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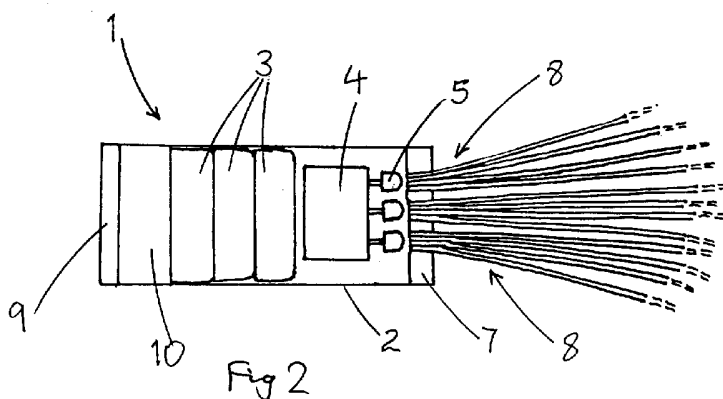
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INT CL **F21V, F21W, G02B**
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(54) Abstract Title: **Colour mixing decoration with optic fibre**

(57) A decorative illumination 1 includes at least two light sources of different colours and at least one optic fibre 6. A controller 4 varies the brightness of each source to mix the colours. Preferably the light sources comprise red, green and blue LEDs 5, which can synthesise the full spectrum of colours. The light can be used as part of a hair decoration (16, fig 6), clothing (13, fig 5), a drinking vessel (24, fig 9A), a toy (28, fig 10), indoor decoration including Christmas trees (42, fig 19), or a hand tool such as a brush (62, fig 24A). The optic fibre can be supported by a ductile wire (36, fig 15A).



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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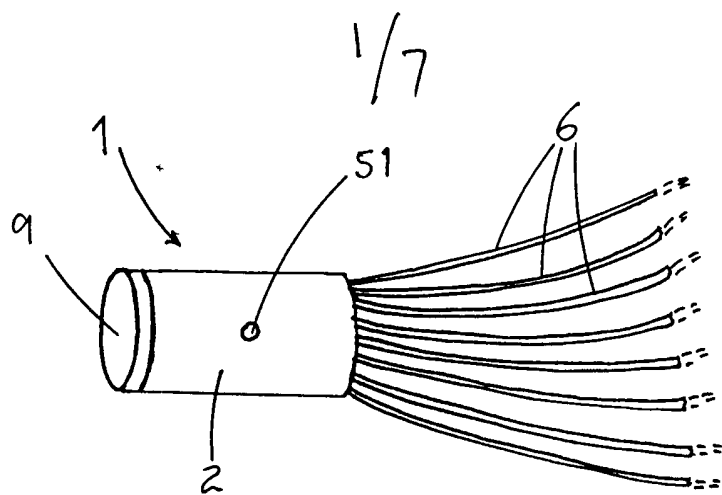


Fig 1

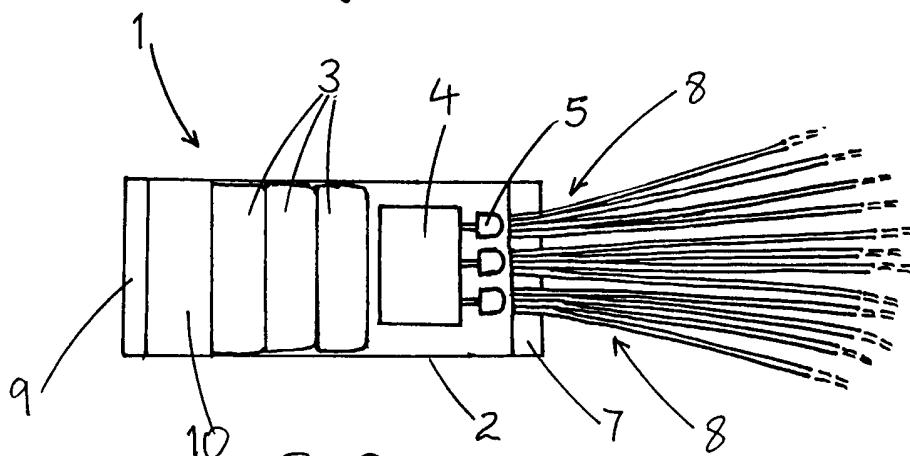


Fig 2

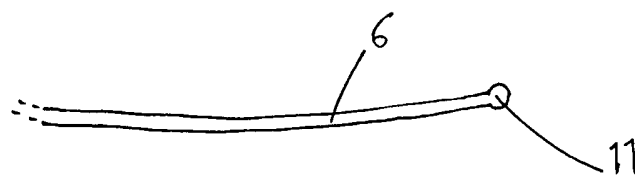


Fig 3

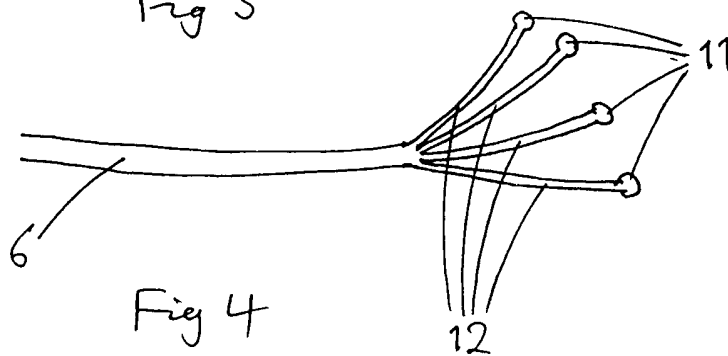


Fig 4

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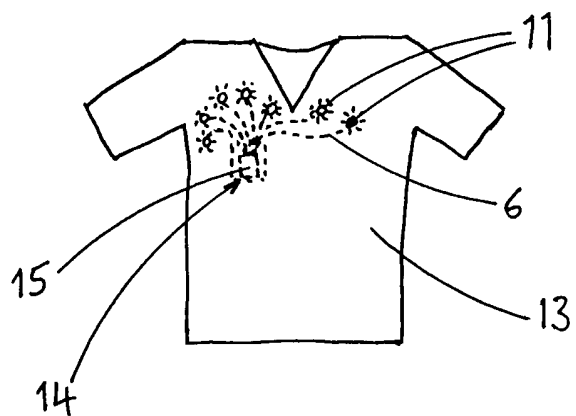


