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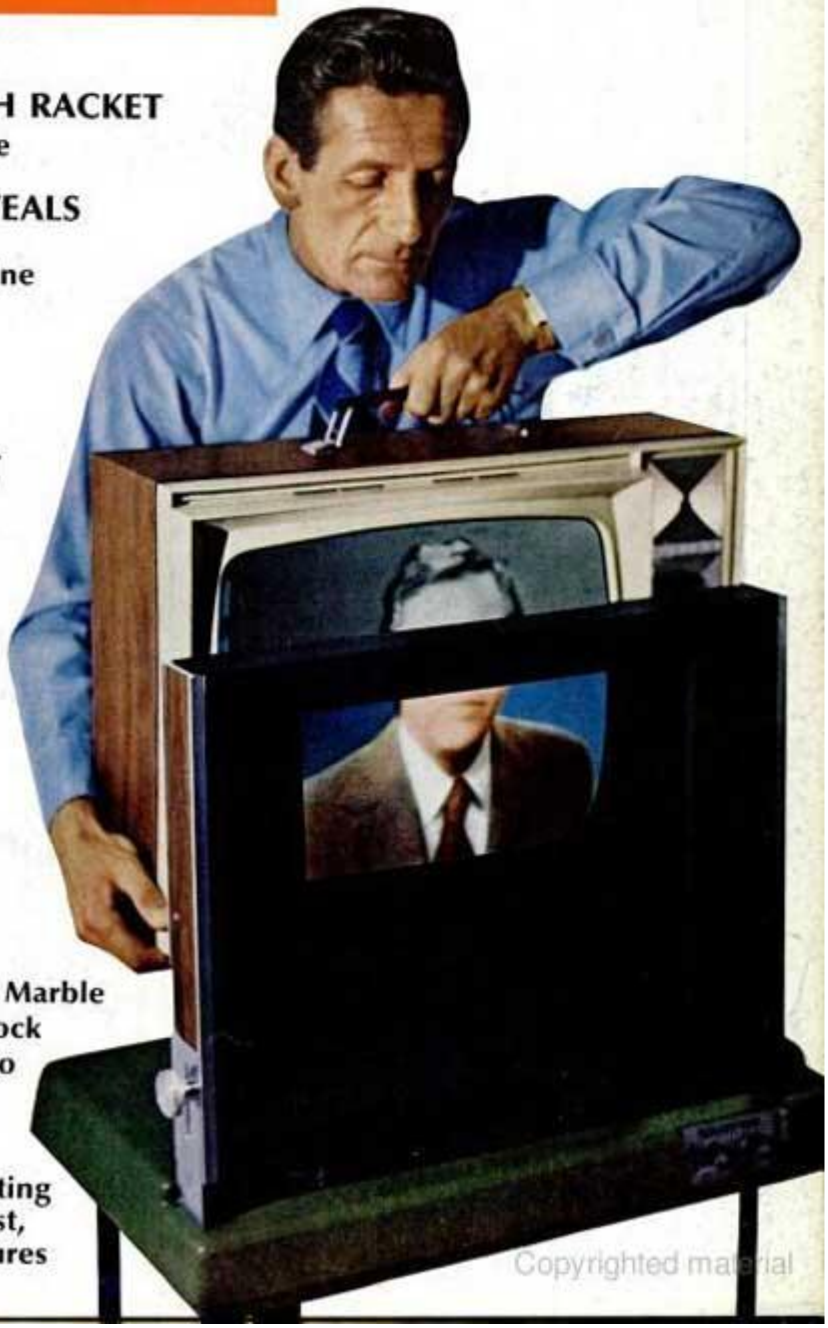
THE *What's New* MAGAZINE

Add-On Converter Lets You View Real COLOR TV On Your Black-and-White Set



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Add-On Converter Turns Your B&W TV Into a Color Set

You'll blink in amazement at this device. A striped endless belt flashes red and blue-green images and your eyes create a realistic color TV picture

By RONALD M. BENREY PHOTOS BY ORLANDO GUERRA, DRAWINGS BY RAY PIOCH

A color picture from a black-and-white TV set? Absolutely! This is the amazing news from a small Canadian electronics firm I visited recently. The company has developed a converter that perches in front of any medium-size (up to a 20-inch screen) black-and-white TV. The maker expects to market it in kit form for about $100.

