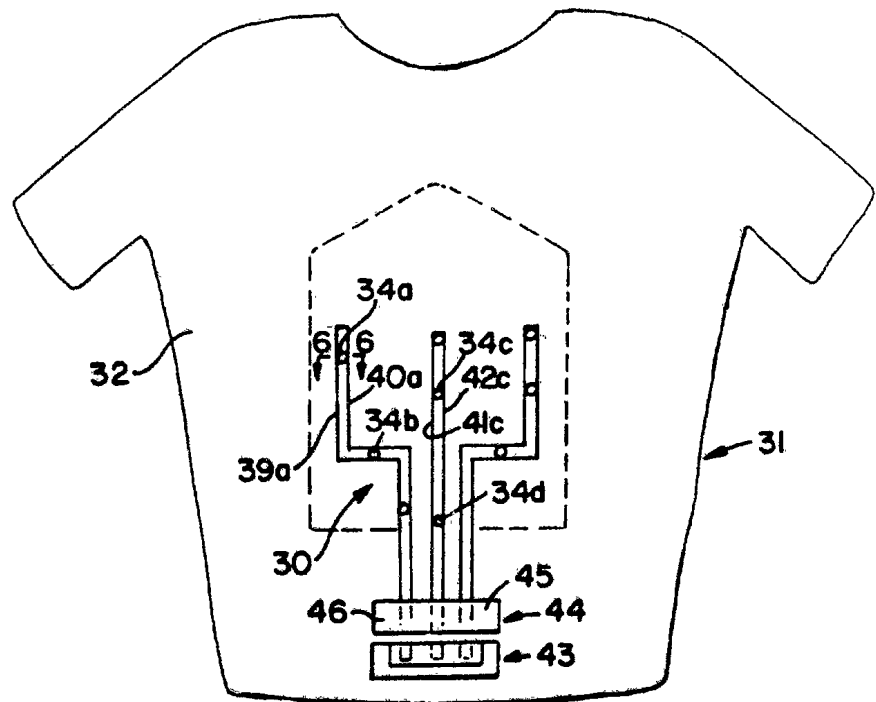


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(54) Title: LIGHT, AUDIO AND CURRENT RELATED ASSEMBLIES, ATTACHMENTS AND DEVICES WITH CONDUCTIVE COMPOSITIONS

(57) Abstract

Generally improved current related assemblies, attachment and devices have at least one current operated module (34a-34d) with means preferably for removably affixing said at least one current operated module (34a-34d) in a predetermined position on apparel (31), objects and things, battery pack means (43) to provide electrical power for operating said at least one current operated module (34a-34d), control means (43) operatively associated with said battery pack means (43) for controlling the operation of said at least one current operated module (34a-34d), and an improved and modified conductive composition (39a, 40a, 41c, 42c) including, a metallic mixture having silver and a plastisol to provide high conducting and low surface resistivity, printed, screened, painted, coated on or molded into said apparel (31), objects



and things including, connecting means (44) for removably connecting the deposited conductive composition (39a, 40a, 41c, 42c) to the at least one current operated module (34a-34d) and to the battery pack means and control means (43) to establish a current and signal flow path therebetween.

DESCRIPTION**LIGHT, AUDIO AND CURRENT RELATED ASSEMBLIES,****ATTACHMENTS AND DEVICES WITH CONDUCTIVE COMPOSITIONS****Technical Field:**

5 This invention relates generally to light
illuminating, light illuminating and sound, sound
alone and other current related operating assemblies,
attachments and devices for use in the actuation and
activation of motors and other mechanical devices, on
10 apparel, craft projects, toys, ceramic projects,
customized gifts, point of purchase displays,
advertising media and specialty applications, all
generally referred to as apparel, objects and things
and more particularly to light illuminating, light
15 illuminating and sound, or sound alone assemblies,
attachments and devices which include, conductive
compositions suitably affixed to the interior or
exterior of the apparel, objects and things so as to
define either a current flow path or both a current
20 flow path and a design and/or embodied in the design
so as to provide the desired current flow path on such
apparel, objects and things.

Background Art:

Conductive compositions when used herein are
25 intended to mean electrically conductive liquids,
inks, pastes and granules modified so they can be
relatively easily painted, deposited, screened, coated
or molded integrally with such apparel, objects and
things, and dried or cured by various known techniques
30 to become affixed thereto so as to function as part of
a given assembly, attachment, kit or device.

Such electrically conductive compositions
consist generally of a noble or base metal powder,
carbon, graphite or other conductive particles or
35 mixtures of the same, all combined in a suitable
vehicle which contains a solvent and has a desired
viscosity, and a resin which serves as a rheology
control agent and a binder when the paste is cured or

dried to maintain the conductive integrity of the conductive composition deposited on the apparel, objects and things. Such electrically conductive compositions may or may not include a colorant which can be a pigment or a dye.

5 A difference between the conductive composition used in the attachments, assemblies, kits and devices in accordance with the present invention is that they may provide high conductivity at the voltage required in a variety of configurations as is more fully described below.

10 This may be achieved by providing the conductive compositions with a high metallic composition including, silver and a plastisol based high conductivity compound. Such conductive composition may or may not include a colorant and are manufactured and marketed by Engelhard Corporation of East Newark, New Jersey. While colored conductive compositions are known where the conductive composition includes a colorant, they are more fully described in the Engelhard Corporation international application published as WO95/08829. That application describes a colored conductive composition comprising a colorant, conductive particles, a resin which can function as a binder, and optionally, a liquid which can be an organic liquid or water. There is from about 1 to about 20%, preferably 3 to 20%, and more preferably 5 to 15% based on the weight of the conductive particles of at least one colorant. The colorant can be a dye or a pigment and provide a color in the range from violet to red. This includes all of the colors that are in the visual light wave length band including white. A useful composition comprises from about 2 to 20% and preferably 5 to about 15% by weight of at least one binder. The binder is preferably a resin which can be a thermoplastic or thermosetting resin. There is about 40 to about 80% by weight and preferably 50 to 55% by weight of at least one conductive particle comprising metal or metal compounds, and graphite. Preferred metals or metal compounds include but are not limited to silver, gold, platinum, palladium, copper, brass, bronze, and aluminum. Preferred metal compounds include but are not limited to metal sulfides, carbides, carbonyls and nitrides. WO95/08829 is therefore incorporated by reference as part of the prior art background information.

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Although conductive compositions have been used in signal circuitry in

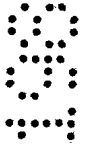


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small mechanical devices which are mechanically connected to each other or in applications where high conductivity was not needed, such conductive compositions did not provide the high conductivity requirements needed in the power circuits for the attachments, assemblies, kits and devices in accordance with the present invention.

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As for the known colored coating compositions, these are primarily compositions which are made either of conductive polymers which can be colored or use conductive particles which are colored or maintain the color inherent in the color of the



particles in the composition such as the natural color of silver, aluminum, copper, bronze, gold and carbon black.

5 Thus, the final conductive composition whether colored or not painted, printed, screened, coated onto or molded integrally with the article, object or things will have a relatively high conductivity and low surface resistivity to both transmit the current requirements and the operating signals for each such attachment, assembly, kit or device because the LED or light or sound modules or other current actuated elements being operated require relatively low electrical power or current at the required voltage.

15 Various electrically conductive compositions, their physical characteristics and the means for achieving the desired conductivity and resistivity conditions are illustrated in the said ~~co-~~ ^{international application WO 95/08829} ~~pending application U.S. Serial No. 08/126,342.~~ While ^{publication} the illustrated embodiments in said ~~application~~ ^{no. WO 95/08829} ~~442~~ are with respect to colored electrically conductive composition, those skilled in the art will readily recognize that the same physical, conductive and resistive characteristics can be achieved in ~~conductive compositions which are not colored, without departing from the scope of the present invention.~~

25 Usually such conductive compositions whether colored or not are in an organic system, but aqueous systems are also possible. They can be applied by forming the conductive composition into some form of film, liquid or paste and then printing, depositing, screening, painting, coating or molding the conductive composition onto or integrally with the substrate defining the apparel, objects and things followed with the step of drying and/or curing the conductive composition so applied to affix it in or on such apparel, objects and things.



