

Here's the control room during a color telecast. Screen at left is a black-and-white reproduction of flower scene in center, which is on the air. Engineer can switch either of the other two scenes on the air



COLOR



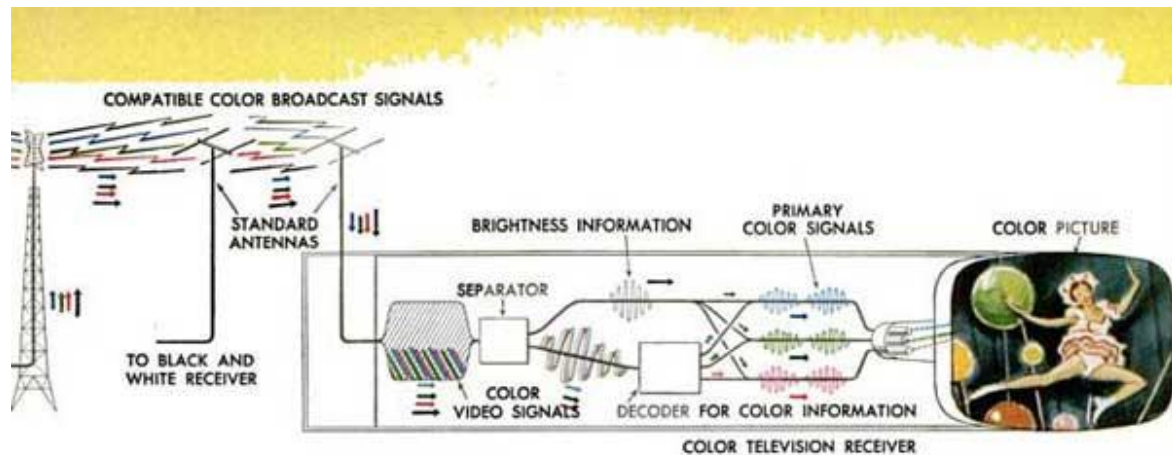
TELEVISION IS HERE

By Michael Day

STEP THROUGH the door marked "restricted" on the 18th floor of the CBS Madison Avenue (New York) studios, or through a hidden portal in the soundproof glass partition of NBC's specially designed "Colonial Theater" on Broadway, and you'll find yourself in a flickering world of color. The only light comes from rows of TV-monitor screens. Some are alive with scenes in full color, playing across the glowing phosphors like miniature movies

in Technicolor. Others duplicate the same pictures in black and white.

Green graph patterns tremble on oscilloscope screens as technicians manipulate scores of dials and switches on the panels before them. Hushed voices of earphoned producers, technical directors and video-control men drone back and forth in weird, technical lingo as they issue orders over an intercom system to cameramen, actors and stagehands outside on the set:



Actually, those same color signals were streaming down your antenna the whole time. And, while your set can't translate the signals into color on its black-and-white screen, it still can produce a perfect black-and-white picture from the same telecast—no matter whose network is beaming the show.

