

A stylized illustration of a television station at night. The scene is dominated by a tall, red brick tower on the left, which has several windows glowing with a yellow light. Inside these windows, silhouettes of people are visible, some appearing to be working at desks or operating equipment. At the top of this tower, there is a large satellite dish and a complex antenna structure. To the right and slightly lower, another red brick building is visible, also with glowing windows and silhouettes of people. The background is a dark, deep blue, suggesting a night sky. The overall style is reminiscent of mid-20th-century graphic design or children's educational book illustrations.

# TELEVISION WORKS LIKE THIS

JEANNE *and* ROBERT BENDICK

\$1.75

# TELEVISION WORKS LIKE THIS

by JEANNE  
and ROBERT BENDICK

**AT LAST — A BOOK FOR THE NON-  
TECHNICAL PEOPLE WHO JUST  
WANT TO KNOW WHAT  
TELEVISION IS ALL ABOUT**

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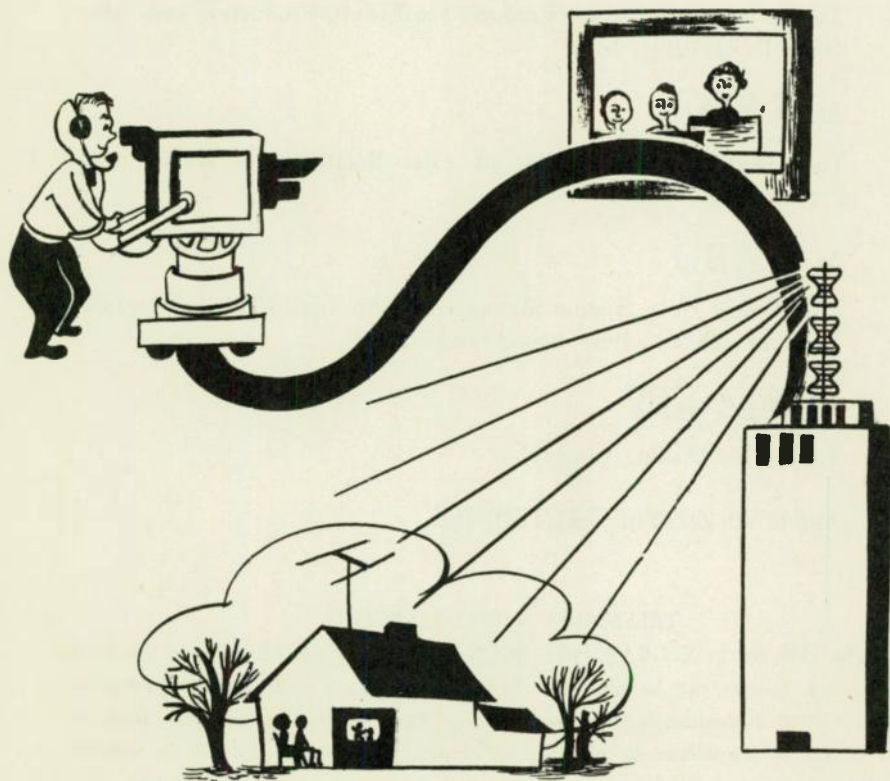
TELEVISION WORKS LIKE THIS presents the entire behind-the-scene story of this magic new medium of communication.

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# TELEVISION

## WORKS LIKE THIS



BY JEANNE AND ROBERT BENDICK

WHITTLESEY HOUSE • MCGRAW-HILL BOOK COMPANY, Inc.

NEW YORK

LONDON

TORONTO



### At WCBS—TV

To Worthington Miner, Director of Program Development; to Merritt Coleman, Manager of Operations; Bob Wood, Network Operations; and to Fred Rheinhard, Andy Mercier, and Phillip Goetz, Engineering Supervisors. Also to Paul Wittlig, Chief Engineer.

### At WNBT

To Warren Wade, Senior Producer; to Elwell, Production and Sets; and Bill Schelberg, Sets.

### At WPIX

To Edward Evans, Director of Film Relations; to Dick Clive, Projection.

### At WABD

To Leonard Hole, Station Manager; and to Tony Kraber, Program Manager; and Bob Bare, Sound Engineer.

### At WJZ—TV

To Marshal Diskin, Director.

And to Vin Zeluff of ELECTRONICS.

#### TELEVISION WORKS LIKE THIS

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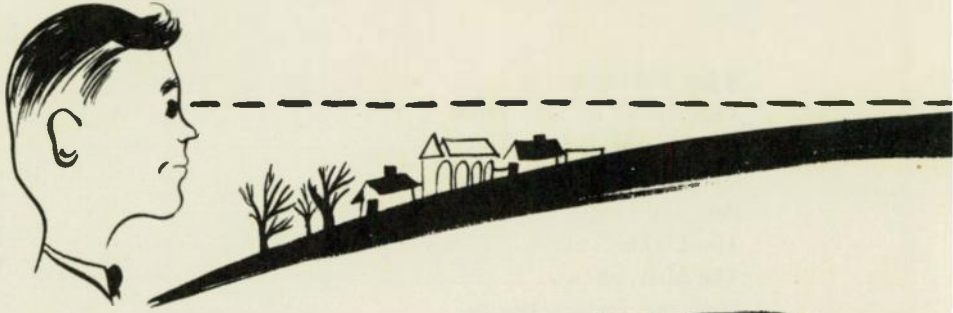


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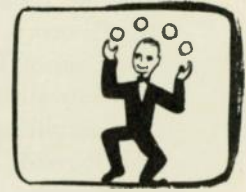
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# WHAT TELEVISION IS

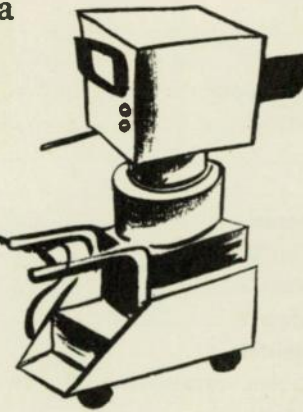
Television means seeing across space.



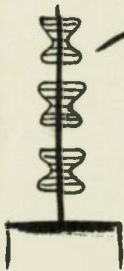
Television is the picture of an action,



taken with a special camera



and sent in the form  
of radio waves

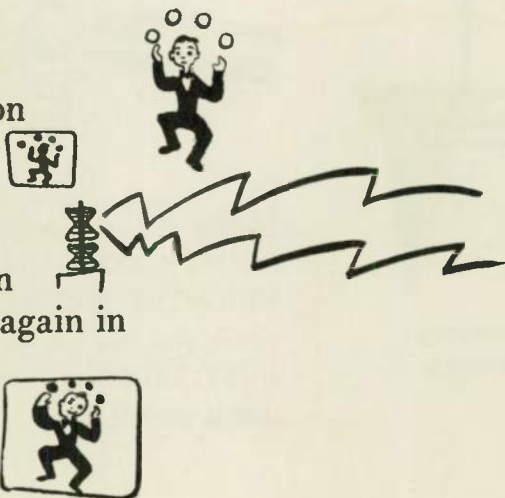




across space to your receiver.



Television is an action  
Then a picture  
Then electricity  
Then radio waves  
Then electricity again  
And finally a picture again in  
your receiver,  
All in an instant.



# THE WORDS IN THIS BOOK

## (AND SOME OTHERS TOO)

**ACTUALITY BROADCAST** Television reporting of an event, not produced by the studio.

**AMPLITUDE MODULATION (AM)** A way of mixing the signal from the television camera or the microphone with the radio wave that is going to carry it through the air. The waves that carry television pictures are always amplitude-modulated.

**ANTENNA** The part of the radio receiver that picks the radio waves out of the air, or the part of the transmitter that sends them into the air.

**AUDIO** Anything to do with television sound.

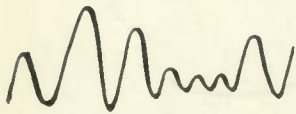
**AUDIO-FREQUENCY WAVES** Electrical waves of the same length as sound waves.

**AUDIO SIGNAL** Sound that has been changed into electrical impulses.

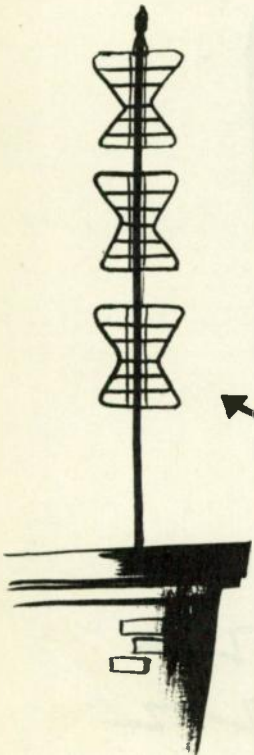
**BALOPTICON (BALOP)** A special kind of projector used for charts and still pictures.

**BAND** A range of radio frequencies within two definite limits.

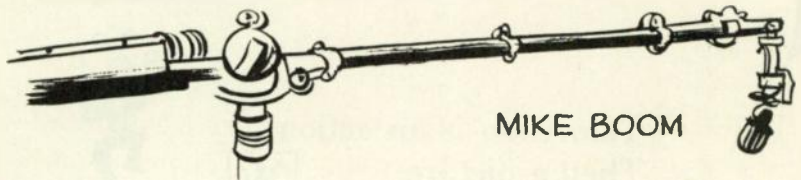
**BAT-WING ANTENNA** A television broadcasting antenna made of a series of radiators placed along a mast, like this.



AMPLITUDE  
MODULATION



BAT-WING  
ANTENNA



MIKE BOOM

**BOOM** A telescoping pole from which the mike is hung.

**BOUNCE** Sudden changes in the brightness of the picture.

**BRIGHTNESS CONTROL** The knob on your receiver with which you can change the amount of light in the picture.

**BUSY PICTURE** One with so much background detail that it is confusing.



**CARRIER WAVE** The electromagnetic wave that carries radio or television signals through the air.

**CATHODE-RAY TUBE** An electron tube in which the electrons are freed from their source in a ray or beam. The receiver picture tube is a cathode-ray tube.

**CHANNEL** A band of frequencies given by the Federal Communications Commission to each television (and radio) station for broadcasting. Within the studio, the sets of cables and monitors assigned for a show to "live," film, and still pictures are called channels.

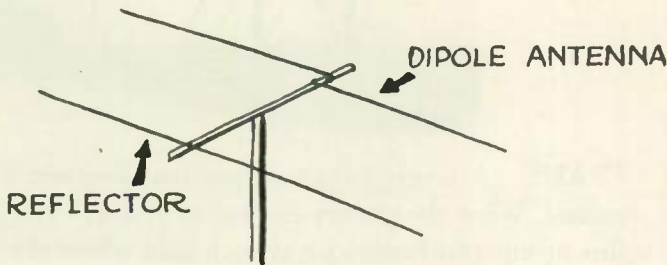
**COAXIAL CABLE (COAX)** A special copper cable with a conducting wire suspended inside. Also a bunch of these cables bound together.

**CONTRAST CONTROL** The receiver knob which regulates the light and shadow of the picture.

**CONTROL ROOM** Room where engineers and director work with monitors and control equipment for a program.

**DEAD SPOT** A place where radio or television signals are received badly or not at all.

**DIPOLE ANTENNA** An antenna split in the middle. It looks like this.



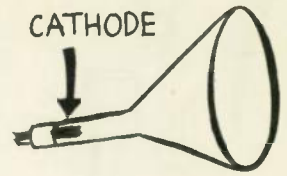
**DIRECTIONAL ANTENNA** Any antenna, either broadcasting or receiving, which sends or receives radio waves better in some directions than others.

**DOLLY** A small, wheeled platform on which the camera is mounted.

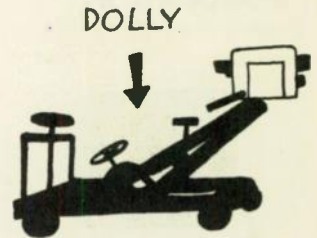
**DRY RUN** A rehearsal without studio facilities.

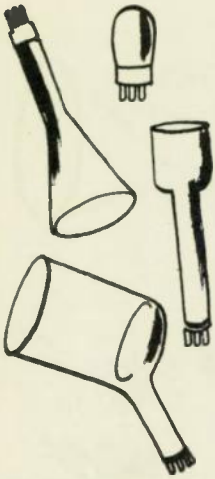
**ELECTRON** A minute particle of negative electricity.

**ELECTRON GUN** The place in an electron tube out of which electrons are shot in a thin beam.



COAXIAL CABLE





**ELECTRON TUBES**

**ELECTRON TUBE** A vacuum or gas-filled tube where electrons are put to work.

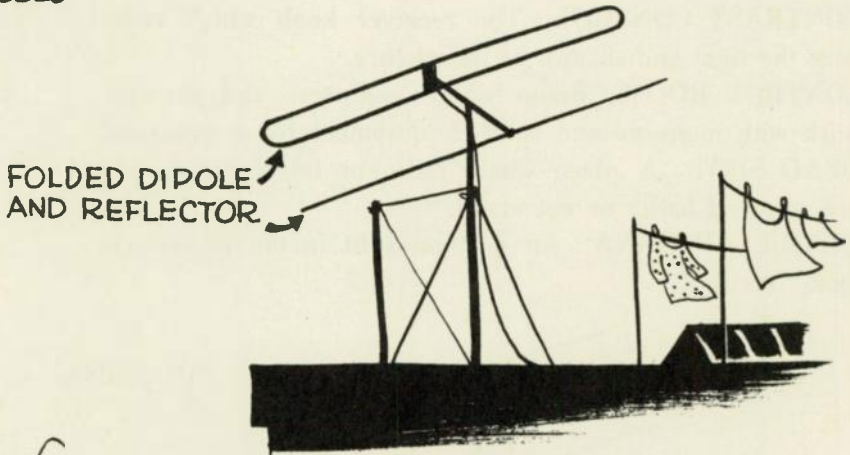
**FADING** Unwanted lessening and increasing of a radio signal.

**FEED** Any picture, sound, or signal received by the studio.

**FLUORESCENT SCREEN** A chemically coated screen which gives off light when it is hit by electrons. The receiver screen is fluorescent.

**FOCUS CONTROL** The adjustment on the receiver which makes the picture sharp.

**FOLDED DIPOLE** A dipole antenna folded back on itself like this.

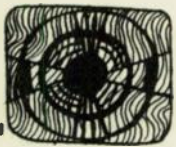


**FREQUENCY MODULATION**

**FRAME** A single television picture. You see 30 frames a second. When the picture is "out of frame," you see a black line at top and bottom or at each side where the new frame begins. When the cameraman "frames" his picture, he gets his subject in just the right place on his camera screen.

**FREQUENCY** The number of cycles (or complete motions) of electromagnetic waves in one second.

**FREQUENCY MODULATION (FM)** A way of varying the frequency of the carrier wave to match the signal. All television sound is FM.



**HERRINGBONE**

**HERRINGBONE** A pattern across the picture caused by interference.

**HIGH-FREQUENCY WAVES** Very short radio waves.

**HORIZONTAL HOLD** The receiver knob used to adjust the picture when it slips off to either side.

**ICONOSCOPE (IKE)** A kind of television camera tube.

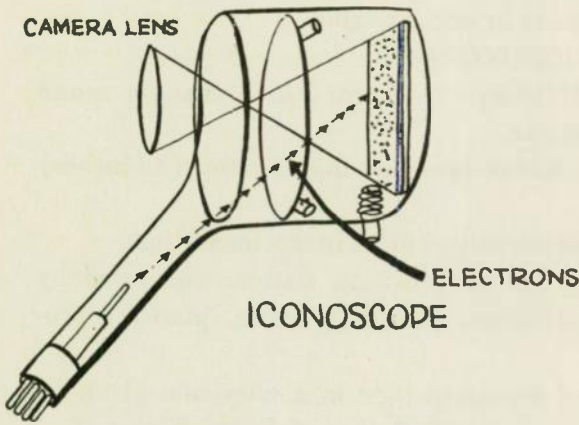
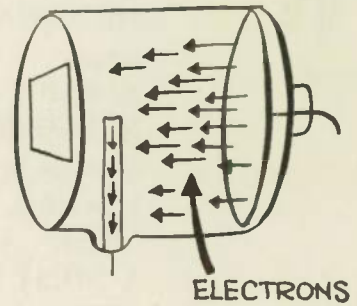


IMAGE DISSECTOR



**IMAGE DISSECTOR** A kind of television camera tube now used in broadcasting film.

**IMAGE ORTHICON (ORTH)** An extremely sensitive camera tube which needs very little light.

**INTERFERENCE** Any signal, natural or man-made, which disturbs the good reception of the sound or picture.

**KILOCYCLE** A frequency of 1,000 cycles a second.

**KINESCOPE** The television picture tube in the receiver.

**LEAD-IN** The wire which conducts the signal from the antenna to the receiver.

**LINE** A single sweep of the electron beam from left to right across the television screen in either the camera or the receiver. There are 525 lines in the picture at present.

**LINE-OF-SIGHT** A path from transmitting to receiving antenna with nothing in the way.

**LINK** A system for passing along radio waves from a remote location or from one transmitter to another. It can be either a radio relay reflector or a coaxial cable.

**LIVE** Short for "alive"; television of real things and people being taken by the television camera, as opposed to film or still pictures.

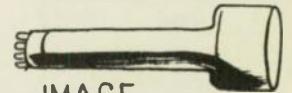
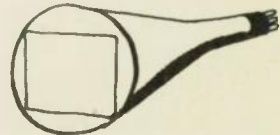
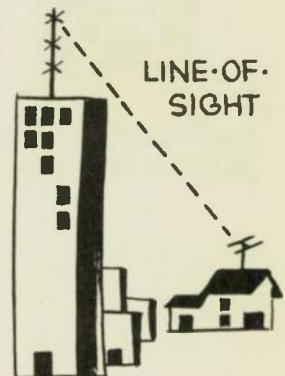
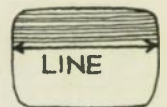


IMAGE ORTHICON



KINESCOPE





"DISH"

**MAGNIFIER** Anything placed in front of the television screen to enlarge the picture.

**MICROWAVE RELAY REFLECTOR (DISH)** A dishlike metal reflector behind the antenna or wave guide to beam the microwave signals in one direction.

**MEGACYCLE** 1,000,000 cycles.

**MICROPHONE (MIKE)** A device which changes sound into electrical impulses.

**MICROWAVES** Radio waves less than 1 meter (39 inches) long.

**MOSAIC** The photosensitive plate in the Iconoscope.

**NETWORK** A group of television stations connected by coaxials or relay stations, or with a central plan for programming.

**NOISE** A spot of unwanted light in a television picture.

A **NOISY** picture is one with flashes of light all over it.

**ORTHICON** An Image Orthicon or Studio Orthicon camera tube.

**PHONEVISION** A way of receiving special programs by means of a cable directly to your set. As planned now, the telephone company would turn the program on at your request, and you would pay extra for it on your telephone bill.

**POTS** The volume-control knobs on the audio engineer's desk (short for potentiometers).

**PROJECTION TELEVISION** A combination of lenses and/or reflectors which enlarge a television picture and project it onto a screen.

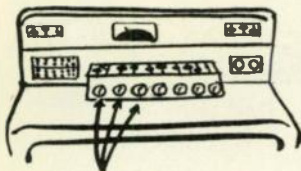
**RADIATOR** The part of the broadcasting antenna which radiates the waves out into space.

**RADIO LINK** See **LINK**.

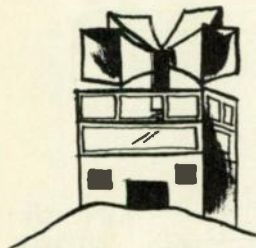
**RADIO WAVE** An electromagnetic wave made by quick changes of current in the broadcasting antenna, and traveling through space at 186,000 miles a second.

**RELAY STATION** A station which automatically picks up radio waves and rebroadcasts them, greatly increasing the distance covered by the original transmitter.

**REMOTE** Any program originating outside the studio.



"POTS"



ONE TYPE OF  
RELAY STATION

**RUN-THROUGH** A rehearsal.

**SCANNING** The line-by-line sweep of the electron beam across the screen in the camera and receiver tubes.

**SERVICE AREA** The region around a transmitter where its signals can be clearly received.

**SIGNAL** The sound or picture after it has been changed into electricity or radio waves.

**SNOW** Black or white dots on a picture, which show when your antenna is sending a weak signal into the set.

**SUPER-TURNSTILE ANTENNA** See **BAT-WING ANTENNA**.

**SYNCHRONIZATION (SYNC)** The process of keeping the electron beams in the camera and receiver doing the same thing at the same time.

**TELE, TV** Short for television.

**TELECAST** The broadcast of a television program. The word is not used much now.

**TELEGENIC** Anyone who looks well on television.

**TEST PATTERN** A drawing of lines and circles broadcast by television stations for testing, and to allow you to adjust your receiver.

**TRANSMITTER** The equipment from which the signals are broadcast.

**VERTICAL HOLD** The control knob used to adjust the picture when it slips up or down on the television receiver screen.