In the present invention there are many different ways of applying and activating the conductive compositions which may be applied to different materials such as fabric, plastic, wood, paper, cardboard and rubber as may be required for the given application. These include:

1. painting, depositing, screening or coating the conductive composition directly on the exterior or interior of the particular substrate either independently of or as part of the particular design,

2. painting, depositing, screening or coating the conductive material directly on the exterior and then layering over the conductive material with the design, the underlayer providing the conductive current path, and the covering layer the design of non-conducting material so that the light illuminating and/or sound units can be brought into contact with the underlayer of conductive composition,

3. painting, depositing, screening or coating the conductive material on the inner surface, for example, a panel of fabric or other material, forming the design on the exterior of the fabric or other material so that the light illuminating or sound devices can be connected through the particular material to the associated conductive material, and

4. forming by molding or otherwise the conductive material either as part of plastic material such as in the form of stripes or on the surface of the particular plastic material so the light illuminating or sound devices can be connected thereto to provide the desired circuitry.

Thus the conductive compositions in the present invention have a wide and extensive usage depending on the application because the conductive composition can be applied independently or as part of the design where matching colors that are the same as the associated design are needed and the light

illuminating, sound devices or other current operated attachments can be easily connected into assembled and functioning positions.

One type of application for which the present application is particularly suited is to replace the known type of modern light illuminating, light illuminating and sound and/or sound alone assemblies, attachments, kits and devices generally characterized by at least the following elements, first a plurality of light emitting diode (LED) modules and/or sound modules, means for affixing, generally removably affixing, the LED modules and/or sound modules into assembled position, battery pack means to provide electrical power for illuminating said LED modules and/or operating the sound modules, control module means operatively associated with said battery pack means for controlling the operation of the LED and/or the sound modules, and physical, hard wire and the like current conducting connecting lines for independently connecting each or several of said LED and/or sound modules to said battery pack and operatively associated control means.

Such light illuminating, light illuminating and sound and sound alone assemblies, attachments, kits and devices are well known in the commercial marketplace, and there are a multitude of prior art patents which show and describe various such devices for use on apparel, objects and things for a corresponding wide variety of purposes as, for example, U.S. Patents 4,823,240; 4,709,307; 4,599,682; 4,570,206; 4,839,777; and 5,113,325.

All of these forms of assemblies, attachments, kits and devices required disassembly of some or all of the elements and parts in order, for example, to clean apparel on which they were mounted or to modify the connection in the system. Further, all of these prior art attachments, assemblies, kits and devices are characterized by the use of some form

of hard wire conductor, flexible circuit boards, flexible current conducting tapes which served as the current conducting means between the LED modules and/or sound modules and the battery pack and the control means for supplying current and signals.

5 The present invention improves and advances over all of the commercially known and the prior art patented attachments, assemblies, kits and devices by providing a substantially simple and cheap current
10 conducting means in the form of a conductive composition ~~either colored or not~~ modified to provide the necessary high conductivity and low resistivity characteristics, and means for connecting and delivering current and signals to the LED and/or sound
15 modules from the battery pack and the control means.

Thus the improved attachments, assemblies, kits and devices in accordance with the present invention require means for connecting the LED and/or sound modules to one end of the electrically
20 conductive composition painted, deposited, screened, coated or molded integrally with the substrate defining the apparel, objects and things and ^{may} provide a removable connection at the opposite end so that the battery pack and the control means operatively
25 associated with the LED and/or sound modules can be easily separated from the assembly.

Optionally the LED and/or sound modules can be removably connected to the substrate defining the apparel, objects and things to further facilitate
30 disassembly of the improved attachment, assemblies, kits and devices in accordance with the present invention.

Using the electrically conductive composition provides an improved attachment, assembly, kit or device and meets and overcomes the problems
35 associated with the disassembly of the light illuminating, light illuminating and sound, and sound alone attachments, assemblies, kits and devices for



the purpose of cleaning the associated apparel on which such attachments, assemblies, kits and devices are used. Further, however, it provides greater facility and flexibility in the uses and applications of light illuminating, light illuminating and sound or sound alone attachments, assemblies, kits and devices, for example, to toys, jigsaw puzzles, warning signals, advertisements, operation of motors and other mechanical things, etc., as is more fully described and illustrated herein.

The use of colored conductive coating compositions in such attachments, assemblies, kits and devices has particular significance from a commercial standpoint because it enables the manufacturers of various devices, assemblies, kits, toys, pop-up books and the like to be easily and cheaply designed, manufactured and sold into the commercial marketplace.

Summary of the Invention:

Thus the present invention provides generally improved attachments, assemblies, kits and devices having at least one current operated module with means for affixing said current operated module in a predetermined position on apparel, objects and things, battery pack means to provide electrical power for operating said at least one current operated module, control means operatively associated with said battery pack means for controlling the operation of said at least one current operated module, and electrically conductive means including, conductive composition means with or without colorant affixed to the apparel, objects and things for communication with the at least one current operated module and connecting means remote from the current operated modules for removably connecting the conductive composition means to the battery pack means and the control means.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided an electrical system for use on an object, said electrical system comprising, at least one current operated module having means for affixing the module in a predetermined position on said object, battery pack means to provide the current for operating said at least one current operated module, and conductive composition means connecting said battery pack means to said at least one current operated module for delivering current to said current operated module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

According to another aspect of the present invention there is provided a light illuminating assembly comprising:

- a. at least one LED module including, means for affixing said LED module in a predetermined position on an object,
- b. battery pack means to provide electrical power for illuminating said at least one LED module, and
- c. conductive composition means between the at least one LED module and the battery pack means for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

According to a further aspect of the present invention there is provided a combination of an electrical system and objects, including:

- a. at least one current operated module with means for affixing said at least one current operated module in a predetermined position on at least one of the objects,
- b. battery pack means to provide electrical power for illuminating said at least one current operated module, and
- c. conductive composition means formed on said objects so when said objects are interconnected communication between the at least one



current operated module and the battery pack means is established for transmitting current to the at least one current operated module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

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According to a still further aspect of the present invention there is provided a combination of an electrical system with a jigsaw puzzle having a plurality of interconnecting pieces, including:

- a. at least one LED module with means for affixing said LED module in a predetermined position on at least one of the interconnecting pieces of said jigsaw puzzle,
- b. battery pack means to provide electrical power for illuminating said at least one LED module, and
- c. conductive composition means affixed on said interconnecting pieces of said jigsaw puzzle so when they are interconnected to form the jigsaw puzzle communication between the at least one LED module, the battery pack means is established for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

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According to a still further aspect of the present invention there is provided a combination of an electrical system with toy blocks having a plurality of interconnecting pieces, including:

- a. at least one LED module with means for affixing said LED module in a predetermined position on at least one or more of the interconnecting pieces of said toy blocks,
- b. battery pack means to provide electrical power for illuminating said at least one LED module, and
- c. conductive composition means formed on said interconnecting pieces of the toy blocks so when they are interconnected, communication between

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the at least one LED module and the battery pack means is established for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

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Throughout the description and claims of this specification, the word "comprise" and variations of the word, such as "comprising" and "comprises", are not intended to exclude other components or integers.

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Further objects and advantages and a better understanding of the present invention will become apparent from the ^{following} detailed description ^{of preferred embodiments} ~~which follows~~ taken in connection with the accompanying drawings in which:

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Brief Description of the Drawings:

FIGURE 1 is a diagrammatic sketch of an article of clothing having affixed thereto one form of light illuminating assembly in accordance with the present invention in which the conductive composition is affixed to the exterior of the garment in operative association with the design, decoration, slogan, etc. also on the exterior of the garment,

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FIGURE 2 is a diagrammatic sketch showing how one of the LED modules are connected across the conductive composition stripes of the light illuminating assembly shown in FIGURE 1,

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FIGURE 3 is a schematic diagram for the current carrying circuit for the light illuminating assembly shown in FIGURES 1 and 2 of the drawings,

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FIGURE 4 is an exploded view of one form of composite battery pack and control member and the operative connection thereto of one end of the respective conductive composition stripes for the assembly shown in FIGURE 1 of the drawings,

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FIGURE 5 is a diagrammatic sketch of an article of clothing having affixed thereto another form of light illuminating assembly in accordance with the present invention in which the conductive composition is affixed to the interior of the garment to enable the LED or sound modules of the assembly to be disposed for operative association with the design, decoration, slogan, etc., disposed on the exterior of the garment,

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FIGURE 6 is an enlarged cross-section taken on line 6-6 of FIGURE 5 showing one means for removably connecting the LED module in assembled

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position on the front panel of the article of clothing shown in FIGURE 4,

5 FIGURE 7 is an enlarged view of the removable connection shown in FIGURE 5 between the conductive composition printed, painted, screened or coated on the interior of the apparel and the battery pack and control means for supplying current and for operating the LED modules,

10 FIGURE 8 is a plan view of a disassembled jigsaw puzzle having the conductive composition painted across the various pieces of the jigsaw puzzle and interconnected to a composite battery pack and control module to provide an assembly in accordance with the present invention,