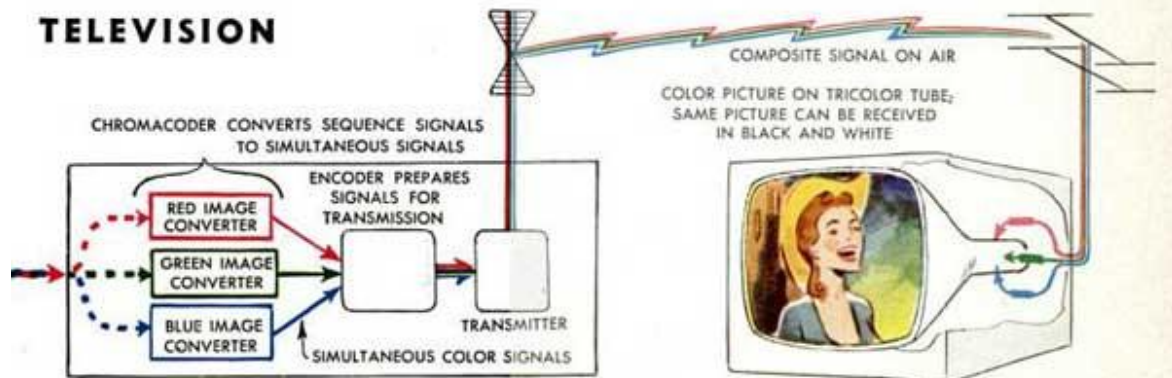
According to the big networks, color TV is here to stay. By the end of this year, 50,000 color sets will be operating. But don't get too excited unless, as one set manufacturer puts it, "you're in the mink-coat-and-foreign-car category." The first sets will cost about \$1000, and most will go to potential advertisers and engineers. As mass production and simplification sets in, the price tag is expected to move down, but it may be several more winters before the price levels off at what manufacturers guess will be about 100 percent higher than black and white today. For awhile, replacing a picture tube will cost as much as a whole black-and-white set (about \$250). Since color circuits are more complicated, repairs will cost proportionately more. You'll be able to convert your old set, if

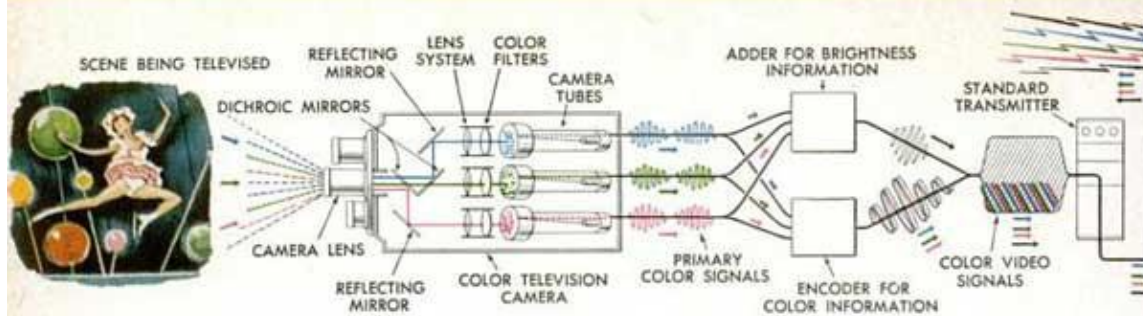
Dr. Frank Stanton, president of CBS, shows heart of CBS system, the Chromacoder. This electronic panel converts sequence signals, representing colors, into simultaneous signals for the air



In CBS system, camera sees through a rapidly rotating color wheel. Signals from the camera are in a red-green-blue sequence. After passing through control room, signals go to Chromacoder which converts them into three simultaneous signals for transmission. On the air, signals of CBS and RCA systems are identical

TELEVISION





RCA COLOR TELEVISION

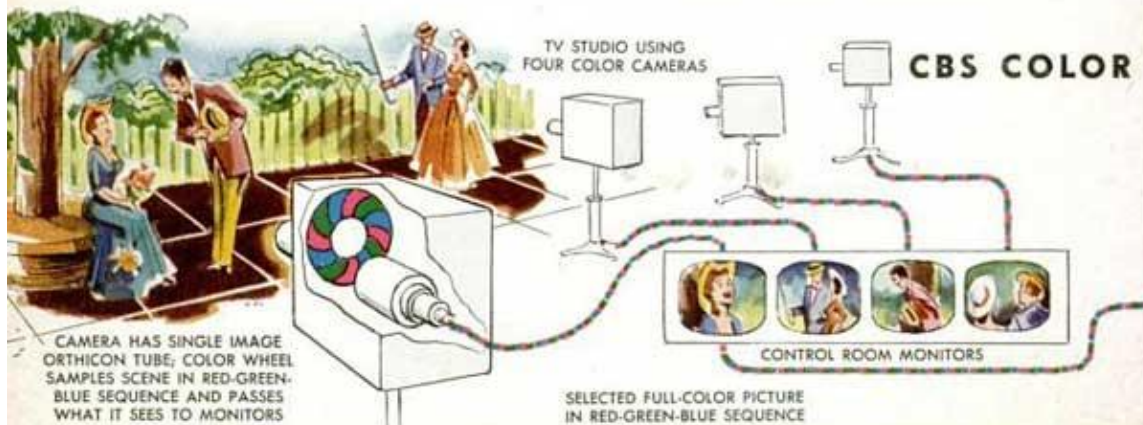
In RCA system, full-color image is focused on special mirrors which reflect one color, allow other two colors to pass. Color images then are focused on three camera tubes, which produce three color signals. Samples of signals are combined to add black-and-white signal. Process is reversed during reception