**VIDEO** Means "see" and is applied to the television picture. Sometimes television itself is called "video."

**VIEWER** Anyone watching television.

**WAVE GUIDE** A hollow metal tube which conducts electromagnetic waves.

**WAVELENGTH** The distance between two waves, from the top of one to the top of the next.

**WIDE-ANGLE SHOT** A camera shot taking in a large part of the field of action.

**WING IT** To do a show without rehearsal.



SNOW

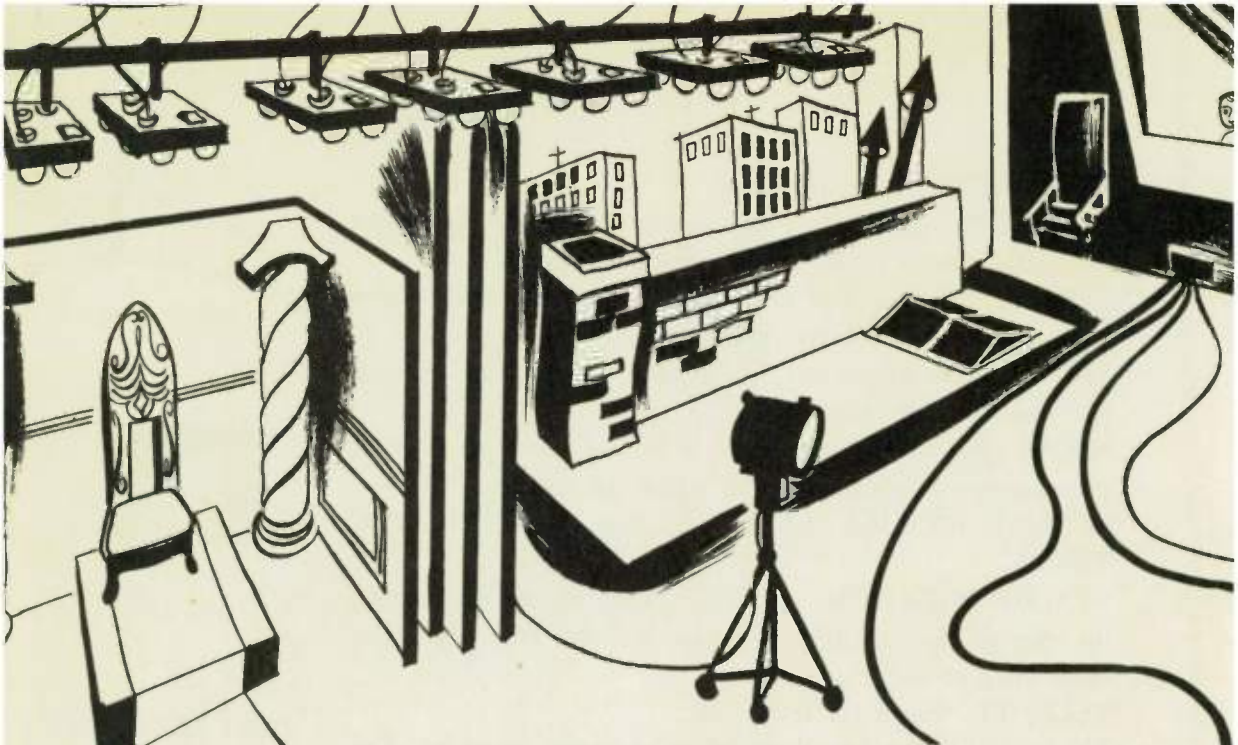
TEST PATTERN



VIEWERS



WAVE GUIDE

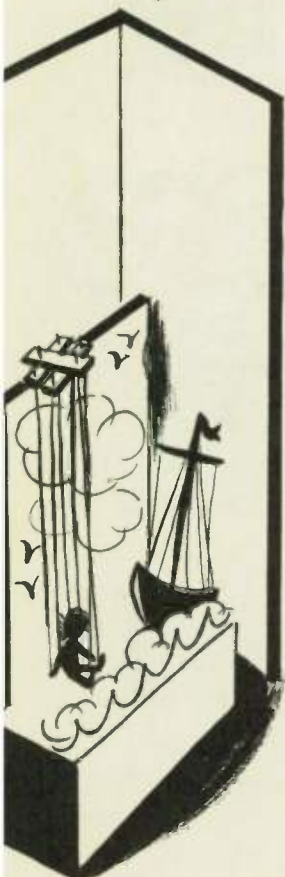


## ON THE STUDIO FLOOR

All the action in front of the studio cameras takes place on the floor. A lot of things have to go on this floor, so the bigger it is, the better. It may be in the loft of a railroad station, a theater, a floor of an office building or a department store. It may even be in a built-over stable.

The sets have to go on the studio floor; the cameras, the microphone booms, the lights, and many people. You might see a street scene in one corner and a kitchen where everything really works in another. There will probably be a living room somewhere, and a puppet stage.

The reason for having as many sets as possible on one floor is that one group of cameras, mikes, and lights can be used for all of them, and one control room.





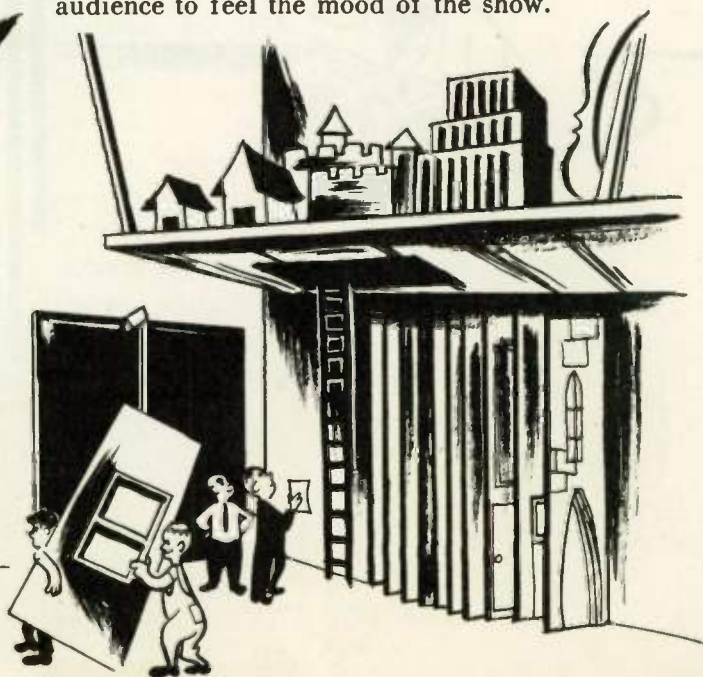
The man who directs traffic on the floor is called the floor manager. He carries a small walkie-talkie tuned to the director in the control room, and it is his job to see that things on the floor happen in the right place at the right time.

# SETS AND PROPS

The people who design the stage sets for television shows have to think of some special things. Because the picture on your television set is small, the designer tries to give it a feeling of space. He makes his sets look deeper from front to back than they really are by using perspective cleverly.

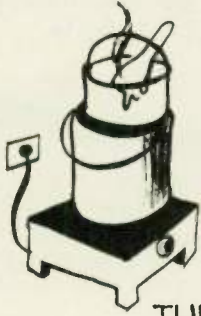
Designers try to build the set so cameras can look into it from a variety of angles. They peep through doors or picture frames.

In a busy studio, the set department has to make so many sets a week that there isn't time to build them all new. Using stock parts—doors, windows, and walls that fit together—the set department can construct a new set in a few hours. Then if there is time, they paint it in color even though the television audience sees it only in tones of gray. Color helps the actors and the studio audience to feel the mood of the show.





Sometimes the sections into which doors are fitted and pictures or fixtures are hung are made of wood so they will be strong. But most other sections are made of canvas, stretched and glued over wooden frames, then painted.



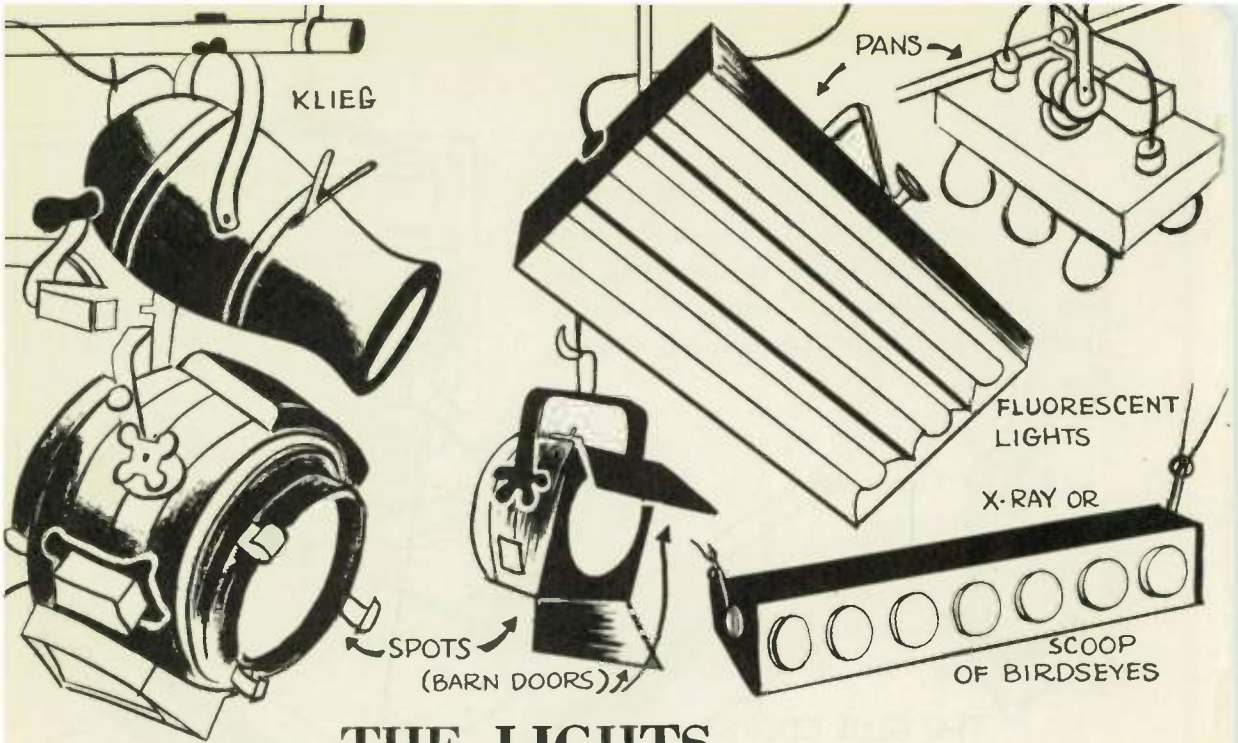
THE GLUE COOKS ON A LITTLE STOVE

Mirrors, or glass in picture frames or windows, are seldom used because they catch reflections of the studio lights.

Every station has certain basic sets that are used over and over, with just the trimmings changed. There is always a living room and perhaps a kitchen. There are permanent sets, too, for shows that go on regularly. These are put up in a special place on the floor and rarely moved.

The studio usually has its own furniture, pictures, ornaments, and other things that make the set look finished. These are called props, short for properties. But unusual props are rented or borrowed. A set may need a dozen soda-fountain chairs, a suit of armor, or a stuffed moose. It wouldn't be practical to try to keep all these things on hand.





## THE LIGHTS

BROAD



When a television show is on the air, there is little time to adjust the lights. The lighting must be right for every part of the set, right for long shots and close-ups.

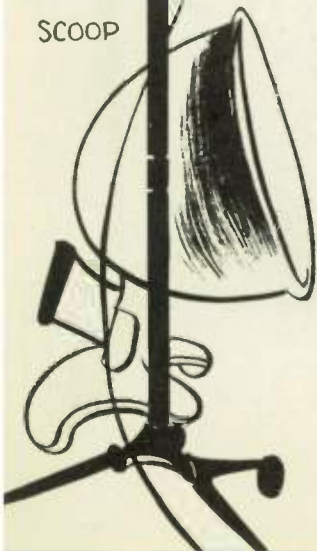
The first part of lighting a set is to get good, all-over light. Then other lights are used to spotlight the places where the main action takes place.

Different studios use different kinds of basic lighting. One may use banks of fluorescent lights. Another may use pans of birdseyes. Another may use blocks of plain electric lights. The additional lights are all similar, the same kinds that are used in making movies.

In television, not all lighting effects are made by the lights. Some are made by the engineer as he controls the brightness and contrast of the picture that comes to him in the control room. He can make a brightly lighted set appear to be in moonlight.

Once, television lights had to be very strong and hot. Studios tried cooling them down by putting them in jackets of running water. Sometimes the jackets broke and everyone on the set got wet. Now, with an improved camera tube, the lights are cooler and easier to work under. (And anyway, the studios are air-conditioned!)

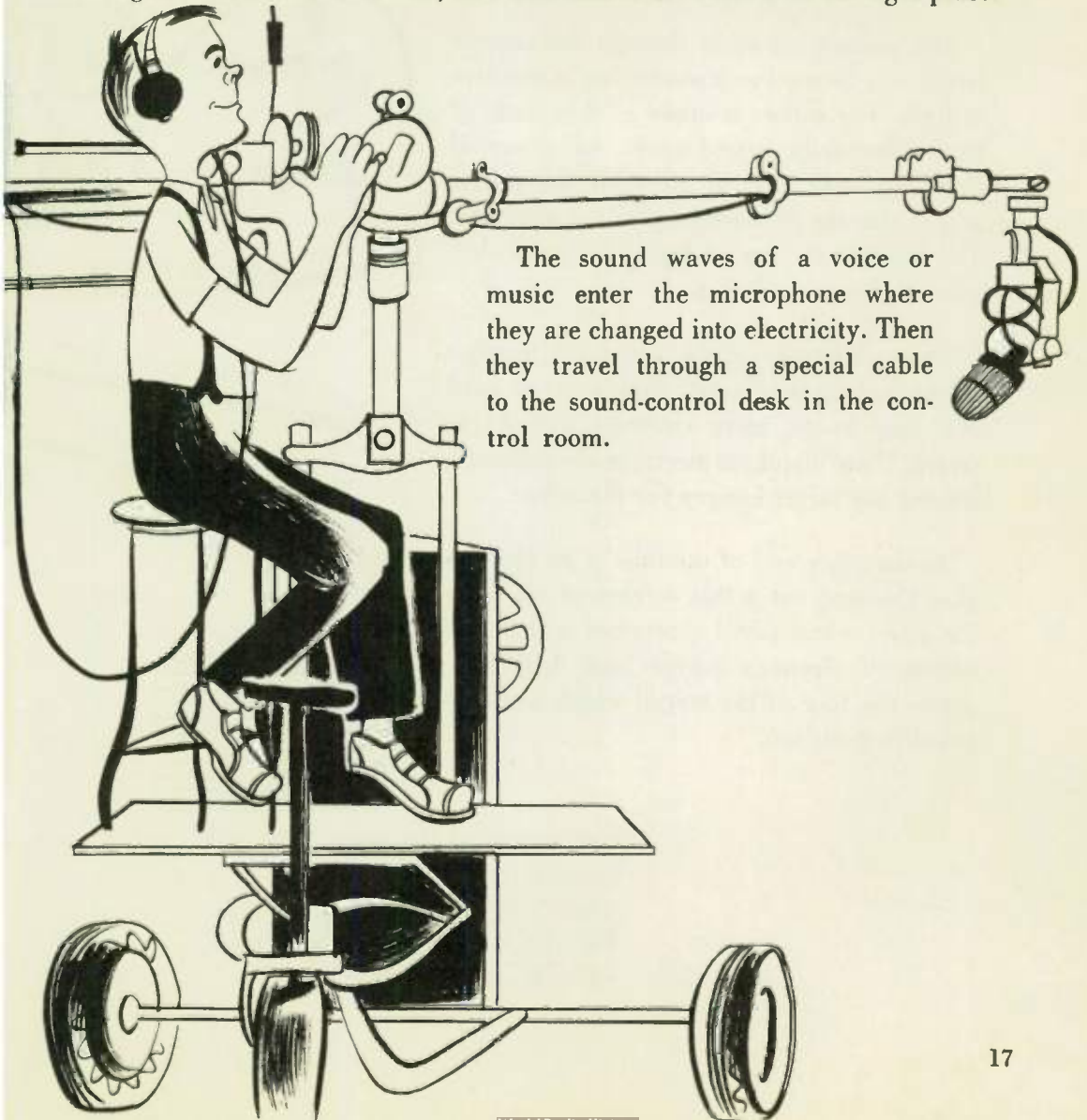
SCOOP



# THE MICROPHONES

No matter how much an actor in a television show moves around, there must always be a microphone at hand so that he can be heard. There are mikes hidden behind books, in flower vases, and almost any place else on the set where they are out of sight. Another mike is attached to the mike boom that follows him wherever he goes.

A mike boom is a high stand with a jointed metal pole attached to it, and the microphone hangs from the end of the pole, like bait on a fishing line. The boom man can turn a crank to extend the pole and he can swing the whole thing from side to side. But he has to be careful not to let the mike show in the picture. The boom man wears earphones connected to the sound engineer in the control room, who tells him if the mike is in the right place.



The sound waves of a voice or music enter the microphone where they are changed into electricity. Then they travel through a special cable to the sound-control desk in the control room.

# HOW THE PICTURE BEGINS

The television picture begins in the camera.

There is no film in this camera. Its job is to change the picture it sees into a sort of electrical picture that can be sent through wires and across space.

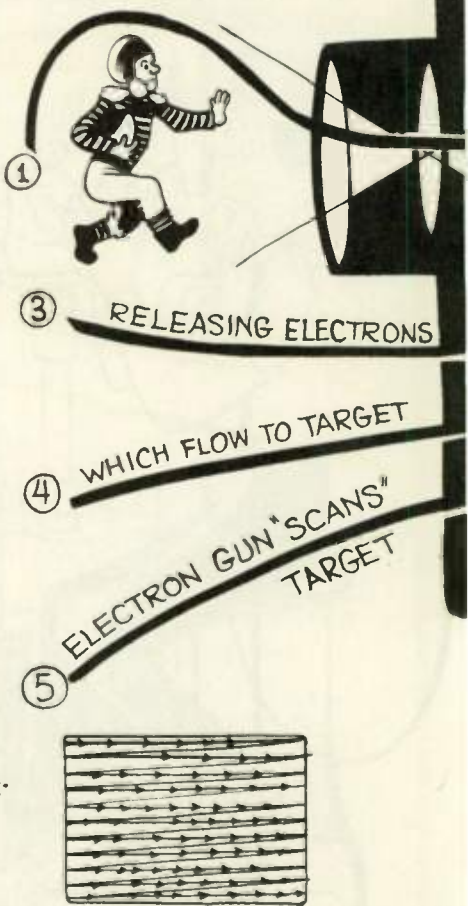
The heart of the camera is an electron tube. Usually this tube is a special one called the Image Orthicon, and it works like this.

The picture comes in through the camera lens and is focused on a screen that is sensitive to light. The screen is made of thousands of tiny, chemically coated spots. As a ray of light hits each spot, it gives off the microscopic charges of electricity called electrons. The brighter the ray of light, the more electrons the spot sends out.

These electrons shoot along to another screen called the target, hitting it so hard that they knock more electrons out of the target. These displaced electrons are collected, leaving the target hungry for electrons.

At the other end of the tube is an electron gun, shooting out a thin stream of electrons the way a water pistol shoots out water. This stream of electrons moves back and forth across the face of the target, which has light sensitive spots too.

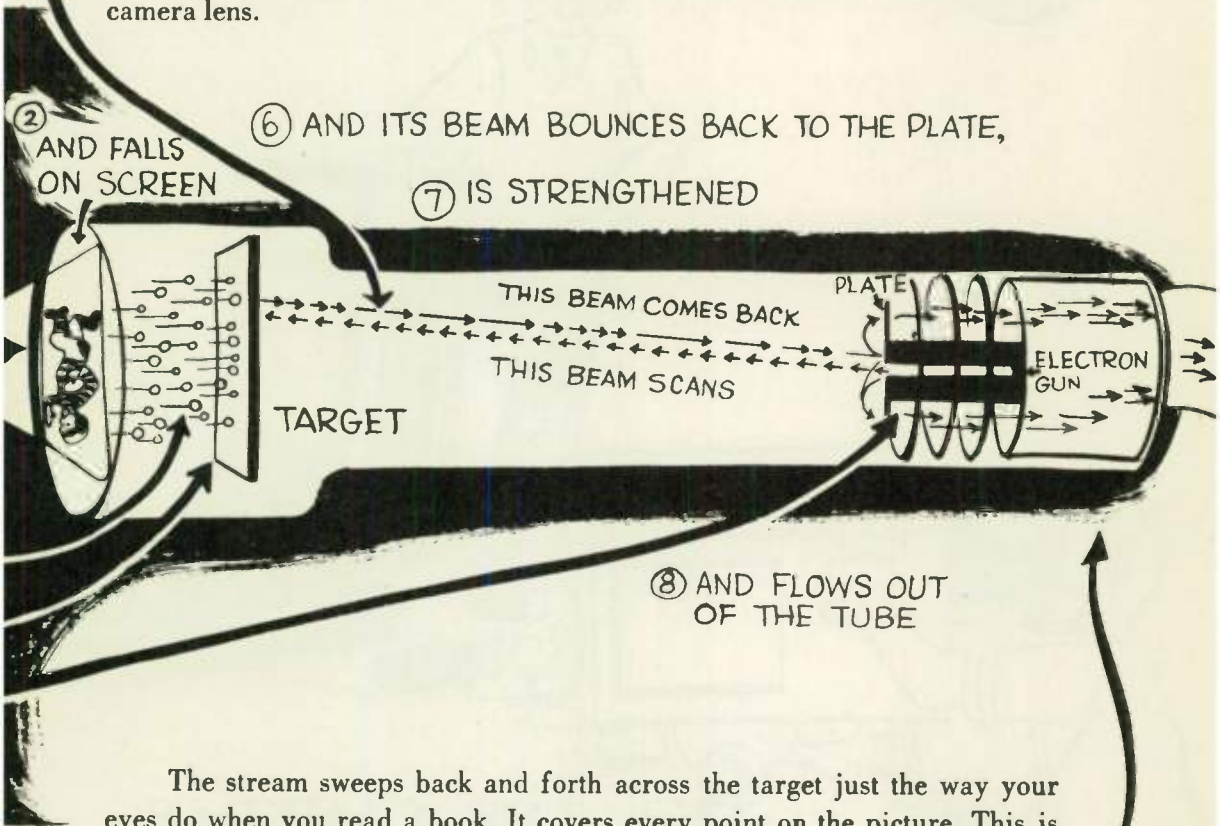
LIGHT ENTERS LENS



THE BEAM SCANS THE TARGET SOMETHING LIKE THIS-BUT IT TAKES 525 LINES TO MAKE A PICTURE (THE ONES WITHOUT ARROWS DON'T COUNT)

As it moves, each spot grabs electrons back from the stream to replace the ones that were knocked out of it.