Fig 5

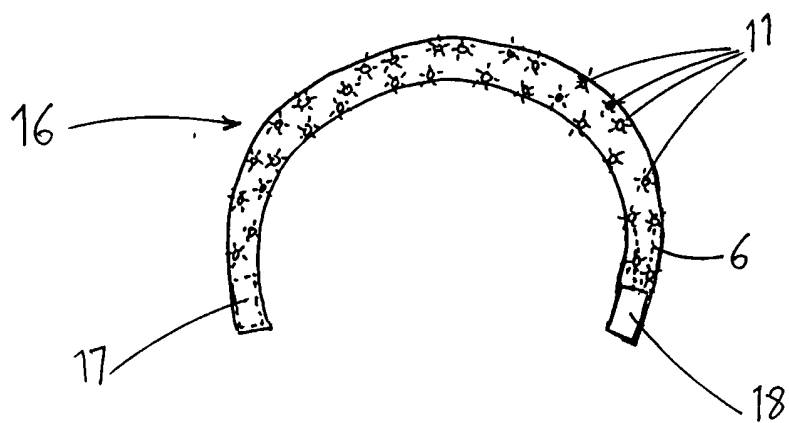


Fig 6

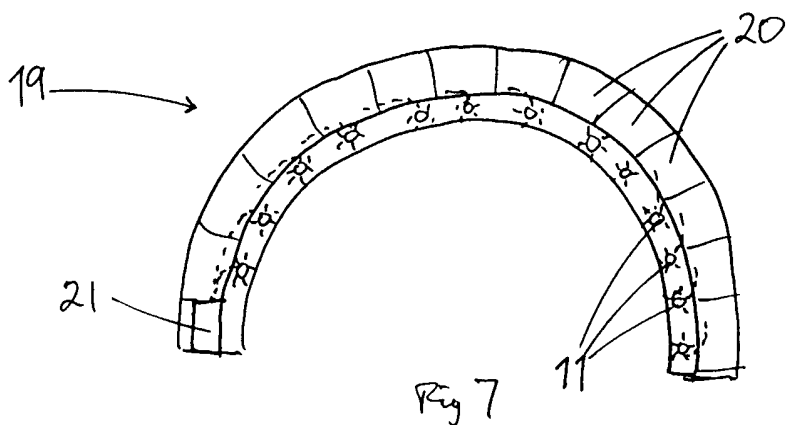


Fig 7



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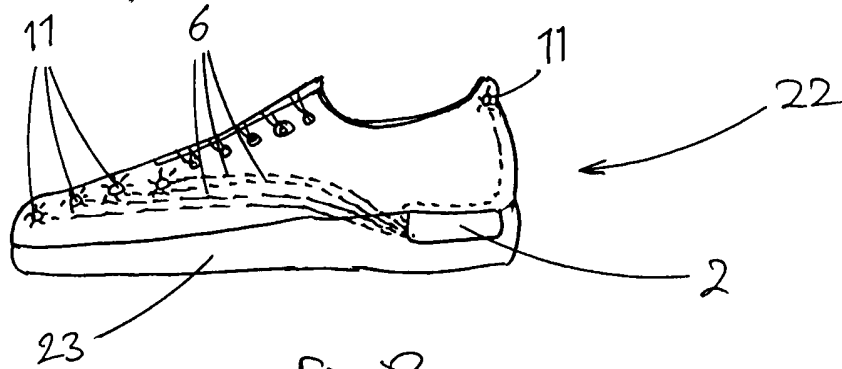


Fig 8

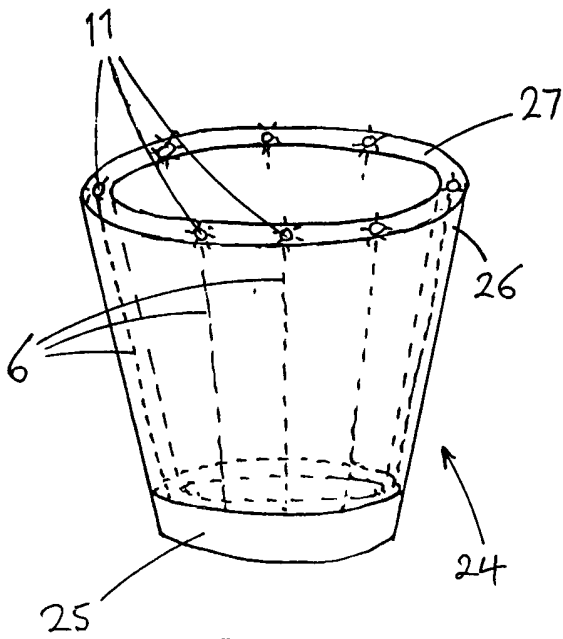


Fig 9A

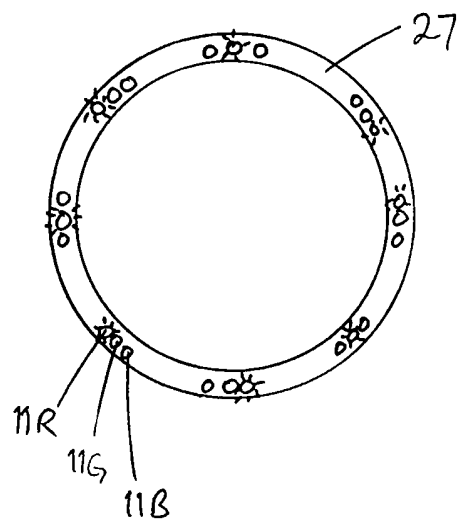


Fig 9B

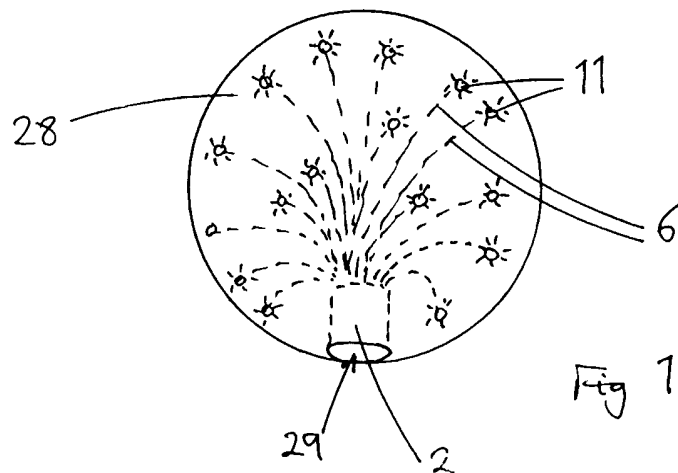


Fig 10



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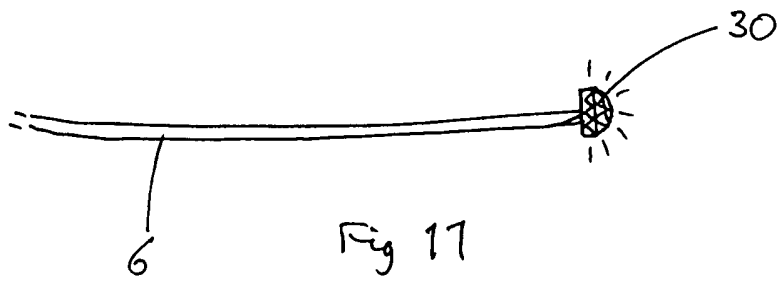