Through a bit of optical alchemy, it turns the picture you see into a color image—provided, of course, that it's a color transmission. Black-and-white broadcasts remain two-toned without color tinting.

The converter is connected to a B&W TV with a simple adapter plug that you snap onto the picture-tube prongs under the regular picture-tube socket. This plug-in feature makes it easy to move the converter from one set to another. And that's all there is to it. There are two controls to fiddle with: color intensity and hue, just like a conventional color set.

PS editors saw a converter in operation last June at the Consumer Electronics Show in Chicago. The demonstration was impressive, but raised many questions, including:

- When will the device be on the market?
- How will it be sold in the U.S.?
- Most of all, how does it work?

To get the answers, I flew to Canada and talked with Frederick Topping, president of Spectrac, Ltd. (1320 Ellesmere Rd., Scarborough, Ontario).

"At first," Topping told me, "the converter will be sold in semi-kit form. The circuit board will be prewired and adjusted, but the owner will do the final electrical wiring and some mechanical assembly. Kits will be available before mid-1972."

Why kit form? To keep the price tag below the magical $100 figure. Apparently, selling the converter as a kit saves substantially on assembly costs, shipping costs, and import duty.

Grand illusion. Conventional color TVs produce a color image through a well-known optical illusion. Perhaps you've seen the phenomenon demonstrated: Shine three light beams—one red, one green, and one blue—on a white screen and you can then create a wide range of colors by varying the relative brightness of the three beams.

The right recipe of all three beam intensities makes white; red and green only, with no blue, makes yellow; red and blue only makes magenta; and so on—every different combination of beam strengths produces the *illusion* of a different color.

Conventional color-TV screens are covered with thousands of tiny red, blue, and green phosphor dots which are illuminated in triads or clusters of three. Separate electron beams sweep across the screen, making dots within each group glow with the right relative color brightnesses to produce a particular color at each triad. Your eye blends the points of red, green, and blue light from each triad into a full-color picture on the screen.

Sequential filters. Spectrac's converter uses a different optical illusion based on findings of Edwin H. Land and others; it uses the colors red and cyan. The principle involved is simple.

Your eye is alternately shown an all-red and an all-cyan image (each lasting about 1/60 second). This is called a "field sequential" color presentation.

Your eye and brain automatically transform the rapidly changing two-color images into the illusion of a full-color picture. The specific color of any picture element is determined by the relative brightnesses of the red and cyan images in that element.

Continued

Slide your black-and-white set behind this moving-belt converter and you see a color picture. Picture tube needs adapter plug.

A color TV produces an image through a well-known optical illusion. With a

(Apollo TV cameras employ a spinning-filter disk before the camera lens to obtain a three-color sequence; earth-based electronic converters then show you a normal broadcast signal.)

During the early days of black-and-white TV, you may remember, moving color filters to generate a color-TV image were proposed. In fact, briefly in the early '50s the official U.S. color-TV system was one designed by CBS Laboratories, using a large, spinning filter disk to rotate red, blue, and green filters before a B&W picture tube. A major hang-up of this system: mechanical unreliability. Turning a large disk at several hundred rpm is bound to be troublesome and potentially dangerous.

Endless plastic belt. The Spectrac converter has no high-speed moving parts; its key moving element—an endless belt—loafs along at a gentle 1⅓ inches per second. It uses an unusual moving-mask arrangement to sequentially uncover fixed red and cyan filters. The endless plastic belt is printed with a pattern of thin parallel black lines. These black stripes are slanted slightly toward the left (when the belt is viewed from the front).

