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EQUIPMENT GUIDE FOR CLASSROOM TELEVISION.
SYLVANIA ELECTRIC PRODUCTS INC., NEW YORK, N.Y.
EDRS PRICE MF-$0.25 HC-$1.52 36P.

DESCRIPTORS- *EDUCATIONAL TELEVISION, *EQUIPMENT MANUFACTURERS, *EQUIPMENT UTILIZATION, *GLOSSARIES, PROJECTION EQUIPMENT, INSTRUCTIONAL TELEVISION, CLASSROOMS, VIDEO TAPE RECORDINGS, VIDICON EQUIPMENT

THE GUIDE IS DESIGNED TO ACQUAINT EDUCATORS WITH EDUCATIONAL TELEVISION HARDWARE. FEATURES INCLUDE A GLOSSARY OF TECHNICAL TERMS, DESCRIPTIONS OF VARIOUS TELEVISION CAMERAS AND LENSES, PROJECTION EQUIPMENT, TAPE RECORDERS, MONITORS, AND TELEVISION RECEIVERS. NECESSARY EQUIPMENT FOR DISTRIBUTION SYSTEMS, PROTABLE STUDIOS, LARGER AND PROFESSIONAL STUDIOS, AND COMPLETE EDUCATIONAL TELEVISION INSTALLATIONS IS DETAILED. (MS)

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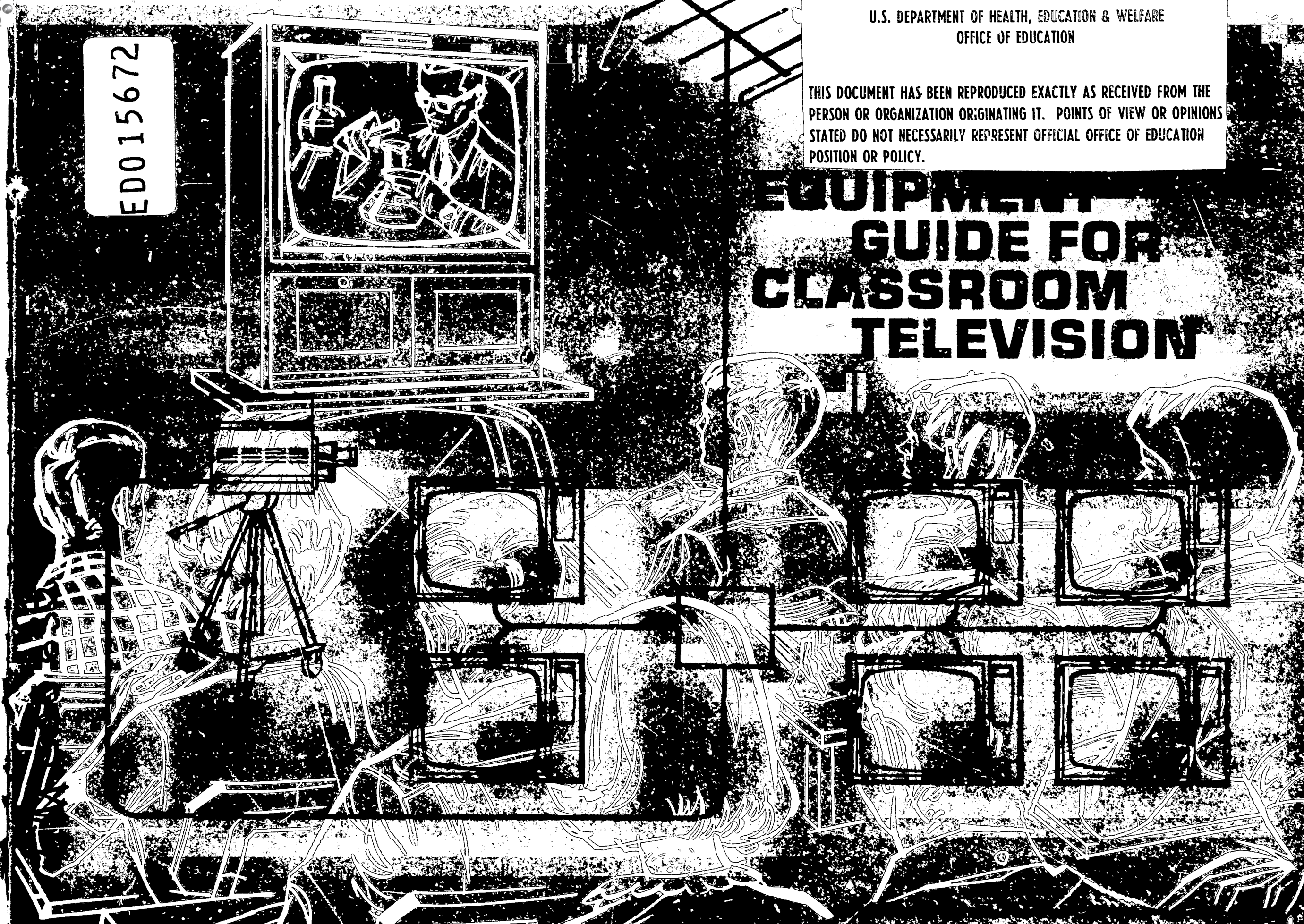

INTRODUCTION

THIS is the second publication by Sylvania to be devoted entirely to the subject of educational television. The first, *Television in Education,* published in mid-1962, covered four distinct aspects of ETV: its background and accomplishments, how television is transmitted, some of the equipment requirements, and the facilities within the school which should be prepared to accommodate the use of television in the curriculum.

Although there was hardly a shortage of informative literature on any aspect of this important subject, we felt we could still make a helpful contribution in the form of a brief and lucid survey of the above aspects that would serve as a good starting point for the non-technical school administrator. The enthusiastic reception accorded that first book (including its use as a text at Harvard) quickly confirmed our judgment.

This response also included a number of questions that indicated the need for more detailed knowledge about equipment, especially the specific types needed to accomplish the various uses to which television has already been put. Again, the answers to most of these questions could be found among the considerable bulk of literature already in existence, but not in the readily available format we had previously found to be so useful.

Hence, we decided to produce a second book that would concentrate on the "hardware" of ETV, and include a number of typical ETV systems ranging from simple electronic enlargement to fully equipped studios. Where feasible, a suggested equipment list for each is provided.

However, equipment represents only a portion of the total investment that a school must make. Installation alone is a significant part, and can be realistically estimated only in terms of a specific school . . . its location, type of construction, the distances to be covered, number of transmitting and receiving points and the over-all complexity of the system. To this must be added the continuing overhead costs of maintenance and personnel.

We mention these factors not to discourage anyone from reading on beyond this page, but only to help place as realistic a perspective as possible at your disposal. After more than ten years, television's role in the educational process has been proven repeatedly to be a valuable one, even though the vast majority of schools have yet to take advantage of it.

Thus it is to your interest as an educator, as well as to Sylvania's as an equipment manufacturer, that any step into television be taken with as full an understanding of all its ramifications as possible.

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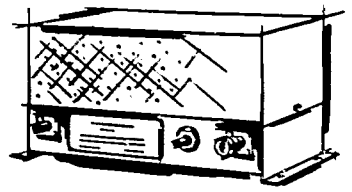
THE LANGUAGE OF TELEVISION

The traditional location for a glossary is, of course, at the end of a book. However, we have placed it up front, and given a slightly fuller explanation and description of the terms that are likely to be of most *practical* interest. This is in keeping with the over-all purpose of this book which is to provide the non-technical person with a rapid, yet meaningful step forward in the direction of further understanding of the "things" in television with which he may soon be closely concerned.

ADJACENT-CHANNEL INTERFERENCE

The distortion of sound and/or picture due to simultaneous reproduction of programs from stations utilizing wave lengths contiguous to one another.



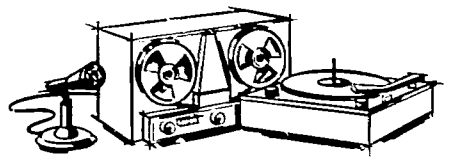
AMPLIFIER

An electronic component which receives a weak signal from any original sound or visual source (microphone, record player, tape-head, or television camera) and strengthens it to the point where it can drive a speaker or reproduce a picture on a television screen. While AUDIO and VIDEO amplifiers are designed differently according to their respective function, the basic principle of a good amplifier is that it does not change (i.e. distort) the original signal in any way other than to give it the necessary boost along the way.

ANTENNA

A device for receiving and then conducting radio and/or television signals that have been transmitted through space. In television, the simplest form of antenna is the familiar "rabbit ears" placed atop the receiver. An extension of this type is the roof antenna which can service up to four sets, depending upon the strength of the signal received and the distance of the sets from the antenna. For optimum quality and consistency of reception, the antenna is connected to a MASTER DISTRIBUTION SYSTEM with electronic amplification for all available broadcast channels.