15 FIGURE 9 is a schematic diagram of the current carrying circuit for the assembly on the jigsaw puzzle shown in FIGURE 8,

20 FIGURE 10 is an exploded view of the composite battery pack and control member for the assembly on the jigsaw puzzle shown in FIGURE 8,

25 FIGURE 11 is a plan view of a jigsaw puzzle with a light illuminating assembly in accordance with the present invention affixed to pieces and parts of the puzzle so that the LED modules are disposed in series with the current and control sources for the light illuminating assembly,

30 FIGURE 12 is a plan view of another jigsaw puzzle with a light illuminating assembly in accordance with the present invention affixed so that individual sound modules are associated with pieces of the jigsaw puzzle and are independently connected in parallel respectively to the current and control sources so they can be separately operated,

35 FIGURE 13 is an exploded perspective front view of children's toy blocks having a light illuminating assembly in accordance with the present invention affixed thereon and showing the composite

battery pack and control member connected to the conductive composition formed on the various toy blocks,

5 FIGURE 14 is a perspective side view of one of the toy blocks shown in FIGURE 13 showing the conductive paint thereon and the associated composite battery pack and control member mounted in the illustrated block,

10 FIGURE 15 is a schematic diagram of the current carrying circuit for the light illuminating assembly in accordance with the present invention as shown in FIGURE 13, and

15 FIGURE 16 is a diagrammatic front view of a sweatshirt having still another form of the present invention thereon in which the conductive composition materials are so affixed that they are incorporated into the fabric of the sweatshirt and enable merely touch activation of the attachment, assembly, kit or device connected to the garment or apparel.

20 Description of One Embodiment:

 Referring to FIGURES 1 to 4 of the drawings, one form of an attachment in accordance with the present invention shows a garment in the form of a sweatshirt generally designated 10 having a decoration 25 11 of a Christmas tree on the outer surface of the front panel 12 which is generally screened or otherwise printed thereon. Garments with these and other decorations are available in the commercial marketplace and hence do not have to be more fully 30 described.

 Those skilled in the art will readily understand that while a sweatshirt is illustrated, this and such other forms of the attachments, assemblies, kits and devices in accordance with the 35 present invention can be applied to any piece of apparel or to various forms of fabric and the like materials without departing from the scope of the invention.

In the attachment, assembly or device generally designated 13 in accordance with the present invention, the improved conductive composition in the form of two spaced lines as at 14 and 15 are printed, painted, deposited, screened or coated on the outer surface of the front panel 12 about the periphery of the Christmas tree decoration 11 so that a plurality of randomly spaced LED modules 16a, 16b, 16c, etc. can be connected by their respective current conducting connecting lines, for example, lines 17 and 18 for the LED module 16a, across the conductive composition lines 14 and 15, all of which is clearly shown in FIGURES 1, 2 and 3 of the drawings.

The ends 19 and 20 of the conductive composition lines 14 and 15 remote from the positions where the various LED or sound modules 16a, 16b, 16c, etc. are connected to the exterior of the sweatshirt 10, are detachably connected by any suitable means such as male plug-in connectors 21 and 22 to female connectors, not shown, on a printed circuit board generally shown at 23 having an IC chip 24 which is operatively connected to a suitable electrical power source such as batteries 25a and 25b.

The printed circuit board 23 is part of the composite battery pack and control member generally designated 26 and shown in exploded form at FIGURE 4. The composite battery pack and control member 26 also include other elements such as an on-off switch 27 for placing the attachment, assembly, kit or device into operation for delivering power and operating signals to the LED modules as at 16a, 16b, 16c, etc. and/or sound modules which can also be added to the circuit by connecting them across the conductive composition stripes 14 and 15 in the same manner as above described for the LED modules and as shown at FIGURE 2 of the drawings.

The electrical circuit for this attachment, assembly, kit or device in accordance with the present

invention is illustrated at FIGURE 3 and like numbers corresponding to the parts as above described are also shown in this FIGURE 3.

Description of Another Embodiment:

5 Referring further to the drawings, FIGURES
3, 4 and 5 illustrate another form of assembly,
attachment, kit or device generally designated 30 in
accordance with the present invention also as applied
for use on apparel, such as a sweatshirt 31. In this
10 form of the invention the conductive composition is
coated on the interior surface of the garment, and the
LED and/or sound modules are connected to the
conductive composition and extend to the exterior of
the garment as will now be more fully described,

15 Thus, sweatshirt 31 has a panel 32. On the
outer surface, not shown, the panel will have a
design, decoration, slogan, name, etc. which is
generally indicated by the dotted lines 33. Such
designs, decorations, etc. can be printed, screened,
20 painted or hot stamped on the outer face of the panel.
Sweatshirts bearing such decorations, designs,
slogans, etc. as indicated in the first form of the
invention above described are well known in the
commercial marketplace and accordingly will not be
25 more fully illustrated or described.

In accordance with the general concept and
uses of light illuminating, light illuminating and/or
sound assemblies, kits or devices, the light
illuminating, light illuminating and/or sound or sound
30 alone attachment or assembly, kit or device 30 is
affixed or attached to the inner surface of panel 32
and so assembled thereon as is hereinafter described
to illuminate or be otherwise operatively associated
with the design, decoration, etc. 33 on the outer
35 surface of the panel 32.

Thus, the attachment, assembly, kit or
device 30 as illustrated includes, a plurality of LED
modules 34a, 34b, 34c and 34d, etc. which extend

through a corresponding plurality of slits or openings in panel 32, only one of which is illustrated as at 35a in the FIGURE 2 cross-section of the drawings for LED module 34a.

5 In FIGURE 2 one form for removably affixing the LED module into assembled position is shown as including, an LED module threaded about the exterior adjacent the lower end as at 36a so that when the LED module is extended through the slit or opening 35a in
10 the panel 32, a matching threaded element 37a can be removably threaded on the LED module 34a to hold the same in assembled position and permit the easy removal thereof for any purpose. The removable connecting means illustrated at FIGURE 2 is the subject matter of
15 and is shown and described more fully in co-pending application U.S. Serial No. 08/004,718 filed January 14, 1993, now U.S. Patent No. 5,278,734.

The LED modules 34a, 34b, 34c, 34d, etc. have there respective current conducting lines as, for
20 example, at 38a and 39a for the LED module 34a shown in FIGURE 2, connected by any suitable means to conductive composition lines painted, printed, screened or coated onto the inner surface of panel 32 in two striped lines as at 39a and 40a for LED modules
25 34a and 34b and 41c and 42c for LED modules 34c and 34d. While the LED modules illustrated are connected in groups of two LED modules to their associated conductive composition striped lines, those skilled in the art will readily recognize that this is solely for
30 illustration purposes and that there could be one or more LED modules and/or sound modules on a given pair of conductive composition stripes without departing from the scope of the present invention.

In this regard it is known in the art that
35 individual LED modules can be separately connected to hard wire or the like type current conducting lines in order to give the LED modules greater freedom of

movement for illuminating the design, decoration, slogan, etc. on the front panel of the sweatshirt or other garment.

5 Such structure is rendered unnecessary by the use of the modified conductive composition means in accordance with the present invention because the modified conductive composition is affixed to the inner or outer face of the fabric forming the panel 32 and is washable therewith, and the positioning or
10 repositioning of the LED or sound modules can be easily accomplished with respect to the modified conductive composition.

The respective conductive composition stripes 39a, 40a, 41c and 42c forming the current and
15 signal flow path on the inner surface of the panel 32, at the end remote from or spaced from the sections connected to the LED modules 34a, 34b, 34c, 34d, etc., communicate with a composite battery pack and control member 43 through a removable or detachable connector
20 generally designated 44 in such a way that the battery pack and control member 43 can be removed and replaced from assembled position on the inner surface of the panel 32. Thus, when it is necessary or desirable to clean the sweatshirt, not only can the LED modules be
25 removed and replaced but also the combined battery pack and control unit can also be removed and replaced with relative ease. However, because of the characteristics of the modified conductive composition, the garment or apparel on which it is
30 printed, screened or coated can be washed without damage to the conductive composition means thereon.

In the present illustrated form of the invention, the removable and detachable connector 44 consists of a VELCRO® fastener which is not only used
35 for this purpose but also is treated to make it conductive for operative association with the conductive composition stripes to provide the

operative communication between the LED modules 34a, 34b, 34c, 34d, etc. with the battery pack which supplies the current and power for operating the LED modules and the control means which supplies the electronic signals for operating the LED modules.