Before a telecast, each camera must be "tuned in" for delicate shadings of flesh tones. Here a cameraman focuses on a girl beside a color wheel to adjust camera for perfect color pickup

"Too much red on number three . . . there's a 'kick' in that vase lip on number two preview; move it back . . . we pick up convergence on number two; how's your registration? . . . gamma check on number four, please . . ."

These are the control rooms for the new coast-to-coast color telecasts. Both NBC and CBS have been telecasting color shows around the East Coast—and NBC has even microwaved color shows to the West Coast—for many months. Starting with the Rose Bowl game on New Year's Day, NBC expects to send out several network shows weekly in color. Most of their 70-odd primary stations have already agreed to put in the \$22,000 color-conversion equipment, and more are expected to follow. If the shows look just as black and white as usual on your set, that's because you happen to have a black-and-white set. If you'd been watching the same channel on one of the handful of existing color sets owned largely by TV and advertising executives, you'd have seen the show in a dazzling array of brilliant hues.



CAMERA HAS SINGLE IMAGE ORTHICON TUBE; COLOR WHEEL SAMPLES SCENE IN RED-GREEN-BLUE SEQUENCE AND PASSES WHAT IT SEES TO MONITORS

SELECTED FULL-COLOR PICTURE IN RED-GREEN-BLUE SEQUENCE



CBS color camera at right is about the same size and shape as conventional black-and-white camera at left

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worked to set up specifications that would make the big dream come true. Finally last October FCC members saw the results.

On color receivers produced by 13 different manufacturers, NBC's Nanette Fabray sang before a multihued background; dancers in colorful costumes whirled across vivid color sets. Pretty girls flipped swirling red skirts to show brilliant green slips beneath. Then, CBS took its show outdoors to prove how well its color cameras worked on remote pickup. In a program called "Autumn in New York," the lenses panned garden colors, climbed to dizzying skyscrapers in midtown, browsed through a sidewalk cafe to zoom in on dishes of pink lobster, bright, delicious-looking salads and plates of sweet red berries. The Allen B. Du Mont Laboratories flashed close-up and distant shots of brilliantly colored scenes across the phosphors. And all the while, regular black-and-white sets beside the color screens faithfully reproduced everything coming in on all the channels.

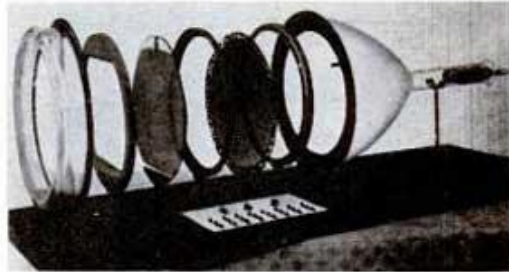
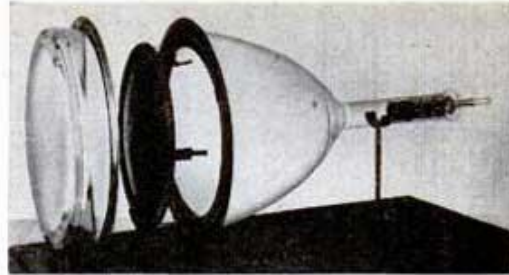
As for those 13 different color sets, they looked exactly like black-and-white receivers, but the cabinets were larger by half. For the present, color screens are 14 inches (producing a 12½-inch-wide picture), but 21-inchers are in the works.