NOTE: Items in small capitals are described in this glossary.

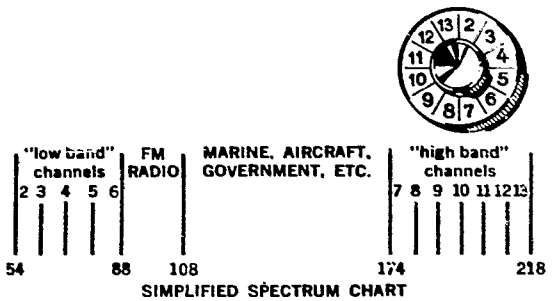


AUDIO

Refers to the sound portion and the related equipment of any communications system. Depending upon the type of television system in use, audio may be transmitted either over the same signal carrier with the television impulses or may be a completely independent system.

AUDIO-VIDEO MIXER (MODULATOR)

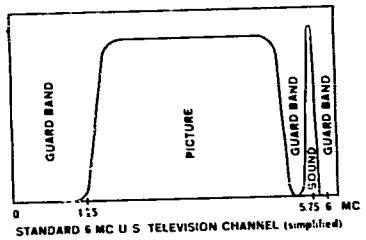
An electronic component of an RF (radio frequency) transmission system that combines (or "modulates") the separate audio and video signals from microphone and camera respectively into a single high frequency signal for transmission to the receiving equipment where the signals are again separated and directed to the speaker and screen.



BAND

A portion of the frequencies in the spectrum allocated by the FCC for specific purposes. For example, AM radio extends from 550-1600 kilocycles, VHF (very high frequency) television from 54-88 and from 174-218 megacycles for channels

2-6 and 7-13 respectively, FM radio from 88-108 megacycles, UHF (ultra high frequency) television from 470-890 megacycles (channels 14-83). A new ETV band of 2500-2690 megacycles was allocated in 1963 for point-to-point MICROWAVE transmission.



STANDARD 6 MC U S TELEVISION CHANNEL (simplified)

BANDWIDTH

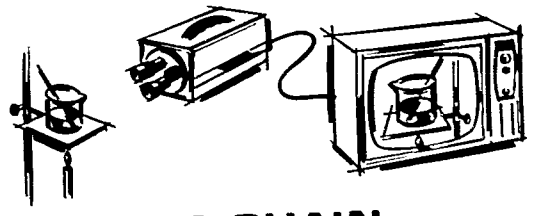
The frequency range of a specific signal being transmitted. Each broadcast television channel in the United States covers 6 MEGACYCLES for both audio and video. For example, channel 2 covers a bandwidth extending from 54-60 megacycles.

BROADCAST

The "open circuit" transmission of either radio or television signals through the air at frequencies which can be received by any appropriately tunable equipment within range of the transmitter. All broadcasting is regulated by the Federal Communications Commission.

CAMERA

In television, that device which by utilizing an optical system, a light-sensitive electronic tube, and an electronic scanning device converts a visual image into electrical impulses.



CAMERA CHAIN

One or more cameras with such associated electronic devices as needed to transmit a television picture.

CANDLE-POWER

Refers to the amount of light in a given area. One foot-candle is the amount of light emitted by a standard candle at one foot distance. Average office or classroom lighting generally ranges from 25-75 foot-candles. Bright sunlight is approximately 10,000 foot-candles. The VIDICON television camera can deliver a picture with as little as 8 foot-candles, but the desirable light level in a studio would be a minimum of about 250 foot-candles.

CARRIER

The electronic wave by which audio and video impulses are carried from transmitter to receiver.

CHANNEL

The segment of the broadcast spectrum to which a television station is assigned or to which a CLOSED CIRCUIT television camera is tuned when transmitting via radio frequencies. The actual channels used in any closed circuit installation would normally be those not allocated to a local broadcast station.

CLOSED CIRCUIT

A system of transmitting television signals to receiving equipment that is directly linked to the originating equipment by COAXIAL CABLE, MICROWAVE relay, or telephone lines.

COAXIAL CABLE

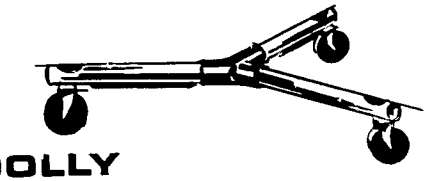
A special cable designed to carry several channels of telephone and television signals simultaneously. Use of this cable maintains the privacy of the system and avoids external interference.

CONTROL CONSOLE

An assembly of television studio equipment which contains the switches, meters, monitors and controls required for operating and adjusting the various components of a major installation.

CONVERTER

In television, an electronic device that converts broadcast signals from one frequency range to another. A VHF receiver with a converter can receive UHF channels. Or a master antenna and distribution system so equipped can service any number of standard VHF receivers with programs initially telecast and received on UHF frequencies, then converted to permit reception on any VHF channel not being used in the particular area.



DOLLY

A wheeled (castered) platform designed to support and provide mobility to a camera on tripod and/or other equipment.

EDUCATIONAL TV STATION

A non-profit television station operating to serve community needs in the areas of instruction, cultural development, etc.

EIA STANDARDS

EIA is the Electronics Industry Association which sets a number of standards for equipment manufacturers. Their standards *must* be met by any television equipment intended for broadcast transmission or reception.

FILM CHAIN

A combination of various types of projectors, a MULTIPLEXER, and a television camera used to facilitate the pickup and use of projected materials.

HEADSET

A device whereby an individual or individuals can listen to an audio source. When a microphone is added, intercommunication between headsets can be achieved.

IMAGE ORTHICON

The type of television camera pickup tube commonly used in live broadcasting cameras and in the most highly sophisticated closed circuit installations having professionally trained staffs.

INTERLACE

A method of scanning the faceplate of the vidicon tube in two separate fields of alternate lines so that each image is scanned twice. (Described in detail on pages 8-9.)

KILOCYCLE

1000 cycles (1 kc) per second, a cycle being used as a unit of measurement of frequency. AM radio is broadcast in the kilocycle range. (1 kc is approximately two octaves above middle C on piano.)

KINESCOPE RECORDING

A film recording made by a 16mm motion picture camera specially designed to photograph a television program directly off the front of a television tube. The sound portion of the program is also recorded simultaneously. The film so produced can then be shown on any 16mm projector, as well as on television.

MASTER DISTRIBUTION SYSTEM

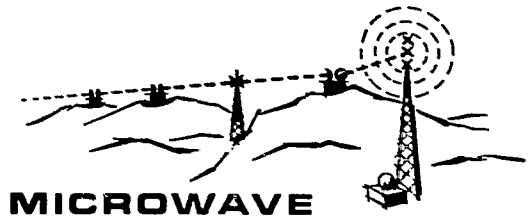
Comprises antenna and amplifiers for boosting over-the-air signals, plus cables and tap-off connections for use of cameras and receivers throughout a building.

MASTER TV CONTROL

The area or point from which all signals are controlled and adjusted prior to distribution.

MEGACYCLE

1,000,000 cycles (1 mc) per second, used as a unit of measurement of frequency. 1,000 kilocycles is equal to one megacycle.

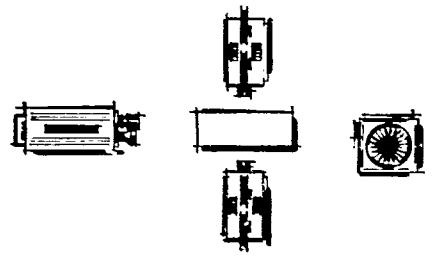


MICROWAVE

A method of transmitting closed circuit radio and television signals through the air on a highly directional line-of-sight system from the originating station to one or more receiving stations. When terrain, man-made obstacles, or distance interferes with the line-of-sight, relay stations are used en route. Although a private system, microwave transmission is regulated by the FCC.

MONITOR

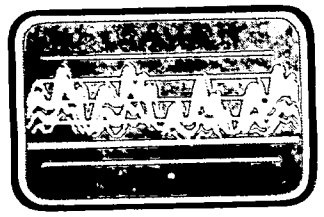
A special type of high quality television receiver used specifically in VIDEO transmission, rather than RF. Video monitors are not tunable to channels, and must be used with video cameras. They normally have no provision for sound reception. (The term "monitor" is also used informally to designate any receiver being used by the cameraman or program director to check the picture being sent out.)



MULTIPLEXER

In television, a specialized optical device that makes it possible to use a single television camera in conjunction with one or more motion picture projectors and/or slide projectors in a film chain. The camera and projectors are in a fixed

relationship, and prisms or special (dichroic) mirrors are used to provide smooth and instantaneous non-mechanical transition from one program source to the other.



OSCILLOSCOPE

A test instrument that indicates voltage and current characteristics on a screen similar to that of a television receiver.