VELCRO® fasteners are known in the art, but the VELCRO® fastener which serves as the removable and detachable connector 44 must be modified by adding the conductive composition for the present illustrated form of light illuminating assembly, kit or device. Thus, the first VELCRO® member 45 of the modified VELCRO® fastener defining the removable and detachable connector 44 is painted or coated with conductive composition and affixed to the inner surface of panel 32 such as by epoxy or sewing the same in assembled position so that the respective conductive composition stripes 39a, 40a, 41c and 42c, etc. can in turn be brought into conductive communication with the first VELCRO® member 45 by any suitable means such as overlapping, abutment or adhering the same to the conductive composition stripes 39a, 40a, 41c, 42c, etc., all of which is clearly shown in FIGURES 5 and 7 of the drawings.

The associated second VELCRO® member 46 serves two purposes. First, it is also modified by painting or coating with the conductive composition so as to provide communication with the electrical power source and electronic signals provided by the combined battery pack and control 43 but in assembled position communicates with the conductive composition on the first VELCRO® member 45 to enable the current and control signals from the combined battery pack and control 43 to be transmitted and transferred through the conductive composition stripes 39a, 40a, 41c and 42c, etc. to the LED modules. Second, the modified VELCRO® fastener which defines the removable and detachable connector 44 provides for a simple

removable connecting means for the combined battery pack and control 43 so it can be removed and replaced as may be necessary or desirable for any reason.

5 While this embodiment of the invention is illustrated for a piece of apparel, those skilled in the art will readily recognize that the light illuminating assembly, kit or device illustrated in FIGURES 5, 6 and 7 can be applied to any type of apparel, fabrics, wearable and non-wearable clothing
10 such as T-shirts, safety uniforms, natural or man-made material, and to objects and things such as hats, umbrellas, shoes, goggles or glasses, headbands, armbands, knapsacks, drinking glasses and other vessels.

15 Further, while a light illuminating attachment, assembly, kit or device has been illustrated that a light illuminating and/or sound, or sound alone attachment, assembly, kit or device can also be used without departing from the scope of the
20 present invention. Such variations are adapted to provide a corresponding myriad of applications, for example, to identify slogans, for advertising purposes and for safety and health purposes.

A light illuminating assembly, kit or device
25 in accordance with the present invention, because of the use of the conductive composition stripes as the element for carrying the electrical current and control signals between the battery pack and the LED and/or sound module, can be easily adapted for use on
30 games or toys as is illustrated in FIGURES 8 to 15 now to be described.

Description of Another Embodiment:

FIGURE 8 shows a light illuminating and or
sound device attachment, assembly or device in
35 accordance with the present invention as applied to a jigsaw puzzle generally designated 50 having a plurality of associated and interconnecting pieces as

at 51a, 51b, 51c, 51d, etc. by which the jigsaw puzzle is established when in use, and on which the conductive composition is painted, deposited, screened or coated as a plurality of pairs of current
5 conducting stripes as at 52a and 52b; 53a and 53b; 54a and 54b, etc. on the back surface of the associated interconnecting pieces of the jigsaw puzzle so that either a plurality of LED modules, LED and sound modules or sound modules, not shown in FIGURE 8 but
10 illustrated in FIGURES 11 and 12 to be described, can be connected across the conductive composition stripes 52a and 52b; 53a and 53b; and 54a and 54b.

While reference has been made to painting or coating the conductive composition on the back surface
15 of the pieces of the jigsaw puzzle, it is also possible to use either a colored conductive composition and/or a colorless conductive composition so that the conductive composition stripes 52a, 52b, 53a, 53b, 54a, 54b, etc. can be printed, painted,
20 screened, deposited or coated on the front or outer surface of the pieces 51a, 51b, 51c, 51d, etc. of the jigsaw puzzle.

The conductive paint will communicate at one end through a suitable releasable connector member
25 generally designated 55 to a composite battery pack and control member 56, such as the same type of VELCRO® fastener as above described for the form of the invention as shown in FIGURES 5, 6 and 7.

This combination of elements for a light
30 illuminating assembly, kit or device in accordance with the present invention allows for a wide variety of operative arrangements to be associated with the assembly of the pieces of the jigsaw puzzle. It also permits the introduction of musical or other sound
35 attachments, not shown, which can also be connected in series or parallel to the conductive paint stripes.

Description of Another Embodiment:

FIGURE 11 illustrates a jigsaw puzzle generally designated 60 after the pieces 61a, 61b, 61c, 61d, etc. have been fully assembled with a light illuminating assembly, kit or device in accordance with the present invention thereon in which the LED modules 62a, 62b, 62c, 62d, etc. are connected in series on the associated conductive composition stripes 63 and 64 disposed on the back surface of the respective pieces 61a, 61b, 61c, 61d, etc. for the given jigsaw puzzle.

The conductive composition stripes 63 and 64 communicate at the end remote from the point of attachment of the respective LED modules is connected by a suitable releasable connector generally designated 65 to the composite battery pack and control member generally designated 66 so that the operating current and signals can be transmitted through the conductive composition stripes 63 and 64 to the LED modules 62a, 62b, 62c, 62d, etc.

One form of composite battery pack and control member is shown at FIGURE 10 of the drawings, and the circuitry therefor is shown at FIGURE 9 of the drawings. Such composite battery pack and control members and the circuitry associated therewith are available on the open market and accordingly are not more fully described as they will be easily understood by those skilled in the art.

Description of Another Embodiment:

FIGURE 12 shows the use of another attachment, assembly, kit or device in accordance with the present invention for use on a jigsaw puzzle which differs from the form of the invention as illustrated in FIGURE 11 in that the assembly uses sound modules which are independently connected by parallel conductive composition stripes to the composite battery pack and control member.

Thus, referring to FIGURE 12 the jigsaw puzzle generally designated 70 consists of a plurality of associated and interconnected jigsaw puzzle pieces as at 71a, 71b, 71c, etc. which have been fitted together to provide the finished jigsaw puzzle 70. Spaced on various of the associated and interconnected pieces 71a, 71b and 71c, etc. of the jigsaw puzzle 70 are sound modules diagrammatically illustrated as at 72a, 72b, 72c and 72d so that when the said pieces of the jigsaw puzzle 70 are assembled, the respective sound modules will in turn be electrically connected to operatively associated pairs of conductive paint stripes as at 73a and 73b for sound module 72a; 74a and 74b for sound module 72b; 75a and 75b for sound module 72c; and 76a and 76b for sound module 72d. Each of these respective pairs of conductive paint stripes at the end of the respective pairs of paint stripes remote from the end connected to its associated sound module will in turn be connected to a suitable releasable connecting assembly generally designated 77; such as by a VELCRO® connector as above described for the form of the invention shown in FIGURES 5, 6 and 7. However, in this form of the invention, the respective sound module 72a, 72b, 72c and 72d can represent four different sounds; for example, a cat, a horn, etc. when the sound is touched. In order to accomplish this, the respective conductive composition stripes 73a, 73b, 74a, 74b, 75a, 75b, 76a and 76b represented by the character numerals A, B, C and D are connected by any suitable male plug means, not shown, which fits into a female plug assembly, as at 55 on the composite battery pack and control member 56 shown in FIGURE 10 of the drawing, and at the circuitry therefore as shown at FIGURE 11. The composite battery pack and control member 78 is substantially identical to that shown by the circuitry and exploded view at FIGURES 9 and 10.

In this form of the attachment, assembly, kit or device in accordance with the present invention, the sound modules and their associated pairs of conductive paint stripes are independently
5 connected to the composite battery pack and control member 78, hence the desired operation for the sound modules 72a, 72b, 72c and 72d will become a function of the setting in the control member chip of the composite battery pack and control member 78.

10 As in the earlier forms of the present invention above described, one type of composite battery pack and control member is shown at FIGURE 10. These devices are known as are the electronic chips which provide the desired forms of operation and are
15 available in the commercial marketplace. Accordingly these composite units as shown herein have not been more fully described because they will be understood by those skilled in the art.

Description of Still Another Embodiment:

20 To demonstrate the versatility of the present invention, still another form of light illuminating assembly, kit or device is shown at FIGURES 13, 14, 15 and 16 as being used in conjunction or in combination with toys such as an erector set,
25 building blocks, etc.

Thus, referring to FIGURES 13 and 14 one type of well known children's building blocks generally designated 80 is shown having a plurality of building block pieces as at 81a, 81b, 81c and 81d,
30 which are made so that when the blocks are interconnected one with the other, they can form, for example, the column as diagrammatically illustrated in FIGURE 13.

35 Toys, games and other devices such as these are available in the commercial marketplace as, for example, erector sets, LEGO® building block sets, etc.