In many recent color demonstrations, technicians have hovered over sets, tinkering and making adjustments, leading observers to wonder if every color set would come equipped with a built-in electronics engineer. Last November 1, when NBC microwaved Bizet's opera "Carmen" in superb, delicately shaded colors, news and magazine reporters were loaned color sets and permitted to tune them in unassisted.

How do they work? Remarkably well. A typical set has five or six knobs. Four are

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Newest CBS tube is shown at top. It is simpler and less expensive than the former color tube at bottom

the familiar ones on your standard black-and-white (monochrome) set: channel selector, brightness, contrast and focus control. One new one is the "chrome control." Turn it all the way left, and color fades to a bland, washed-out mess resembling a badly over-exposed color transparency. At far right, color jumps out in a dense intensity and brilliance, startling but hardly "true" color. In between lie the subtle shadings to suit your taste.

There's also a "convergence control," a delicate adjustment for aligning the three color signals coming into the tube so that they strike the tube face in perfect register. If this adjustment is off, people on the screen may suddenly develop green or red ears or grow purple halos.

Actually, TV color signals are identical to black and white. But instead of a single signal carrying a single picture there are three signals riding together, carrying three separate images. One shows all the red values in the scene being shot, another all the green, a third all the blue.

Each network has its own special cameras and gear for breaking down the scene into these three colors. What the NTSC has set up is not a new "system" but a set of standards. "It's like standardizing railroad tracks," explains NBC chief engineer O. B. Hanson. "Any railroad can streamline its cars and engines. But all must fit the same gauge track. Like railroad cars, each network can run its own equipment, as long as it fits the same standards."

When the signal leaves the transmitter,

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it is the same for all networks—three color signals riding in close frequency to black-and-white and sound signals.

All this electronic information is picked up by your home color receiver. The black-and-white signal tells the set how much brightness is in the picture. Impulses for each of the three color images are separated and zipped to three electron guns (one for green information, one for red and one for blue) at the base of the big tri-color tube. The inner face of this tube, pioneered by RCA and recently modified by CBS, is coated with up to 750,000 dots of red, green and blue phosphor, mechanically arranged in 250,000 tiny triads. Behind this surface a perforated screen or "shadow mask" with 250,000 microscopic holes is so perfectly registered over the triads that the three electron beams angling through them hit only the right phosphors. The green beam, piercing a tiny hole in the mask, hits the green phosphor of a triad and makes it glow. The red beam, angling in from another direction through the same perforation, is masked from the blue and green dots but "tickles" the red one.

Thus, each beam lays down its own image in its own color. Since the dots are so tiny and closely packed, your eye melts them together into one picture in true-to-life color.

In the host of vital circuits between scene and screen, startling things occasionally happen to the colors. If the three guns are out of alignment, you get a cascade of color flecks instead of the picture. One or more colors have been known to drop out until emergency equipment could be brought into play.

Though controls on present sets are simple, you may find yourself diddling with dials a lot more to get the picture you want. Color signals are more sensitive to interference than monochrome and an accurate shade may stubbornly elude capture.

Vance Hallack, producer in charge of color for NBC, wryly recalls that during the 1950 FCC demonstrations, transmission engineers fought bitterly all day with the receiver engineers, each blaming the other for the poor color coming through. "Finally, during a break," he says, "I sent out for green bananas and substituted them for yellow ones in a fruit bowl on the set. Soon as we started up again, a receiver man called up, screaming:

"What's with the green bananas?"

"Don't know what you're talking about," I told him. "They're yellow on our monitors." That kept him quiet for half an hour. Then he called again and said: 'Got your

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yellow bananas—but your apples are blue."