PROJECTION TELEVISION

A unit composed of a high-intensity picture tube, and a series of mirrors and lenses arranged in such a manner as to project an enlarged television picture on a screen.

RECEIVER

Any television set, though more specifically, one designed for tuned (radio frequency) channel reception of sound and picture. May be either a standard "home set" or one designed especially for classroom use.

RESOLUTION

The details that can be distinguished on the television screen. Vertical resolution refers to the scanning lines one sees on the screen. Horizontal resolution refers to the number of variations within each scanning line, and is variable according to the bandwidth used. Broadcast (and RF closed circuit) television, limited to 4.5 megacycle bandwidth, has about 300 lines of horizontal resolution as seen on an RF receiver. With high resolution video cameras and monitors, operating on a 10 megacycle bandwidth, horizontal resolution can be as high as 800 lines. (Described in detail on pages 8-9.)

RF (RADIO FREQUENCY)

A system of transmission utilizing tuned bandwidths of the radio spectrum to carry both audio and video signals. The advantages with RF are that several programs (audio and video) can be transmitted and received simultaneously throughout a school over a single coaxial cable. The disadvantages are in the relatively lower picture quality obtainable when compared with video because of RF bandwidth restrictions.

SWITCHER

A control device which permits the selection of one image from any of several cameras. The image selected is then processed into the transmission equipment.

SWITCHER-FADER

A control that permits each of two or more cameras to be selectively fed into the distribution system. The "fader" permits gradual transition from one camera to another.

SYNCHRONIZING GENERATOR

An electronic device that synchronizes the image scanned by the camera with the image appearing on the receiving tube. It is also required to avoid "picture roll up" when switching between two or more cameras in a single program.

TRANSMISSION LINE

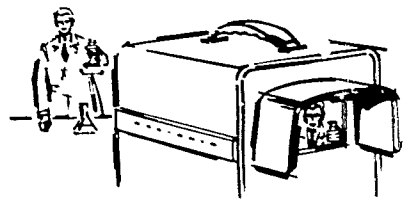
A conductor system designed to transmit electrical impulses along a continuous path from one place to another.

VIDEO

A system of transmitting television, utilizing bandwidth frequencies from zero to fifteen megacycles to carry the picture signals. Only one video signal at a time can be transmitted over the cable. Normally, a separate audio cable must be used for sound, if required. Picture quality is superior to that of RF, but the range of transmission is comparatively short and requires more frequent line amplification.

VIDICON

The camera pick-up tube used in the vidicon camera and which gives this type of camera its name. The vidicon camera is used in most closed circuit systems as well as for filmed programs in broadcasting.



VIEWFINDER

Basically, a small television monitor which is built into the television camera and picks up only the picture from that particular camera, thus enabling the cameraman to see exactly what his camera is "seeing."

ZOOM LENS

A lens which allows continuous change of its focal length while being used, thus permitting camera to pick up from close up to long shot of the same scene without having to be moved itself.

THE VIDICON CAMERA

The vidicon camera takes its name from the vidicon tube which forms the heart of its operation. Only 6½" long and 1" in diameter, this tube made it possible to develop inexpensive, compact television cameras simple enough for operation by non-professionals in both industry and education.

The choice of models is quite broad, ranging from basic industrial types at about $800 to professional broadcasting types at about $5000. Operating costs are quite low. For example, the vidicon tube has a life expectancy of about 5000 hours and can be replaced for about $150. Hourly operating costs come to less than 5¢.*

Apart from its moderate cost, the vidicon camera has been used increasingly by professionals as well as amateurs because of its own special performance qualities. For example, practically all filmed television programs use the vidicon camera, largely because of its uniform gray scale and relative absence of visual disturbances known as "noise."

Given reasonable care, such as any precision instrument deserves, it is difficult to damage the vidicon tube. Under proper lighting conditions, it may be left in operation for hours at a time, intentionally or unintentionally, and without change of scene. The training required for operating the camera is little more than required for operating a standard home receiver, though far more interesting. Thus, as will be seen in later pages, many television teachers set up and operate the cameras themselves, or call upon a student for assistance.

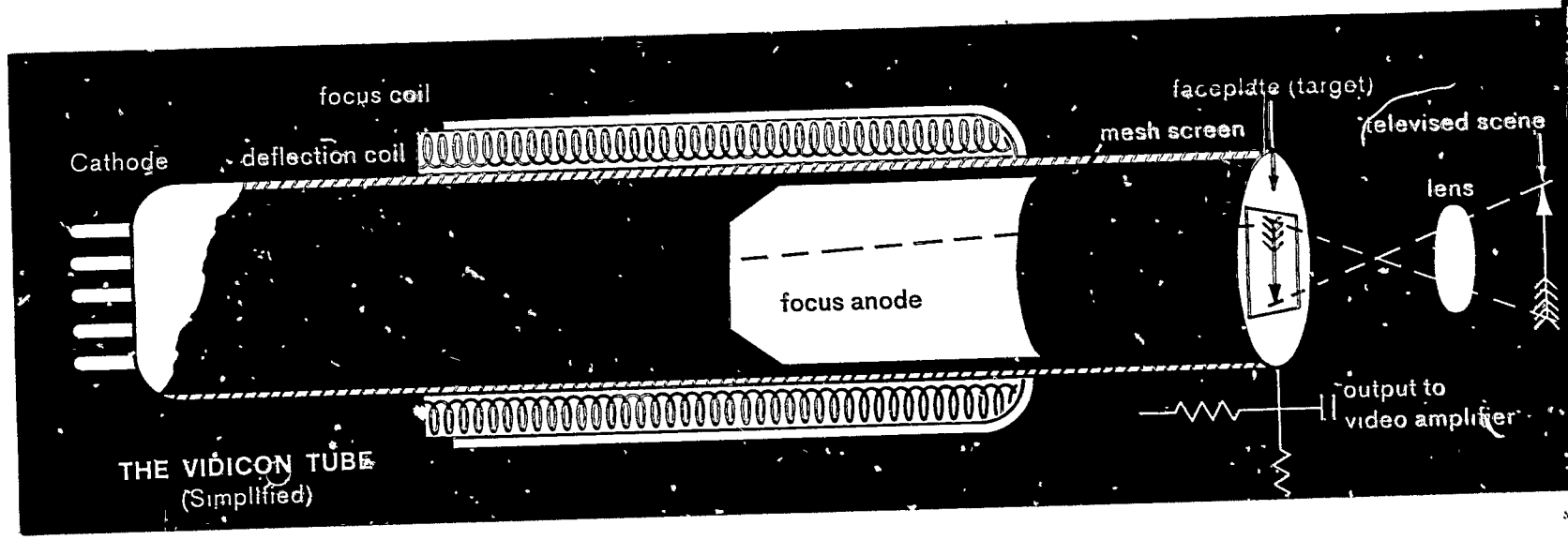
**These figures are in marked contrast with the image orthicon tube (and camera) used in commercial broadcasting, which is in the $20,000 class, and has hourly operating costs of $1.00 to $1.50.*

HOW THE VIDICON CAMERA WORKS

To those who still marvel at the transmission of sound through the air, television presents an even greater challenge to the imagination. Perhaps those who may soon be working directly with television cameras would find it interesting to read a brief and non-technical explanation of how they function.

Although the vidicon camera uses conventional 16mm motion picture lenses, the resemblance to the film camera ends right there. For the external image viewed by the lens is not brought to focus on a moving strip of film, but on the photo-conductive faceplate of the vidicon tube.

From the rear of the vidicon, an electron gun shoots a narrow beam that scans the image on the faceplate in a precisely calculated pattern of movement from left to right and from top to bottom, similar to the eye's movement in reading. This movement of the electron beam is controlled by two sets of deflecting coils. Horizontal deflecting coils move the beam from left to right, then back again to begin the next line. At the same time, vertical deflecting coils bring the beam down to the proper starting point under the previously scanned line. During each retrace movement, the beam is automatically shut off, or "blanked."



THE VIDICON TUBE (Simplified)

Every 1/30 of a second, the beam scans 525 of these lines, which cover the complete image. However, to prevent an annoyingly evident flicker, the beam does not scan the lines in a single continuous sequence, but uses a technique known as *interlacing*. That is, instead of scanning all 525 lines successively from top to bottom, the beam first scans the "odd" lines forming one *field* of 262.5 lines. Then the beam returns to the top again to complete the second field of 262.5 "even" lines. Each of these two fields takes 1/60 of a second to complete, and together they comprise one *frame*.