The belt, supported by spring-loaded rollers, is held upright in front of the picture tube. A simple synchronous motor drive (including a worm-gear drive mechanism) turns the left roller to move the belt slowly from right to left (again, as seen from the front).

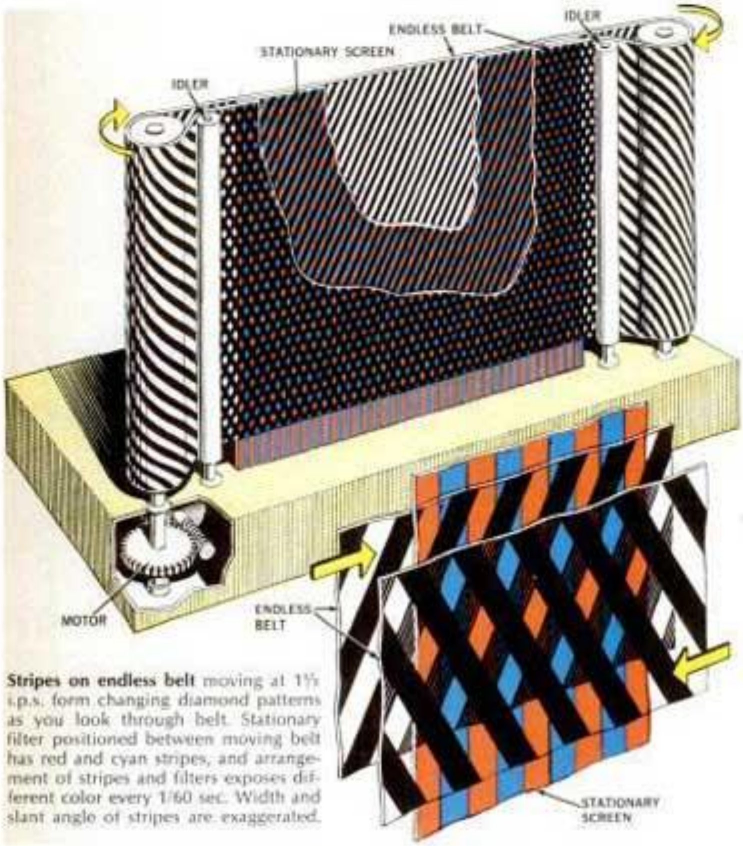
Inside the endless belt stands a stationary plastic filter, carrying alternate red and cyan vertical stripes.

Diamond patterns. Consider, for a moment, the moving black-striped belt. Although the stripes lean toward the left on the front surface of the belt, they lean toward the right on the belt's rear.

Remember, you look *through* the belt, and see the superimposed black stripes forming rapidly changing patterns. The front and rear slanting lines intersect to create long, skinny diamond patterns that develop at the top of the converter, grow to fill the area, then dissolve at the bottom of the screen (see photos). At the midpoint of a color cycle, when the screen is all red or all cyan, the narrow diamond pattern extends from the top to the bottom of the screen.

Actually, you could see these diamonds only by examining the converter very closely—the stripes are so narrow (about 0.022 inch) that the pattern seems invisible.

Stripe spacing, slant angle, and the width of the red and cyan filter



Stripes on endless belt moving at 1⅓ i.p.s. form changing diamond patterns as you look through belt. Stationary filter positioned between moving belt has red and cyan stripes, and arrangement of stripes and filters exposes different color every 1/60 sec. Width and slant angle of stripes are exaggerated.

Color-photo sequence shows development of sequential color fields. A red band appears at top of converter screen (left) and spreads downward, keeping pace with the electron-beam painting red information on the picture tube. In middle photo, red has expanded over most of screen, while at right it is moving off the screen as cyan sequence begins. Narrow diamond patterns, which "grow" to height of screen, sequentially expose red and cyan on the stationary filter. Your eyes create the color image.

stripes (on the stationary filter) have been carefully planned so the moving diamond pattern acts as a moving mask that alternately uncovers only red or only cyan stripes. The speed of the moving belt is set so the moving diamond pattern is in step with the single electron beam that paints the image on the phosphor screen (a B&W picture tube has only one beam).