All of these sets, toys, games and other devices are characterized by associated and interconnected parts by which buildings, mechanical devices and other shapes, designs and forms may be formulated.

5 The present invention is particularly adapted for application to these toys, games and other devices with associated and interconnected parts because the conductive paint stripes for transmitting the current and power for illuminating any LED modules
10 and/or operating audio devices as well as the electronic signals for operating such LED modules and/or audio devices can be easily applied to the associated and interconnected parts as by painting, coating, printing, screening or molding integrally
15 with the blocks so that when the parts are together, an electrically and electronic line for current and other signals is established.

 The high conductivity of the conductive compositions is ideally suited for such mechanically
20 interconnected parts first because it can be deposited on the interchangeable or interconnected parts in such a number of different ways, and second because the conductive composition when so painted, printed, screened, coated on the interconnecting parts or
25 molded integrally therewith provides a relatively low circuit resistance without impairing the high conductivity of the conductive composition.

 Thus, in FIGURES 13 and 14 the conductive paint stripes are shown as at 82a and 82b for building
30 block piece 81a, 83a and 83b for building block piece 81b, 84a and 84b for building block piece 81c, and 85a and 85b for building block piece 81d. Each of the conductive paint stripes 82a, 82b, 83a, 83b, 84a, 84b, 85a and 85b will be so affixed to the building blocks
35 or molded into the building blocks that they will be in conductive contact with each other when the building blocks 81a, 81b, 81c and 81d are assembled together.

Further, as shown in FIGURES 13 and 14, conductive composition stripes can also be painted, printed, coated, screened or molded so they will provide a current and signal flow path on the inside of the building block piece as at 86a and 86b for building block piece 81a or 81d. Connecting conductive paint stripes across the bottom of the building block piece as at 86a and 86b can thus be provided so that the LED module 87 which is affixed or removably connected in the side of the building block 81a or 81d can have its electrical conducting lines as at 82a and 82b connected to the respective connecting conductive composition stripes on the interconnected building blocks for communication with the associated and interconnected conducting composition stripes 82a, 82b, 83a, 83b, 84a, 84b, 85a and 85b for the building block pieces 81b, 81c and 81d.

The composite battery pack and control member can be mounted in one of the associated and interconnected building block pieces, as indicated by the dotted lines for building block 81d, and any suitable type of connector assembly for connecting the composite battery pack and control member to the conductive composition stripes will provide means for transmitting the current and signals from the composite battery and control member to said conductive composition stripes and the associated LED modules and/or audio devices.

Description of a Still Further Embodiment of the Invention:

The modified conductive composition is adapted to provide a still further attachment, assembly, kit or device in accordance with the present invention in which the LED and/or sound modules can be touch activated by the wearer of the garment or apparel on which the attachment, assembly, kit or device is mounted.

Thus, by reference to FIGURE 16 of the drawings, a sweatshirt generally designated 90 is shown having a panel 92 with a design decoration, slogan, etc. generally designated 92 as shown by the dotted lines thereon which is a common article of commerce.

Integrally affixed in any manner as above described into the fabric of the sweatshirt 90 is the modified conductive composition material as indicated by the stripes 93a and 93b; 94a and 94b; and 95a and 95b.

The conductive composition stripes 93a and 93b communicate at one end with a switch means 96 and at the end remote therefrom with a composite battery pack and control member 97 so that when the switch 96 is touched by the wearer of the sweatshirt, the composite battery pack and control member 97 is activated to deliver current and operating signals to the associate conductive composition stripes 94a, 94b, 95a and 95b so that randomly connected LED modules as at 97a, 97b, 97c and 97d connected to the conductive composition stripes 94a and 95b; and the randomly connected sound modules as at 98a, 98b, 98c, 98d and 98e will be activated and operated.

The composite battery pack and control module 97 and the switch 96 and spaced LED modules 97a, 97b, 97c and 97d and 98a, 98b, 98c, 98d and 98e are all connected so as to facilitate the operation by touch control of this type of attachment.

While the foregoing description illustrates various preferred embodiments of apparatus and systems in accordance with the present invention, it will be appreciated that certain changes and modifications may be made in the structure of these disclosed arrangements without departing from the spirit and scope of the invention and that the same is defined by the claims as hereinafter set forth.

Industrial Applicability:

Current conductive compositions are provided and used on all types of substrates in assemblies, attachments and devices for transmitting current and operating signals from a current operating module having an electrical power source to motion, lights, audio equipment and other electrically operated devices. The current conductive compositions replace and supersede hard wire conductors in electrical current carrying circuits.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An electrical system for use on an object, said electrical system comprising, at least one current operated module having means for affixing the module in a predetermined position on said object, battery pack means to provide the current for operating said at least one current operated module, and conductive composition means connecting said battery pack means to said at least one current operated module for delivering current to said current operated module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

2. The electrical system of claim 1 including, means for detachably connecting said conductive composition means to said battery pack means.

3. The electrical system of claim 1 wherein the current operated module is an LED unit, and the LED unit is removably connected to said object.

4. The electrical system of claim 1 wherein the conductive composition means has a relatively high conductivity and low resistivity to transmit relatively low electrical current at the required voltage.

5. The electrical system of claim 1 wherein:

- a. the object has a portion thereof forming a panel,
- b. said conductive composition means is affixed to said panel, and
- c. the current operated module is removably connected in assembled position to said panel and communicates with said conductive composition means.

6. The electrical system of claim 1 wherein the conductive composition means has a high silver content and includes, a plastisol to facilitate the affixation



thereof to said object.

7. The electrical system of claim 1 further comprising means for controlling and signalling the operation of said at least one current operated module.

5

8. A light illuminating assembly comprising:

a. at least one LED module including, means for affixing said LED module in a predetermined position on an object,

b. battery pack means to provide electrical power for illuminating said at least one LED module, and

10

c. conductive composition means between the at least one LED module and the battery pack means for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

15

9. The light illuminating assembly of claim 8 wherein the conductive composition means has a relatively high conductivity and low resistivity to transmit low electrical current at the required voltage.

20

10. The light illuminating assembly of claim 8 including:

a. means for removably connecting said battery pack means to said conductive composition means, and

25

b. means on the connecting means for conducting current to the conductive composition means from the battery pack means.

11. The light illuminating assembly of claim 10 wherein:

a. the removable connecting means is a "VELCRO" fastener having one side disposed for contact and communication with the conductive composition means, and

30



b. the opposite side of the "VELCRO" fastener is operatively connected to the battery pack means to permit the removal thereof from assembled position.

12. The light illuminating assembly of claim 8 further comprising means for
5 controlling the operation of said at least one current operated module.

13. A combination of an electrical system and objects, including:

a. at least one current operated module with means for affixing said at least
one current operated module in a predetermined position on at least one of
10 the objects,

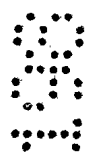
b. battery pack means to provide electrical power for illuminating said at least
one current operated module, and

c. conductive composition means formed on said objects so when said
objects are interconnected communication between the at least one
15 current operated module and the battery pack means is established for
transmitting current to the at least one current operated module, said
conductive composition means including a colorant wherein said colorant
is a substantially non-conductive portion of said conductive composition
means and is distributed throughout said conductive composition means.

14. The combination of claim 13 wherein the conductive composition means
has a relatively high conductivity and low resistivity to transmit low electrical
current at the required voltage.

15. The combination of claim 13 including, means for removably connecting
25 said battery pack means and the control means to said conductive composition
means and means on the connecting means for conducting current to the
conductive composition means from the battery pack means and the control
means.

30



16. The combination of claim 13 further comprising means for controlling the operation of said at least one current operated module.

17. A combination of an electrical system with a jigsaw puzzle having a plurality of interconnecting pieces, including:

- 5
- a. at least one LED module with means for affixing said LED module in a predetermined position on at least one of the interconnecting pieces of said jigsaw puzzle,
- 10
- b. battery pack means to provide electrical power for illuminating said at least one LED module, and
- 15
- c. conductive composition means affixed on said interconnecting pieces of said jigsaw puzzle so when they are interconnected to form the jigsaw puzzle communication between the at least one LED module, the battery pack means is established for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

20

18. The combination of claim 17 wherein the conductive composition means has a relatively high conductivity and low resistivity to transmit low electrical current at the required voltage.

25

19. The combination of claim 17 including, means for removably connecting said battery pack means to said conductive composition means and means on the connecting means for conducting current to the conductive composition means from the battery pack means.

30

20. The combination of claim 17 further comprising means for controlling the operation of said at least one current operated module.