Fig 11

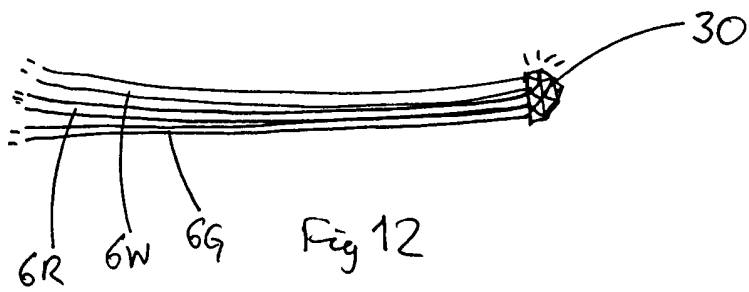


Fig 12

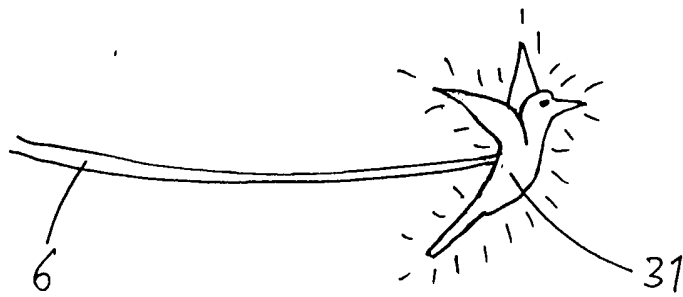


Fig 13

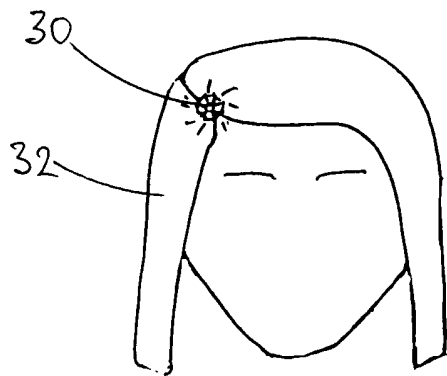
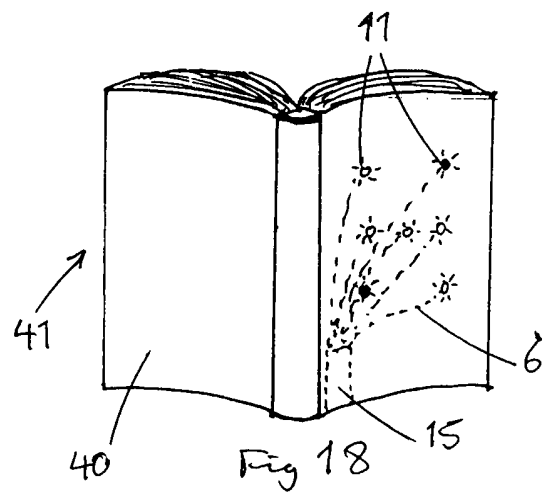
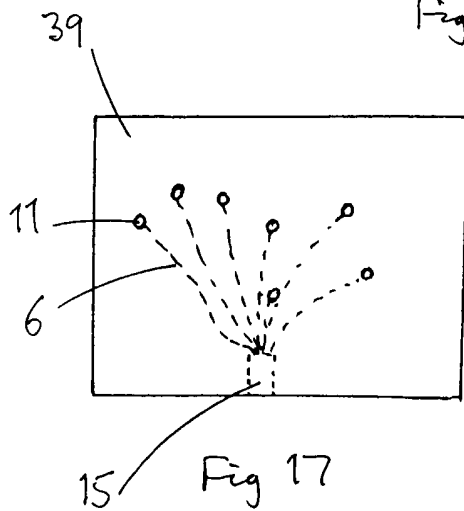
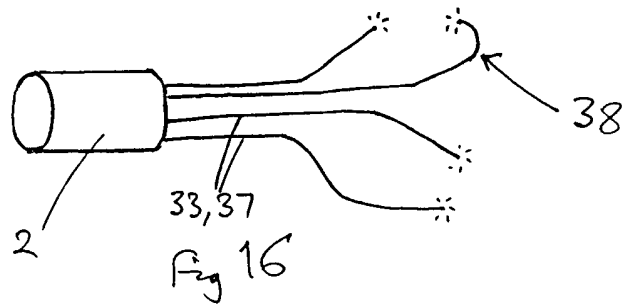
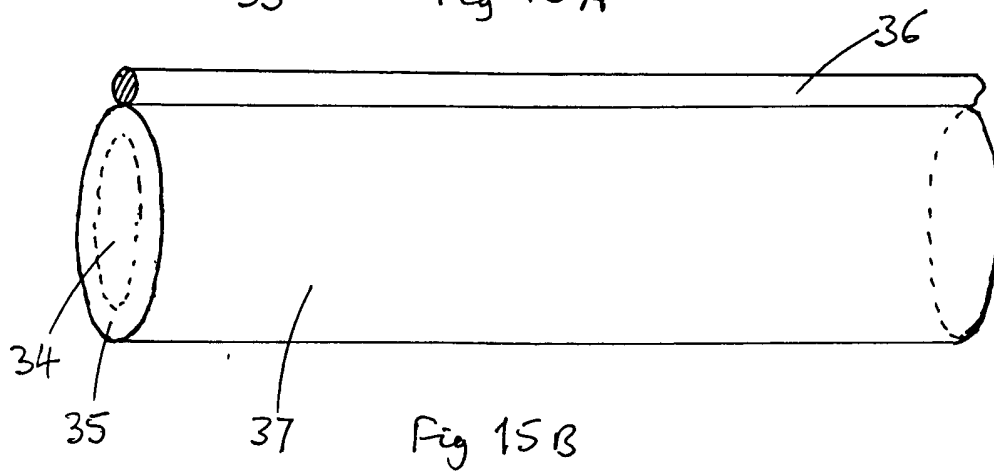
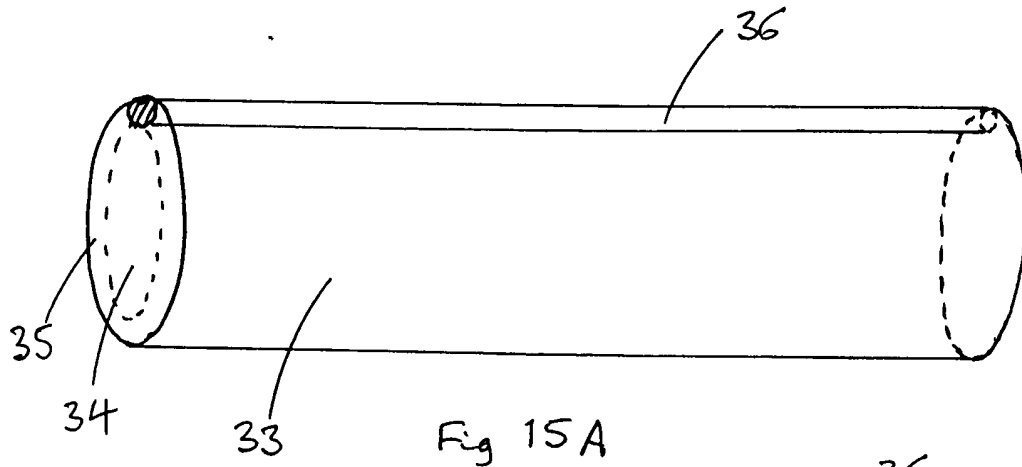
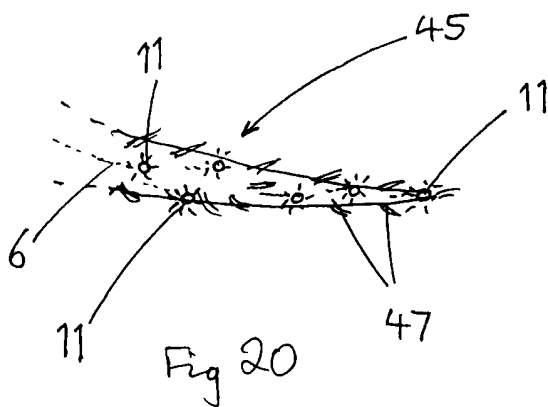
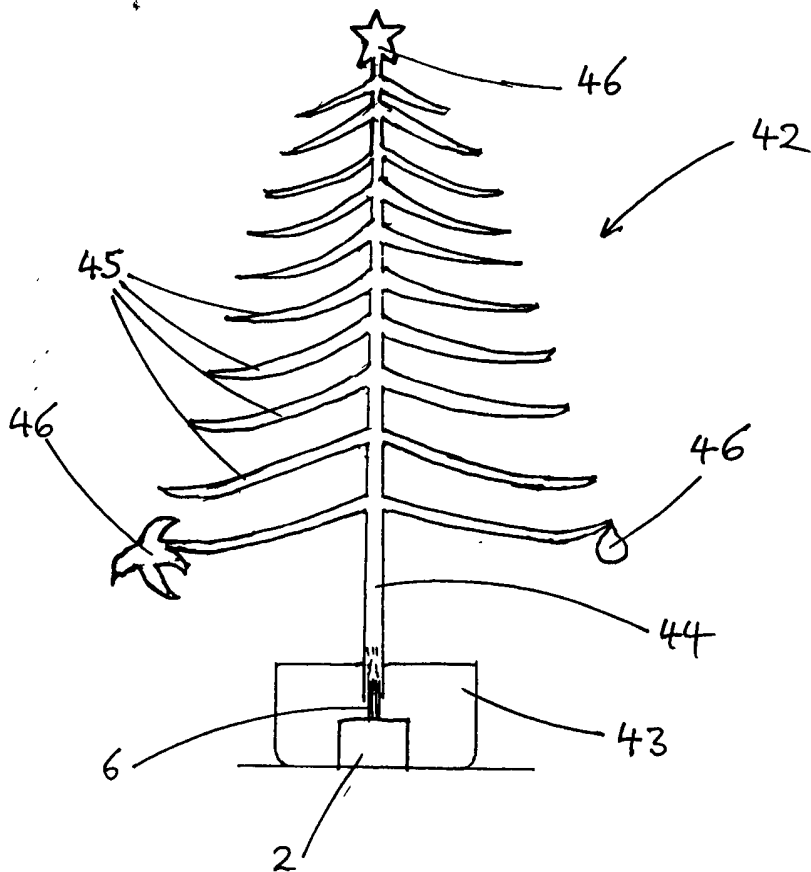


Fig 14

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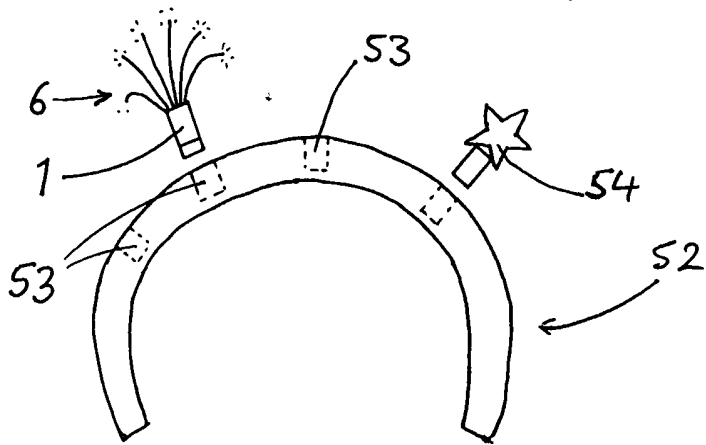


