Here's Your Color TV

To convert this Zenith to color, CBS engineers added adapter in back, filter disk in front.

It means new entertainment—and new problems—for everyone who owns a set or is thinking of buying one.

By Martin Mann

AFTER 10 years of spiteful, even vicious, squabbling, color television is here. Columbia Broadcasting System is set to start TV shows this month in realistic, full color, using its own "field-sequential" method. It is this method that has won the official blessing of the Federal Communications Commission as *the* U. S. color TV system.

Your receiver, like the rest of the 10,000,000 already built, can't receive these shows. It will get either a blur or several small pictures side by side when tuned to color TV.

But you needn't stay out of the color picture long.

Manufacturers of some sets will have color attachments for their own sets on the mar-

Despite the FCC's "final" decision in favor of CBS color, many TV manufacturers are continuing their fight against it. They have started legal action that may delay the timetable set for color. It'll probably take a ruling from the U.S. Supreme Court to put a stop to the wrangling once and for all.

ket in a few weeks. Several firms have also promised to offer adapters and converters for other makes of sets soon.

An *adapter* hooked to your set clears up the screen so that you can see the colorcasts in black-and-white, but not in color. Probable cost: at least $35.

A *converter,* which includes an adapter plus a spinning color disk, brings you the whole thing—full-color pictures. Probable cost: at least $110. You may be able to convert your set yourself at less cost, but that depends a great deal on the set (see p. 120).

It'll probably be summer at the earliest before new sets, with color built in at the factory, reach the market. Prices should start around $300 for a combination color and black-and-white set with a 10-inch viewing tube magnified by a lens.

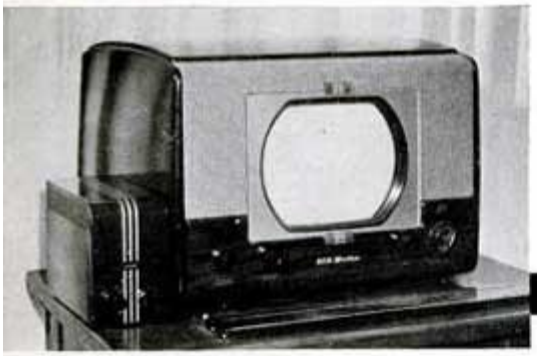
So far, only two stations in the country—New York's WCBS-TV and Philadelphia's WCAU-TV—are definitely committed to transmit color. And they will start with no more than 20 hours a week, mostly at off-hours times.

These shows will be available to any of the other 61 Columbia network stations that want them and are connected to New York by coaxial cable or microwave relay. Anybody else who wants to telecast color can

WHAT CAN YOU DO WITH THE SET YOU HAVE NOW?

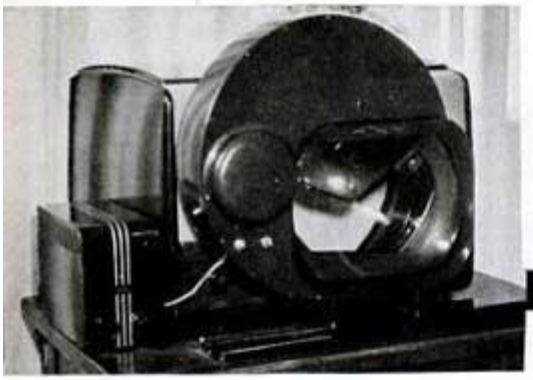
LEAVE IT ALONE

This blur is what most existing TV sets will get when tuned to a CBS colorcast. Some others may show several small pictures side by side. The reason today's sets can't get color shows is that technical standards were changed for color. Of course, old sets still receive black and white.



INSTALL AN ADAPTER

An adapter—the black box at the far left in the photo—brings in a clear, single picture from colorcasts. But in black and white, not color. The adapter is actually an extra electronic circuit that changes the works of your set to make them conform to the new color standards.



INSTALL A CONVERTER

Here's color. Adding a motor-driven color disk to the adapter does the trick (these two units together are called a converter). The disk puts red, blue, and green filters in front of the tube in exact step with similar filters in the TV camera, creating the illusion of full color.

When sets with the color built into them become available—probably in six months or so—they may look like these experimental models designed by CBS engineers. The color disk is completely enclosed, folding aside when the receiver is switched to black-and-white telecasts.

buy color cameras and originate his own.

How quickly colorcasting will spread—to more popular hours and to more stations—depends on how quickly the public buys sets that can receive color. The same show can *not* be broadcast in color and in black-and-white at the same time. It's certain to be several years before the big majority of the top programs are broadcast in color.

So there's no reason to junk your present set. But if you don't own a TV receiver now and are thinking of buying one, the decision becomes more difficult. You can go ahead and buy the black-and-white set and be sure of several years of fine entertainment. You can probably add an adapter or a converter when you want to. On the other hand, you can wait—meanwhile missing a few months' shows—for a set with built-in color or one with a built-in adapter.