21. A combination of an electrical system with toy blocks having a plurality of interconnecting pieces, including:

a. at least one LED module with means for affixing said LED module in a predetermined position on at least one or more of the interconnecting pieces of said toy blocks,

5

b. battery pack means to provide electrical power for illuminating said at least one LED module, and

c. conductive composition means formed on said interconnecting pieces of the toy blocks so when they are interconnected, communication between the at least one LED module and the battery pack means is established for transmitting current to the at least one LED module, said conductive composition means including a colorant wherein said colorant is a substantially non-conductive portion of said conductive composition means and is distributed throughout said conductive composition means.

10



15

22. The combination of claim 21 wherein the conductive composition means has a relatively high conductivity and low resistivity to transmit low electrical current at the required voltage.



20

23. The combination of claim 21 including, means for removably connecting said battery pack means to said conductive composition means and means on the connecting means for conducting current to the conductive composition means from the battery pack means.



25

24. The combination of claim 21 further comprising means for controlling and signalling the operation of said at least one current operated module.



25. An electrical system according to claim 1 and substantially as herein described with reference to the accompanying drawings.

5

DATED: 6 January, 1998

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ATTORNEYS



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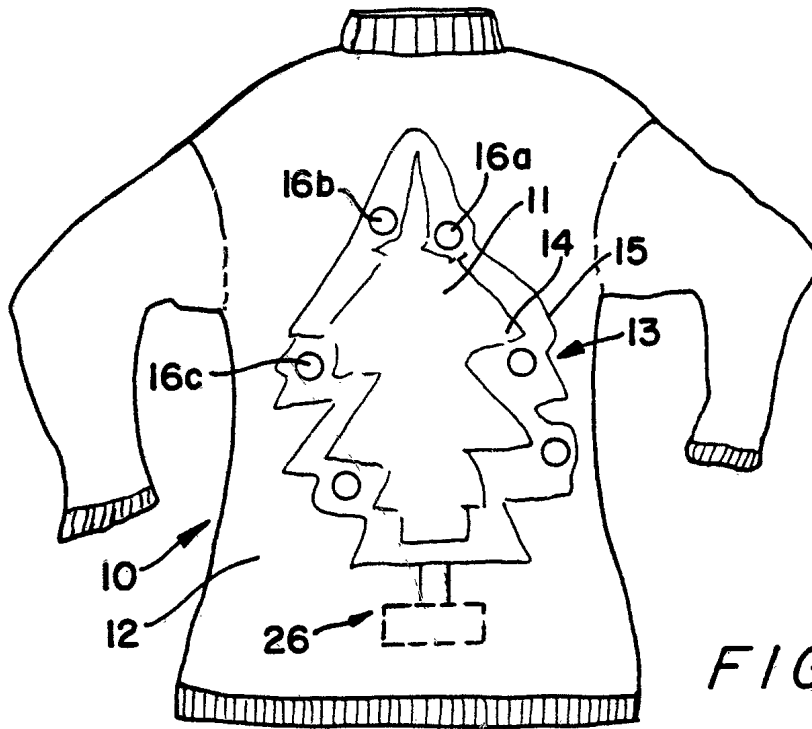