Fig 21

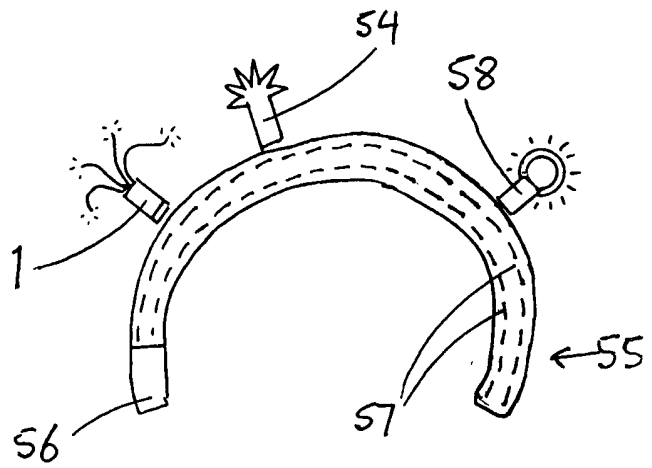


Fig 22

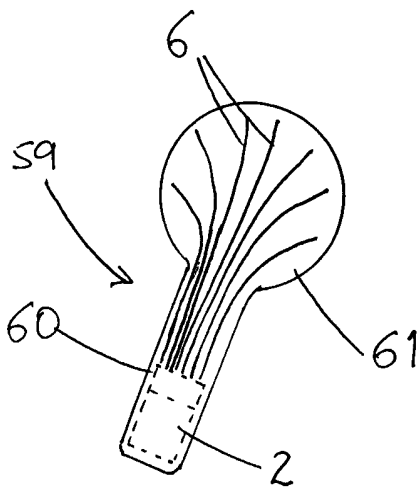


Fig 23

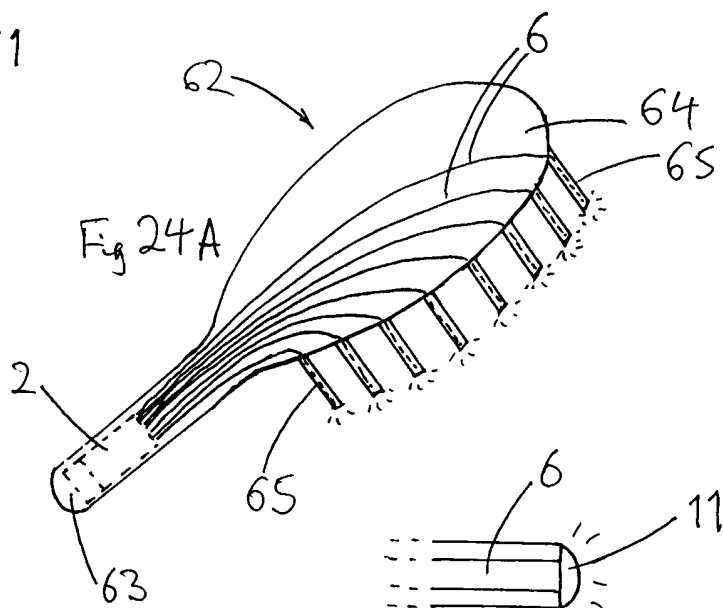


Fig 24A

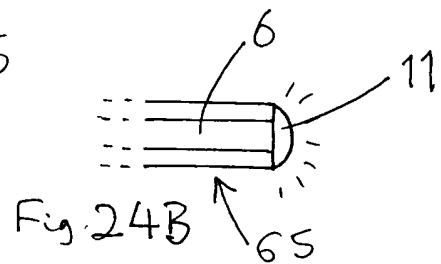


Fig 24B

PERSONAL ADORNMENT

The present invention relates to apparatus for decoration and personal adornment, illuminable by means of optical fibres. More particularly, but not exclusively, it relates to such apparatus for decorating the hair, and to clothing incorporating such illuminable apparatus.

Many forms of personal ornamentation have been invented over the years, but the vast majority of these have relied for their effect on being viewed in ambient light. The concept of illuminated items of adornment has only achieved any real success with the advent of small, low-energy, low-temperature light sources, particularly light-emitting diodes (LEDs), together with the widespread availability of optical fibres for leading light to a desired point, thus allowing much greater flexibility in the location of the light source, remotely from the point at which the light is to be displayed.

LEDs can now be produced to emit light of many colours, such as white, yellow, red, green, blue, purple or ultraviolet. Other colours may be possible, but each LED can only emit a single colour.



However, despite the apparent potential of LEDs in combination with optical fibres, few if any such devices have achieved any commercial success. Nevertheless, it is believed that this is an application which could achieve significant success, given just the right products to spark a user's interest, for example by increasing their functionality to obviate the problem of "the novelty wearing off" and/or by making them simpler to use.

It is hence an object of the present invention to provide illuminable apparatus adapted for the adornment of a person's hair, clothing and other items, and clothing, items of personal adornment and other items incorporating such illuminable apparatus, which provide more features attractive to a wearer or someone viewing the item or otherwise provide an improved performance over existing illuminable apparatus.

According to a first aspect of the present invention, there is provided a source of decorative illumination comprising at least one first light source adapted to emit light of a first colour, at least one second light source adapted to emit light of a second colour, at least one optical fibre operatively linked adjacent a proximal end to the or one of said at least one first light source and to the or one of said at least second light source, and control means for the light sources adapted so to control a brightness of the or each first and second light source that a selected colour produced by a combination of said first and second colours is emitted from a distal end of the or each optical fibre.

Preferably, the illumination source further comprises at least one third light source adapted to emit light of a third colour, the or each said optical fibre being operatively linked also to the or one of said at least one third light source, and the control means being adapted so to control a brightness of the or each first, second and third light sources that a selected colour



produced by a combination of said first, second and third colours is emitted from the distal end of the or each optical fibre.

Advantageously, said first, second and third colours are combineable to produce white light.

Said first, second and third colours may comprise red, green and blue.

Preferably, each said light source comprises a light-emitting diode (LED).

Advantageously, a single chip means is provided, comprising each said LED.

In a preferred embodiment, the illumination source comprises a first LED adapted to emit a first colour, a second LED adapted to emit a second colour, a third LED adapted to emit a third colour and a plurality of optical fibres, each being operatively linked at its proximal end to each of the first, second and third LEDs.

The control means is preferably adapted so to alter said the brightnesses of the light sources as to change the emitted colour from a first selected colour to a second selected colour.

Advantageously, the control means is adapted to alter the brightnesses continuously.

Alternatively, or additionally, the control means is adapted to alter the brightnesses in a stepwise manner.



The control means may be adapted to change the emitted colour according to a predetermined sequence.

The control means may be adapted to change the emitted colour substantially randomly.

The control means may also be adapted to turn the light sources on and off in a random or predetermined sequence.

The illumination source may thus produce flashing or twinkling illumination.

Each said light source, a power supply means therefor and the control means may be located within a single casing means.

The power supply means may comprise replaceable or rechargeable electrical cell means.

The power supply means may alternatively or additionally comprise solar cell means.

Preferably, each said fibre comprises a rounded distal tip, optionally a generally spherical distal tip.

Said distal tip may comprise a coloured material.

Said distal tip may be adapted to spread light emitted therefrom and/or to render a distal end of each fibre safer in wear.



Alternatively or additionally, at least some of the fibres may be provided at a distal end with an illuminable decoration means, such as a simulated or real gemstone.

Said decoration means may be detachably mounted thereto.

Advantageously, at least some of said fibres may be split adjacent a distal end thereof to form a plurality of distal tips.

Preferably, the illumination source comprises activating means.

Said activating means may be adapted to activate the light sources only when ambient light levels are below a predetermined threshold.

The optical fibres may be replaceably detachable from the casing means, either individually or as a connected group.

The illumination source may also comprise means to generate an audible output.

Said generator means may be controlled by the control means, optionally substantially synchronously with changes in the relative brightness of the light sources.

The optical fibres may be provided with reinforcing means.

Said reinforcing means may be selectably deformable to hold a respective optical fibre substantially in a desired conformation.



According to a second aspect of the present invention, there is provided apparatus to decorate a person's hair, comprising at least one source of decorative illumination as described in the first aspect above, the or each optical fibre thereof being adapted to be woven or threaded through the person's hair.

Preferably, the or each optical fibre is adapted to be concealable within the person's hair, optionally being coated with material coloured to resemble a natural hair colour.

Alternatively, some or all of the fibres may be so treated as to contrast with the hair.

Advantageously, the casing means of the or each illumination source is provided with means of attachment to a wearer's hair, clothing, headgear or person.