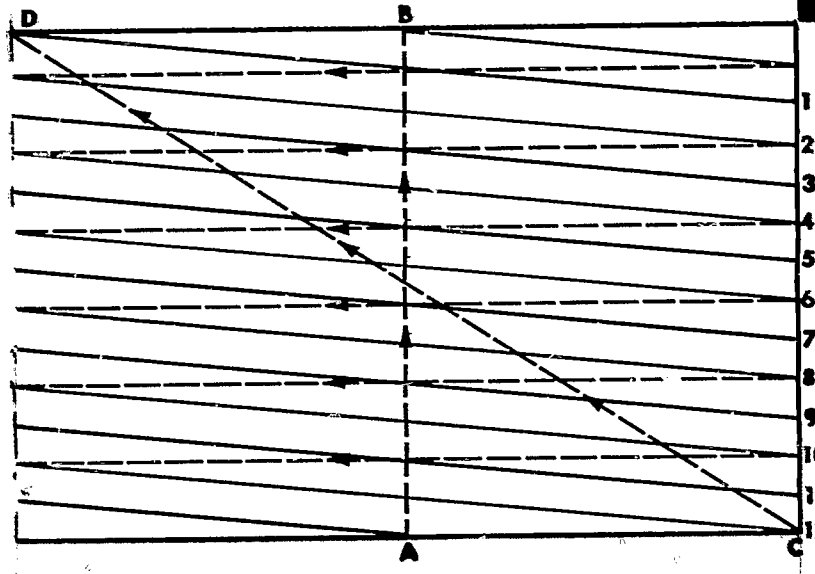
There are two types of interlace. In 2-to-1 *locked* interlace, the lines of the second field fall exactly between the lines of the first field, so that 525 lines are actually produced by the camera. In *random* interlace, as the term suggests, some of the lines of the second field will overlap those of the first, and thus reduce the effective number actually transmitted.

All broadcast television requires locked interlace, which is provided by a synchronizing generator. The sync generator also prevents image "roll-up" when switching from one camera to another in closed circuit transmission.*

**Low cost vidicon cameras generally offer only random interlace, although Sylvania models 400 and 600 can be used with an external sync generator to provide locked interlace when desired.*

Now, while the beam is scanning each line, it is also varying in intensity as it responds to the varying tones of the image on the faceplate. In effect, these variations may be compared to the screened dots of the photoengraving which also presents the eye with an illusion of continuous tone. Of course, the printed photograph remains static, whereas the television image is constantly changing. The speed of this change can be readily appreciated with some simple multiplication. By scanning 525 lines each 1/30 of a second, the beam produces a total of 15,750 lines per second.

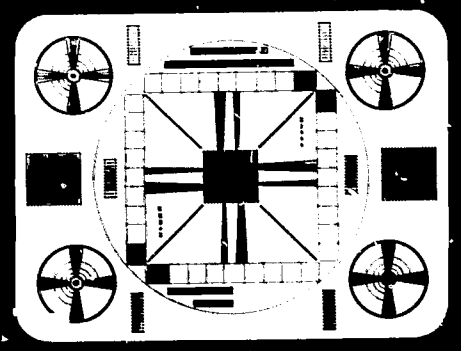
The number of tonal variations within each line is another factor to consider, as this determines the degree of detail that can be transmitted. In RF transmission, for example, bandwidth limitations as established by the FCC, hold the maximum number of variations per line to 350. Multiply 350 times 15,750 and the variations per second come to a little over 5½ million. Hence, a potential bandwidth of 5½ megacycles.



2-TO-1 INTERLACED SCANNING

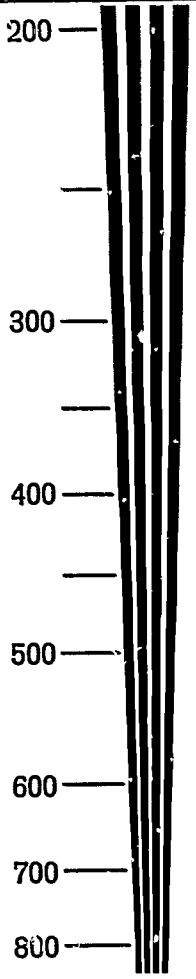
The first field of odd-numbered lines is shown in black. At the end of this field (a), the beam blanks out and retraces vertically to (b) where it begins scanning the second field of even-numbered lines. At the end of the second field (c), one frame has been completed, and the beam again blanks out while returning to (d) to begin the entire process again. Time elapsed: 1/30th of a second.

VIDEO RESOLUTION



Each television channel has a maximum bandwidth of 6 megacycles allocated to it, which must be used for the sound as well as the picture, plus some attenuation at the extremes to avoid interference with adjacent channels. So in actual practice, the picture portion of a channel, whether broadcast or closed circuit RF, is limited to about 4 megacycles. Other factors, such as losses in transmission, further reduce horizontal resolution from the nominal 350 lines to about 300.

After the beam passes through the photoconductive faceplate, it enters an external circuit and is then converted into a variable voltage. When this amplified voltage passes through the coaxial cable (or through any other signal carrier), the entire scanning process is essentially duplicated on the television receiver. The same *number* of lines are repeated on the receiver, whether it is 5 inches or 23 inches in its diagonal dimensions. On the larger screen, the image is simply *shown* larger, just as with a photographic image projected on a movie screen.

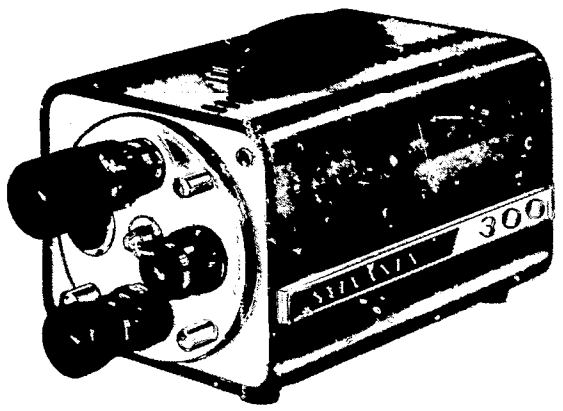


The type you can read at any place on this chart, as seen on a television screen, indicates the horizontal resolution the system is capable of producing. As you can see, the thickness of line for the letters matches the lines at left which duplicate those used on standard resolution charts. Standard broadcast reception will normally achieve resolution ranging from 275 to 325, while video resolution on properly tuned cameras and monitors can be as high as 800 lines.

SYLVANIA TELEVISION CAMERAS

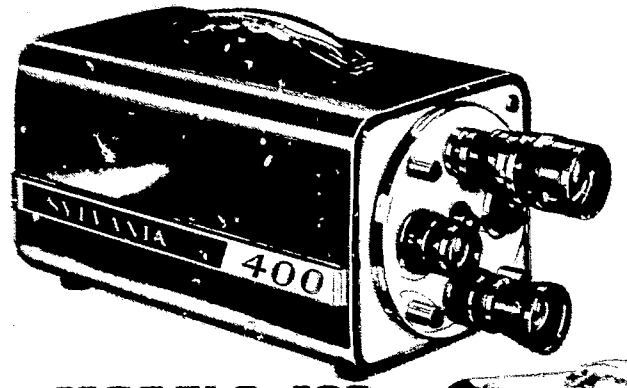
Here is a range of models that meets virtually every requirement to be found in the educational field, from the most modest of applications to sophisticated professional installations. Each Sylvania camera is a completely self-contained unit, complete with all operating controls and power supply. For operation, these cameras need only to be connected to the receiver . . . either directly, or through a switching device when more than one camera is being used in televising a lesson or a program.

All feature a crystal controlled horizontal scan, necessary to assure constant and stable image reception when multiple cameras are in operation. Models 300, 400 and 600 can be tuned directly to channels 2 through 6. Model 300 is tunable from 42-88 megacycles (subchannels plus channels 2 through 6). This permits use of the camera with any standard RF receiver. With the exception of model 300, which transmits RF only, the model designation of each camera indicates its horizontal video resolution.



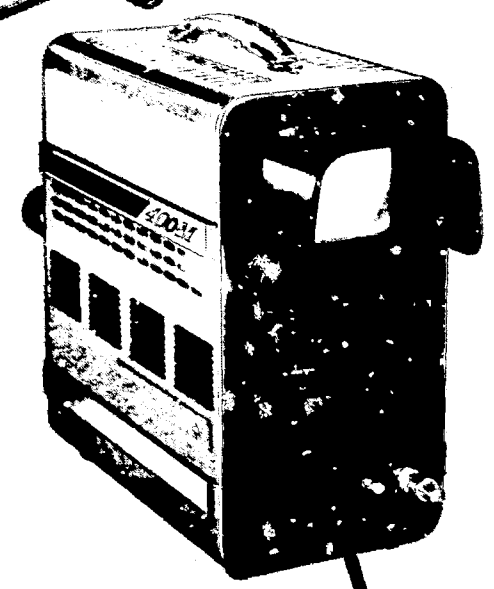
MODEL 300

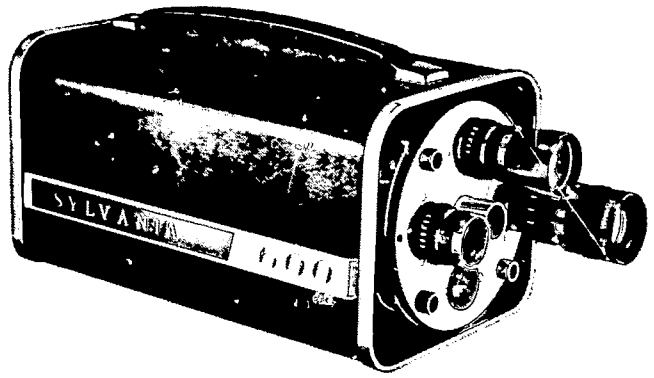
This is the basic RF camera that originally brought the cost of closed circuit television within range of the smallest companies . . . and later of schools as well. For maximum use of wide angle and telephoto lenses, it includes a 4-position lens turret, which includes a closeup position for viewing objects in detail. The Electronic Self Adjustment feature automatically adjusts the contrast of the picture to varying lighting conditions without requiring the lens opening itself to be changed. Exclusive of lenses, the 300 measures only 12"x7"x6". Even with a full complement of three lenses, it weighs but 16 pounds.