FIG. 1

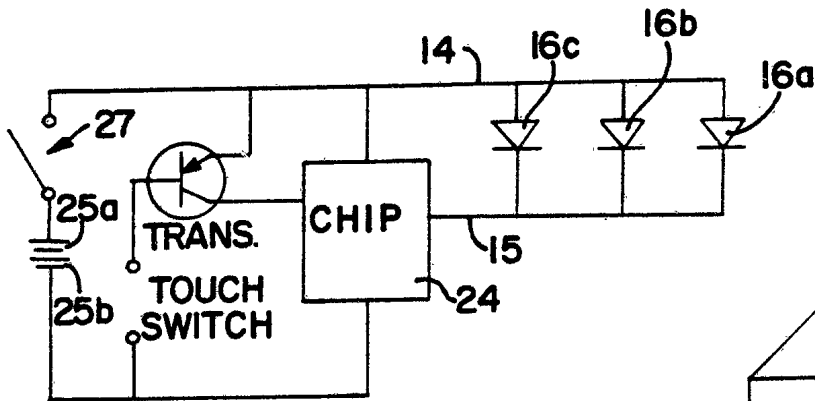


FIG. 3

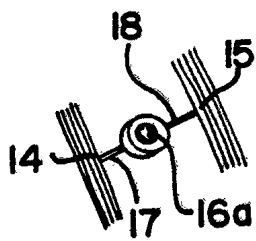


FIG. 2

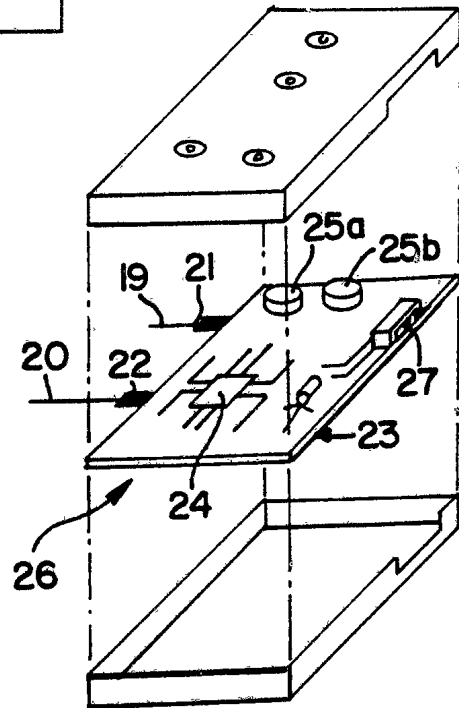


FIG. 4

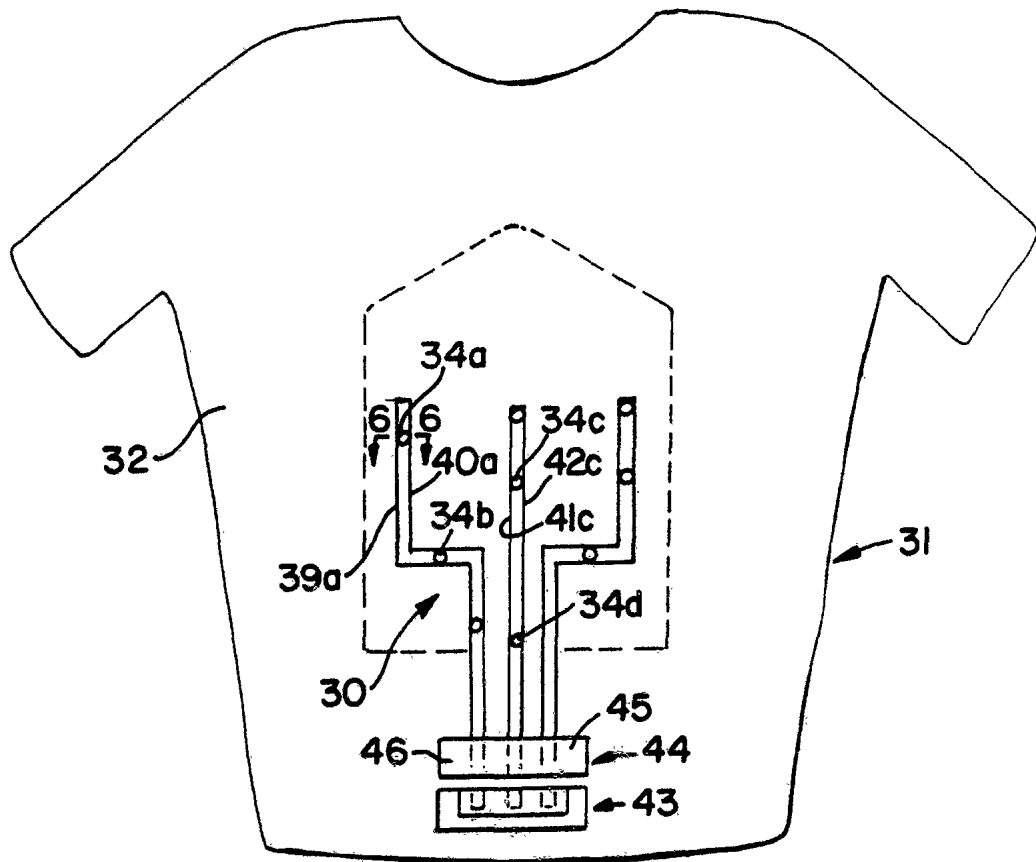


FIG. 5

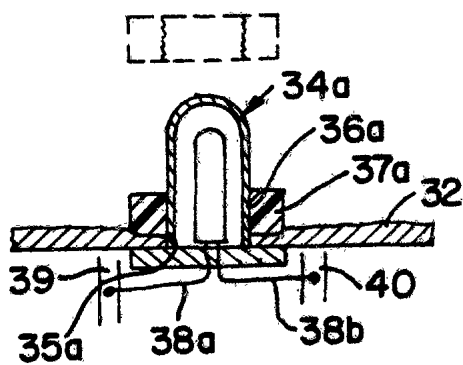


FIG. 6

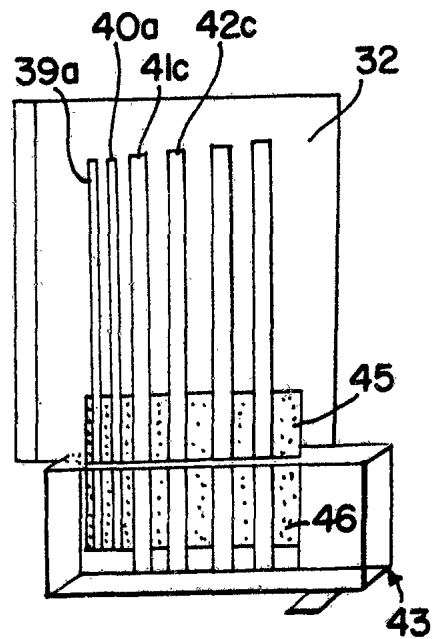
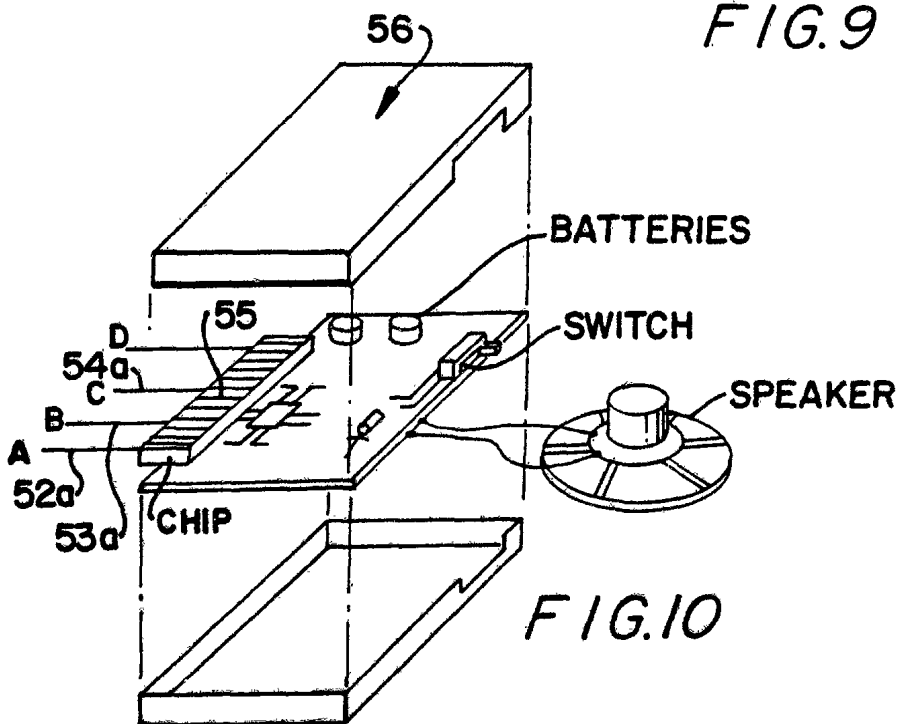
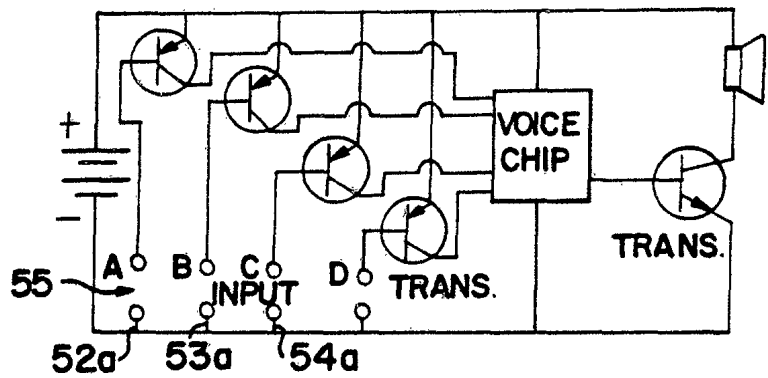
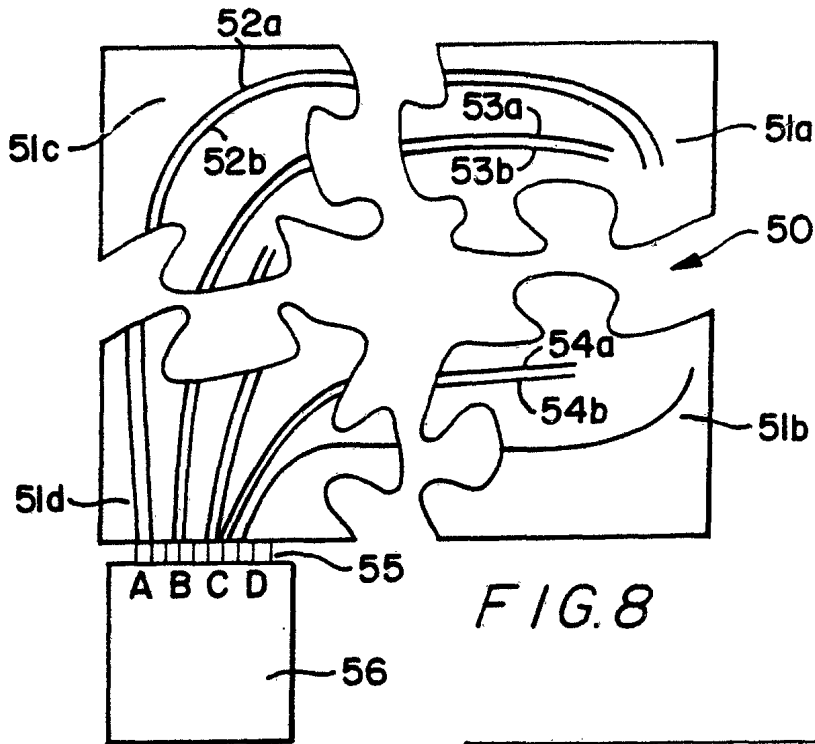