Alternatively or additionally, said casing means may be mountable to an existing item of adornment, such as a hairclip, hairband or the like.

According to a third aspect of the present invention, there is provided an item of personal adornment comprising at least one source of decorative illumination as described in the first aspect above.

In a first embodiment, the item of personal adornment is attachable to a person's hair.

The item may then comprise a hairclip or the like.



In a second embodiment, the item of personal adornment is wearable on a person's head, body or limbs.

The item may then comprise a headband, a necklace, a bracelet or the like.

In a third embodiment, the item of person adornment is mountable to a person's clothing.

The item may then comprise a brooch or the like.

Alternatively, the item of adornment may comprise a zone of flexible material, optionally textile, mountable to clothing.

The zone may be detachably mountable to the clothing, such as by means of corresponding patches of hook or loop repositionable fastening fabric, buttons, poppers or the like.

In each embodiment, the or each illumination source may be detachably mounted to the item of adornment.

The item of adornment may comprise power supply means connectable to the or each detachable illumination source.

In each embodiment, the optical fibres may extend within an interior of the item.

The distal tip or tips of each optical fibre may then be disposed adjacent a surface of the item.



Alternatively or additionally, the item may be transparent or translucent and at least some of said distal tips may be disposed within the interior of the item.

According to a fourth aspect of the present invention, there is provided an item of personal apparel comprising at least one illumination source as described in the first aspect above.

The item of apparel may comprise an item of clothing, headgear or footwear.

Preferably, the or each illumination source is separable from the item of apparel, for example so that the item may be cleaned.

The item of apparel may comprise a woven fabric material, and the optical fibres may then extend through a weave of the fabric material.

The light sources and control means may then be detachable from the optical fibres so as to be separable from the item of apparel while leaving the optical fibres in place.

Each optical fibre may be provided with a surface coating coloured to resemble material of the item of apparel.

According to a fifth aspect of the present invention, there is provided a drinking vessel, item of glassware or crockery comprising at least one source of decorative illumination as described in the first aspect above, wherein the optical fibres thereof extend within wall means of the respective drinking vessel or item of glassware or crockery.



The optical fibres preferably extend to points adjacent a surface of the item, optionally adjacent a rim thereof.

According to a sixth aspect of the present invention, there is provided a plaything comprising at least one source of decorative illumination as described in the first aspect above, wherein the optical fibres extend within an interior of the plaything.

The plaything may comprise a ball.

Alternatively, the plaything may comprise a rattle or the like.

According to a seventh aspect of the present invention, there is provided an item of stationery comprising at least one source of decorative illumination as described in the first aspect above.

The light sources and control means of the or each illumination source are preferably concealed in use, for example being embedded within the item of stationery.

The optical fibres may be embedded within the item of stationery.

Advantageously, only a distal tip of each optical fibre is visible in use.

The item of stationery may for example comprise a book, calendar or greetings card.



According to an eighth aspect of the present invention, there is provided a tool or implement comprising at least one source of decorative illumination as described in the first aspect above.

Said tool or implement may be adapted for personal grooming.

Said tool or implement may comprise brush or comb means.

The optical fibres of the or each illumination source may then extend through or comprise at least some of bristle means of the brush means or tooth means of the comb means respectively.

According to a ninth aspect of the present invention, there is provided an item of household décor comprising at least one source of decorative illumination as described in the first aspect above.

Said item of décor may comprise an item of festive décor, such as a Christmas tree.

According to a tenth aspect of the present invention, there is provided an optical fibre comprising an elongate member of ductile material extending longitudinally thereof.

Preferably said ductile material comprises a metal.

Said elongate member may comprise a wire or strip of said ductile material.



Said elongate member may be mounted to a surface of the optical fibre.

Alternatively, said elongate member may be embedded partially or wholly within the optical fibre.

The elongate member is preferably substantially coextensive with the optical fibre.

According to an eleventh aspect of the present invention, there is provided a source of decorative illumination as described in the first aspect above, comprising one or more optical fibres as described in the tenth aspect above.

It is envisaged that for each of the second to ninth aspects above, a simpler illumination means, comprising at least one light emitting diode, at least one optical fibre operatively linked adjacent a proximal end thereto, and control means adapted to turn the or each LED on and off on a random or predetermined sequence, may provide many of the benefits of the illumination source disclosed in the first aspect above.

Said simpler illumination means may for example comprise a plurality of LEDs, at least one of which is adapted to emit light of a different colour from others of the plurality, a plurality of groups of optical fibres, each group being linked adjacent a proximal end of each of its fibres to a respective light source, and control means for the light sources adapted to turn each light source on and off in a random or predetermined sequence.

Embodiments of the present invention will now be more particularly described by way of example and with reference to the accompanying drawings, in which:



Figure 1 is a perspective view of a body of a hair decoration device embodying the present invention;

Figure 2 is a schematic cross-section of the body of the device shown in Figure 1;

Figure 3 is a scrap elevation of a distal end of an optical fibre of the device shown in Figure 1;

Figure 4 is a scrap elevation of a distal end of an alternative form of optical fibre to that shown;

Figure 5 is a frontal elevation of a T-shirt embodying the present invention;

Figure 6 is a perspective view of a first head band embodying the present invention;

Figure 7 is a perspective view of a second head band embodying the present invention;

Figure 8 is a side elevation of a shoe embodying the present invention;

Figure 9A is a perspective view of a drinking tumbler embodying the present invention;

Figure 9B is a plan view from above of a tumbler similar to that shown in Figure 9A;

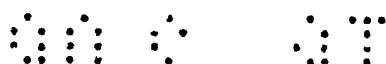
Figure 10 is a schematic perspective view of a ball embodying the present invention;

Figure 11 is a scrap view of a distal end of a first decorated optical fibre usable in devices embodying the present invention;

Figure 12 is a scrap view of a distal end of a decorated bundle of optical fibres usable in devices embodying the present invention;

Figure 13 is a scrap view of a distal end of a second decorated optical fibre usable in devices embodying the present invention;

Figure 14 is a frontal elevation of a decorated optical fibre as shown in Figure 11, in wear;



Figures 15A and 15B show, schematically, two alternative forms of wire-reinforced optical fibre usable in devices embodying the present invention;

Figure 16 is a schematic view of such a device comprising optical fibres as shown in Figure 15A or Figure 15B;

Figure 17 is a schematic elevation of a picture or card embodying the present invention;

Figure 18 is a schematic elevation of a book embodying the present invention;

Figure 19 is a schematic cross-sectional elevation of a Christmas tree embodying the present invention;

Figure 20 is a scrap view of an end of a branch of the Christmas tree shown in Figure 19;

Figure 21 is a schematic elevation of a third head band embodying the present invention;

Figure 22 is a schematic elevation of a fourth head band embodying the present invention;

Figure 23 is a schematic elevation of a baby's rattle embodying the present invention;

Figure 24A is a schematic perspective view of a hairbrush embodying the present invention; and

Figure 24B is a scrap schematic view of a tip of a bristle of the hairbrush shown in Figure 24A.

Referring now to the Figures, and to Figures 1 and 2 in particular, a hair decoration device 1 comprises a body 2, containing a plurality of button-cell electric batteries 3, an integrated circuit chip 4 and three light-emitting diodes (LEDs) 5, here one red LED, one green LED



and one blue LED. The LEDs 5 may comprise an integral part of the chip 4. (NB: different numbers of LEDs 5 and different colour combinations may be used if desired).

A plurality of optical fibres 6 extend outwardly from a first end 7 of the body 2. The optical fibres 6 may be provided in bundles 8, as shown in Figure 2, which is particularly convenient in embodiments in which the optical fibres 6 are separable from the body 2 of the device 1. However, the respective proximal ends of the bundles 8 would in practice be located more closely together than is shown (for clarity) in Figure 2, as would the LEDs 5. The light from each LED 5 should be passed into the proximal end of each optical fibre 6. Should the dimensions of the LEDs 5 cause difficulties in this regard, for example, a light guide, diffuser or the like may be interposed between the LEDs 5 and the proximal ends of the optical fibres 6.

A second end of the body 2, remote from the first 7, here comprises a transparent lens 9, which allows any ambient light to reach a photodetector 10 within the body 2. An on-off button switch 51 is provided on a side of the body 2.

In use, the body 2 is concealed in a wearer's hair, for example being clipped to hair at the nape of her neck, or held within a plait. The optical fibres 6 are threaded or woven into the wearer's hairstyle, such that a distal end of each fibre 6 is disposed adjacent a surface of her hair. The fibres 6 may be spread throughout the hair or concentrated in particular regions as preferred.