MODELS 400 AND 400/M

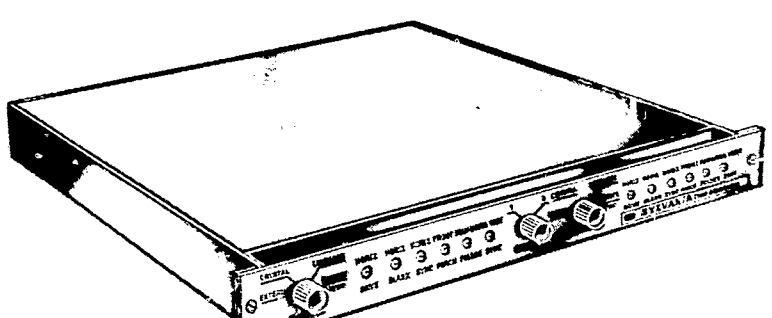
Similar to Model 300, but can transmit both RF and video (400-line resolution) simultaneously. Thus, either of these two cameras can be added to an existing installation and used with both RF and video receiving equipment. Model 400/M incorporates a 5" video monitor.





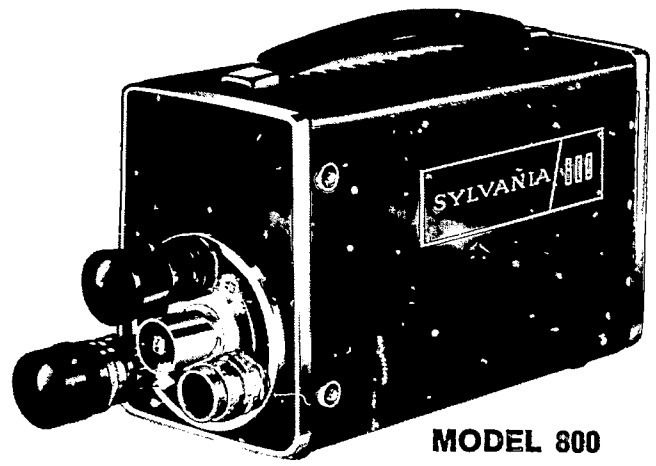
MODEL 600

High resolution video/RF camera for applications where transmission of fine detail is especially important, yet where a modest investment in camera equipment is also indicated. Circuitry includes a special voltage regulator to hold electrical focus constant even when line voltage varies. RF and 600-line video resolution can be transmitted simultaneously.

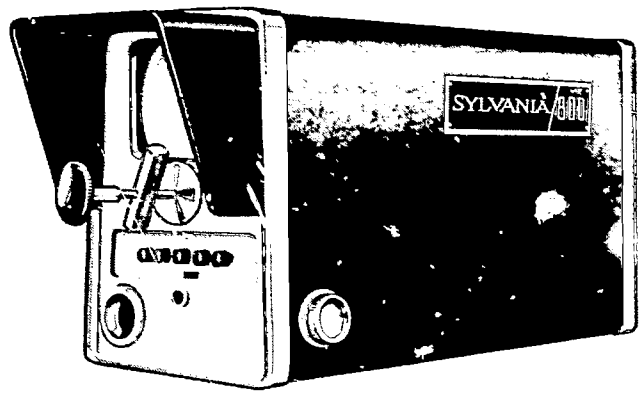


ALL-TRANSISTORIZED SYNC GENERATOR

Provides 2-to-1 locked interlace synchronizing pulses for models 400, 400/M and 600. Also EIA sync for models in 800 series when not equipped with built-in sync generator.



MODEL 800

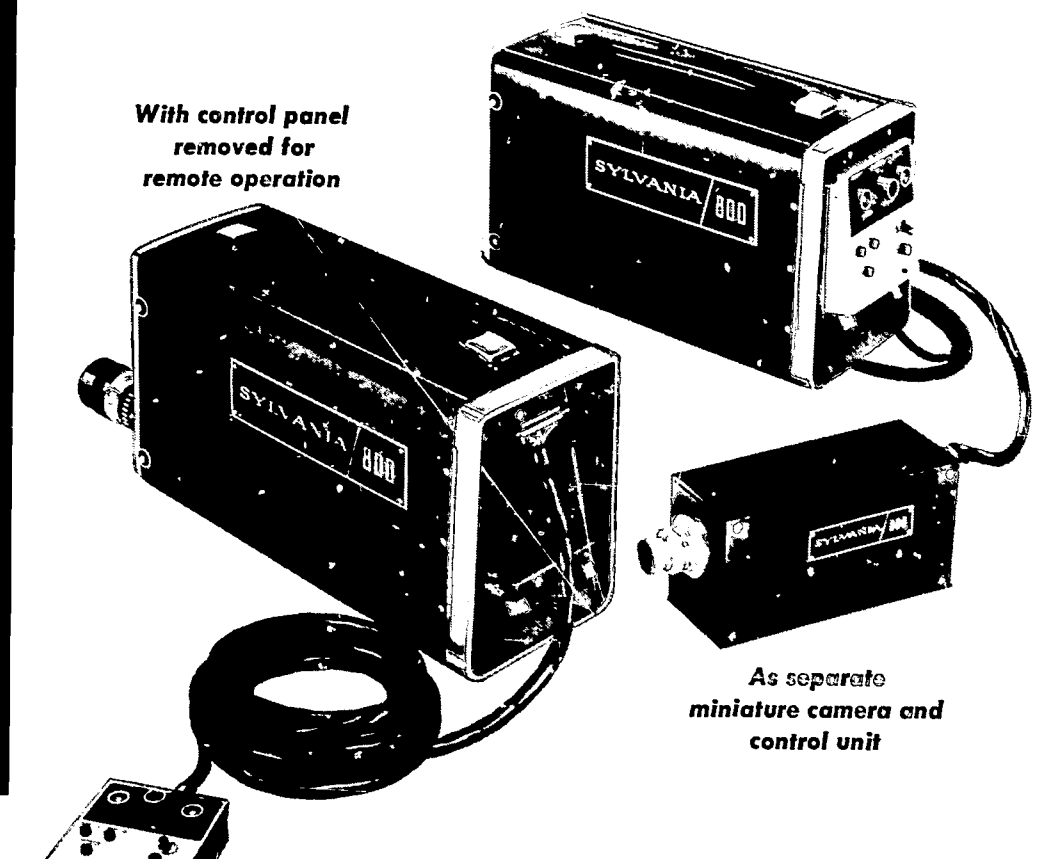


MODEL 800/M

SERIES 800 ... TRANSISTORIZED, BROADCAST QUALITY

Premier models of the Sylvania line, with 800-line video resolution, and unique design that permits operation in three distinctly different modes. As a self-contained camera, the 800 measures only 6" wide, 8½" high and 14" long, yet contains its own synchronizing generator and meets all broadcasting requirements. Both its 3-position lens turret and optical focus are motorized and electronically controlled from the rear control panel. Its 18 watt power consumption lends itself readily to battery power, making the 800 available for use in any environment where there is no AC power available.