As the beam zigzags down the front of the screen, the converter moves a color band in pace with the beam. During one downward sweep the band is cyan-colored; during the next, the filter shows a red band, and so on. This system duplicates the cyclic action of a two-color wheel.

Controlling motor speed. A synchronizing circuit locks the drive motor's speed "in sync" with the moving electron beam. In Topping's original patent, a photoelectric eye looks at the black stripes as they move by, and, if necessary, sends a corrective synchronizing signal to the motor. Several other schemes, however, will do the job, and Topping isn't saying how the sync system will work on production models.

The converter's electronic circuitry, mounted inside the base, decodes the incoming color-TV signal and controls the electron-beam intensity to create proper red and cyan image brightness. The circuitry is similar to that of the color decoder used in a regular color receiver; in fact, Spectrac modifies a standard color-circuit board manufactured by a Canadian set maker.

One question I asked Topping concerned the limited frequency response of a B&W TV. I wanted to know if the narrower bandpass (compared to a color TV) of the intermediate-frequency amplifier circuitry chopped off any color signal before it reached the converter. Topping explained the converter circuit board has a frequency-compensation circuit to restore the reduced color-signal strength.

Picture quality. The big question, of course, is, "How good a color picture does the device produce?" Topping tells me that the converter "can't create as good a color picture as a standard color set, but most viewers will find the image pleasing and acceptable."

I tend to agree, but keep in mind that your $100 will not buy the picture quality of a properly adjusted $500 color TV.

The converter has two major shortcomings to my eye. The first concerns color accuracy: The filter system doesn't accurately reproduce yellow tones, or colors close to yellow, such as orange, gold, and chartreuse. And white areas in the color picture seem to have a slight cyan (bluish-green) cast.

Slim rectangular frame of converter is a bit larger than viewing area. A simple adapter plug snaps onto picture-tube pins, feeding in color signals from circuit in converter base. Two knobs control color intensity and hue. Units like this lab model will handle most 17-, 19-, and 20-inch sets. Models for 25-inch TV sets may be developed.

No color fringing. However, grass is green, the sky is blue, and flesh tones are excellent. What's more, the converter can't produce annoying color fringes around objects in the picture, as will an out-of-adjustment color TV. This is an important plus.

A second, and more serious, problem concerns the image brightness. I made an exposure-meter test and found the converter reduces picture brightness by about 90 per cent. You must view the image in a dimly lit room or it washes out. By contrast, you can view most new color sets in a sunlit room—even outdoors—thanks to their ultra-bright picture tubes.

The severe brightness loss is the result of two factors that are inherent in the design; they can't be engineered out:

- At any instant, the black stripes cover 50 percent of the TV screen's surface, cutting brightness in half.
- The red and cyan filter stripes are fairly dense, further reducing brightness.

Another minor problem is a random flickering in the picture. Topping said this was only a characteristic of the handmade $50,000 prototype I saw. He explained that production versions will have precision-made optical components, and will be flicker-free.

The converter is obviously well designed both mechanically and electronically. The belt-drive mechanism is not much more complex than the innards of an electric clock, and operating speed is so low the mechanical end should function indefinitely with little maintenance.

Is the converter for you? The electronic circuit board is all solid-state, and since the components are not working particularly hard, reliability should be high. The less-than-perfect color accuracy, and the dim picture are serious flaws that you should consider carefully before you place your order. If you aren't a steady viewer of a conventional color TV, you'll probably approve of the picture you see.

Ultimately, of course, money is the deciding factor. Given the choice between the converter and a 20-inch color TV, I'd take the color set—provided I could swing the $200-plus difference. If not, the $100 converter is a cheap way to step up to color TV. ■

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Courtesy of Cliff Benham