Instant Colour

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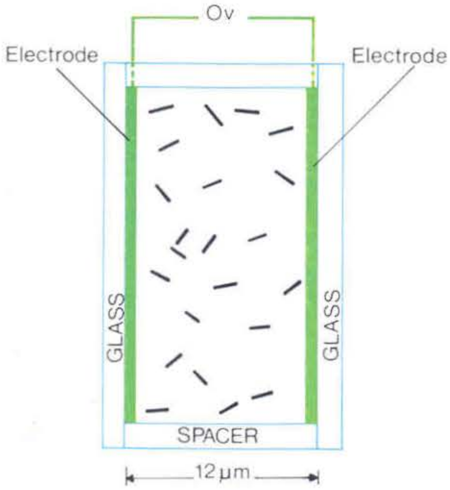
Colour filters and colour change devices as we know them today, along with barndoors, shutters, irises and gobos are likely to become obsolete. How will this happen?

Consider a totally novel device, looking like a few thin sheets of glass sandwiched together, that can be slotted on the front of any conventional theatre luminaire. Four thin wires running from this device to the control room enable the operator to select the colour that the luminaire emits. The major difference between this and conventional colour change devices is that:

(a) No colour filter is required.
(b) Any colour in the visible spectrum may be selected.

Fig. 1.

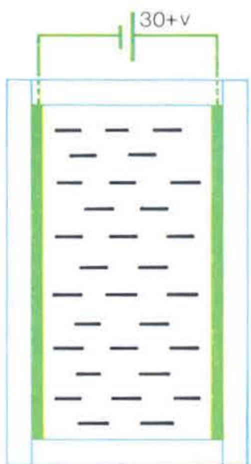


(c) Colour changes may be either instantaneous or over any desired period of time.

This is such a totally new and exciting idea that the possible advantages of such a device should be fully explored. Let us presume that every luminaire in a theatre is fitted with this device which we shall call for simplicity M.I.C. (*Modulation Induced Colour*). A complete stage colour wash is possible in an infinity of different colours. Or every luminaire can be a different colour and change to another different colour on every cue. Or how about a dynamic sunset with selected lamps changing colour gradually and continuously from yellows through to reds over, say, 15 minutes?

M.I.C. is electronically controlled: therefore repeatability is exact and colour states can easily be stored. Other major advantages include the perfect snap or fade to blackout as M.I.C. can go to black (as we said, *every* colour in the visible spectrum) and this facility could be used as a dimmer on discharge lamps (such as CSI or HMI

Fig. 2.



follow spots and projectors) which cannot be dimmed by normal means.

What is this potentially magic device? The answer lies in a milky substance known as liquid crystal. You may have come across it used in the display of digital watches. It functions in the following way:

Consider two flat thin sheets of glass with a transparent electrode deposited on one surface of each of them as shown in fig. 1. The sheets of glass are held a very small distance apart (usually 12 microns) with the electrodes on the inside surfaces and the gap filled with liquid crystals. If there is no potential between the electrodes, the molecules of liquid crystal (L.C.) have a random nature giving the cell a frosted appearance. On the application of a potential between the electrodes (fig. 2) the molecules form up in a fixed crystalline formation and light may pass through the cell—it becomes transparent.

Let us now take this a stage further: it is possible to add a small quantity of a specific dye (pleochroic) that will bond with the Liquid Crystal molecules (fig. 3). Consider that a red dye has been used. With no potential between the electrodes, the molecules (together with their bonded dye) are in random disarray. White light shone through the cell is absorbed to leave red light. With the application of a potential, the liquid crystal and dye mixture instantly transforms to its crystalline structure, and due to a special property of the pleochroic dye the cell becomes transparent. The emitted light is now white. So far, therefore, we have obtained a filter that may turn from red to white or vice versa instantaneously. The rest is now simply the follow-through of this phenomenon to a logical conclusion.

By switching the cell very rapidly between white and red, and by varying the length of time that the colour is on for, any shade of pink may be obtained. The secret being that the cell switches so fast that the eye cannot detect the individual pulses of white and red making up the colour. One cycle would be about 40 milliseconds and thus there would be 25 cycles per second.

The natural progression from this is to stack three cells. One cell containing a dye that is primary red in colour, another being primary blue and the third being primary green (fig 4). By rapid modulation of all three cells any colour in the visible spectrum may be obtained. With all cells switched on (potential present) white light will be emitted. With all cells switched off (random nature) no light will be emitted because red, green and blue by subtraction give black.

A pale magenta consists of a short pulse of red light, a short pulse of blue, followed by a short pulse of white: i.e. a colour is made up sequentially of its primary components and white, and the device has

Fig. 3.