The reason for all this confusion over adapters, converters, built-in color, and black-and-white sets lies in the system of color television the Federal Communications Commission selected. This system is simple, comparatively inexpensive, and gives good color, but it does upset the applecart of present-day TV—it cannot be received by existing black-and-white sets.

To understand why, look closely at a black-and-white TV picture. You will see that it is not a smooth blending of light and dark tones, like a photograph, but is actually composed of 525 individual lines of varying shades of gray. The camera creates these lines by running its electron beam across the scene from left to right, then turning the beam off while it is moved back to the left and down to the next line, then on again while it "scans" this line. During one trip from top to bottom, half the lines (one "field") are scanned. Then the beam goes back to scan the in-between lines it had skipped. Two fields, making one 525-line "frame," are sent out 30 times a second. The same thing occurs in a receiver, the frames following each other so fast they merge.

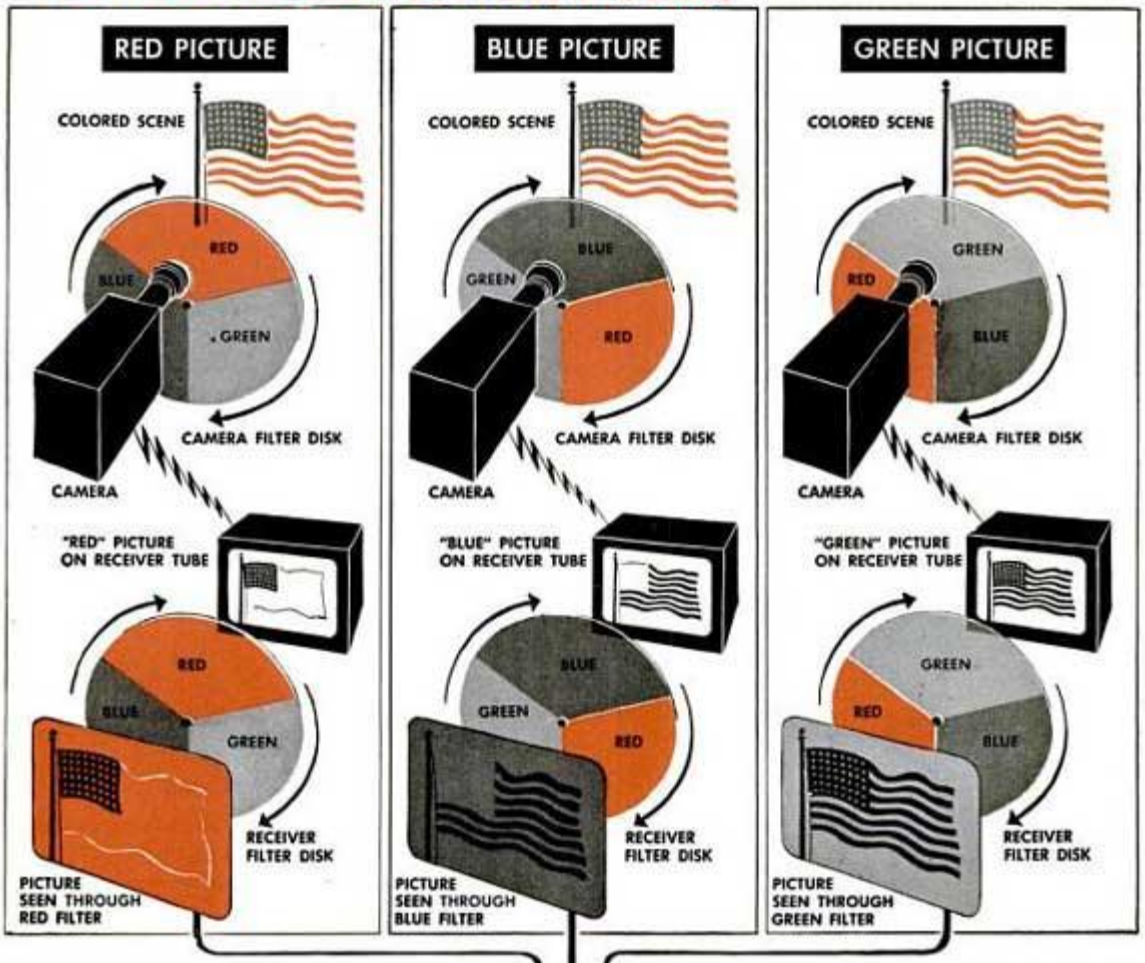
CBS Color Needs More Fields

The CBS color technique works much this way. But the first field is made with a red filter behind the camera lens, the second field with a blue filter, the third with a green filter, and so on. In all *six* fields—two each of red, blue, and green—are needed to make one full-color frame. Again the same thing occurs in a receiver. The fields—each viewed through the correct filter—follow each other so fast they merge into moving, full-color.

Unfortunately, you can't just start transmitting three times as many fields as you did before. (You can't, that is, without taking up more space in the crowded airwaves, and this isn't feasible.) If you increase one part of the load by tripling the number of fields, as CBS color does, you must decrease some other part to compensate. CBS compensates by reducing the number of lines and frames. The lines are cut from 525 to 405, and the frames are cut from 30 per second to 24. (Though this coarsens the picture, the color more than makes up for it.)