Finally the stream bounces back to an electron collection plate. When it leaves the gun, the stream is of a constant strength, but when it bounces back from the target it varies because of the electrons it has lost. The stream varies just as the light and dark varied in the picture that came into the camera lens.

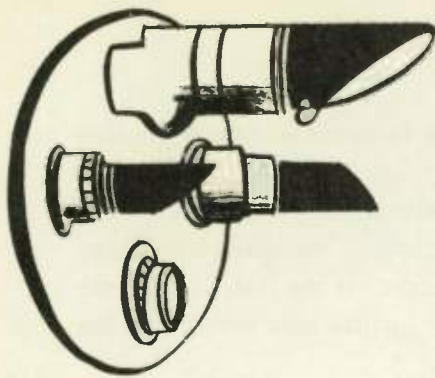


The stream sweeps back and forth across the target just the way your eyes do when you read a book. It covers every point on the picture. This is called scanning.

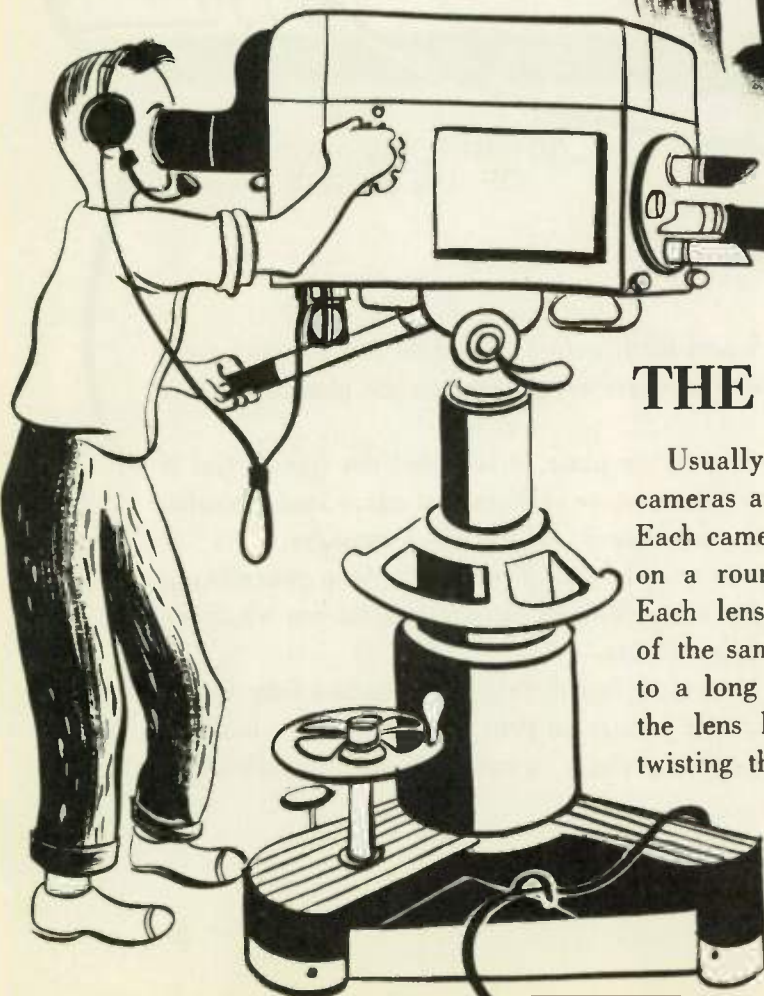
After the beam is collected in the plate, it is called the signal, and it is an electrical reproduction of the picture in light that came into the tube. Before it flows out of the tube, this signal is made much stronger.

The electron beam scans so quickly that 30 separate pictures are being sent out every second. This is fast enough to catch and send out whatever action is going on in front of the camera.

The tube that does all this work is only about 17 inches long but it costs about \$1,400. And though the picture on your television screen is much larger, that first picture on the camera tube is  $\frac{7}{8}$  inch high and  $1\frac{1}{4}$  inch wide.

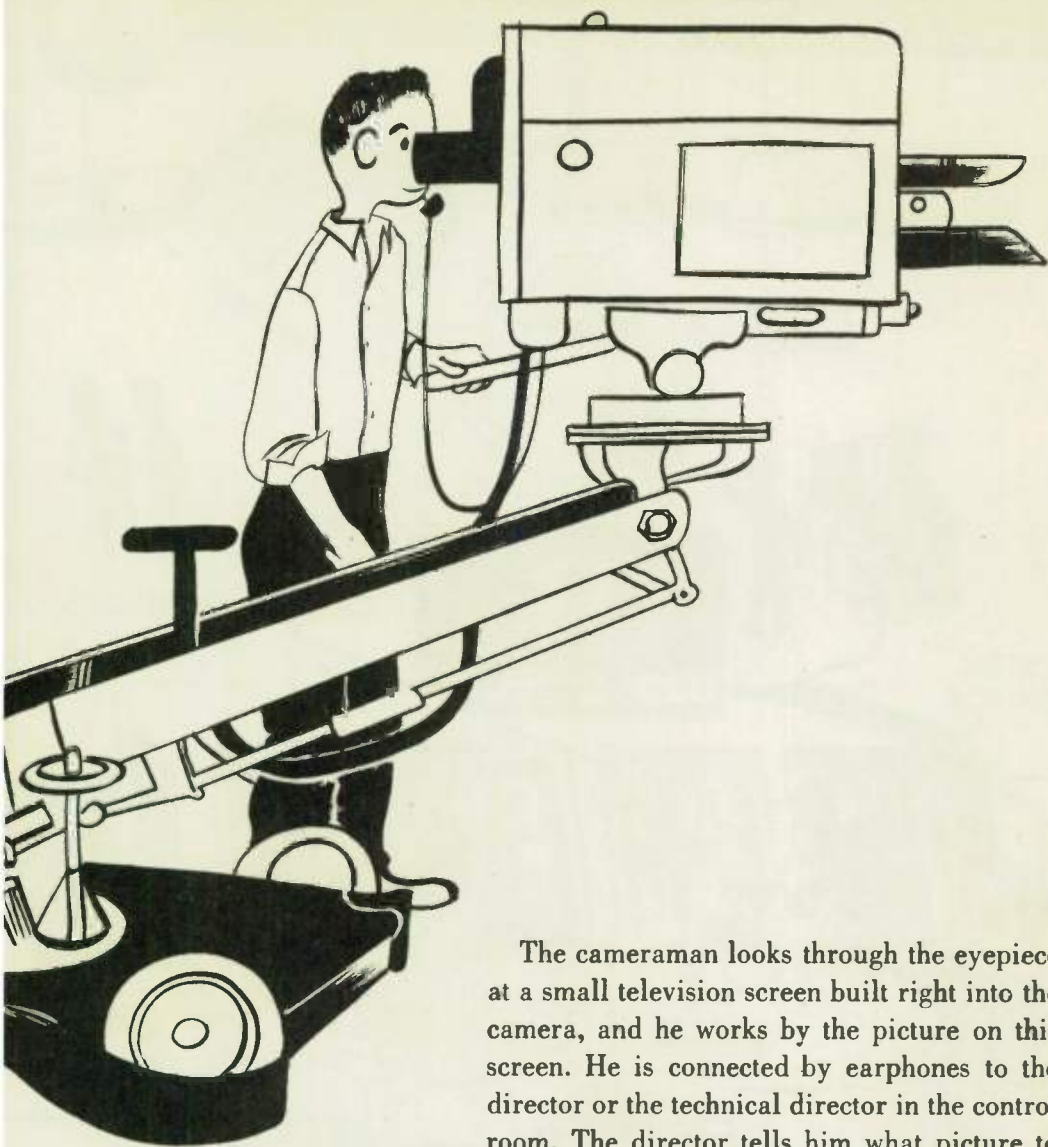


THE TURRET USUALLY HAS A 2-INCH, A 3½ INCH, 5¼ INCH AND A 13 INCH LENS FOR SHOTS FROM A WIDE ANGLE TO A CLOSE-UP



## THE CAMERAS

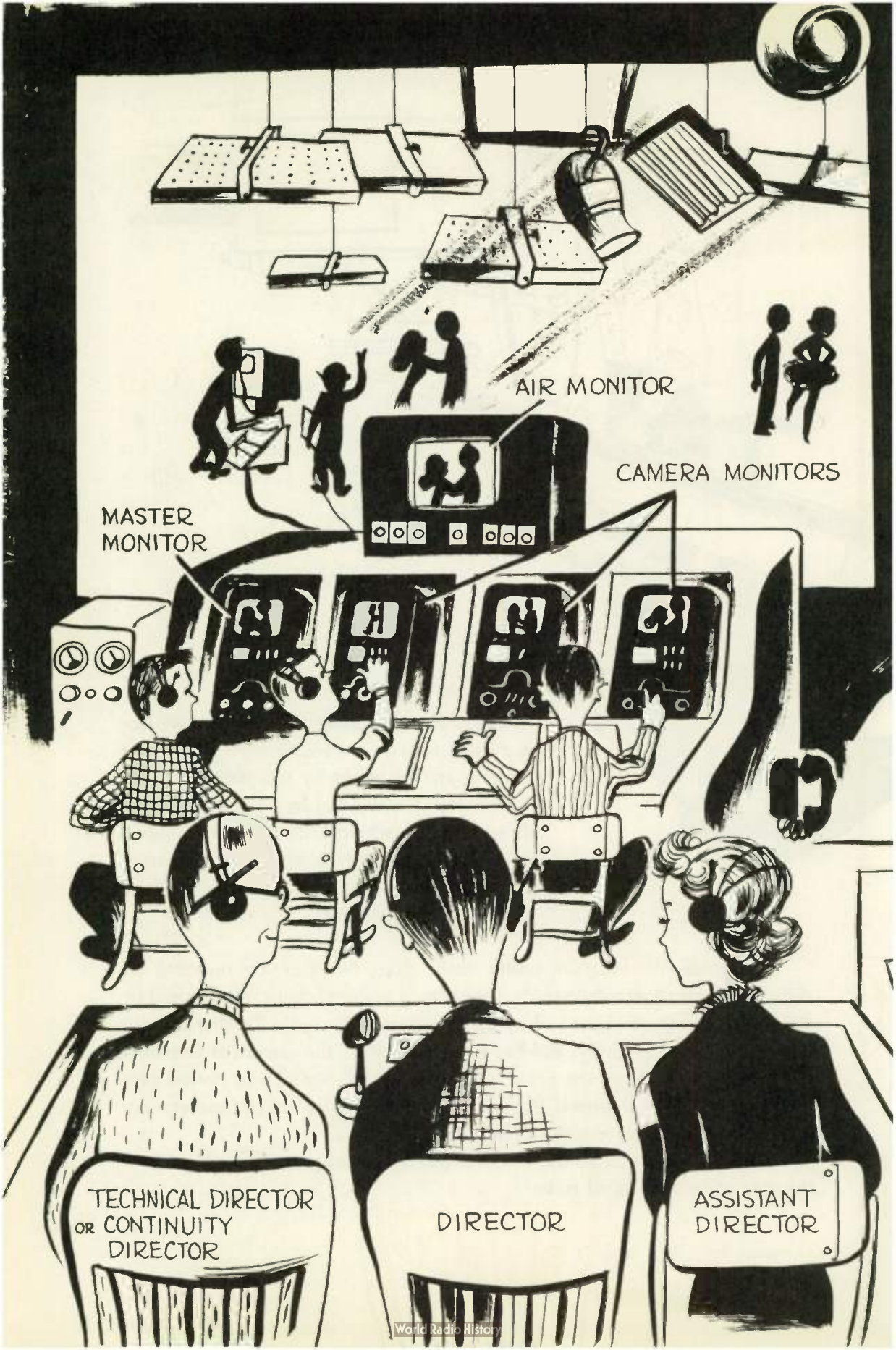
Usually two or three television cameras are used to pick up a show. Each camera has four lenses mounted on a round plate called the turret. Each lens takes a different picture of the same subject, from a close-up to a long shot. The cameraman gets the lens he wants into position by twisting the turret.



The cameraman looks through the eyepiece at a small television screen built right into the camera, and he works by the picture on this screen. He is connected by earphones to the director or the technical director in the control room. The director tells him what picture to get and when to change his position to be in place for the next shot.

All studio cameras are pretty much alike, but they are mounted on different kinds of wheeled stands. One is on a pedestal that can be raised or lowered and is pushed around by the cameraman himself. Another is on a heavy truck called a dolly, and has a crane to which the camera is attached. The cameraman sits on the crane and the assistant cameraman pushes him around. By cranking wheels, the assistant raises or lowers the cameraman and the camera, or moves them from side to side.

The pictures from all the cameras travel through a special cable called the coaxial to the control room.



MASTER  
MONITOR

AIR MONITOR

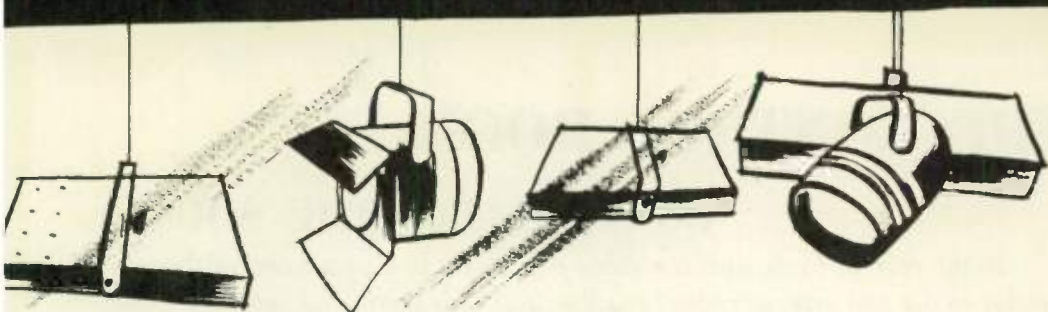
CAMERA MONITORS

TECHNICAL DIRECTOR  
OR CONTINUITY  
DIRECTOR

DIRECTOR

ASSISTANT  
DIRECTOR





## THE CONTROL ROOM

### CONTROLLING THE PICTURE

The control room is set above the studio floor so the people who work there can watch the floor through a big glass window.

The engineers who control the pictures are called video engineers, and they sit at a control desk in front of a number of monitors. Each monitor is a kind of television screen. Some of them are connected to the cameras, others to film and slide projectors in other rooms. There are programs which use all of these; studio cameras, film, and slides.

On each of the camera monitors is the picture from the camera to which it is connected. During a show, all the cameras are taking pictures all the time, and from these the director selects the one to be broadcast. He does this in a split second as he watches all the monitors. A large monitor shows the picture he chooses, which is the one you see in your receiver. We'll see later how he gets it on the air.

The video engineers adjust the contrast and brightness of the pictures coming in from the different cameras so they all match. The picture you receive would be very jumpy if those from one camera were dark, those from another light. Engineers say this kind of a picture is "bouncy."

In addition to the monitor controls, the control room has many cabinets crammed full of electron tubes. Some supply power. Others amplify the signal before sending it on. The rest keep the signal the station is broadcasting in step with the signal your set is receiving. The technical name for this is "in synchronization," and this set of equipment is called the "sync" generator. Other engineers are constantly checking all the equipment to see that everything is working right.

THE SOUND MAN  
SITS HERE



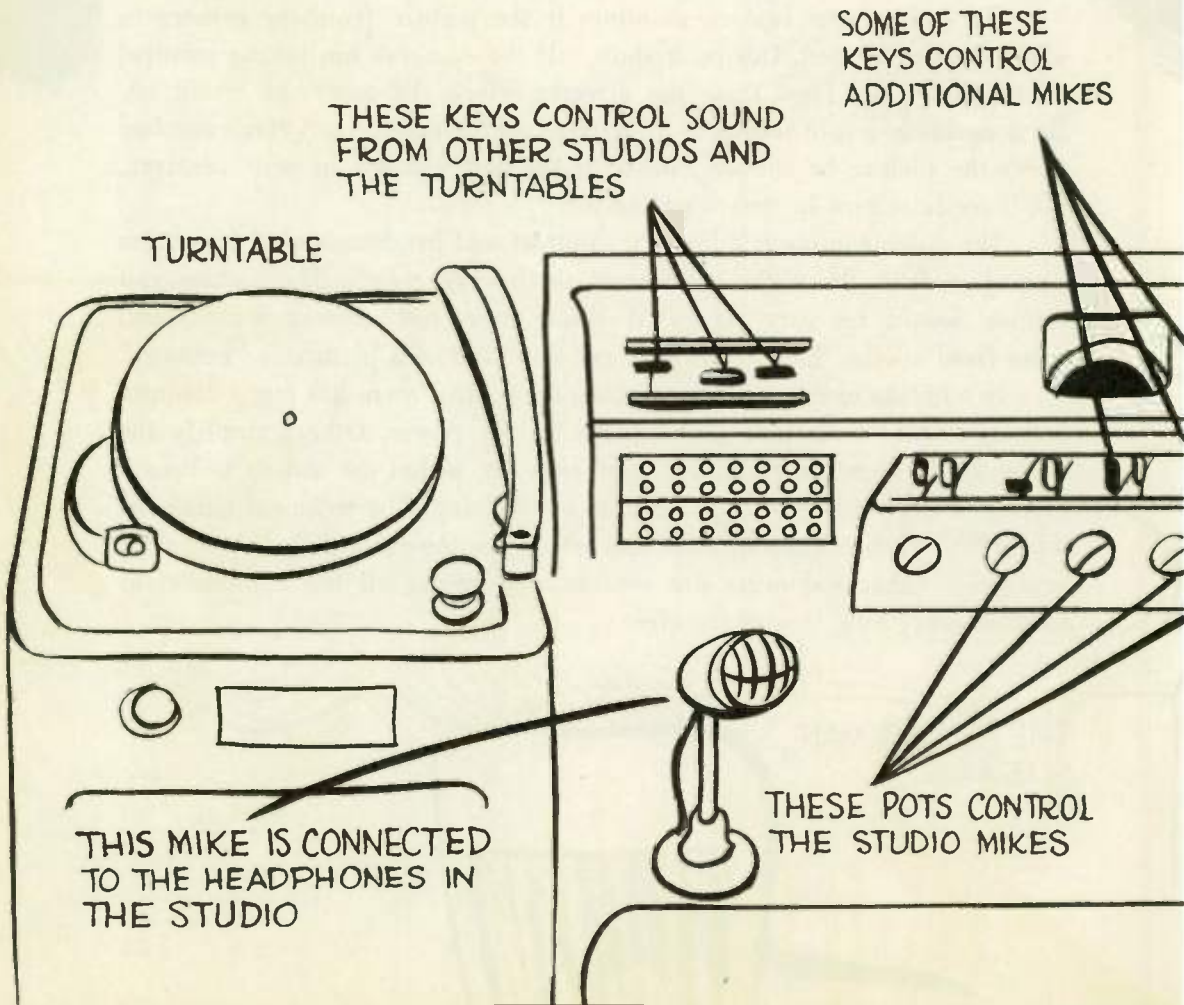
# THE CONTROL ROOM

## CONTROLLING THE SOUND

In the control room with the video equipment is a sound-control board, similar to the one used in radio broadcasting. This board has seven or eight sockets into which microphone cables and other kinds of sound equipment are connected. Each socket is called a position, and there is a knob for each position to control the loudness or volume of the sound. These knobs are called "pots," short for potentiometers.

During a show, one or two microphones may be used to pick up the actors' voices, another for the orchestra, and still another for the announcer. Sometimes when sound film is being used on the program, the sound from the film projector is controlled on this board too.

The audio engineer who operates this equipment watches the monitor that carries the picture being broadcast, to make sure he has the right pots open at the right time.



Next to the sound-control desk are two turntables — large record players. The audio man puts on the records and plays them at the proper time during the show. The director gives him a cue when he wants the audio man to open the pots that bring in sound from any part of the studio.

Somewhere in the studio is the sound-effects man, and the squeaky door, galloping horse, or rain-on-the-window-pane noises he makes are picked up by his own mike and sent by cable to one of the positions on the sound-control desk. At exactly the right moment the audio man opens that pot so the sound can be heard.



# THE DIRECTOR AND THE ASSOCIATES

The director manages the show. He decides who the actors will be, what the sets will be, and what shots the cameramen are to take. He decides on the music, the sound effects, whether or not film is to be used and where. He can call on experts to help him with any of these things, but he has the last word. From the beginning he keeps a picture in his mind of the way he wants the show to look on the air.