With control panel removed for remote operation



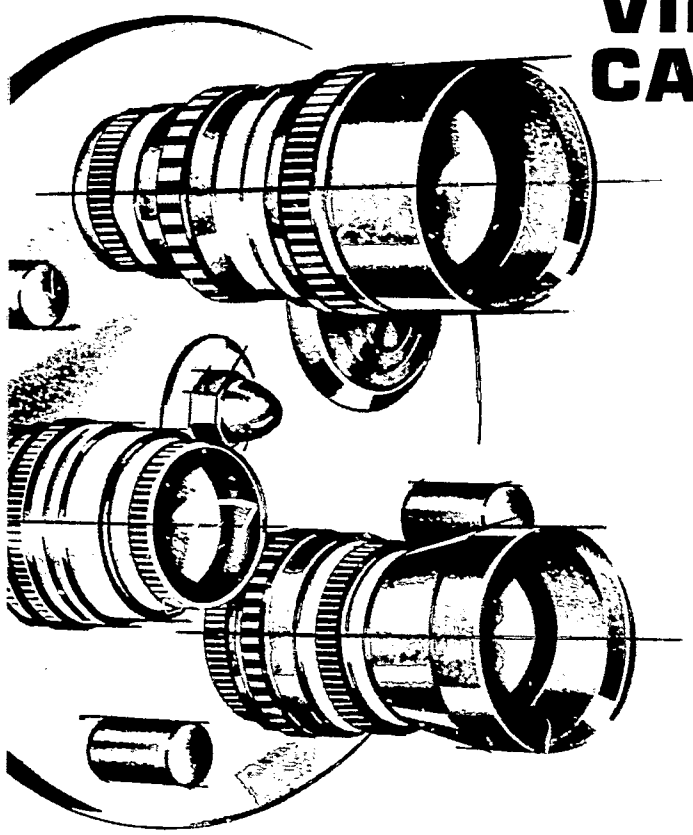
As separate miniature camera and control unit

Series 800 cameras are available with choice of internal or external sync generator, motorized or single-lens turret, video and RF or video output only.

The 800's vidicon assembly is quickly removable from the case and can be operated as a miniature camera up to 25 feet away from the control unit. Weighing but 4¼ pounds, it lends itself to convenient hand operation as well as to lightweight stands or tripods. In this operation, the 800 can also accommodate zoom lenses with optical viewfinders, to give it an unprecedented mobility and versatility.

All the operating controls of the 800 are organized on a single removable panel that permits remote operation from 1000 feet. When used with motorized zoom lens and remote-controlled pan and tilt head, the 800 has virtually unlimited range and angle of coverage.

LENSES FOR THE VIDICON CAMERA



The lenses used in vidicon cameras are identical to those made for 16mm motion picture cameras. All the rules of optics pertain here as well. A basic familiarity with the various types of lenses and the effect they have on a scene is essential to anyone attempting to visualize "through the eye" of the camera.

FOCAL LENGTH

Focal length is the basic identification of the lens, as it determines the area that the lens will cover at a given distance from the camera. The shorter the focal length, the wider the angle. Focal length itself is simply the distance from the optical center of the lens to the focal plane when the lens is focused at infinity. (See fig. a.) In vidicon cameras, the standard and reference lens is the 1" (25 mm). A wide angle lens is ½", other (telephoto) lenses in common use are 2", 3" or longer.

ANGLE OF COVERAGE

This can be readily calculated without recourse to charts or other references. With the 1" lens, the horizontal angle of view will be just half the distance of the scene from the lens, as shown in figure b. With a 2" lens, the angle is a quarter of the distance, as shown in figure c. The vertical angle of view is always on a ratio of 3 to 4.

LENS "SPEED"

This refers to the amount of light that can pass through a lens to the focal plane. Conventionally rated by "f" stops, the speed of a lens is determined by the formula:

$$f = \frac{\text{focal length}}{\text{effective diameter}}$$

Thus a lens with a 1" focal length and ½" diameter is rated at f2. The adjustable built-in iris, or diaphragm, can be made smaller ("stopped down") through a series of precisely calculated f-stops. The larger the f-stop, the "slower" the lens.

Lens speed does not have the same effect on exposure in television cameras as it does in photography, since the image it places on the vidicon's faceplate is scanned at a constant rate. However, the quality of the picture in terms of its clarity and contrast depends upon the amount of available light and camera control setttings. The lens opening thus used in a given scene will depend largely upon the light level.

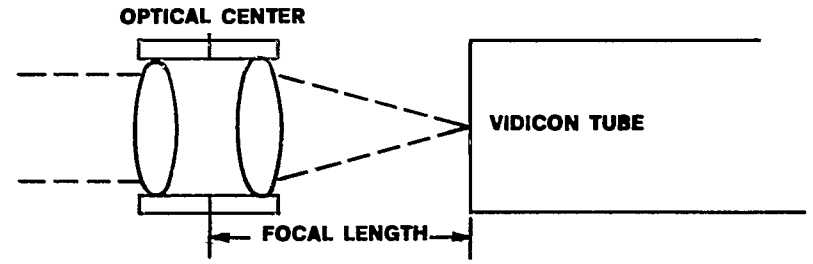
DEPTH OF FIELD

This is the area in front of the camera which will be in focus whenever the lens is focused on a given point. This front-to-back distance will vary in accordance with the "speed" of the lens opening. At its maximum opening, a lens will have the least depth of field, and as the lens is stopped down, the depth of field increases (See fig. d). In operation, this effect can be easily viewed on the monitor.

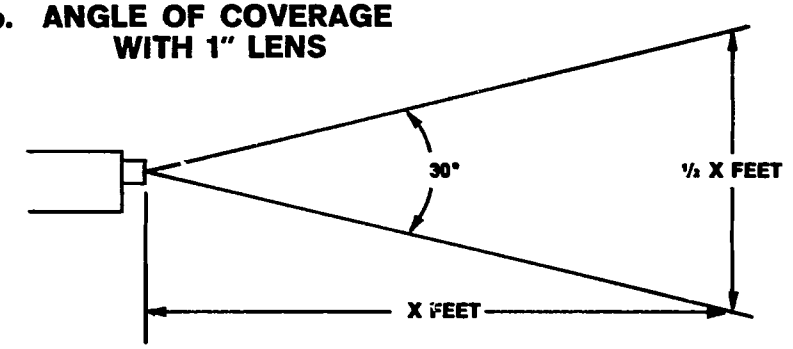
THE ZOOM LENS

The zoom lens provides all the characteristics of conventional lenses in a single unit, as its focal length is continuously variable from wide angle to telephoto. Thus, when once focused at a given distance, it can provide an infinite variety of angles of coverage within the limits of its near and far ranges. This is a more important feature than its more spectacular (and sometimes overdone) effect of zooming in and out while a scene is being viewed.