The device 1 is turned on using the switch 51. Where the optional photodetector 10 is present, it acts to prevent activation of the device 1 until ambient illumination falls below a preselected threshold level, so that the device 1 may be seen to best effect.

The integrated circuit chip 4 is programmed to control the brightnesses of the LEDs 5, both absolutely and each relative to the others. Thus, three substantially monochromatic light outputs are passed together along each optical fibre 6, with the intensity of each being selected by the chip 4.

The human eye has trichromatic vision. Essentially, it comprises three types of colour receptor, each most sensitive in a different region of the spectrum. The brain combines the signal intensities received through each type of receptor to synthesise a perceived colour. Thus, when provided with three superimposed monochromatic lights in the respective regions of the spectrum, the eye and brain will again synthesise a perceived colour, based on the intensities of the three monochromatic lights. Thus, the chip 4 can cause a selected colour to be perceived emerging from a distal end of an optical fibre 6, by controlling the brightnesses of the three LEDs 5 shining into it.

By changing the brightnesses of the LEDs 5, either continuously or in a stepwise manner, the perceived colour emitted from the optical fibres 6 is also changed. Either a random sequence or a predetermined one may be programmed into the chip 4, as preferred. The device 1 can thus appear to emit light of any desired colour, and the colour can be varied at will.

In addition, the chip 4 may be programmed to flash the LEDs 5 on and off in unison, again either in a random sequence or according to a predetermined one. Thus, the device 1 may



display flashing or twinkling points of light emerging from the optical fibres 6, as well as or instead of varying the colour of those points of light.

This gives the wearer's hairstyle a distinctive and attractive appearance, particularly in subdued illumination.

Other illumination arrangements are envisaged, employing physically very similar devices. For example, the bundles 8 of optical fibres 6 shown in Figure 2 may be so disposed that each bundle 8 takes in light at the proximate ends of each of its component/fibres 6 from only one of the LEDs 5. Each bundle 8 thus carries only one colour of light. The bundles 8 can be kept separate, or their fibres 6 intermingled distally of the body 2, as desired.

In these devices, the chip 4 is so programmed that each LED 5 is turned on and off, independently each of the others or synchronized in some manner. The on/off sequences may be random or predetermined. Thus, pinpoints of light of the three LED colours will flash or twinkle on and off amongst the wearer's hair. This gives a different appearance to that produced by the first-mentioned device 1, but again a distinctive and attractive one.

If a distal end of each optical fibre 6 were merely cut off transversely to its length, the light emitted therefrom might not be sufficiently visible unless the fibre 6 were aligned directly towards a viewer's eye. There may also be concern about sharp fibre ends in the wearer's hair.

Therefore, as shown in Figure 3, a distal end of each optical fibre 6 may be provided with a globular, ideally substantially spherical tip 11. This can be formed integrally with the fibre 6,



perhaps by localised melting, or may be separately formed then mounted thereto, for instance using adhesive. The clear globular tip 11 will spread light emitted from the distal end of the fibre 6 so as to increase its visibility, and also forms a relatively safe termination for the fibre 6. It is also envisaged that some or all of the globular tips 11 could be tinted, to modify the colour of the light passed through the optical fibres 6.

A further beneficial modification of a standard optical fibre 6 is shown in Figure 4. Here, the fibre 6 is split into a plurality of sub-fibres 12 adjacent its distal end, each sub-fibre 12 being provided with a globular tip 11. This would produce the effect of a cluster or bunch of pinpoints of light changing colour and/or flashing on and off in unison, without having to run a plurality of optical fibres 6 all the way from the body 2.

It may well be desirable to conceal the passage of the optical fibres 6 through the wearer's hair, for example so that the fibres 6 are not visible in good illumination when the device 1 is not switched on. Each fibre 6 may therefore be provided with a coating, coloured generally to match a wearer's hair colour (thus, alternative "blonde", "red", "brown", "black", etc. fibres will be provided). When threaded through the hair, these will not be readily visible, increasing the effect produced by the device 1 when it is activated.

Alternatively, the fibres 6 could be given a coating of a contrasting colour, so that they may appear as deliberately-tinted streaks in the wearer's hair (should the wearer favour such effects).



In a preferred embodiment, either individual fibres 6 or bundles 8 thereof may be detachable from the body 2, so that the number of fibres 6 may be varied to suit a particular hairstyle, and so that any damaged fibres may be replaced.

As well as being used in hair decoration, devices similar to the device 1 shown in Figures 1 and 2 are usable to decorate items of clothing, such as caps, hats, scarves, skirts, jeans, jackets and so forth. A T-shirt 13 is shown in Figure 5 as an example. A pocket or pouch 14 is provided on an internal or external surface of the T-shirt 13, into which a device body 15 (corresponding to the body 2 of the device 1 shown in Figures 1 and 2) may be reversibly inserted. So as to be inobtrusive, the device body 15 should have a relatively flattened shape, instead of the generally cylindrical form of the body 2 shown in Figures 1 and 2.

A plurality of optical fibres 6 lead from the device body 15, either through the weave of the T-shirt 13 or across its surface, to their respective tips 11, which are arranged in a desired decorative pattern, (which may be part of a larger design, printed, embroidered, or otherwise applied to the T-shirt 13). Thus, when the device body 15 is switched on, the tips 11 of the fibres 6 will change colour and/or flash on and off in preselected colours, adding to the attractiveness of the T-shirt 13.

The proximal ends of the fibres 6 are detachable from the device body 15, so that the latter may be removed from the pouch 14 before the T-shirt 13 is washed. It is believed that the optical fibres 6 will stand up to modern washing cycles without damage. The fibres 6 may be colour coated for concealment amongst the weave of the T-shirt 13, or contrastingly coloured to form part of the design.



It is also envisaged that the device body 15 and optical fibres 6 could be incorporated into a textile patch, which could be mounted detachably to an item of clothing, headgear or footwear by means of hook and loop repositionable fastening fabric, poppers, titch buttons or the like. As above, the optical fibres 6 could be coloured to match the patch or to contrast with it.

Another item which would benefit from provision of illumination arrangements of the type described is a first headband or hairband 16, as shown in Figure 6. In this case, a power pack 17 for example containing button cell batteries 3, is disposed at a first end of the first headband 16, and an LED unit 18, containing an integrated circuit chip 4 controlling a plurality of LEDs 5 is disposed at a second end of the first headband 16 remote from the first end. An electrical wire (not shown) extends between the power pack 17 and the LED unit 18.

A plurality of optical fibres 6 (a majority of which are not shown, for clarity) extend from the LED unit 18 through the material of the first headband 16 to their respective tips 11, which are arranged across a whole visible surface of the first headband 16, either scattered as shown, concentrated in bunches, or forming designs or even words.

Thus, when the LED unit 18 is powered on, pinpoints of light in continuously varying colours will flash on and off across the first headband 16, in a decorative manner.

A second headband or hairband 19, shown in Figure 7, is similar to the first headband/hairband 16, except that it is provided with a plurality of solar cells 20, which are connected to an LED unit 21 at one end of the headband 19. Either a rechargeable storage



battery is provided within the LED unit 21, or the LEDs 5 in the LED unit 21 are directly powered by the solar cells 20. In this case, the LEDs 5, optical fibres 6 and tips 11 will be selected and arranged so that the illumination they produce is visible in bright lighting conditions.

A third headband or hairband 52 (shown in Figure 21) illustrates a further variation on this embodiment, the headband 52 being provided with one or more devices 1 which may be detachably mounted thereto, for example by means of sockets 53 configured to receive a device 1, or by other convenient attachment means. One or more conventionally-illuminated or non-illuminated decorative modules 54 may also be provided, detachably mountable to the third headband 52 by the same means as the devices 1.

A user may thus mount a desired number of illuminated devices 1 and non-illuminated modules 54 to the headband 52, positioned at will. Only representative sockets 53 are shown, but it is envisaged that a much greater number of attachment points would in practice be provided, to give the user greater opportunity to produce her desired effect by exchanging and repositioning the devices 1 and modules 54.

A fourth headband or hairband 55 (shown in Figure 22) illustrates another variation. In this, a power source 56 is disposed at a first end of the hairband 55. Power lines 57 extend from the power source 56 along a length of the headband 55, and may be tapped into at a plurality of points along this length. Thus, the user may attach selected devices 1, decorative modules 54 or even conventional bulbs 58 or LED light sources to the headband 55, from which they will draw power (NB in this case, the device 1 need not contain its own batteries 3).