The director sits at a desk in the control room where he can see everything that happens on the floor and also all the pictures on the monitors. During a show he has a lot to do. He tells the cameramen where to move and what shots to get. In a very complicated dramatic show the director and his assistant, who is sometimes called the associate director, have plotted all the camera movements out ahead of time on the script. While the director is doing other things, the A.D. may give the cameramen their instructions. Sometimes another director called the technical director has this job.

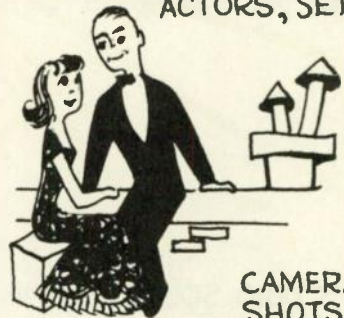
The director talks to the floor manager through his microphone, to the men in the projection rooms, the sound men, and the announcers, telling them exactly what he wants them to do and when.

As the director watches his monitors, he decides what picture he wants to go over the air and he indicates it by calling the number of the camera that is taking that picture.

SCRIPT



ACTORS, SETS



CAMERA SHOTS

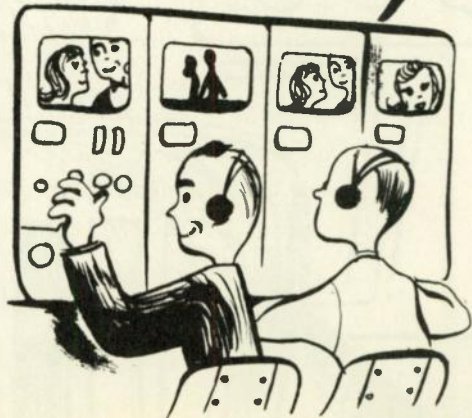


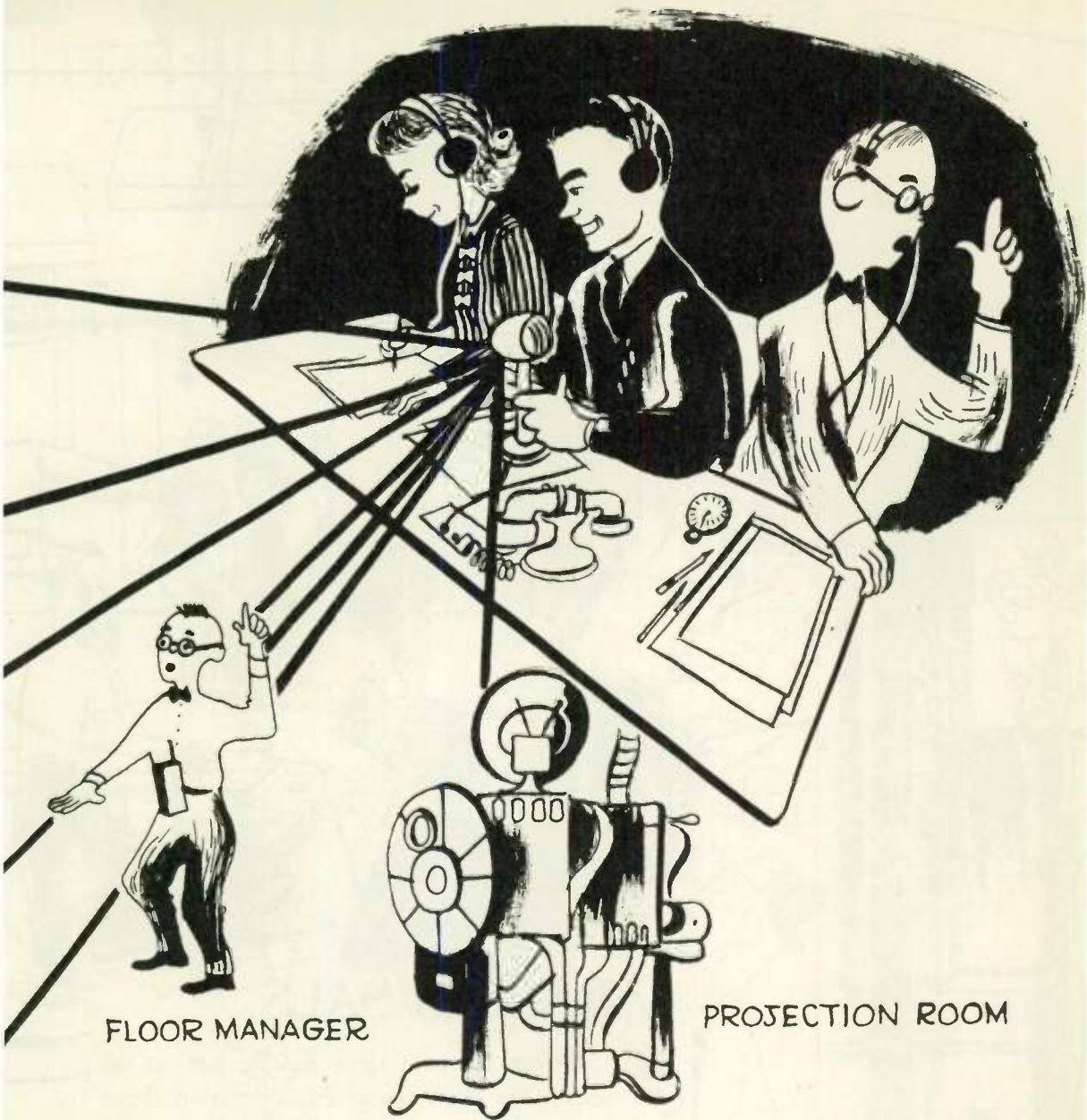
MUSIC

FILM



MONITORS





FLOOR MANAGER

PROJECTION ROOM

He says, "Take one," or "Take two," and one of the engineers punches a button that instantly puts that camera on the air. In some studios the director pushes the buttons himself.

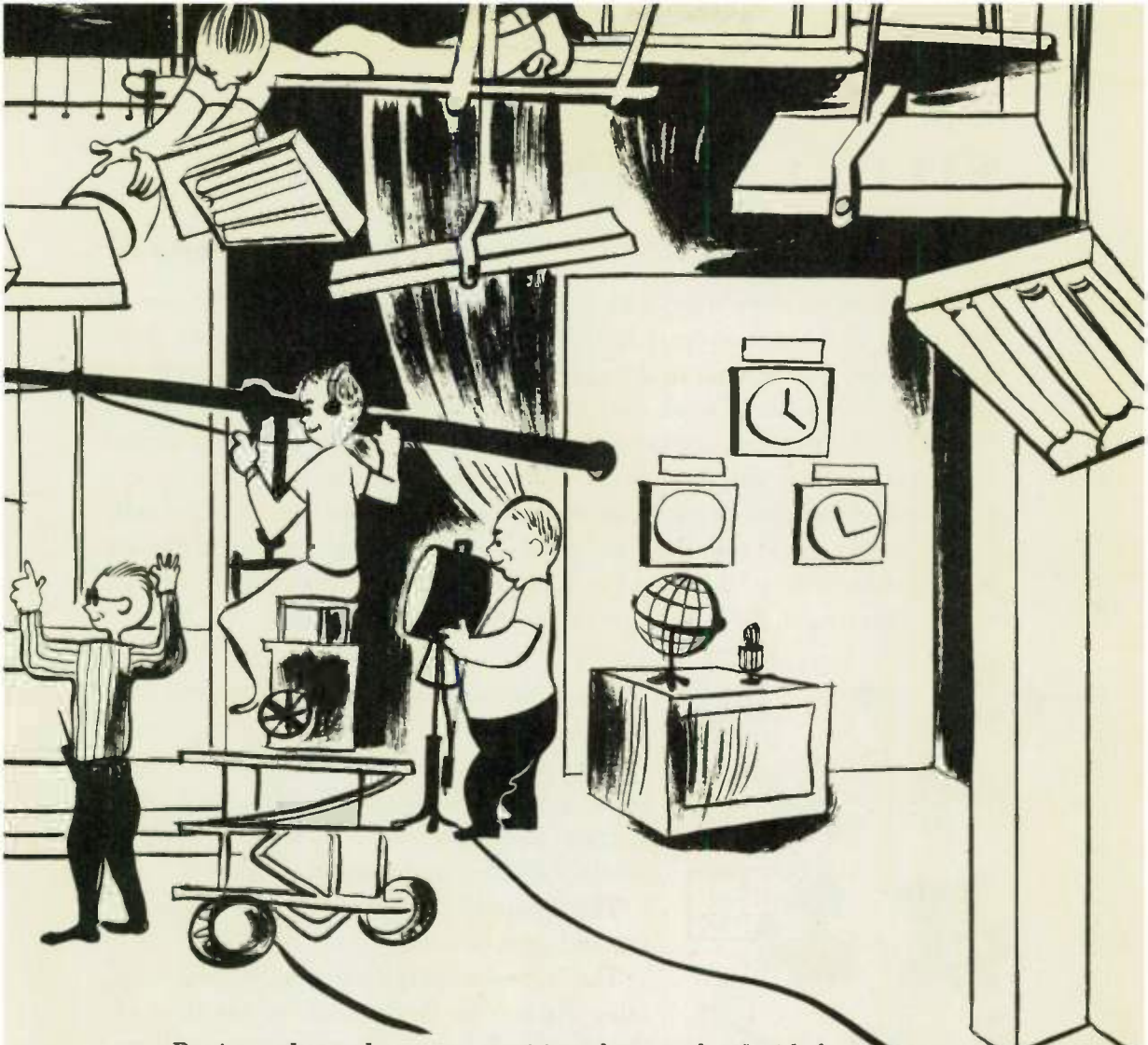
The assistant director cues the director from the script. He yells into the director's ear and tells him what is coming next and how soon. The A.D. keeps track of the time so the show finishes exactly when it should. During the preparation of the show he takes care of many details for the director. A.D.'s also direct film programs and some simple shows.



## REHEARSALS

Before a studio show can be put on the air, it has to be rehearsed. Television shows are so much more complicated than radio shows that they must rehearse from 2 to 10 times as long, and for very complicated shows much more.

The sets have to be put in place, the lights have to be adjusted, the mikes have to be set, the props have to be collected, all before the rehearsals begin.



During rehearsal, camera positions have to be decided on. Now is the time for the director to tell the actors everything he wants them to do, as there is no way to speak to them once the show is on the air. He can only signal them through the floor manager.

Every minute of a rehearsal has to count since it ties up all the facilities of the studio and other shows are waiting their turn to be rehearsed and put on the air. And because they take up so much time and space, rehearsals are very expensive.

Shows in which the audience takes part are rehearsed too, with stand-ins instead of the people who are finally to appear on the air.

# STUDIO SHOWS

## STARTING A SHOW

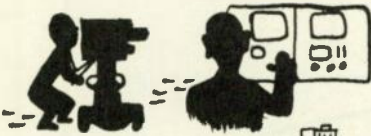
A television show starts with an idea. Sometimes it comes from one of the studio staff or from an advertising agency. Sometimes it comes from someone who has nothing to do with television. But before the idea can be put on the air, a lot of work goes into translating it into a television show.

After the program department has decided to use the idea, it is turned over to a producer and director. (Often the producer directs the show too.) First he decides what he wants the show to be like on the air. Then he calls in a writer to put it into the right words, and a casting director to get the right people to do it. To get a good background and mood, he works with the set department, the lighting man, and the music people.

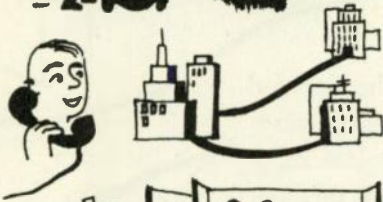


Many other people work at getting the show on the air.

The program-operations department assigns assistant directors, writers, and production assistants to the show. It assigns studio facilities and rehearsal time.



The technical department assigns engineering and camera crews.



The network-operations man notifies the other stations in the network of the time of the show and orders the necessary facilities to carry it from city to city.



The production department starts work on the costumes, props, and scenery, and the publicity man gets out news stories.

Dozens of secretaries bang on typewriters, writing the scripts and reminders from one department to another.



And the budget department figures out the costs on the whole thing.

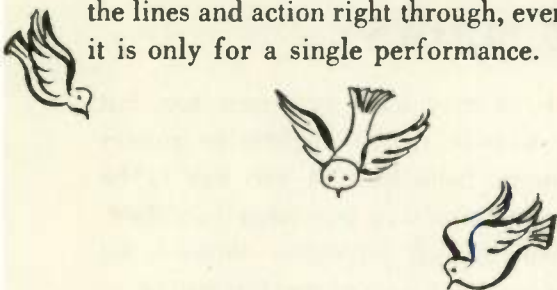
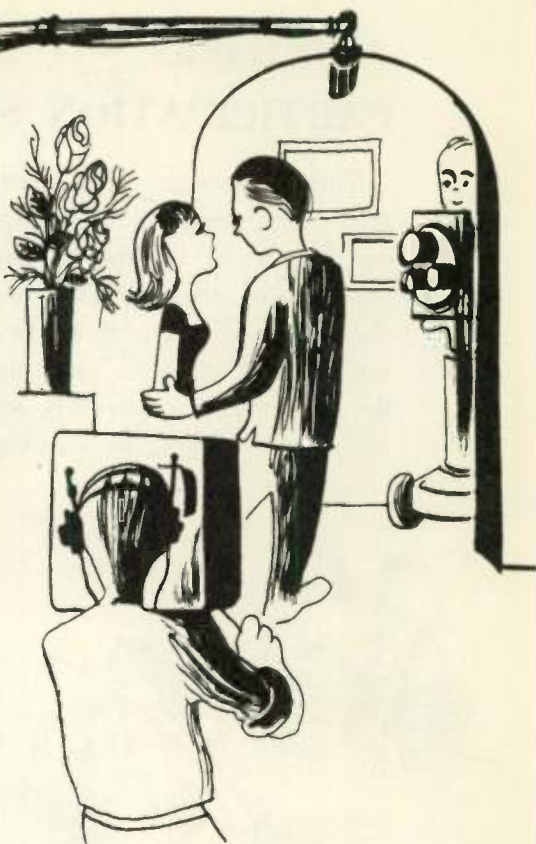
All kinds of shows are produced in the studio.





## DRAMATIC SHOWS

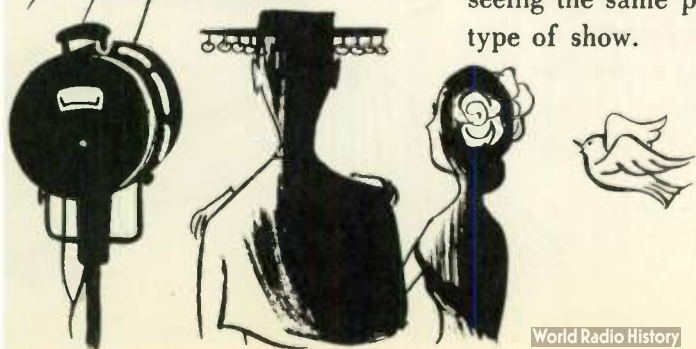
Dramatic shows are usually the most complicated and take the most time to plan and rehearse. Since viewers compare television and movie performances, the television dramatic show must be smooth and finished-looking. But a movie is shot over a period of days or months, with time to retake scenes and change location. A television dramatic show is shot all at once, with no time to correct mistakes. The actors have to learn all the lines and action right through, even though it is only for a single performance.



## VARIETY SHOWS

Almost anything goes into a variety show — singing, dancing, jokes, acrobats, or magicians. The separate acts must be tied together smoothly, usually by a master of ceremonies (who is called the M.C.).

He must keep everything running exactly on time. Variety shows which appear regularly have scouts working all the time to find enough good acts to keep the show entertaining week after week. Viewers get tired of seeing the same performers too often in this type of show.



## AUDIENCE- PARTICIPATION SHOWS

These programs are usually broadcast from a big studio theater where an audience can be part of the show. They take part in all kinds of stunts, quizzes, and contests. Because the audience performers are completely unrehearsed, the M.C. has quite a job to keep the show running smoothly and be sure nobody says anything he shouldn't.

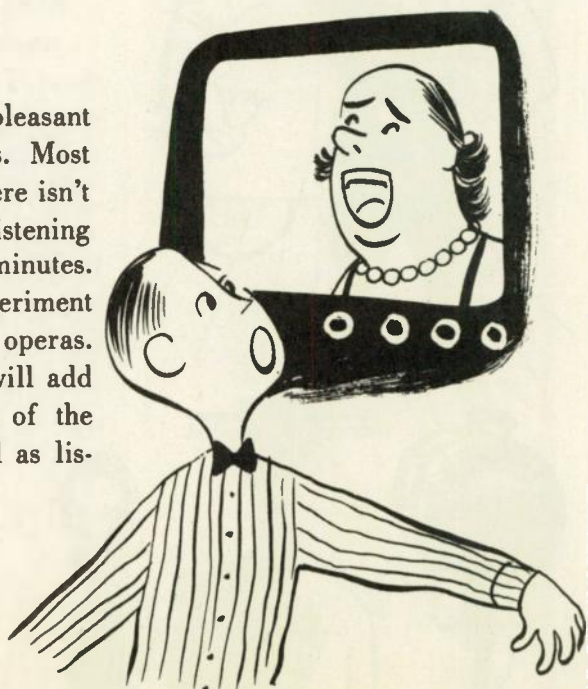


## QUIZ SHOWS

Quiz shows may have audiences too, but there are usually special experts to answer the questions. Something to see has to be part of the question on a television quiz show. This is true of all television shows—the viewers must have something interesting to look at as well as to hear.

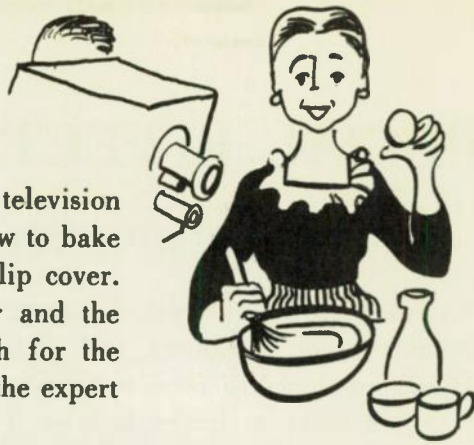
## MUSIC

Singers on television must have pleasant personalities as well as nice voices. Most music programs are short. Usually there isn't enough action to keep the audience listening and watching for more than 15 minutes. Television is just beginning to experiment with the televising of concerts and operas. The problem is to get pictures that will add enough to the audience's enjoyment of the music to keep them watching as well as listening for such a long time.



## HOW TO DO

Teaching is one of the things television does best. Experts can show you how to bake a cake, draw a picture, or sew a slip cover. The camera work has to be clear and the program must move slowly enough for the viewers to see and remember what the expert is doing.



## ★ EDUCATIONAL PROGRAMS

Educational programs show and tell you about things you may not want to do yourself, but which are fun to know. A program may be from an observatory where you can watch how scientists study the stars, or it may be an archaeologist talking about a city thousands of years old. The speaker must know his subject and be interesting, too, and the visual part of the program must be clear and well arranged. No matter how much information the program gives, it won't hold the viewers' interest if it is dull.

A great many films are used on educational programs.



## PUBLIC-OPINION PROGRAMS

These programs bring the "man in the street" and his ideas into your living room. So the questions he is asked must be suitable, and the person who is asking them must be able to size up the people he brings in front of the cameras. He has to be able to avoid "crackpots" who won't fit into the program sensibly.

Round-table discussions by experts are public opinion programs too.



## CHILDREN'S PROGRAMS

Children's programs provide fun and information for children — stories, jokes, games, cartoons, and maybe some things to do. Some shows are built around puppets and others around the children themselves.