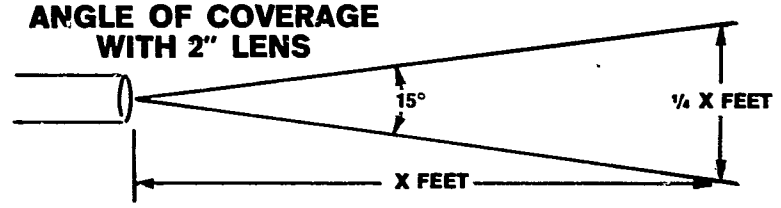
a. FOCAL LENGTH



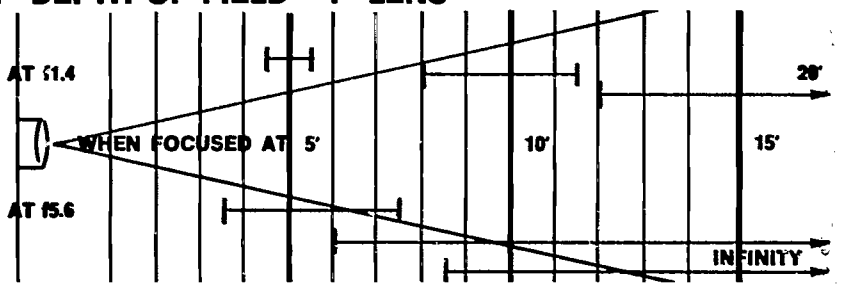
b. ANGLE OF COVERAGE WITH 1" LENS

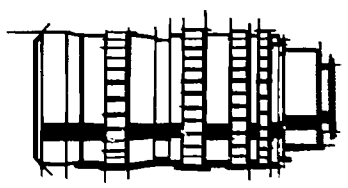


c. ANGLE OF COVERAGE WITH 2" LENS

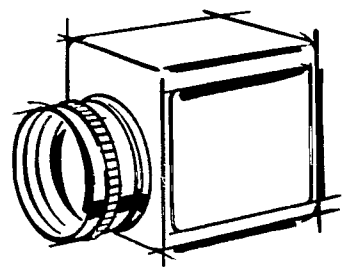


d. DEPTH OF FIELD – 1" LENS



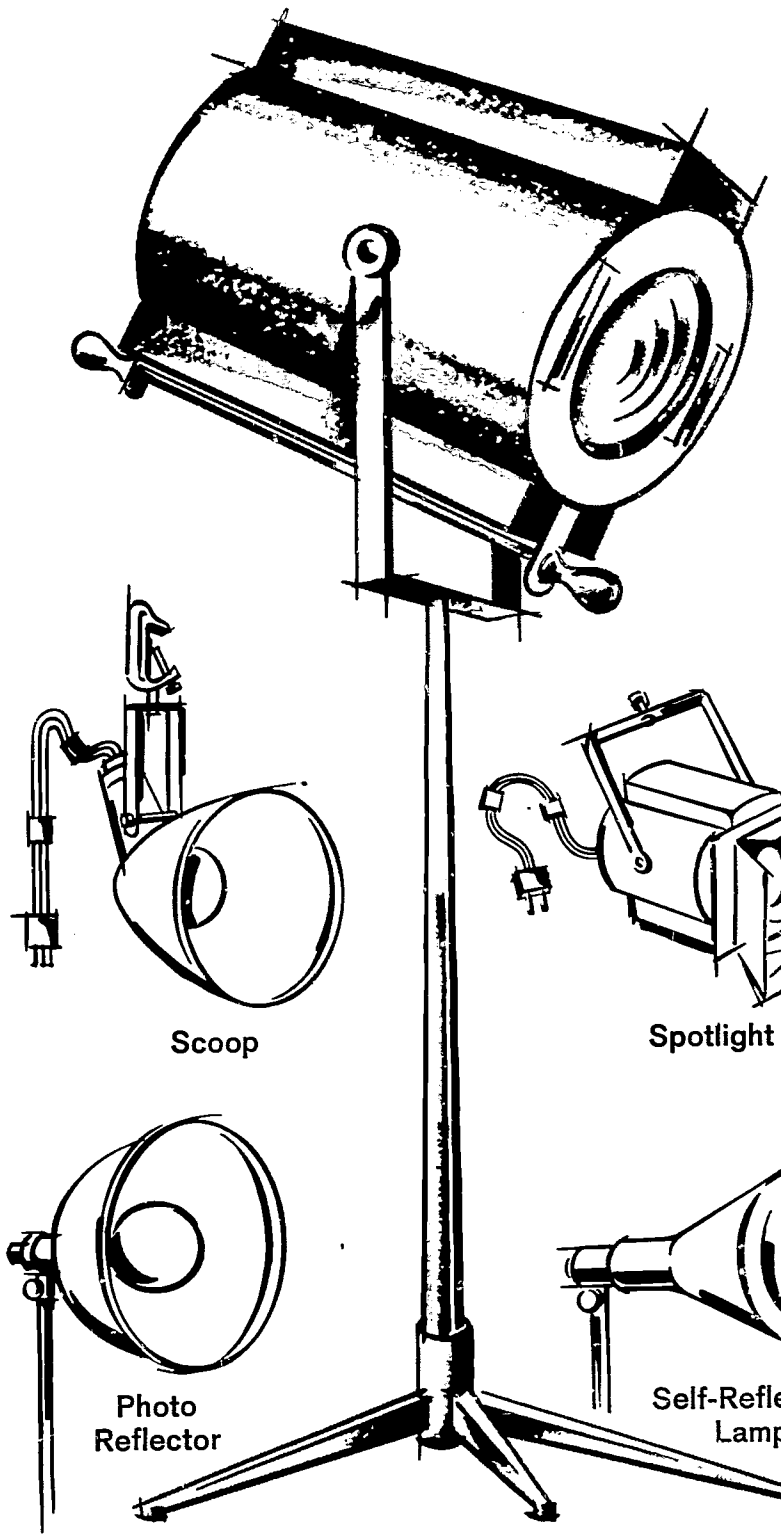


Manual Zoom Lens



Motorized Zoom Lens

LIGHTING FOR TELEVISION



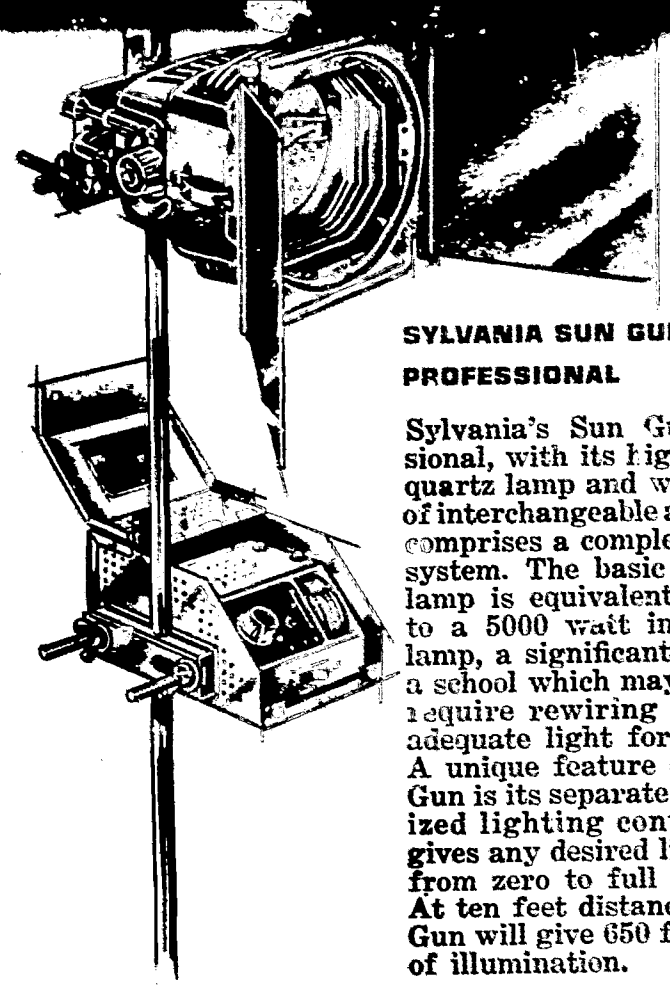
Lighting requirements for school-originated television are relatively simple, compared with stage or motion picture lighting. The basic objective is to achieve a level of illumination that will result in a good picture signal . . . with proper contrast, sufficient tonal balance and absence of picture "noise." Adequate results can be obtained with about 250 foot-candles and lens opening at f2.8. For greater depth of field, without sacrificing picture quality, the light level would have to be increased. Professional broadcast quality at a lens opening of f5.6 or f8 normally calls for about 500 foot-candles. The efficiency of reflecting surfaces will affect the actual amount of light required. (An exposure meter is a valuable assist here.)

Special lighting effects need to be considered only when elaborate productions are being planned. Where three lights (key, back and fill) are being used, the typical ratio for high key lighting is as follows for a lens opening of about f4 to f8: key light — 150 foot-candles, back light — 150 foot-candles, fill light — 120 foot-candles. Unless a school has an experienced lighting technician on the staff, lighting should be kept as simple as possible.

There are a number of specialized lighting fixtures commonly used in television studios. For the main or "key" light, studios generally use the widebeam floodlight known as the "scoop," which can take lamps ranging from 750 to 2500 watts and available in 14" to 42" diameters.

Supplementary lighting from the back to give highlights and to help the subject stand out from the background can be added by spotlights.

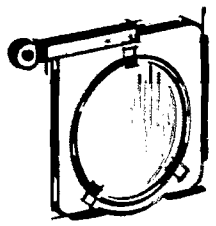
Perfectly adequate lighting for television can also be obtained through the use of less expensive equipment, such as photolamp reflectors and self-reflector lamps, which can be clamped to projections on the walls or placed on floor stands.



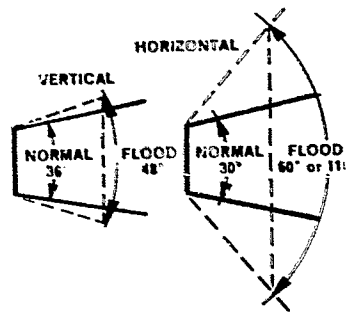
SYLVANIA SUN GUN PROFESSIONAL

Sylvania's Sun Gun Professional, with its high intensity quartz lamp and wide variety of interchangeable accessories, comprises a complete lighting system. The basic 1000 watt lamp is equivalent in output to a 5000 watt incandescent lamp, a significant factor for a school which may otherwise require rewiring to provide adequate light for television. A unique feature of the Sun Gun is its separate transistorized lighting control which gives any desired light output from zero to full brightness. At ten feet distance, one Sun Gun will give 650 foot-candles of illumination.

BEAM ANGLE AND FLOOD LENS

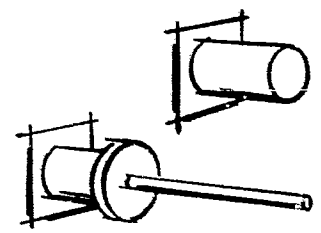


The Sun Gun's normal angle of coverage is 30° vertical, 36° horizontal. For broader light coverage, the dual-purpose flood lens offers a choice of 110° x 48° or 60° x 48° beam spread, simply reversing the lens in its accessory holder.



SNOOTS FOR CONTROLLED LIGHT BEAM

Use of slip-in snoots converts the Sun Gun into a spotlight. One snoot gives medium spot, another affixes onto the first to provide ¾" light control.