In a fifth form, a power source and LED unit replaces the power source 56 shown, and the power lines 57 are replaced by optical fibres, extending within the headband/hairband 55. Transparent decorative items would then be exchangeably mountable to the headband so as to pick up light emitted from the distal tips of the optical fibres.

Similar arrangements may be incorporated into necklaces, brooches and the like.

Devices such as those described may also be incorporated into footwear. Figure 8 shows a shoe 22, with the body 2 of a device 1 implanted in a recess in a sole 23 of the shoe 22. (The body 2 is preferably located towards a heel end of the sole 23 for reasons of space). Optical fibres 6 extend from the body 2 through the shoe 22 (for example, between an outer surface and a lining of an upper of the shoe 22) to their respective tips 11. As above, when the LEDs 5 within the body 2 are activated, pinpoints of light of varying colours flash on and off decoratively across the outer surface of the shoe 22.

Similar devices may be incorporated into other items besides personal apparel. One example is shown in Figures 9A and 9B. A tumbler 24 is made from a clear plastics material (or even glass), with a relatively thick base 25 and walls 26. A body (not shown) containing a power supply, control chip and LEDs is enclosed in the base 25 of the tumbler 24. Optical fibres 6 lead up through the walls 26 of the tumbler 24, with their tips 11 adjacent an upper rim 27 thereof. Thus, when the body is activated, the tips 11 will flash on and off and/or change colour with time, giving a novel appearance to the tumbler 24, of particular interest to children.



In a variant of this embodiment, shown in Figure 9B, the tips of the fibres 6 are arranged in groups of three, each comprising (for example) a tip 11R connected to a red LED, a tip 11G connected to a green LED and a tip 11B connected to a blue LED. The respective LEDs are so controlled that the tips 11R, 11G, 11B of each group flash in turn.

Figure 10 shows a ball 28 of resilient material, provided with a recess 29 to receive a body 2 of a device 1 similar to that shown in Figure 1. The recess 29 is provided with a selectably closable cap (not shown) to retain the body 2 in position while allowing access thereto, for example to turn it on or off, or replace its batteries. Optical fibres 6 lead through the ball to their respective tips 11. The ball 28 may comprise opaque material, in which case the tips 11 will be disposed at an outer surface of the ball 28. Alternatively, the ball 28 may comprise transparent or translucent material, in which case some or all of the tips 11 may instead be disposed deeper within the ball 28. Again, activation of the body 2 produces flashing lights having changing colours from the tips 11 of the fibres 6.

Another plaything is shown in Figure 23. Here, a baby's rattle 59 comprises a handle 60, within which is located a body 2 of a device 1. Optical fibres 6 extend from the body 2 through the handle 60 into a head 61 of the rattle 59. Either the head 61 is transparent or translucent and some or all of the optical fibres 6 terminate within the head 61, or the head 61 is opaque and the optical fibres 6 terminate at its surface. Activation of the device 1 produces lights of changing hue in the head 61 of the rattle 59, optionally also flashing on and off. This is likely to attract or even fascinate a young baby.

The device 1 embedded in the rattle 59 may also be provided with an electronic audio generator (not shown), linked to respective audio transducers or the like, so that the rattle 59



may also emit sounds, such as musical tones. These may be synchronized with the LEDs flashing on and off, and the emitted colours may be coupled to particular musical notes.

Other devices illustrated, such as the ball 28, may also comprise similar sound generation features.

In addition to the globular tips 11 shown in Figures 3 and 4, the optical fibres 6 described may be provided with other distal terminal features, as shown in Figures 11 to 14. In Figure 11, an optical fibre 6 is operatively connected at its distal end to a simulated (or even real) gemstone 30. Thus, when the optical fibre 6 is illuminated, the gemstone 30 will light up decoratively.

Figure 12 shows a further variation, in which three optical fibres 6 are connected at their respective distal ends to a single simulated gemstone 30. This may be used simply to project more light into the gemstone 30 than is possible with the arrangement of Figure 11. Alternatively, a first fibre 6R is operatively linked to a red LED, a second fibre 6W to a white LED, and a third fibre 6G to a green LED. As the LEDs flash on and off, the gemstone 30 will light up with red, white and green light, thus simulating a ruby, diamond or emerald in turn. In place of a simulated gemstone 30, a genuine precious or semiprecious stone may be used if desired.

In Figure 13, an optical fibre 6 has a decorative figurine 31 mounted to its distal end, so as to be lit up when a respective device 1 is activated.



The simulated or real gemstone 30 and figurines 31 are particularly suitable as hair decorations. Figure 14 shows a gemstone 30 in a wearer's hair 32, illuminated by a device 1 and optical fibres 6 concealed in the hair 32.

Although conventional optical fibres 6 are sufficiently flexible to be threaded through a person's hair, or through clothing, the special glass of which they are composed has a degree of resilience, and so there is a chance that they may not remain in position. Modified optical fibres, such as those shown in Figures 15A and 15B, may therefore be advantageous in some applications.

A first modified optical fibre 33 is shown (in part) in Figure 15A. In most optical fibres, a majority of light transmission takes place along a central core region 34 of the fibre. A shell region 35 surrounding the core region 34 frequently has a different refractive index to encourage this, thus channelling light generally axially along the fibre. The first modified optical fibre 33 is provided with an elongate wire 36 of ductile metal extending longitudinally of the fibre 33, embedded within its shell region 35 where it has little effect on light transmission along the fibre.

Alternatively, a second modified optical fibre 37, as shown in Figure 15B, has the ductile metal wire 36 mounted to an outer surface of the fibre 37 and extending longitudinally thereof. (In each case, a metallic strip may replace the generally cylindrical wire 36 shown).

Thus, as shown in Figure 16, the modified optical fibres 33, 37 may be used in place of conventional optical fibres 6, extending away from the body 2 of a device. When the modified fibres 33, 37 are curved or bent, the ductile metal wire 36 ensures that they retain



the desired shape, rather than immediately or gradually returning to a relatively straight form. Relatively sharp bends 38 can therefore be produced if desired.

Further applications for the devices of the present invention are shown in Figures 17 and 18. Figure 17 shows a two dimensional picture 39, which may be part of a greetings card, or may be a frameable picture, a poster or another such form of artwork. A device body 15 of relatively flattened form is mounted to a reverse face of the picture 39, where it is not visible. A plurality of optical fibres 6 extend across the reverse face of the picture 39 to their respective tips 11, which are visible on their own or form part of a larger design on the obverse face. As described above, the device body 15 may be activated, flashing the tips 11 on and off and varying the colours emitted therefrom.

The same arrangement may be applied to art works in bas-relief or even to three-dimensional images.

An allied application is in calendars and books (Figure 18). Here, a cover 40 of a book 41 has a device body 15 of relatively flattened form embedded therein (or mounted to an inner face thereof). A plurality of optical fibres 6 extend within the cover 40 or across its inner or outer surfaces to their respective tips 11, which are visible on the outer surface of the cover 40. Activation of the device body 15 causes the tips 11 to flash on and off and/or change colour as described above, for example forming part of a book cover design. Embossing, metallic effects and even holograms are all in use for the covers of even relatively cheap books, so a simply implementable lighting effect is likely to be of interest to book designers.



The optical fibres 6 may well be sufficiently fine to be applied to or embedded in pages of the book 41, as well as or instead of the cover 40. Books for young children often have pages of stiff card instead of paper, which would be ideal for the incorporation of optical fibres 6 so as to produce attractive light effects to enhance the book's illustrations.

The devices of the present invention may also be incorporated into decorative items such as Christmas trees, as shown in Figures 19 and 20. An artificial Christmas tree 42 comprises a base pot 43 with a hollow trunk 44 extending upwardly therefrom and a plurality of hollow branches 45 extending generally horizontally outwardly from the trunk 44. A device body 2 (which may be battery or mains powered) is concealed within the base pot 43, and a plurality of optical fibres 6 extend up within the trunk 44 and through the branches 45 (largely omitted for clarity). A variety of illuminable baubles 46 are mounted to the branches 45 and the upper end of the trunk 44, one or more optical fibres leading to each bauble 46. Each bauble 46 may for example be lit up in a single colour or in varying colours, or may flash sequentially in several colours, depending on how the optical fibres 6 are linked thereto. The baubles 46 may be permanently mounted to the tree 42, or may be exchangeably detachable therefrom, so that a user may select a preferred set of baubles 46.