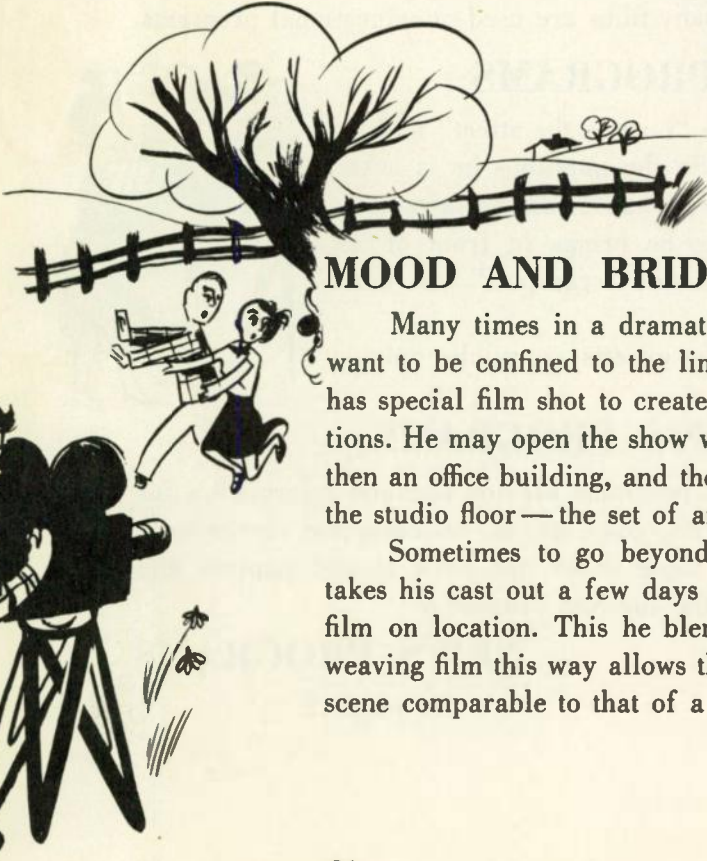
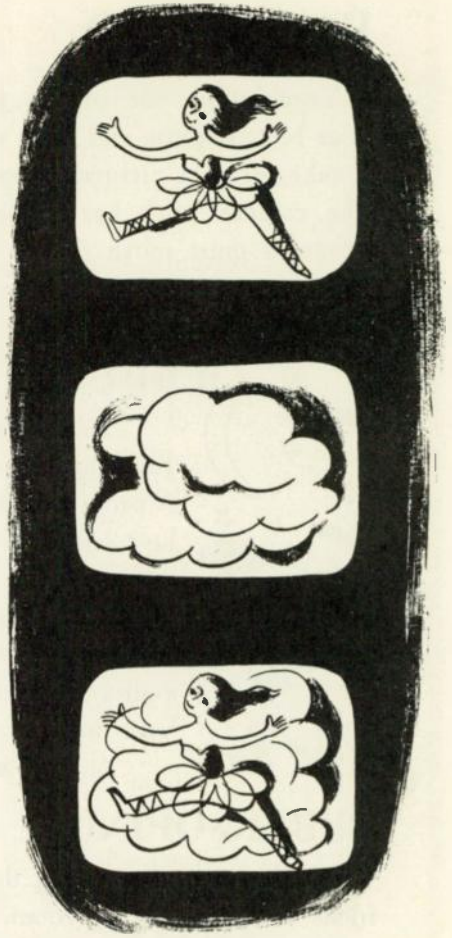
## NEWS PROGRAMS

See page 42.

# SPECIAL EFFECTS

## SUPERIMPOSITION

Pictures from two cameras, a camera and a Balopticon, or a camera and film are sometimes combined to form one picture. A director can make a dancer look as if she were dancing in the clouds by focusing one camera on the dancer and running a film of clouds at the same time in the projector. Then he combines them in the broadcast picture. He can make people appear out of nowhere, show titles on top of a scene, or a conductor's face in close-up over his whole orchestra. By combining the pictures from two sources, the director can create all kinds of effects.



## MOOD AND BRIDGING FILM

Many times in a dramatic show the director does not want to be confined to the limits of the studio floor, so he has special film shot to create the illusion of different locations. He may open the show with some film of a city street, then an office building, and then go to his first live scene on the studio floor — the set of an office.

Sometimes to go beyond the limits of the studio he takes his cast out a few days ahead of air time and shoots film on location. This he blends into the live show. Interweaving film this way allows the director to use a variety of scene comparable to that of a movie.

## PROCESS SCREEN

The process screen is a way of projecting motion-picture film from the rear of a translucent screen so that it shines through and forms a background for the action on the set. For example, you may see a boy sitting on a train, looking out of the window. The train is an actual set, but the scenery flashing past is on the process screen. Still pictures can be projected as backgrounds, too. The actors can be in front of the Taj Mahal or on a Paris street.



## LAP DISSOLVES AND FADES

Transitions from one scene to another or from one shot to another are made in several ways. At the end of a scene, the picture can be slowly darkened by the video engineer until it disappears (fade-out), and the new scene brought up from the dark screen into brightness (fade-in). In going from one shot to another, the picture from one camera is faded out of the air monitor as the other is brought in, and they overlap. This is a lap dissolve.

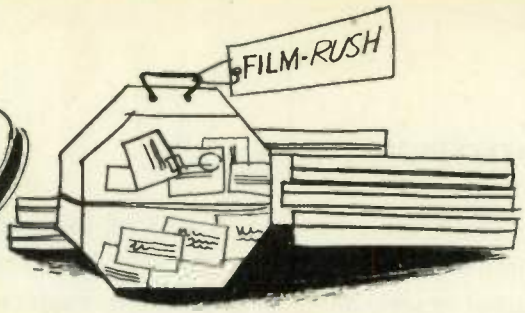
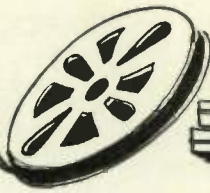


## THE BALOPTICON

The Balopticon is a machine for projecting still pictures or drawings. It holds two pictures at the same time and can project them singly or one on top of the other in superimposition. One slide might be lettering and one a chart. Then, if you wanted to change the lettering but keep the chart, you could replace just the lettering slide. The Balop is also used to superimpose a picture or lettering over a picture from a live camera.



# FILM



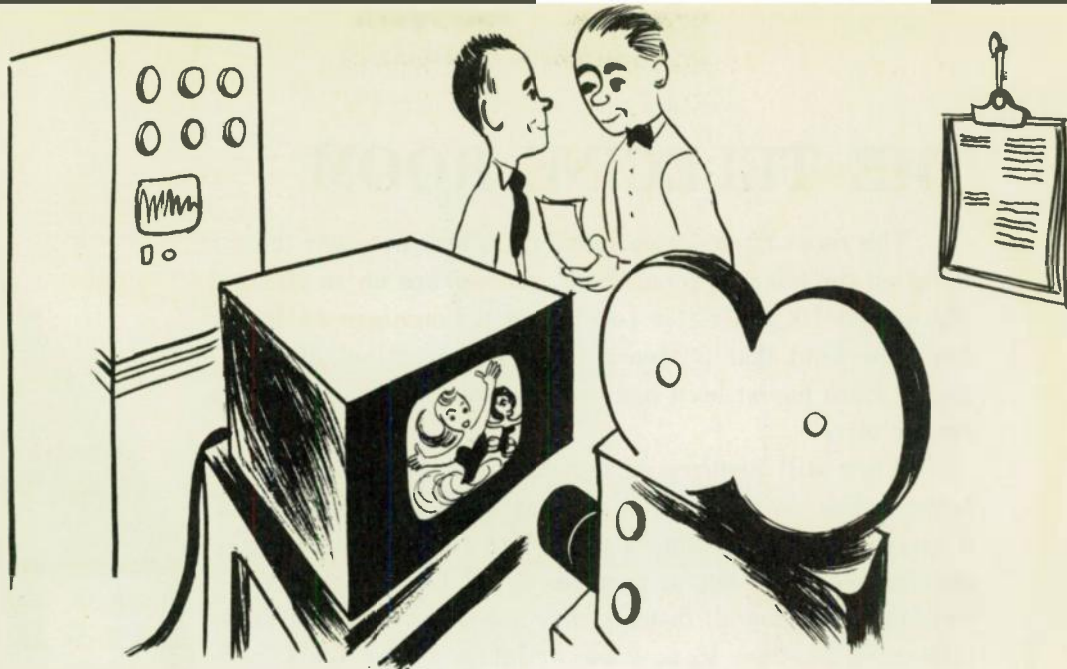
A great deal of film is shown on television. Besides being good entertainment, it helps take the pressure off overworked studio facilities. Few people and very little rehearsal are needed for a film show. All kinds of films are shown; the size can be 16 or 35 millimeter, and they may be features, shorts, educationals, or documentaries.

Recent feature films are seldom shown at present. Motion-picture companies do not want them competing with the same films in the theaters, and so they will not release them to the television stations. So many films are shown on television that if the film companies gave permission, within a few years you could see every film that was ever made in Hollywood. Now television companies are experimenting with some of the movie makers to make complete story films that can be shown during a half-hour program.

Films are important for television programming because they can take you farther out into the world than the limits of the studio or the limits of any live television broadcast would allow. By showing only the high spots of a news or sports event, a film can give the viewer a feeling that he has seen the whole thing, though it has actually been condensed into program length.

Most television studios have their own film cameramen who shoot news and feature stories for the news department, bridging film for dramatic shows and any other movies that are needed for programming and can't be borrowed from film libraries.





## RECORDING

Once a television program is broadcast, it is gone. All the work, rehearsal, sets, and money are used up in just one performance. But a way has been figured out for using a television program over and over again. A recording, sound and picture, can be made of the complete show directly off a television receiver tube.

It's done like this. A motion-picture camera is focused on a receiving tube that is carrying the program. The picture on the tube has been reduced in size so that all the details are sharp. And the camera shoots the whole program from beginning to end without stopping. It is necessary to have a camera that holds a great deal more film than an ordinary one does, because there isn't a second to stop and reload the film magazine without losing part of the show.

Because a motion picture camera takes 24 pictures a second and television shows 30 pictures a second, a special shutter on the camera is adjusted to take care of the difference. The sound may be recorded on the same film or on a separate one.

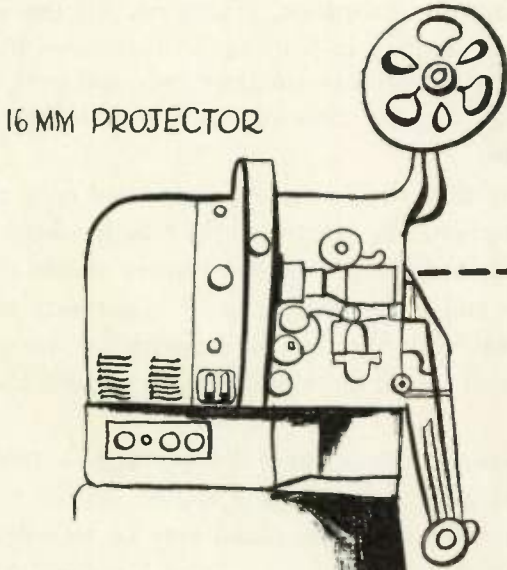
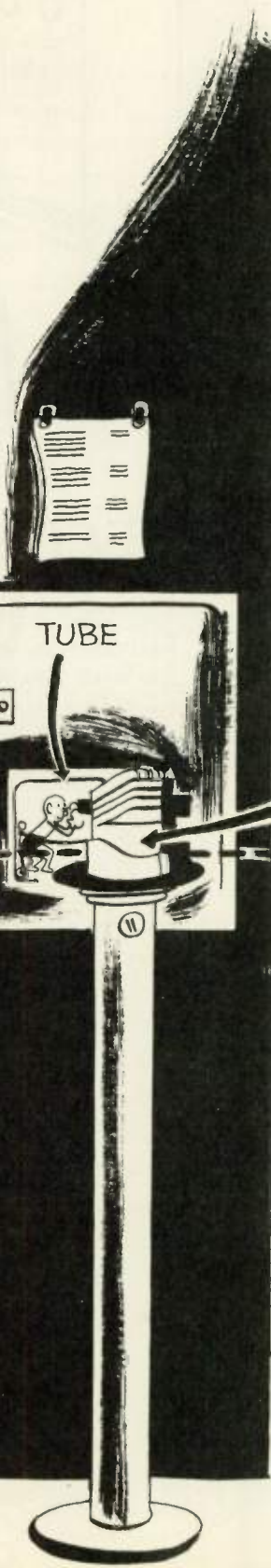
These recorded television programs are shown by stations that are not connected by coaxial cable or relay stations to the one where the show is originated. Or perhaps other network stations want to show the program at a different time. After the recording has been shown, it can be repeated or sent on to still other stations.

Some recording equipment works so fast that the recording is taken, developed, dried and ready to go on the air in 67 seconds.

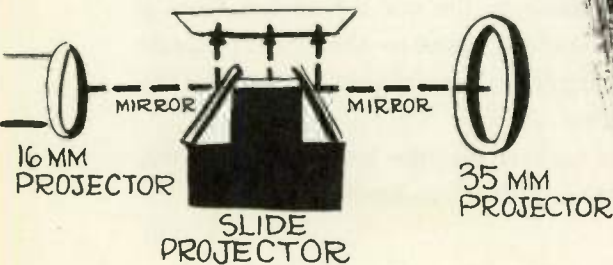
# THE TELECINE ROOM

The room from which movies are sent out over the air is called the telecine room. Some movies are on small-sized film called 16 millimeter (or 16 mm). Some are on larger film (the kind that is shown in theaters), called 35 millimeter. Each has at least one projector of its own, sometimes two or three.

When still pictures or drawings are shown, a kind of lantern slide is used which projects them onto the face of a special television camera tube. The camera tubes in the telecine room are not in cameras at all because they don't have to move around. Instead, they are set in cabinets. These tubes may be either Iconoscopes or Image Dissectors. (There are pictures of both these tubes on page 9). Either tube changes the picture into electricity so it can be broadcast.



THE MIRRORS WORK LIKE THIS  
TUBE

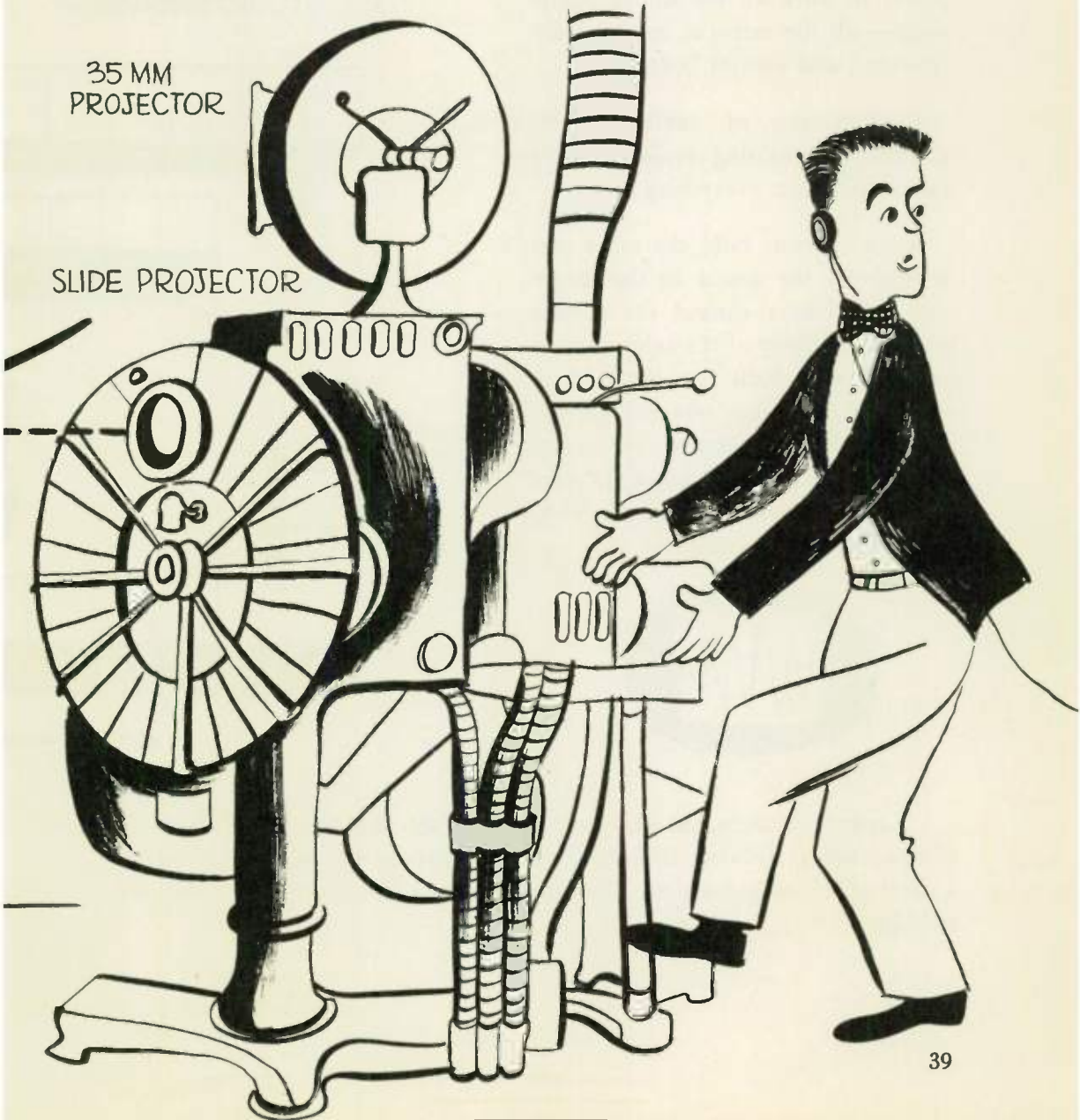




By using mirrors, a 16-mm, a 35-mm, and a slide projector can all project their pictures into one tube.

Film is very inflammable, and because so much of it is used here, the telecine room is made fireproof. There are fireproof cabinets for storing the film and special ducts which bring fresh air into the room and keep it circulating.

Several engineer-projectionists work in the telecine room. Their job is to turn the different projectors on and off on schedule. They put the right films and slides in ahead of time, then listen for the director in the control room to tell them through a connecting loud-speaker exactly when to turn each one on.



# MASTER CONTROL

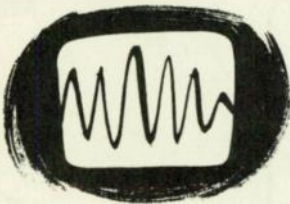
In a big television station, programs from all the floor studios come from their own control rooms by cable into a big master control room. A lot of things happen here.

The whole room is lined with cabinets of electronic tubes that do all kinds of jobs. Each cabinet has hundreds of wires and connections of its own.

One whole row of cabinets supplies power to work all the studio equipment—all the cameras, mikes, loudspeakers, and control boards.

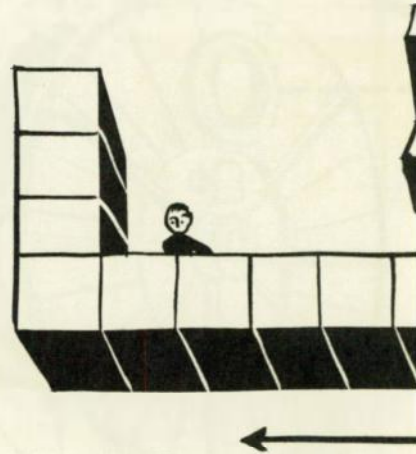
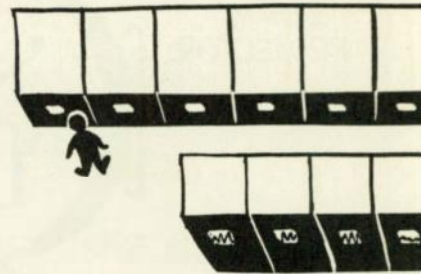
Another row of cabinets holds all the synchronizing equipment: the tubes that keep everything in step.

More cabinets hold the tubes that control all the sound in the studio and still others control the picture equipment. Many of the cabinets have small screens built into them which look like television screens. But instead of having pictures, the screens show graphs in light of exactly what is happening inside the cabinet. They are called oscillographs.

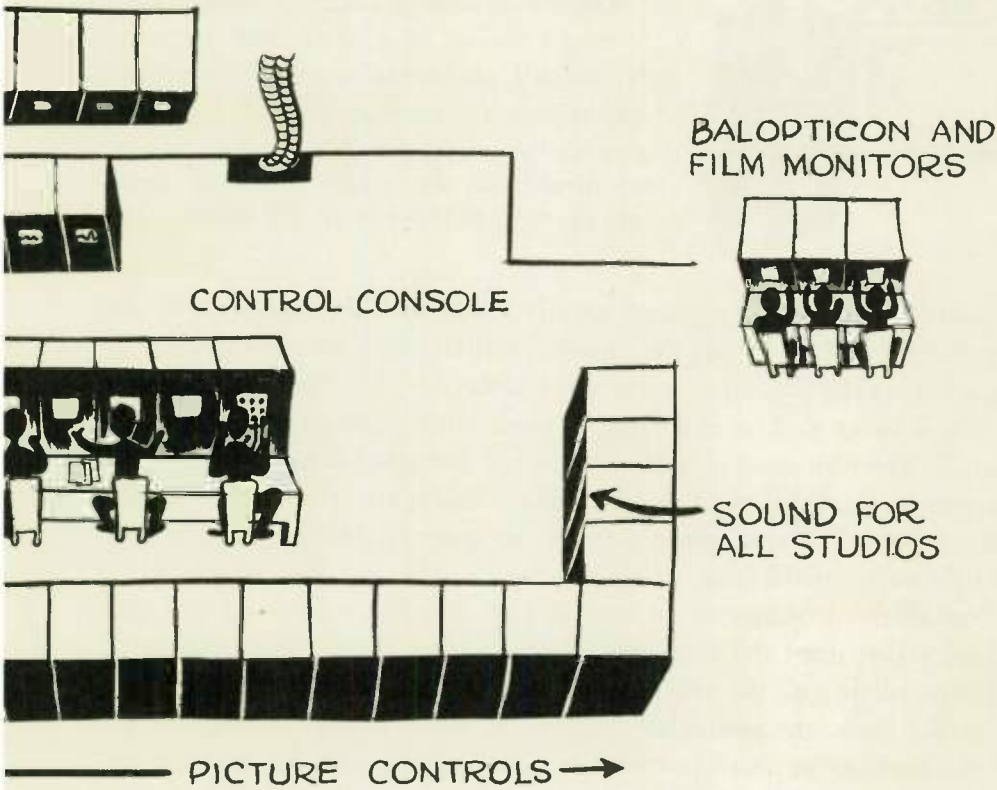


Looking at them, the engineers can tell just how that particular rack of equipment is working. If there is trouble anywhere, the oscillograph paints a chart of it they can see at a glance. There isn't time to stop and look for trouble.

POWER SUPPLIES FOR ALL STUDIO EQUIPMENT

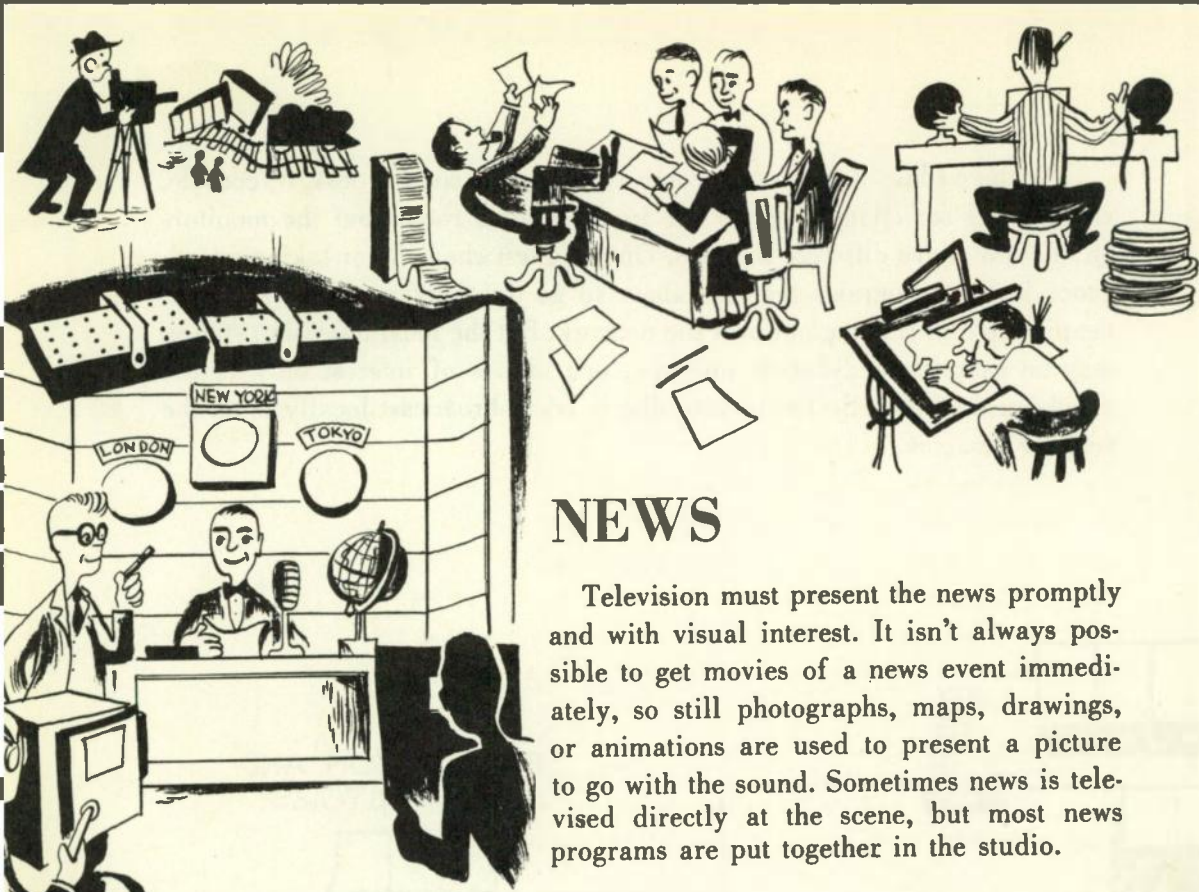


In the middle of the master control room is the control desk, or console, which looks something like the one in the control room. But the monitors on this desk have different pictures. One is a test channel for taking an advance look at programs that are about to go on. Another monitor carries the picture that is going out over the network. But the local television station may be carrying a different program, one that is of interest only to the people in that area. So the picture that is being broadcast locally is on the monitor too.



At one end of the control console is a telephone switchboard where cues are sent by phone to all the studio control rooms.

There is another control board just for monitoring film and pictures from the slide projectors.



## NEWS

Television must present the news promptly and with visual interest. It isn't always possible to get movies of a news event immediately, so still photographs, maps, drawings, or animations are used to present a picture to go with the sound. Sometimes news is televised directly at the scene, but most news programs are put together in the studio.

Getting the program together usually starts with a conference of the news editors and film editor, the director, writers, and the commentator to decide what are the important news stories of the day. The film editor reports what film is being shot or is coming in from other parts of the country or abroad. To this film must be added maps and animated charts made in the art department and still pictures from the photographic services that supply the newspapers. The conference decides the order of the stories and how much time each should take.

Now all the departments go to work fast. The film cutters cut and edit the films, artists draw the maps and charts, writers write the commentary, the picture editor gets the still pictures, so that by rehearsal time all the parts of the show are assembled. Sometimes there is live material to be fitted in—perhaps an interview with someone in the news or direct news pick-ups from other cities. This kind of news show uses all the studio facilities: the floor, the film channel, and the Balop channel. And all of this preparation has to be done every day.

All news shows are not this complicated. Some are regular newsreel films; others are just a commentator reading news; others are only still pictures with the commentator's voice.

# SPORTS

A great number of television hours are devoted to sports. One big problem faces the director who handles television sports, and the success of the program depends upon how well he works it out.

Because of the size of the television picture, if the entire field of action is shown (the way you see it when you're there), the individual players are too small to be seen clearly. On the other hand, a close-up of just a few players eliminates the picture of the surrounding action. The director has to compromise between these two choices. So he uses a basic shot showing a fair portion of the arena with medium-sized figures. Then he cuts back and forth to quick close-ups and long shots, giving viewers the impression that they are seeing everything that is happening.

THE CAMERAMEN AND THE COMMENTATOR WORK IN THE "CAGE."

The commentator works in a "cage" overlooking the field, with a monitor right in front of him. While he is talking about the play he sees on the monitor, he has to watch the field, too, to see how the complete action is developing.

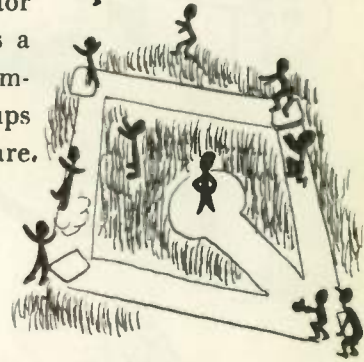
THE DIRECTOR AND THE ENGINEERS WORK IN THE CONTROL ROOM.

Sometimes the studios have special control rooms in the sports stadiums. Sometimes the crews work from the mobile truck. Camera positions are always selected carefully so that the action can be seen from various angles, but without confusing viewers who are accustomed to seeing the entire game from one position.

The cameramen, commentator, and director are a team who must know their sport well, in order to anticipate each play and get the important things on the screen.



THE DIRECTOR HAS TO CHOOSE



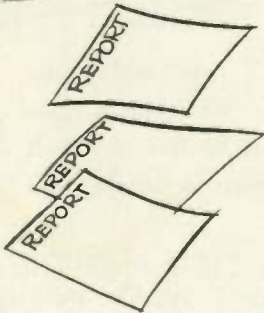


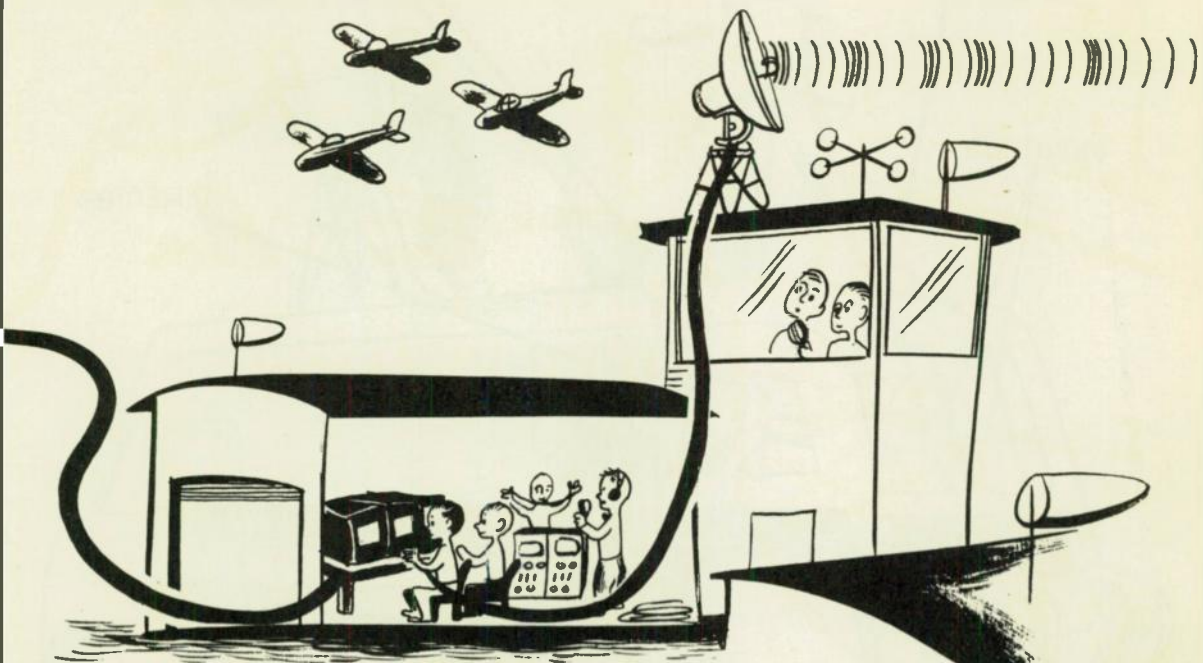
## REMOTE OPERATIONS

Any program which does not originate in the studio is a remote operation. Sometimes these programs are staged by the station; for example, museum shows, sidewalk interviews, or a variety show in a hospital. Sometimes they are public events which are reported by the television cameras; for example, the circus, all sporting events, or a political convention.

When planning any remote show, the director and a survey engineer go out to the location. They check the space they will have to work in, the positions for the cameras, the source of enough electric power to run the equipment, and the location for the radio link so that it will be in a direct line with the transmitter. And they have to figure out what lighting will be needed.

After the director has made his survey, he goes ahead building the show pretty much the way the studio director does, but keeping his action within the limitations of the remote location. If the event is not being produced by the station, his main job is in placing his cameras and mikes to best advantage with the set conditions of the program. He must work closely with the people who are putting on the show so he will know what is going to happen and when.





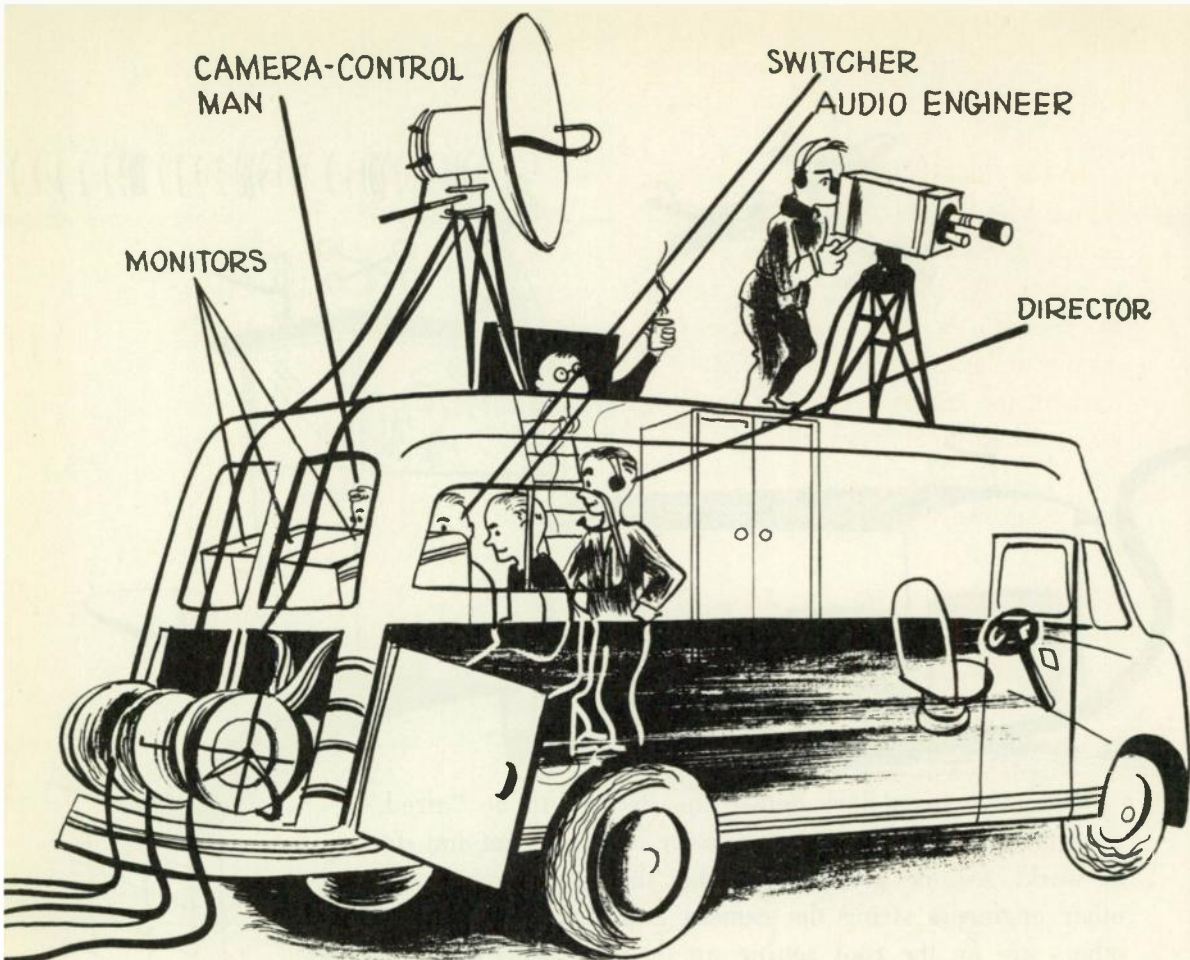
Hours or even days before the show is to be "aired," the engineers move in with over a ton of equipment and start to work. As one group assembles the control-room gear, other engineers string the camera and power cables. Still others are on the roof setting up the microwave relay reflector. Sometimes the telephone company does this job.

When remote shows come regularly from the same places, the installations there are semipermanent and all the surveying and setting up does not have to be done each time.

Once the cable is laid, the cameras and lights are set up. The transmitter, the cameras, and the control equipment are all tested, and the intercommunication system among the director, cameramen, and engineers is checked. Constant telephone contact is kept with the studio, too.

Now the director takes his place behind the control monitors. If it is a produced show, there is a real rehearsal. Otherwise the crew just runs through camera positions and lenses before the show starts. The director and cameramen work as a team, selecting the right lenses and cutting at the right time to get close-up, wide-angle and medium shots, even though they have never seen the action.





## TELEVISION ON WHEELS

For the programs that happen outside the studio, there is a special unit designed to carry all the equipment, even a control room, wherever it is needed. This unit is usually a specially built truck that is a sort of television studio by itself.

Not only does the truck carry equipment from one place to another, but it provides all the machinery necessary for operating that equipment. When the truck reaches the program location, the cameras and mikes are taken out and put where they are needed. Sometimes they are right on the roof of the truck. Sometimes the camera may be connected to the truck by more than 1,000 feet of cable.

These cables connect the cameras and mikes to the control desk in the truck, just as the studio cameras and mikes are connected to the studio control room. The engineers work in the truck control room the same way they do in the studio. There is usually one engineer to control the pictures, one audio engineer, a switching engineer and the director.

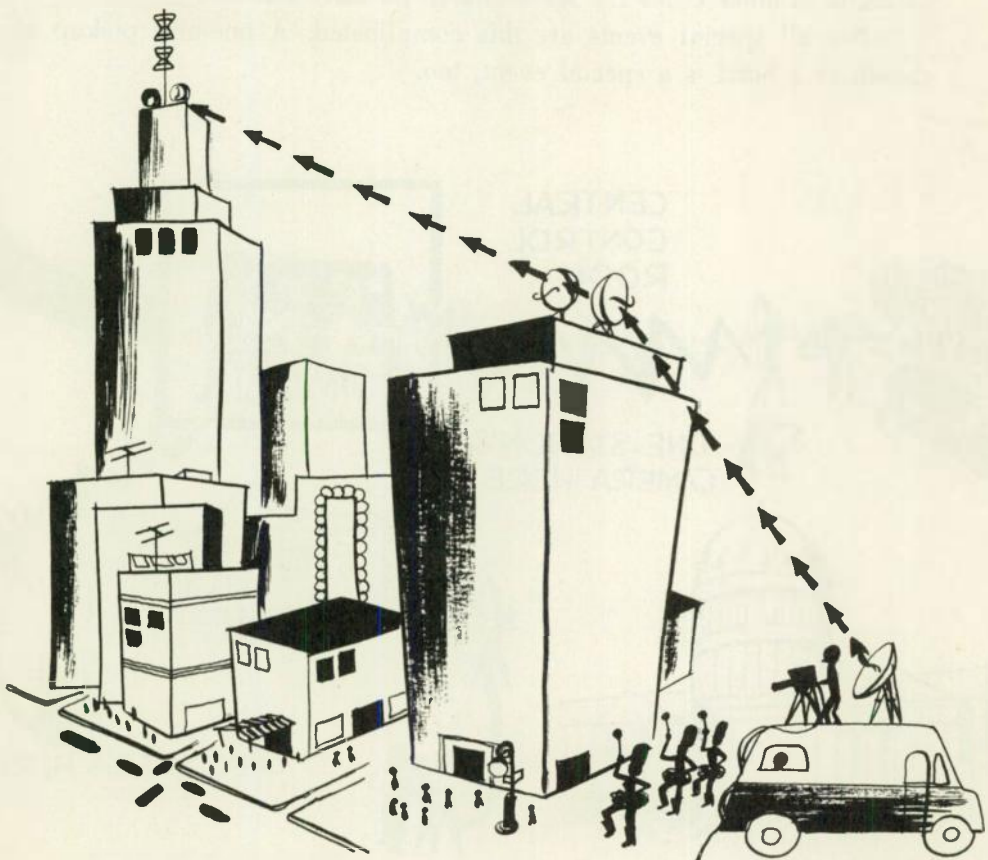


The mobile unit has to supply power to work all the equipment. Sometimes it does this by plugging into the electric power in a nearby building. Sometimes it carries its own gasoline-engine generator along.

Finally, the truck has to send the signals back to the studio or to the transmitter to be rebroadcast to your receiver. It doesn't have enough power to broadcast directly. There are two ways the signal may be sent back to the transmitter. One is through a coaxial cable. The other is by a special radio link—a broadcast from the truck to the station transmitter.

That is what the big round thing on the roof of the truck is for. It is a microwave relay reflector, but television men call it just the dish, or link.

The signal from the dish to the receiving antenna at the station must be in direct line-of-sight. That means there must be nothing between them to interfere. But suppose there are high buildings in the way? Well, then there has to be a relay station to pass the radio waves along. It could be another link, or two; on top of a high building that is in line of sight to both the mobile truck and the transmitter.



# SPECIAL EVENTS

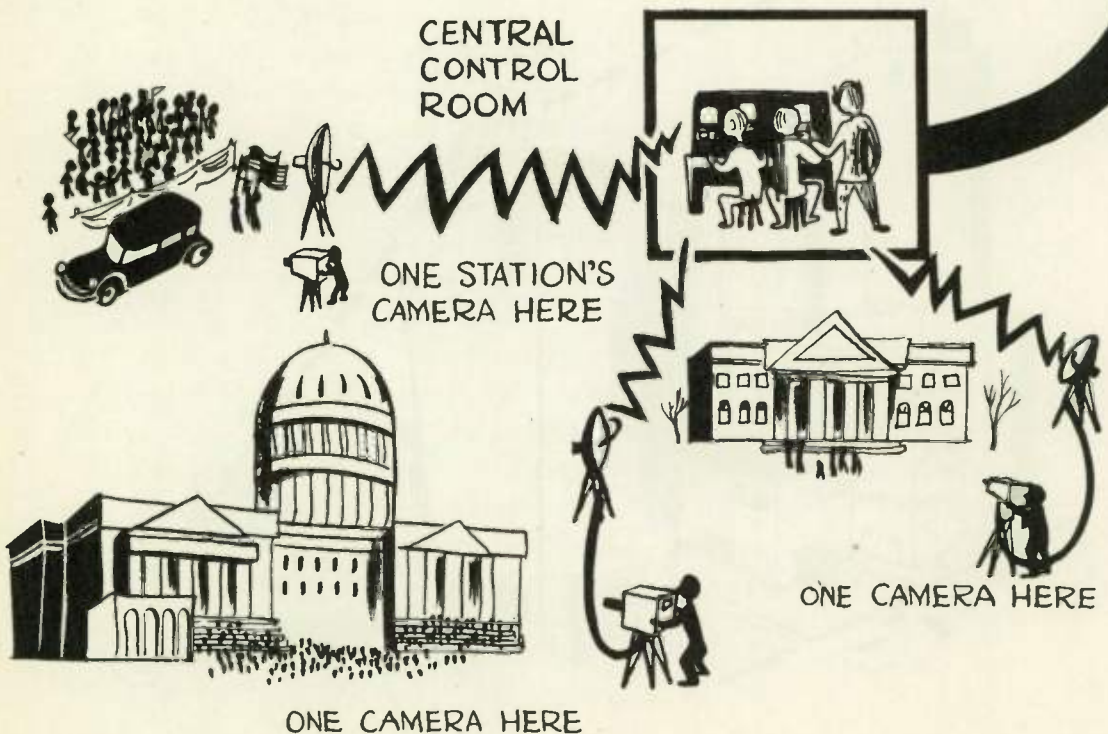
Covering important events is a big part of television. The event may be a parade or the opening of Congress, an election or air maneuvers on a carrier ship. These special-events broadcasts take you right to the scene.