FIG. 7



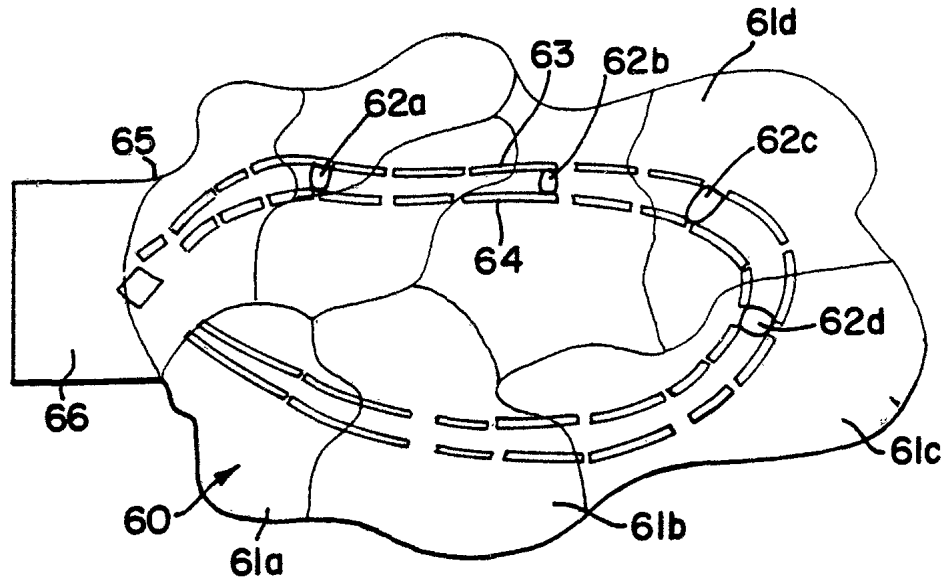


FIG. 11

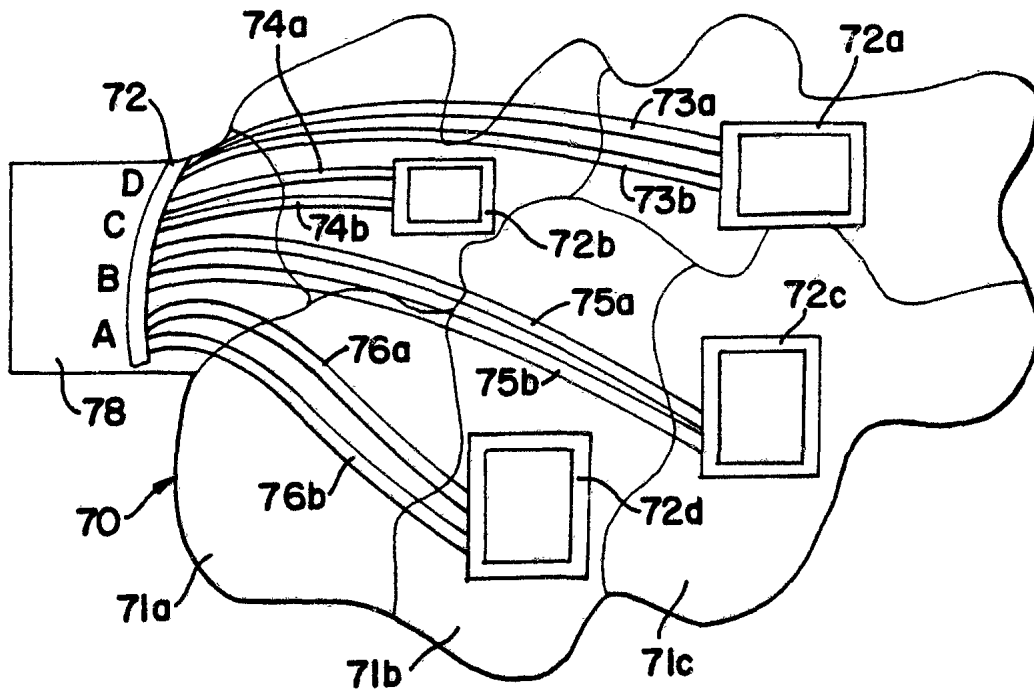


FIG. 12

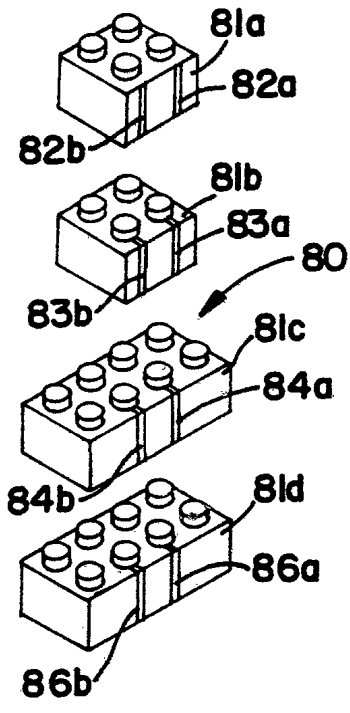


FIG. 13

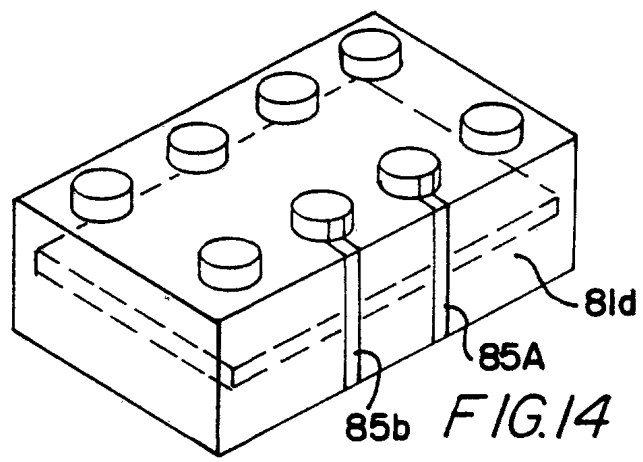


FIG. 14

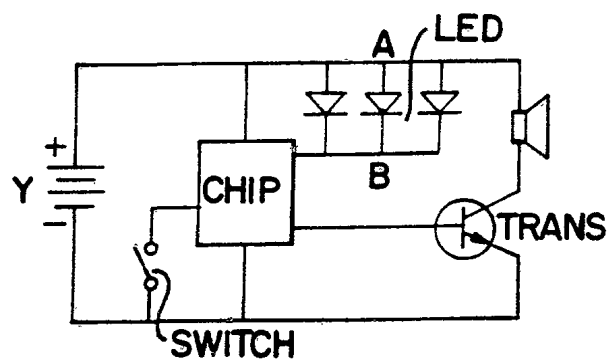


FIG. 15

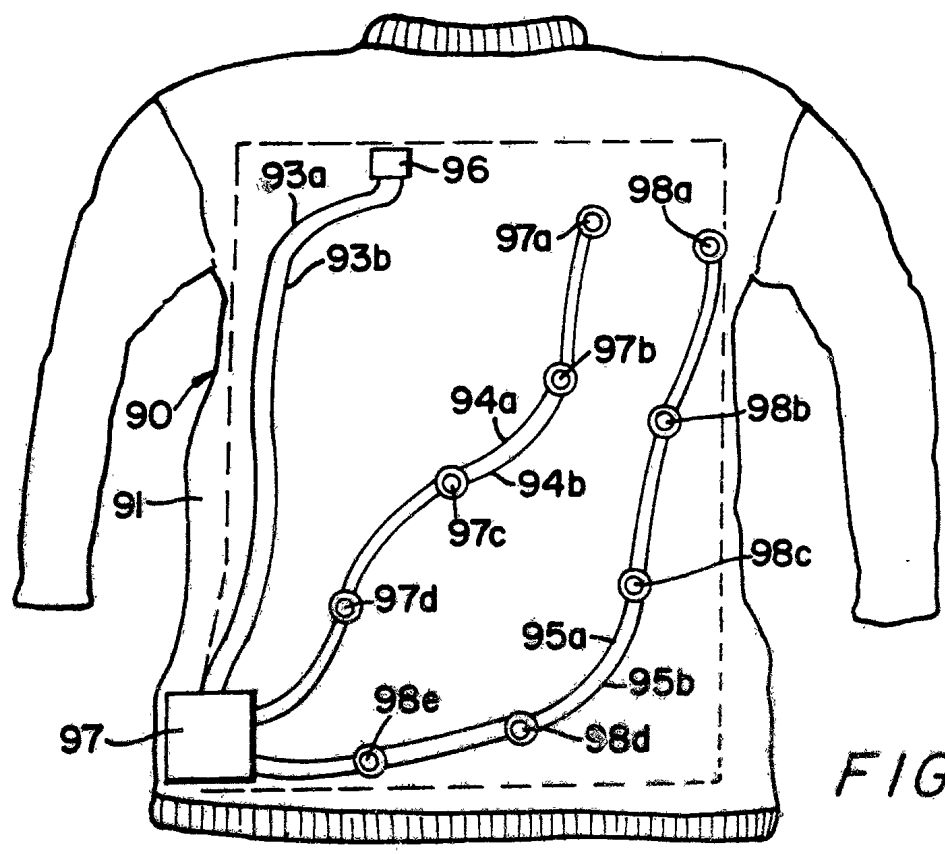


FIG. 16

INTERNATIONAL SEARCH REPORT

International application No
PCT/US94/05829

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : F21L 15/08; A63H 33/04; H01B 1/00
US CL : 362/103,800; 428/33,901; 446/91

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 362/103,104,105,106,107,108,800; 428/33,901; 446/91

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,128,843 (GURITZ) 07 July 1992, col. 2, lines 30-68; col.3, lines 1-3; and col.5, lines 24-36.	1-31
Y	US,A, 5,209,873 (YAMAMOTO ET AL.) 11 May 1993, col. 1, lines 6-20; col. 6, lines 35-40; and col. 8, lines 48-63.	1-41
Y	US, A, 4,869,701 (KAWAI ET AL.) 26 September 1989, col. 1, lines 27-42; col. 7, lines 36-54; and col. 8, lines 35-40.	36-41

Further documents are listed in the continuation of Box C. See patent family annex.

<p>* Special categories of cited documents:</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p>	<p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>*Z* document member of the same patent family</p>
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<p>Date of the actual completion of the international search</p> <p style="text-align: center;">15 AUGUST 1994</p>	<p>Date of mailing of the international search report</p> <p style="text-align: center; font-size: 1.5em;">SEP 02 1994</p>
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<p>Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230</p>	<p>Authorized officer</p> <p style="text-align: center;"><i>Stephen F. Husar</i> STEPHEN F. HUSAR</p> <p>Telephone No. (703) 305-1932</p>
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