In addition to or instead of the baubles 46, the optical fibres 6 may extend through an interior of each branch 45 with their respective tips 11 disposed at a surface of the respective branch 45, interspersed with artificial needles 47 or the like. Thus, the tree 42 itself is covered with a plurality of twinkling points of light in continually varying colours.

A further item into which the present invention may be incorporated is a hairbrush 62. (Figure 24A). A body 2 of a device 1 is located in a handle 63 of the hairbrush 62, and a



plurality of optical fibres 6 extend from the body 2 into a head 64 of the hairbrush 62. The head 64 has a plurality of bristles 65 extending from one face thereof. Some or all of these bristles 65 may be linked to a distal end of a respective optical fibre 6, or may have an optical fibre 6 extending therethrough (see Figure 24B). Thus, lights of varying colours, optionally flashing on and off, would be emitted from the distal tip 11 of each optical fibre 6 (doubling as a distal tip of a respective bristle 65).

Several of the types of product illustrated and described above are believed never to have been produced hitherto when comprising any form of LED/optical fibre illumination. It is hence envisaged that such products could beneficially be produced, provided with simpler illumination arrangements, such as at least one LED 5 operatively linked to at least one optical fibre 6, ideally a plurality thereof, and a control chip 4 programmed to cause the LED 5 to flash on and off and/or vary in brightness.

It is believed, for example, that items of clothing, glassware, crockery, playthings such as balls and rattles and grooming tools such as brushes and combs would all benefit from such simpler illumination arrangements, which are believed in that context to be novel.

It is also believed that the provision of illuminable decorative figurines and gemstones on a distal end of an optical fibre lit from a proximal end by one or more LEDs is also novel and useful, irrespective of the control system provided to control the LEDs.



CLAIMS

1. A source of decorative illumination comprising at least one first light source adapted to emit light of a first colour, at least one second light source adapted to emit light of a second colour, at least one optical fibre operatively linked adjacent a proximal end to the or one of said at least one first light source and to the or one of said at least second light source, and control means for the light sources adapted so to control a brightness of the or each first and second light source that a selected colour produced by a combination of said first and second colours is emitted from a distal end of the or each optical fibre.
2. An illumination source as claimed in claim 1, further comprising at least one third light source adapted to emit light of a third colour, the or each said optical fibre being operatively linked also to the or one of said at least one third light source, and the control means being adapted so to control a brightness of the or each first, second and third light sources that a selected colour produced by a combination of said first, second and third colours is emitted from the distal end of the or each optical fibre.
3. An illumination source as claimed in claim 2, wherein said first, second and third colours comprise red, green and blue.
4. An illumination source as claimed in any one of the preceding claims, wherein each said light source comprises a light-emitting diode (LED).



5. An illumination source as claimed in any one of the preceding claims, wherein the control means is adapted so to alter said the brightnesses of the light sources as to change the emitted colour from a first selected colour to a second selected colour, optionally being adapted to alter the brightnesses continuously.
6. An illumination source as claimed in any one of the preceding claims, wherein the control means is adapted to turn the light sources on and off in a random or predetermined sequence.
7. An illumination source as claimed in any one of the preceding claims, provided with power supply means comprising solar cell means.
8. An illumination source as claimed in any one of the preceding claims, wherein at least some of the fibres are provided at a distal end with an illuminable decoration means, such as a simulated or real gemstone.
9. An illumination source as claimed in any one of the preceding claims, wherein at least some of said fibres are split adjacent a distal end thereof to form a plurality of distal tips.
10. An illumination source as claimed in any one of the preceding claims, comprising activating means adapted to activate the light sources only when ambient light levels are below a predetermined threshold.



11. An illumination source as claimed in any one of the preceding claims, wherein the optical fibres are replaceably detachable from a remainder of the illumination source, either individually or as a connected group.
12. An illumination source as claimed in any one of the preceding claims, comprising means to generate an audible output.
13. An illumination source as claimed in any one of the preceding claims, wherein the optical fibres are provided with reinforcing means.
14. An illumination source substantially as described herein with reference to the Figures of the accompanying drawings.
15. Apparatus to decorate a person's hair, comprising at least one source of decorative illumination as claimed in any one of the preceding claims, the or each optical fibre thereof being adapted to be woven or threaded through the person's hair.
16. Apparatus as claimed in claim 15, wherein the or each optical fibre is adapted to be concealable within the person's hair, optionally being coated with material coloured to resemble a natural hair colour.
17. Apparatus as claimed in either claim 15 or claim 16, wherein a casing means of the or each illumination source is provided with means of attachment to a wearer's hair, clothing, headgear or person, or is mountable to an existing item of adornment, such as a hairclip, hair band or the like.



18. An item of personal adornment comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14.
19. An item of personal adornment as claimed in claim 18, attachable to a person's hair.
20. An item of personal adornment as claimed in claim 18, wearable on a person's head, body or limbs.
21. An item of personal adornment as claimed in claim 18, mountable to a person's clothing.
22. An item of personal adornment as claimed in claim 18, comprising a zone of flexible material, optionally textile, mountable to clothing, optionally detachably.
23. An item of personal adornment as claimed in any one of claims 18 to 22, wherein the or each illumination source is detachably mounted to the item of adornment.
24. An item of personal adornment as claimed in claim 23, comprising power supply means connectable to the or each detachable illumination source.
25. An item of personal adornment as claimed in any one of claims 18 to 24, wherein the optical fibres extend within an interior of the item.



26. An item of personal apparel comprising at least one illumination source as claimed in any one of claims 1 to 14.
27. An item of personal apparel as claimed in claim 26, wherein the or each illumination source is separable from the item of apparel, for example so that the item may be cleaned.
28. An item of apparel as claimed in either claim 26 or claim 27, comprising a woven fabric material, the optical fibres extending through a weave thereof.
29. A drinking vessel or item of glassware or crockery comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14, wherein the optical fibres thereof extend within wall means of the respective drinking vessel or item of glassware or crockery.
30. A plaything comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14, wherein the optical fibres extend within an interior of the plaything.
31. A plaything as claimed in claim 30, comprising a ball or a rattle or the like.
32. An item of stationery comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14.



33. An item of stationery as claimed in claim 32, wherein the optical fibres are embedded within the item of stationery, optionally with only a distal tip of each optical fibre visible in use.
34. An item of stationery as claimed in either claim 32 or claim 33, comprising a book, calendar or greetings card.
35. A tool or implement comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14.
36. A tool or implement as claimed in claim 35, comprising brush or comb means, the optical fibres of the or each illumination source extending through or comprising at least some of bristle means of the brush means or tooth means of the comb means respectively.
37. An item of household décor comprising at least one source of decorative illumination as claimed in any one of claims 1 to 14, optionally comprising an item of festive décor, such as a Christmas tree.
38. An optical fibre comprising an elongate member of ductile material, optionally metal, extending longitudinally thereof.
39. An optical fibre as claimed in claim 38, wherein said elongate member comprises a wire or strip of said ductile material.



40. An optical fibre substantially as described herein with reference to Figures 15A, 15B and 16 of the accompanying drawings.
41. A source of decorative illumination as described claimed in any one of claims 1 to 14, comprising one or more optical fibres as claimed in any one of claims 38 to 40.

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Claims searched: 1-13, 15-37, 41

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Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X: 1-6, 9, 22-28 at least, Y: 35, 36	FR2788105 A (CASTILLE) See e.g. abstract, fig 10 & p6 lines 15-23
X,Y	X: 1-6, 9, 26 at least, Y: 35, 36	US2004/0066658 A1 (LEUNG ET AL) See e.g. paragraphs 0013, 0014 & 0022
X,Y	X: 1-6, 9, 15 at least, Y: 35, 36	US2003/0156429 A1 (MACDONALD) See e.g. abstract, fig. 5 & paragraphs 0027, 0028
X,Y	X: 1-6, 9, 37 at least, Y: 35, 36	US2003/0147235 A1 (LIN ET AL) See e.g. abstract, fig 5, led 56 & paragraphs 0012, 0024
X,Y	X: 1-6, 9, 37 at least, Y: 35, 36	US2002/0136024 A1 (KUYKENDAL ET AL) See e.g. abstract, figs, paragraphs 0004 & 0009
X	1-6, 9, 26, 30, 37 at least	EP1435483 A1 (ELITE TRADING CO) See e.g. abstract, figs & paragraph 0006
Y	35, 36	DE29921295 U1 (NIEBUHR) See e.g. abstract & figs

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
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Field of Search:

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The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC