ENGINEERING

Lighting in Any Shape

Electroluminescence, a way to convert electricity directly into light, could illuminate our homes in the not-too-distant future.

By STEPHEN BRONZ

WINDOWS, wallpaper, and draperies that glow to light the home at night could be standard equipment in the not-too-distant future. Electroluminescence, hailed as the most important lighting discovery since Edison's incandescent lamp and the fluorescent bulb, will be responsible.

The possible uses of electroluminescence stretch the imagination. The lights need not be in set shapes of bulbs or tubes. Electroluminescence can provide area lighting, two-dimensional lighting that can come in any shape. Thin layers, a few thousandths of an inch thick, of an electroluminescent source might be used to cover ceilings and walls. Windows coated with the material could transmit sunlight in the day and light the room at night.

Direct Conversion

"Electroluminescence" is a way to convert electricity directly into light. It can be accomplished by exciting a thin film of phosphors with an alternating current. The phosphor film is sandwiched in between two electrically conductive surfaces, at least one of which is translucent. The "bread" of the sandwich can be a mesh of tin oxide, no thicker than the "meat."

When the alternating current is sent through the outer layers, an alternating electric field is set up across the phosphors in the middle. The electric field "excites" or energizes the electrons in the phosphor layer. Essentially, as the electrons "calm down" they emit their excess energy in the form of light.

This method is akin to the principle behind fluorescent lamps and television sets. In all three light is produced by exciting a phosphor. In a fluorescent lamp, light is produced by the action of ultraviolet rays. Television sets show pictures because of a beam of high-speed electrons. Electroluminescent sources glow because the phosphors are excited by an electric current.

In one respect electroluminescence is different from previous forms of electric lighting. The electricity is converted directly into light. There is no tungsten filament to heat white-hot as in the ordinary incandescent light bulb. The electricity does not have to be converted into ultraviolet radiation to produce, in turn, fluorescent lighting.

Versatile electroluminescence can change colors as quickly and as easily as the intriguing chameleon. A turn of a knob might change the color of the light from blue to red or white.

Technically, the colors are varied by mixing different phosphors or by changing the frequency of the alternating current. As the frequency changes, different colors inherent in the electroluminescent source are emphasized.

Electroluminescence can also form an image. A photoconductor, a material that conducts electricity in proportion to the amount of light falling upon it, is placed in front of electroluminescent material. When an image is focused on the photoconductor and when electricity is applied to the two layers, the photoconductor will translate the image into an invisible picture of varying voltage.

The varying voltage, in turn, will be translated into a picture by the phosphors in the electroluminescent screen. The device can "see" things beyond the visible spectrum. It could be used to give a brighter X-ray picture than is now possible with a fluoroscope.

If an electroluminescent screen can be made to perform the function of a television tube, as it may well be made to do, television sets no thicker than a painting could be hung on the wall. The bulky picture tube would be eliminated because the electroluminescent screen would translate the electric impulses into a picture without the intermediate step of bombardment by high-speed electrons.

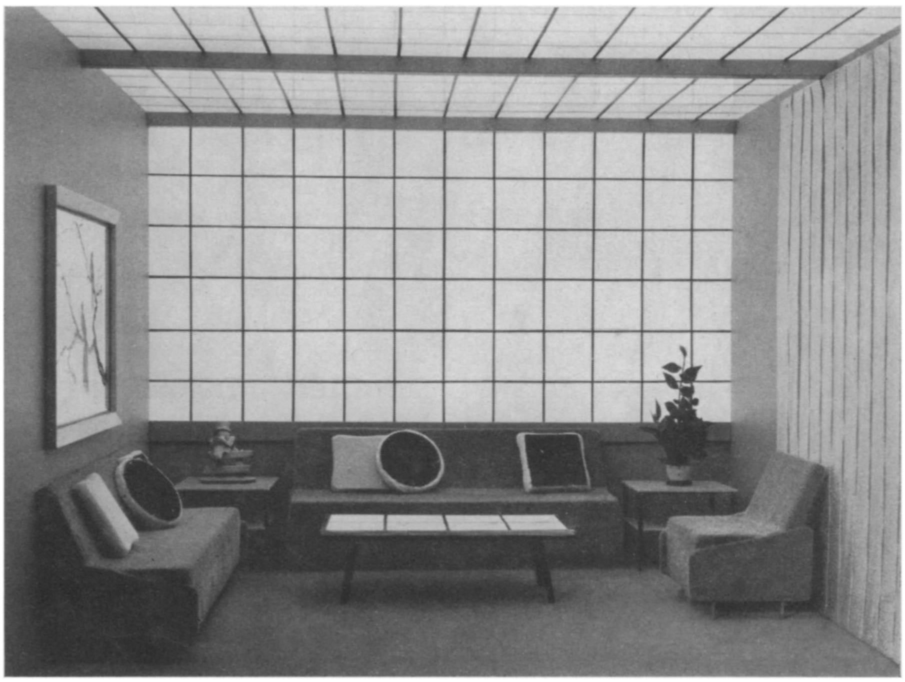
There is a considerable amount of electroluminescent lighting in use today. Electroluminescent panels are now used as night plotting boards for the bridges of ships, instrument dials, and night lights for the homes. The 1960 Chrysler and Imperial automobiles will have electroluminescent panels illuminating their dashboards.

Sandwich Structure

The panels, the most extensively used form of electroluminescence at the present, are made by coating a plate of glass with an electrically conductive layer. On top of this is placed the powdered phosphor layer embedded in plastic film. To complete the sandwich the inside surface of a protective moisture barrier is coated with a dielectric, or conductive layer, made perhaps of aluminum.

When a wire connected to the dielectric layer is plugged into an electric circuit, the panel glows. Instead of a glass-based panel, ceramic, plastic or nylon might be used. With a nylon light source, soft draperies could be plugged into the electric outlet and made to glow.

Before our homes are lighted by glowing ceilings, however, some major problems must be ironed out in the laboratory. Electroluminescence still is too costly to compete with filament, fluorescent or mercury lighting, except where only a dimly glowing panel is needed, because the sources have a low brightness and a low



ELECTROLUMINESCENCE AT HOME — This prototype living room built by Westinghouse has a luminous ceiling, windows, mural and coffee table. The windows transmit sunlight in the day and emit a soft glow at night when plugged into a circuit.

efficiency at regular levels of voltage and frequency.

The brightness of the light can be increased in two ways. The strength of the current can be increased by raising the voltage or by quickening the frequency of the alternating field's oscillations.

Both, however, have technical limits. Too strong a current will destroy the insulating properties of the phosphor film and too rapid a frequency will not give the electrons enough time to get "excited," to "calm down," and to emit light.

Even disregarding technical limits, the voltage and frequency of the electrical system would have to be raised to make a panel bright enough to light a room with electroluminescence. Consequently, a luminous ceiling would cost an estimated $12,000, ten times as much as a luminous ceiling of fluorescent lamps behind diffusing plastic.

Considerable progress has been made since intensive research on electroluminescence began in 1950. America's three largest electric light manufacturers, General Electric, Westinghouse and Sylvania, are conducting extensive laboratory research programs on electroluminescence.

Although low-cost electroluminescence is not just around the corner, it could occur within the next decade. Windows, wallpaper and draperies may light the home.

A Soviet physicist, in 1923, made the first known observation of electroluminescence.

At the city of Nizhni-Novgorod, Oleg Vladimirovich Lossev discovered that a crystal of silicon carbide properly oriented between two direct current electrodes will glow. Thirteen years later, a French scientist, Georges Destriau, found that an alternating current could excite sulfide phosphors to produce light.

However, as Prof. Destriau recently recalled, his electroluminescent source was so dim that "you had to turn out the lights and adapt your eyes to the darkness before you could glimpse its faint light."

Indeed, these early efforts were considered mere laboratory curiosities. It was not until 1950 that industry became interested in electroluminescence.

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GEOPHYSICS

Radioactivity Found High Off Antarctic Continent

THE AMOUNT of radioactivity in the waters of the Pacific Antarctic is more than twice as great as the natural amount.

Mr. B. A. Nelepo of Moscow State University told the International Oceanographic Congress meeeting at the United Nations headquarters in New York that this radioactivity was uniformly distributed over a vast area, indicating that the contamination was caused by the fallout of radioactive products from the atmosphere.

The measurements on which he based his results were taken last year in the south Pacific adjacent to the Antarctic continent east of the Balleny Islands.

The region of highest activity, he said, was found to be the upper mixed layer of ocean water, about 50 yards in depth. Radioactivity decreased considerably with depth in the layer between 50 and 150 yards.

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