These changes cause the trouble. Existing

HOW CBS COLOR TELEVISION WORKS



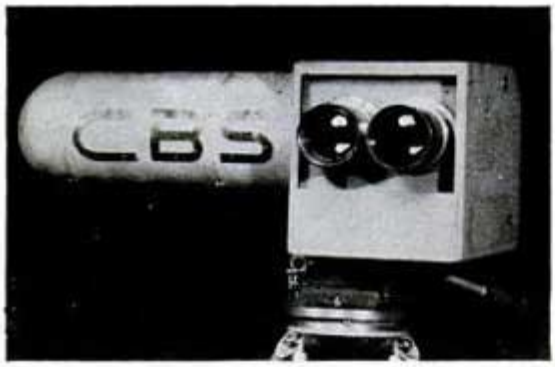
Color TV actually transmits a series of black-and-white pictures, each made through a colored filter. These appear on the viewing tube in black and white, gaining their color only because you look at them through a filter like the one on the camera. The drawing above (which shows equipment simpler than that actually used) explains how a U. S. flag is televised. Light from red stripes can pass only the red filter, so a signal for red stripes is transmitted only when the red filter is in position. This signal creates a white area on the receiver tube, which is colored red by the receiver filter. The blue is sent in a similar way. Light from the white stripes and stars passes all filters, so you see a quick succession of red, blue, and green, which blend to make white.

receivers are designed for 525-line, 30-frame TV. Their deflection circuits move the electron beam back to the left 15,750 times (525 x 30=15,750) a second and to the top 60 times (for 30 two-field frames) a second. For color, the electron beam must scan 405 lines in three colors 24 times every second, moving to the left 29,160 times (405 x 3 x 24=29,160) a second and to the top 144 times (for 24 six-field frames) a second.

Changing the deflection circuits so that the electron beam moves at these new rates is what is involved in adapting a black-and-white receiver to color standards. In many sets, this is extremely simple, requiring no more than the replacement of a resistor or two. But in others, particularly more elaborate ones with "locked" deflection circuits that keep the picture very steady, extensive changes may be needed. Adapted black-and-white sets also need a switch—automatic ones have been invented—to cut the new circuits out for old-style black-and-white.

Receivers adapted in this way will show

Several different types of lightweight color cameras have been developed. The one above, shown being focused on model Patty Painter, has also televised surgical demonstrations.



Another style of color camera used by CBS for its experimental telecasts is shown above. Most cameras do not use filter disks, but have vari-colored drums rotating behind their lenses.

colorcasts, but only as black-and-white pictures. To add the color itself, you need a rotating filter disk in front of the screen.

This complicates things still more. The receiver disk must rotate exactly as fast as the camera disk or the colors will wash out. It must also be "in phase"—red in front of the viewing screen when red is behind the camera lens—or actors may have green faces and blue lips. Simple circuits, synchronizing receiver and camera disks the way receiver and camera tubes are now synchronized, can accomplish this dependably.

The disk also limits the size of the direct-view picture to about 12½ inches. The disk obviously has to be twice the diameter of the viewing tube, and few people would want disks bigger than two feet across in their living rooms.

Since the change-over to this color system raises so many problems, why did the Federal Communications Commission pick it? The answer is simple. The Commissioners felt it was the only good one!

Four different systems were suggested, but the real contest arose between Columbia's and RCA's. The RCA method had the big advantage of being "compatible"—it required no change in deflection rates and could be received on existing sets (in black and white) just as they are. This would eliminate the big change-over problems: TV fans wouldn't miss any shows even if they didn't want to alter their sets, and telecasters wouldn't lose any audience by shifting to color.

But overriding the compatibility advantage, the FCC found many serious faults with the RCA system. To quote a few from the Commission's 59-page official report, "the color fidelity is not satisfactory . . . the picture was marred by misregistration (colors failed to superimpose properly) . . . at none of the demonstrations was a practical home receiver shown . . . no practical converter (for putting color—not just black and white—on existing sets)."

Report Praises CBS Color

The FCC's reaction to CBS color was just the opposite. Again quoting from the official report, ". . . a color picture that is most satisfactory . . . receivers are simple and should be within the economic reach of the great mass of purchasing public . . ."

But why did the FCC have to approve any system now? Why couldn't the color decision wait until RCA's compatible system was improved? The Commission said a *good* compatible system might never be developed. And delaying the decision while more and more black-and-white sets were built would only make it harder—or even impossible—to adopt a noncompatible system like Columbia's.

Although the FCC has settled for a long time to come the standards for color television, improvements in the system are already on the way. Many laboratories are working on the three-color tube (PS, June '50, p. 108), which can be used with the Columbia technique. This tube would eliminate one of the main objections to CBS color—the cumbersome filter disk that limits the screen size.

Meanwhile beautiful color is here. For a reasonable investment of money and effort you can start enjoying it right now. END

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