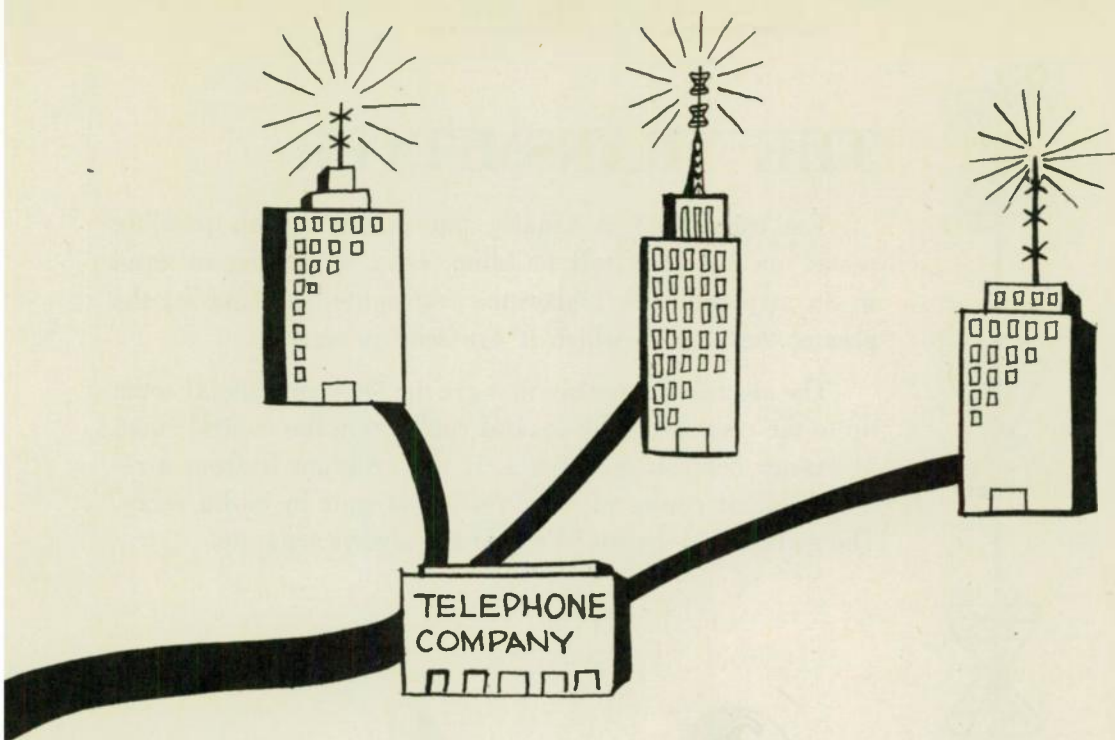
Sometimes in covering one of these events it is necessary to have remote units at various locations where different things are happening. At a Presidential Inauguration, one unit would be set up on the Capitol steps, two or three units would be placed along the route of the parade, another might be on the White House lawn, and still another up in an airplane, watching the entire scene.

The pictures and commentary from each of these locations are sent to one central control room by coaxial cable or radio relay link. There is a director at each pick-up point to direct his own crew, and at the central control room an overall director switches from one location to another.

The pictures from the coordinating control room are sent to local television stations for transmission over the air. At the same time, they go by cable to other cities for transmission on their stations.

Not all special events are this complicated. A one-unit pickup of a speech in a hotel is a special event, too.





## POOL BROADCASTS

Pool broadcasting in television means that all the companies interested in a special event agree to have one company pick up the event and send the pictures to all stations. On a complicated event, each station covers one part of the broadcast or contributes equipment and personnel.

Sometimes limitation of space and facilities make pool broadcasting necessary. If the President were to make a speech from the White House and every station covered it individually, perhaps a dozen cameras with all the equipment and men for each unit would have to be crammed in at the scene. Since this isn't possible and yet the coverage is important to all the stations, they agree to a pool broadcast.

There are not enough cable or radio relay-link facilities for transmitting a special event to different parts of the country if each station does it individually. So the stations pool on the coaxial cable, too.

The program travels through the cable, which is owned by the telephone company, from city to city. At each city the cable goes to the telephone-company terminal, then separate cables branch off to the various station transmitters. In this way all the television stations in all cities are broadcasting the same program at the same time.

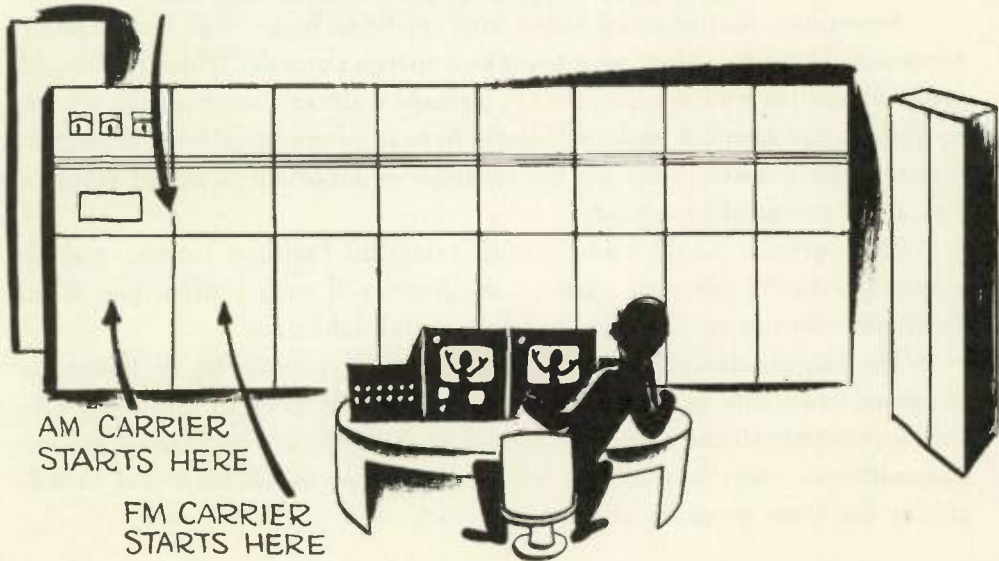
# THE TRANSMITTER

The transmitter is usually put in the highest possible place; on top of a tall building, on a mountain, or even in an airplane. The higher the transmitter antenna is, the greater the area to which it can send programs.

The electrical impulses that are the television signal come up to the transmitter by coaxial cable from the control room or master control. Sometimes, if the program is from a remote unit, it comes directly from that unit by radio relay. The picture and the sound signal are always separate.



THE TUBE THAT GENERATES THE FINAL POWER TO BE FED INTO THE ANTENNA IS IN HERE



AM CARRIER  
STARTS HERE

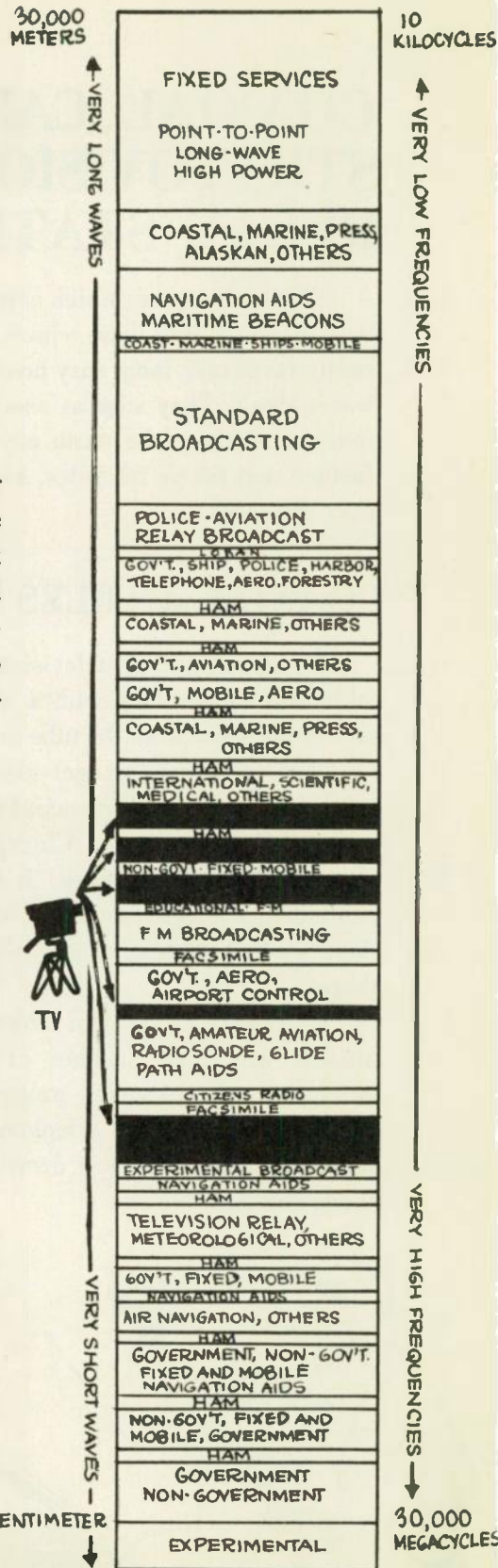
FM CARRIER  
STARTS HERE

BECAUSE SO MANY SERVICES USE RADIO WAVES, THE GOVERNMENT ASSIGNS THEM ALL SEPARATE CHANNELS. EACH USER TRANSMITS RADIO WAVES OF DIFFERENT LENGTHS AND FREQUENCIES.

The transmitter has to generate the power to carry these signals through the air. The electron tubes that do this work get so hot that water is always flowing around them to cool them. If for any reason the water stops flowing, automatic controls turn the tubes off to keep them from blowing up. Some transmitters have tubes cooled by air.

The electromagnetic waves that carry the signal through the air are called the carrier waves. When the signals are added, the carrier has been modulated. The waves that carry the picture are amplitude-modulated, or AM. The waves that carry the sound are frequency-modulated, or FM. (More about this on page 6, 8.) The sound and picture waves travel side by side in the channel or band of radio frequencies that is allotted to each station by the Federal Communications Commission.

Because there are other services that use the frequencies directly above and below the television band, only a limited number of stations can operate in any area without interfering with each other. But stations quite a distance apart can operate on the same channels without any trouble.



# COAXIAL CABLES, STRATOVISION, RELAY STATIONS

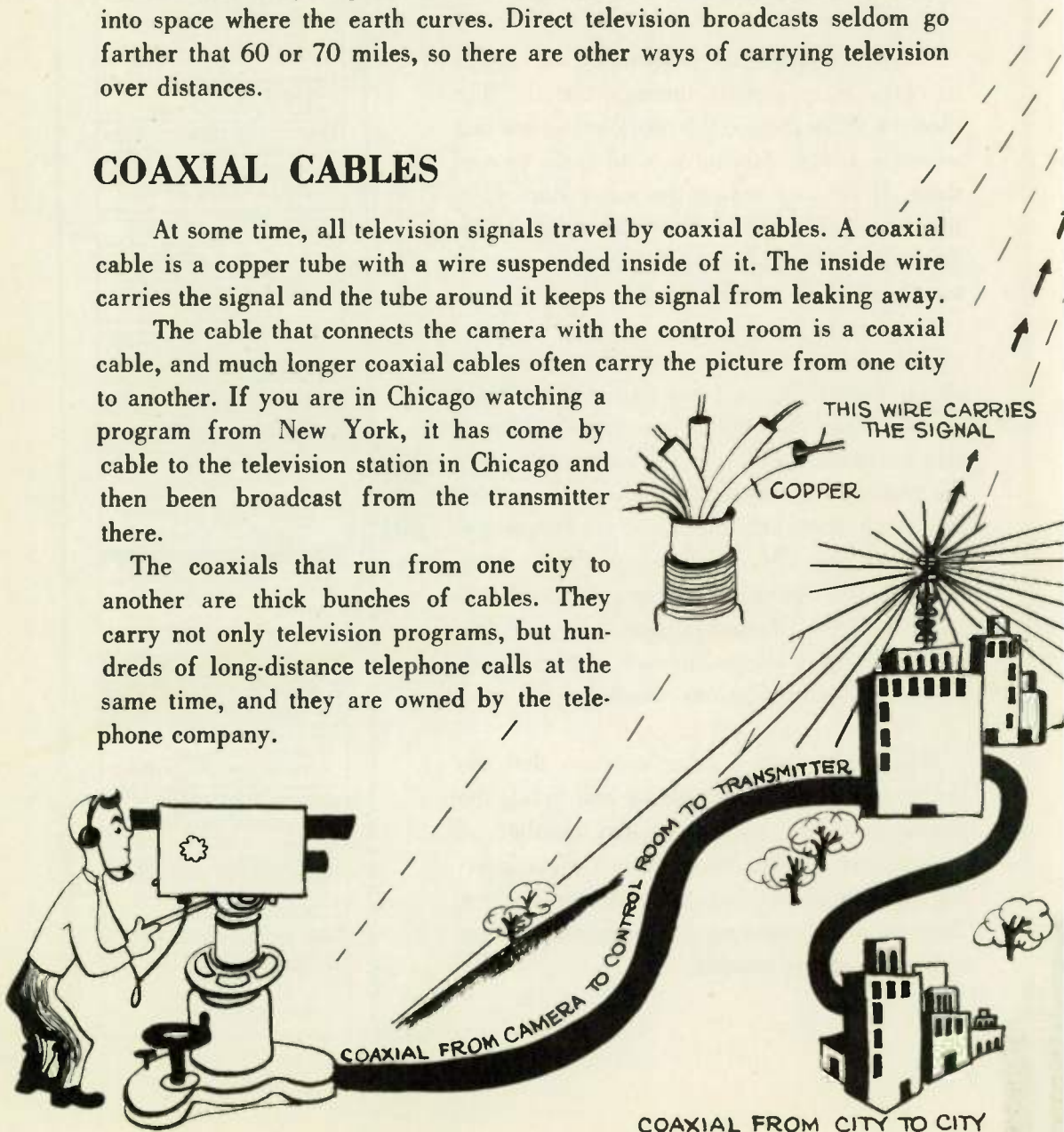
The radio waves which carry television signals cannot be broadcast over long distances like those which carry an ordinary radio program. Ordinary radio waves take long, easy bounces around the earth, but the short television waves don't. They stop as soon as they come to earth, or go shooting off into space where the earth curves. Direct television broadcasts seldom go farther than 60 or 70 miles, so there are other ways of carrying television over distances.

## COAXIAL CABLES

At some time, all television signals travel by coaxial cables. A coaxial cable is a copper tube with a wire suspended inside of it. The inside wire carries the signal and the tube around it keeps the signal from leaking away.

The cable that connects the camera with the control room is a coaxial cable, and much longer coaxial cables often carry the picture from one city to another. If you are in Chicago watching a program from New York, it has come by cable to the television station in Chicago and then been broadcast from the transmitter there.

The coaxials that run from one city to another are thick bunches of cables. They carry not only television programs, but hundreds of long-distance telephone calls at the same time, and they are owned by the telephone company.



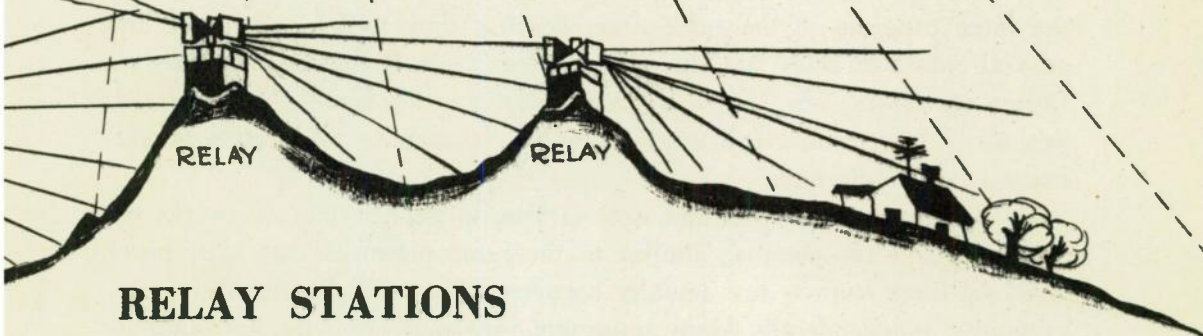


## STRATOVISION

Experiments in television transmitting have been made from transmitters built into airplanes. The planes fly around in the stratosphere, between 24,000 and 30,000 feet up.

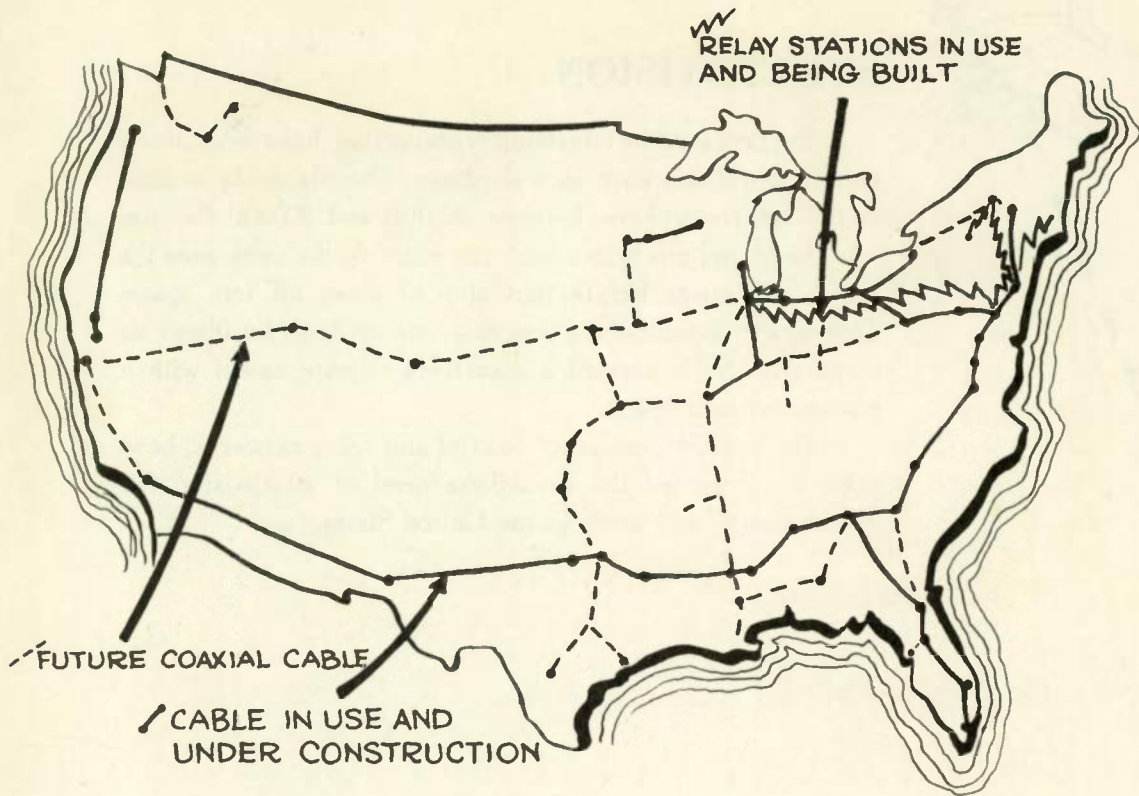
The higher any television transmitter is, the more area the waves will cover before they stop or shoot off into space. That is why broadcasting antennas are on high buildings or mountains. So it seemed a good idea to experiment with a transmitter in a plane.

The rapid extension of coaxial and relay networks, however, has lessened the immediate need of stratovision for densely populated areas in the United States.



## RELAY STATIONS

Sometimes television signals travel distances with the help of relay stations. These stations are placed on hills or mountains, about 50 miles apart. On the top are big reflectors which scoop up the television signals aimed at them. Inside the relay station special radio equipment strengthens the signals and sends them out again, on to the next station. This equipment works automatically. There doesn't have to be anyone around the station at all.