Hallack, and his counterpart at CBS, Jerry Danzig, still shudder over some of the whimsies of the new medium. The minute anyone steps into a shadow his face may turn a hideous green, purple or other unlikely shade on receiver screens. A blue dress may go dirty red.

The shade problem makes "remotes" a tough job, too. Last year when NBC ran a sneak preview of the Penn-Columbia football game, everything was fine until the last quarter. "Then," says Vance, "the sun went below the stadium rim and the final quarter came through in a greenish black and white."

Indoors or out, color TV requires more light than monochrome. RCA, NBC's parent company, says three times more; CBS says six times. Art-museum guards, in charge of a Picasso painting in one scene, were sure the oils would melt and run on the priceless picture. They didn't, but everyone trembled.

Hurdles still confronting color are technical and economical. Most TV executives are confident they'll all be solved in a relatively short time with the brains and effort being applied today.

Already, with all its whimsies, color is cutting dollar corners in a few areas. "We can paint our scenery with light instead of paint," Hallack points out. "We built a gray cyclorama for the studio. By playing lights through varicolored gelatins, we can give an audience 500 different backgrounds per hour if we want. That way a set can be varied all night at no cost. We can paint objects and costumes with colored spots, too—everything but flesh tones."

Flesh is the key to all color TV and it's giving technicians some headaches right now. At NBC, cameramen "tune in" on what they call Gamma Chips—three bars of shading, one black, one white and one a flesh tone—providing full color range. When these are right on the monitors, everything comes out right, they claim. To make sure, they run further tests on color bars.

Finally, they tune in on Marie MacNamara—a pleasant chore. Marie is a natural auburn-haired beauty who has been tuned in on by RCA color cameras daily for 2½ years. "Her natural skin tones are perfect and her hair, one of the hardest colors to telecast correctly, is among the toughest tests we have," Hallack explains.

Radical simplifications in technique and equipment are being announced every month. CBS claims that its new Colortron tube is a simplification of the shadow-mask

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type that suddenly makes possible mass production of one item that posed manufacturing sticklers six months ago. The tube will be in pilot production next month. By next September 15,000 are expected to roll out each month.

RCA's big three-tube color camera that does everything in one operation, but is a cumbersome \$65,000 affair, already is obsolete. At RCA's Princeton labs, technicians are shooting successful color with a camera the size of a standard black-and-white job. Three miniature Vidicon tubes no bigger than two-cell flashlights do the work. The same men are also dollying a brand new single-tube camera that works like a tricolor receiver tube in reverse.

One of the hottest color developments, quietly being perfected in Paramount's laboratories, is a receiving tube known as the "Chromatron." Owned by Dr. E. O. Lawrence (who invented it) and Paramount pictures (who financed its development), this tube may speed the arrival of lower-cost color sets.

Instead of using three electron beams, perforated masks and thousands of phosphor dots, the Lawrence-type tube has a single gun—like a black-and-white tube. Across its screen are 900 vertical lines of red, green and blue phosphor. The gun fires red, green and blue signals at the screen in an ultrarapid sequence through a grid of vertical wires. As each tiny color impulse flies between a pair of wires, it passes through a magnetic field that bends it toward the right phosphor.

Other startling things are in the works. A big headache for advertising men has been the fact that color films don't work well on color TV. Now they won't need film. Brig. Gen. David Sarnoff just announced that RCA's Princeton scientists have perfected a method for storing color signals on half-inch magnetic tape. It does away with all chemical processing. A color "show" can be stored indefinitely and played back anytime—or the tape can be "wiped" and reused.

"Magnetic tape recording of video signals," says the General, "should make possible a simple means by which a TV-set owner can make recordings of television pictures in the home. And they can then be 'performed' over and over."

Nobody believes that color will completely replace black and white. There wouldn't be much point in seeing wrestling bouts or horse races in color. Dr. DuMont has pointed out that Technicolor didn't replace black-and-white movies. "Neither," he says, "can it happen in TV. There will always be plenty of monochrome shows to watch." ★ ★ ★

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