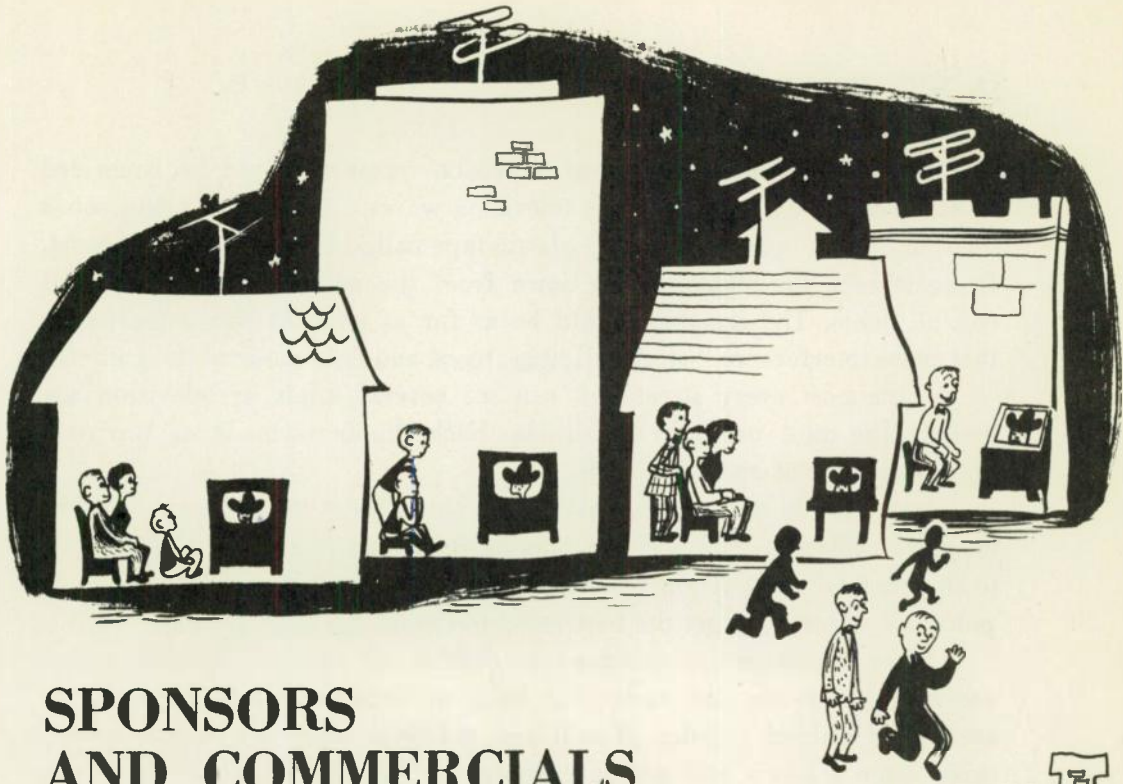
## TELEVISION NETWORKS

In the future, all the stations of a television network will be able to show the same program at the same time, because they will be connected by coaxial cables or relay stations. Now stations from Richmond, Virginia to Boston and from New York City to Chicago and St. Louis are connected this way. And the cable is being extended, and more relay stations are being built all the time.

The key television stations are working to expand their networks of stations across the country, similar to the radio networks that exist now. Until all these stations are actually connected, they will handle their programming independently. Many important programs from the key stations are recorded on film and then shown by the network stations in other parts of the country.

The great advantage of a television network is the very large audience it reaches. This is particularly important when programs are sponsored, because the greater the buying group the advertiser reaches, the more he can afford to spend for the program.





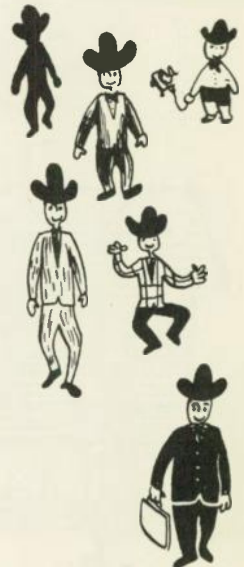
## SPONSORS AND COMMERCIALS

Commercial sponsorship is going to pay for most of the programs that you watch. More and more sellers are using television to demonstrate their wares. The advertising agencies have found that because people watch television so closely, they pay more attention to the commercials and remember them longer.

There is something special about television commercials that is not true of any others. The product can actually be demonstrated. You can see it and how it works.

Commercials have to be changed often because viewers get tired more quickly of watching and hearing the same commercials over and over than they do of just hearing them on the radio or seeing them in a magazine or paper.

Sponsors and advertisers use all sorts of ways to show their products. They have movies, demonstrations, cartoons, playlets, and pictures. Sometimes the commercials are more elaborate than the programs. In fact, commercials are such an important part of a television show that they are reviewed by the critics just like the entertainment part of the program.



# ANTENNAS

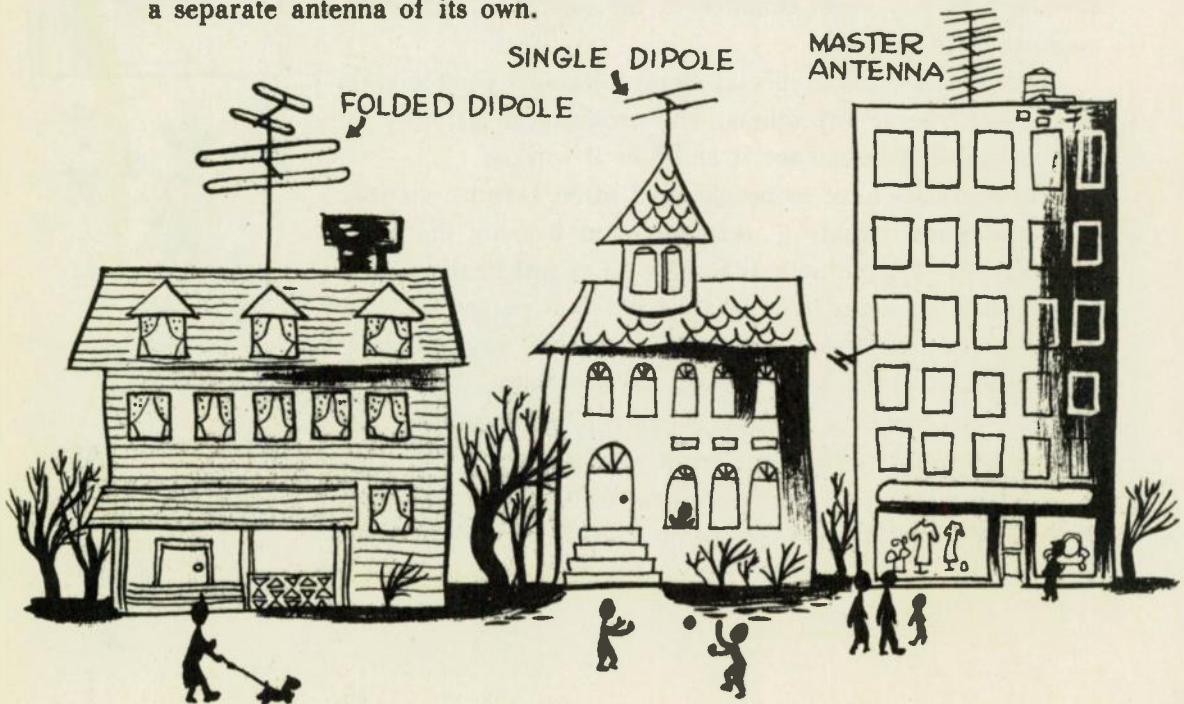
For the best reception, your television receiver should be connected to an antenna, which collects the television waves out of the air and sends them through a special wire-and-plastic tape called a lead-in into your set. In some sets, the signal comes down from the antenna through a small coaxial cable. The antenna should be as far as possible above the things that cause interference—steel buildings, trees, and even automobile ignitions.

On almost every street you can see several kinds of television antennas. The most usual is the dipole. Each dipole is made of two rods placed end to end on a cross pole.

You usually see what appears to be two dipoles on the cross rod, but one is a reflector. The antenna should really be placed at right angles to the transmitter, but since the stations all have different locations, dipoles are adjusted to get the best reception from the most stations.

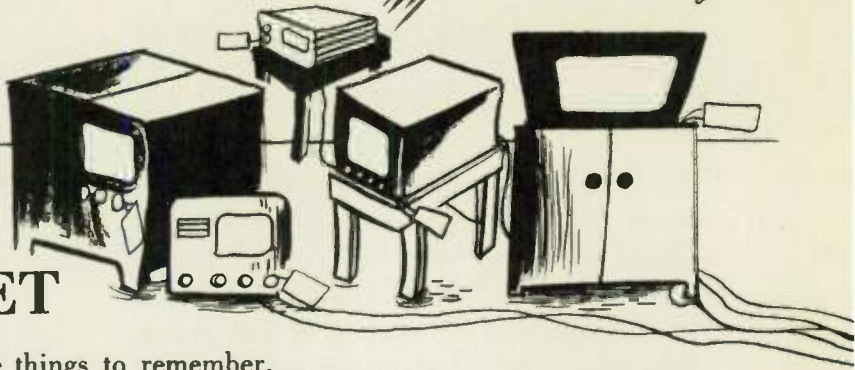
Some receivers are designed to operate on straight dipoles, others are intended to use the rods bent back to form a sort of loop. These are called folded dipoles. You'll see antennas with one dipole to receive some stations and another dipole for the others. When there are a number of stations, it may be hard to adjust the antenna so it receives them all well. So a smaller dipole is set over the first one to pick up additional stations.

Some apartment houses have master antennas. All the sets in the house are connected to the master antenna so that each one doesn't need a separate antenna of its own.





# RADIO & TELEVISION



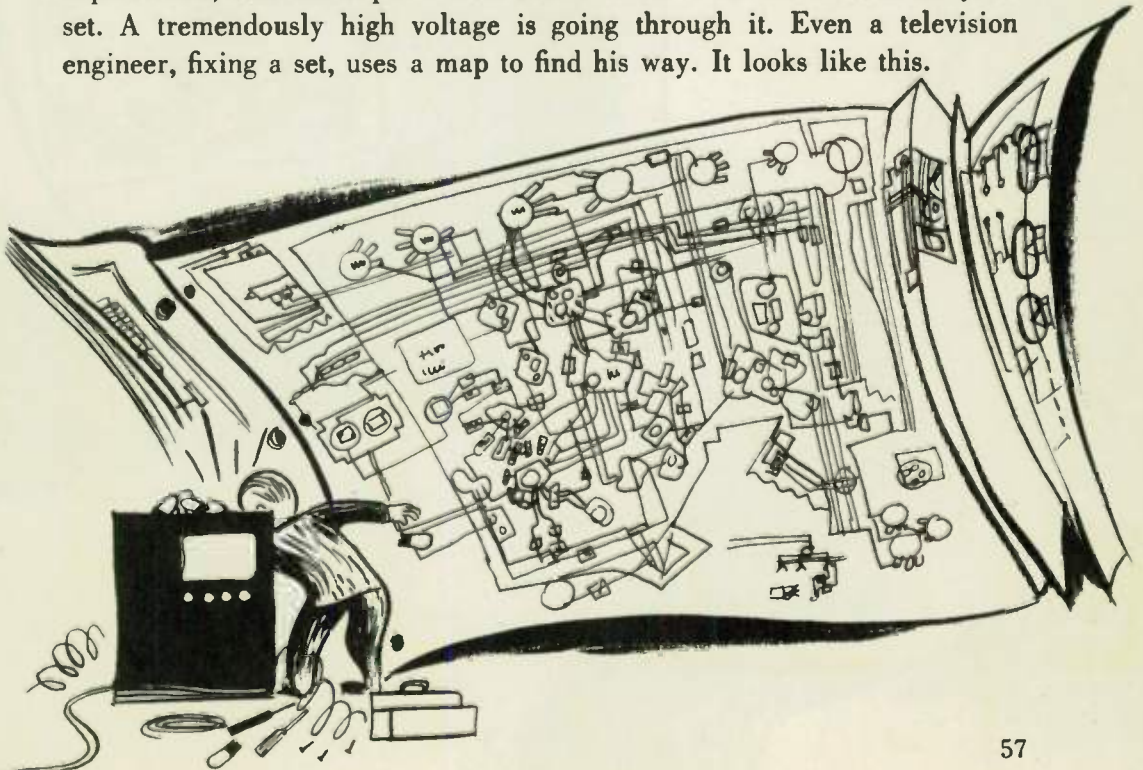
## YOUR SET

Here are some things to remember.

You're fairly safe buying a set made by any reputable manufacturer. But occasionally you may have trouble with even the finest set, so it is a wise idea to take out repair insurance with the people who install it. For a fixed sum they will repair your set and replace the parts.

Don't worry about your set becoming obsolete. The station selector has more channels now than there are stations operating in any area. But if these channels were all filled and new stations were added, a special adaptor could be attached to your set so you could receive those stations, too. Even if color television comes sooner than seems likely now, your black-and-white set can probably be converted to receive it.

If you have assembled your own set and something goes wrong with it, you may know enough to make the repairs yourself. If you aren't experienced, call the repair man. Never fiddle with the insides of your set. A tremendously high voltage is going through it. Even a television engineer, fixing a set, uses a map to find his way. It looks like this.



# HOW THE PICTURE IS RECEIVED

After the antenna has picked the television waves out of the air, they are carried by a special wire into your receiver. The most important part of the receiver is an electron tube, the partner of the one in the camera. This tube is called a cathode-ray tube, and it has an electron gun in it just as the camera tube did.

The big end of the tube is a fluorescent screen. This screen gives off rays of light as long as it is being scanned from behind by the beam from the electron gun. This is usually the screen of your receiver, and the rays of light are the television picture. Sometimes, instead of seeing the picture directly, you see it reflected by a mirror, or projected by lenses onto a larger screen.

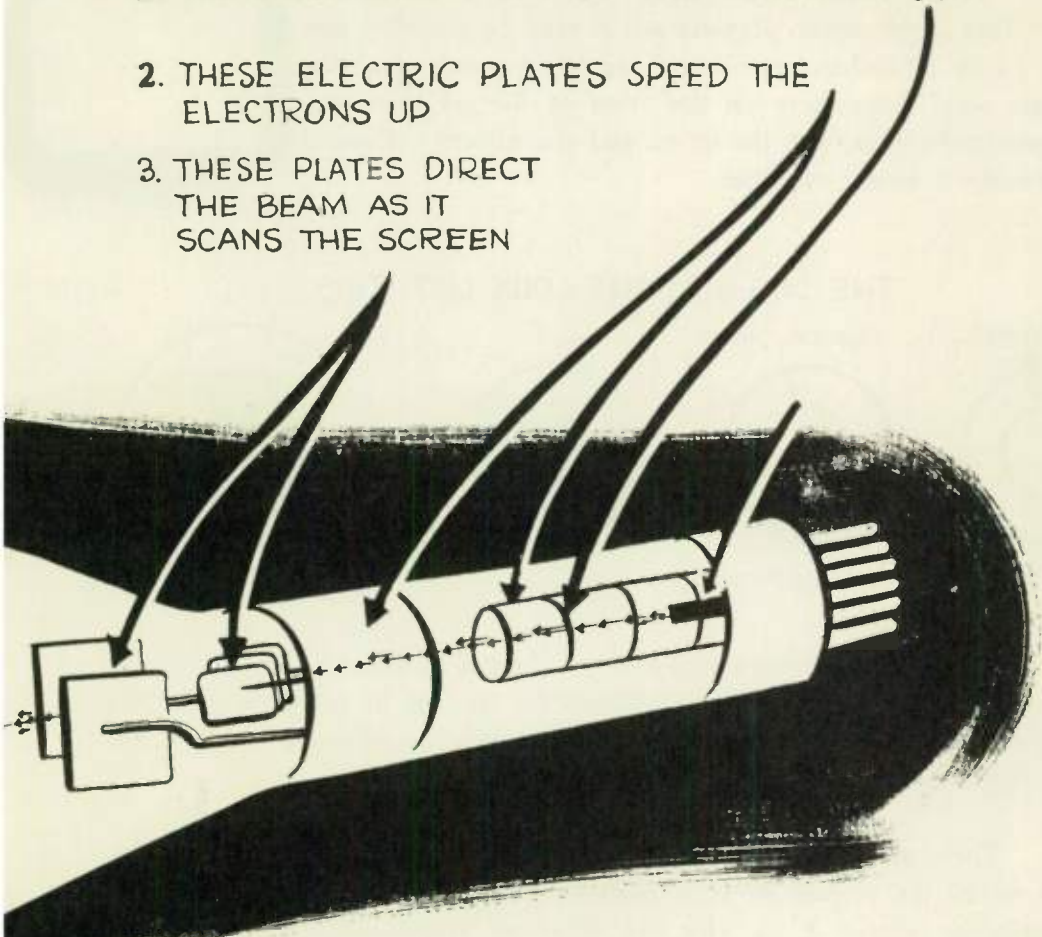
FLUORESCENT  
SCREEN



1. THE BEAM SHOOTS OUT OF THE ELECTRON GUN

2. THESE ELECTRIC PLATES SPEED THE ELECTRONS UP

3. THESE PLATES DIRECT THE BEAM AS IT SCANS THE SCREEN

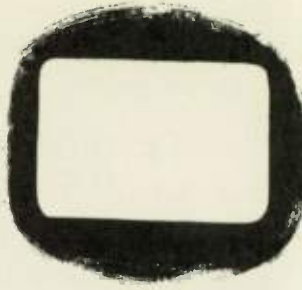


The beam of electrons in the cathode-ray tube fluctuates just the way the beam in the camera tube did. It shoots out of the gun and scans the fluorescent screen in exactly the same way. And since the beam is made of little charges of electricity exactly like the ones that flowed out of the camera tube, it makes a picture in light on the screen just like the picture that first came in through the camera lens.

The picture on the television screen is really built of 525 lines of light and dark, which you can see if you look closely. The beam repeats these 525 lines 30 times a second. You see these lines as a whole picture and the 30 pictures a second as a moving picture because your eyes don't work fast enough to see the spaces in between.

# TUNING YOUR SET

This is the screen of your set. It may be postcard size or 15 by 20 inches, but all sets are tuned pretty much the same way. Somewhere on the front of the set there are some knobs. One turns the set on and also adjusts the sound to make it louder or softer.



## THE DIALS MIGHT LOOK LIKE THIS

BRIGHTNESS



CONTRAST

VERTICAL HOLD

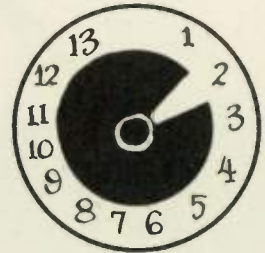


HORIZONTAL HOLD

OFF ON



SOUND

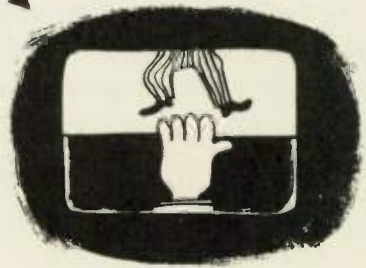
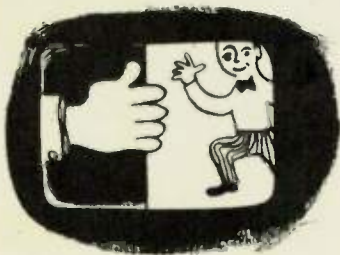


STATION SELECTOR

Somewhere there is a dial with the channel numbers of all the stations you can receive, and some extra ones for stations to come. So you turn your dial to the station you want. There is a fine-tuning knob, too, for tuning the channel in correctly.

There are knobs marked “contrast” and “brightness.” These help you to adjust the picture so it is neither too light nor too dark. Only the engineers seem to know what the difference is between these two knobs and they don’t tell, so just twiddle them until the picture looks right.

The last two knobs are marked “vertical hold” and “horizontal hold.” Vertical hold keeps the picture from slipping off up into the top, like this and horizontal hold keeps it from slipping off to either side, like this.



The test pattern of your station is on—the special signal that each station sends out to help you to tune your set perfectly ahead of time. It should look like this. →



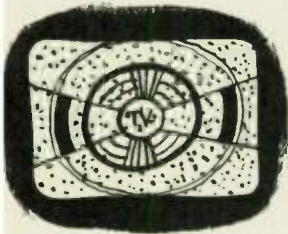
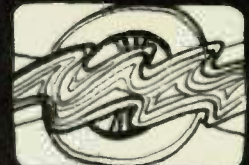
**BUT**

→  
suppose it looks perfectly awful, like this! Turn the tuning dials, then the “hold” dials until the picture straightens out.



**NOW**

→  
suppose there is a stripe of a peculiar pattern running across the picture, like this. It is called a herringbone, and it is caused by another electric signal somewhere in the neighborhood. Or maybe there's a diathermy machine in a nearby doctor's office, and it makes a pattern like this. There's nothing to do but hope it goes off soon! →



Sometimes there are little white or black dots speckling the picture. They are called snow, and come when your antenna is not strong enough to receive the station to which you are tuned.

Here comes the M.C., who usually looks like this. →  
But sometimes he looks like this.

Those extra M.C.'s are called ghosts, and they are reflections of the broadcast signal. They may be bouncing off a cliff or another building and reaching your set a split second later than the original picture. Sometimes a slight change in the direction of your antenna helps. Some ghosts only come when there are certain types of clouds that reflect the signal.

This page prepares you for the worst. Usually these things hardly happen at all.





## TELEVISION TO COME

Color is coming, but nobody knows how soon. There have been successful demonstrations of both mechanical and all-electronic television color. There are problems still to be solved, but because color makes television so much more effective, the engineers will find a way!

There will be an increased number of stations in most cities. Someday television may move out of its present wave band into a band of ultra-high-frequencies. Then there can be more stations in an area than there are now.

Large-screen theater television is coming. Programs of special interest will be shown in regular theaters. A championship prize fight, for example, might be shown in theaters only.

There will be a way of receiving special programs by means of cable directly to your television set. You might have the programs turned on by calling your telephone company, and you would pay extra for them on your telephone bill.

Pictures now are made up of 525 lines. Some time, pictures might have as many as 1,000 lines, which will give them sharper detail.

Television studios will be similar to the motion-picture lots in Hollywood today. They might not be quite so large, but they will have to be much bigger than any television studios of today, to take care of rapidly expanding program schedules.

News service will be greatly extended.

Sets get better all the time, and they will gradually get less expensive. There will be projection sets for seeing larger pictures at home, and these will be more reasonably priced too. But don't wait to buy your set if you haven't got one now! You're missing too much fun.





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