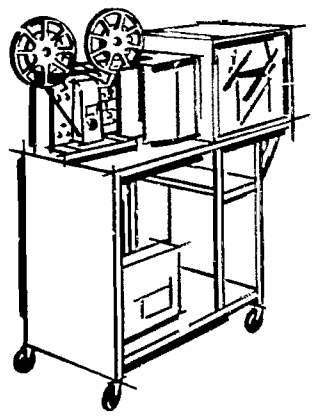


Other accessories for the Sun Gun Professional include large barn doors for horizontal control of light beam, and various other filters and lenses to match beams to camera lens angles.

AUXILIARY ORIGINATING EQUIPMENT

The television camera is hardly limited to the transmission of live images only. Its use with auxiliary projection equipment to transmit filmed, printed and recorded material of virtually every description and to integrate them all with live programming is perhaps of greatest significance.

This means that a school equipped with its own program-originating facilities can make use of motion pictures, filmstrips, slides, photographs, drawings, clippings . . . and utilize them within its own curriculum and schedule as it desires. Further, a school equipped to tape its own productions can amortize the initial preparation costs over repeated showings and to larger audiences than could ever be accommodated "live."

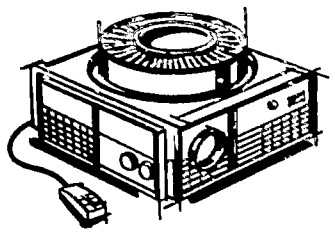


MOTION PICTURES

Conventional motion picture projectors present a problem of synchronization with the television camera and need to be modified for best results. The reason is that the motion picture projector presents a continuing sequence of complete still pictures, at the rate of 24 per second, whereas the scanning rate of the vidicon tube is 1/30 of a second. A flickering effect thus results.

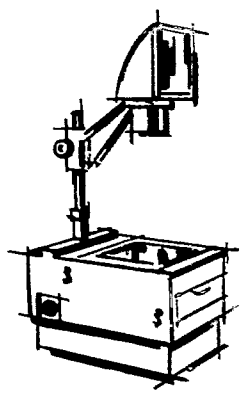
Successful use has been made of conventional projectors whose shutters have been removed. The image is then projected onto a rear-projection screen from which it is picked up by the television camera. Thus, any projector already owned by a school can be utilized.

There are specially designed motion picture projectors whose shutters are synchronized for television, but these are relatively expensive, costing approximately $2,000.



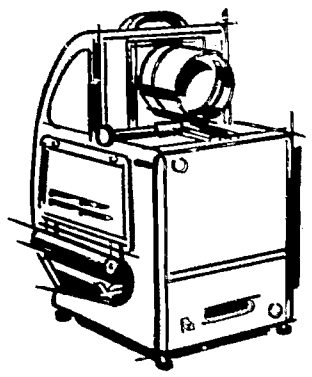
35MM SLIDES

Slide projectors can also be used with rear screen projection techniques. The single lens reflex camera, with its precise through-the-lens viewing, makes it both easy and practical for a school to prepare its own slides from opaque materials.



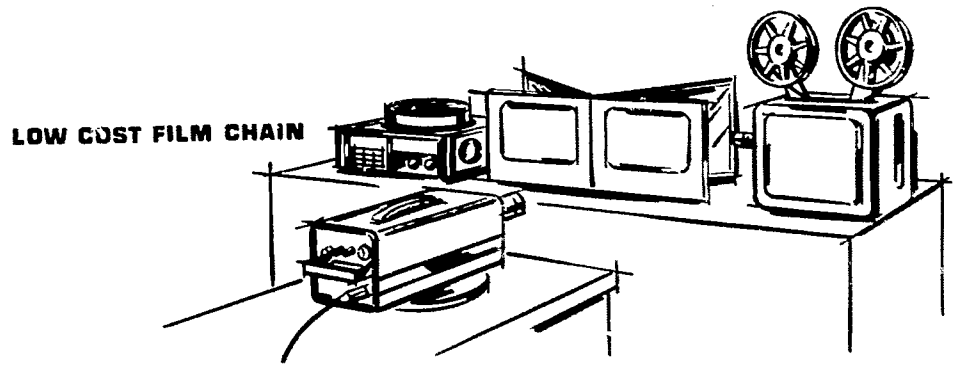
OVERHEAD PROJECTION

The versatile overhead projector, with its large transparencies that can be home-made, drawn upon and used with multiple overlays for "action" while viewing, can also be integrated into the television program. The television camera is generally placed alongside the projector to pick up the image off the screen.

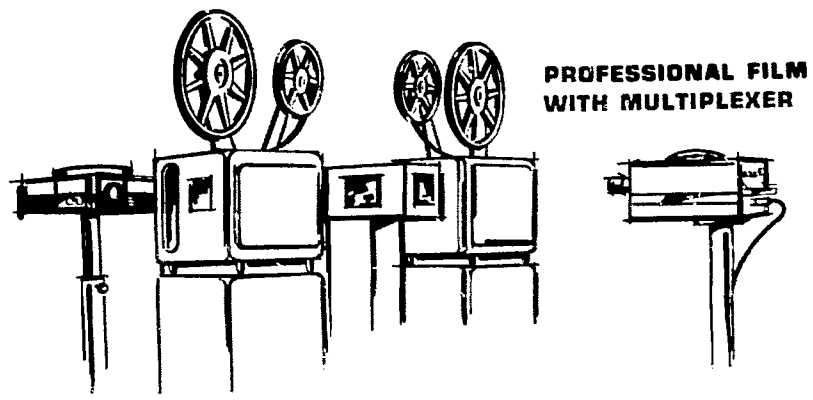


OPAQUE PROJECTION

Opaque materials, such as photographs, clippings, drawings, maps, diagrams, etc., can be used directly without having to be converted to filmed transparencies. Any opaque projector now owned by a school can be used in the same manner as the overhead projector, although there are special models designed for television.



LOW COST FILM CHAIN



PROFESSIONAL FILM CHAIN WITH MULTIPLEXER

FILM CHAINS

A television camera and one or more film projectors mounted in a fixed-position assembly that maintains the necessary optical relationship comprise the film chain. An optical device, the multiplexer, is used for smooth and instantaneous switching from one projector to another, such as from motion pictures to slides.

A professional-type film chain/multiplexer assembly, including a 16mm motion picture projector, 35mm slide projector and mounting assembly would cost approximately $3,500, not including the television camera itself.

Practical and economical alternatives are readily available, however, using the rear-projection screen technique. In one application, the camera itself is mounted on a swivel for use with a pair of projectors. Apart from the initial savings, this method permits other uses to be made of all the equipment.

A school with a master distribution system can use more than one film chain simultaneously to service additional classrooms and special viewing locations. Systems can even be engineered to permit the teacher in the classroom to start and stop the filming himself by remote control.

ADVANTAGES OF CENTRALIZED VIEWING

A school with a master distribution system and a film projection center can overcome some of the inherent problems met in the conventional method of showing films in classrooms. No time is lost in bringing the projector to the classroom, or the class to the projector. Nor is there any change in the classroom atmosphere. The room stays lighted, and students can take notes without difficulty. The tendency to become drowsy is also lessened. Also, since shades need not be drawn, there is no interference with ventilation.

VIDEOTAPE RECORDING

. . . significance of the low-cost portable videotape recorder

The advent of the low-cost, portable videotape recorder ($10-12,000) may well have an effect on educational television comparable to the changes videotape has long since made in commercial broadcasting. Until 1963, videotape recorders were in the $50,000 class and warranted only in major state-wide or university installations.

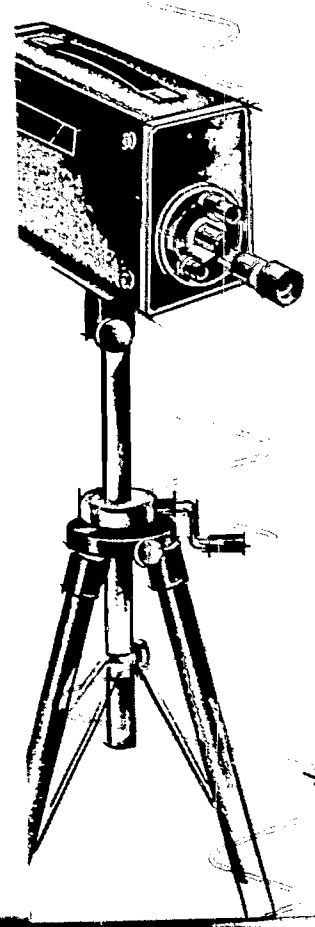
But now, any school with a master distribution system can look forward to the use of the growing libraries of specially taped lectures and courses. Even more significant, schools who would want to originate their own closed circuit programming can now amortize the original production costs by recording on tape for repeated showings at any convenient hour.

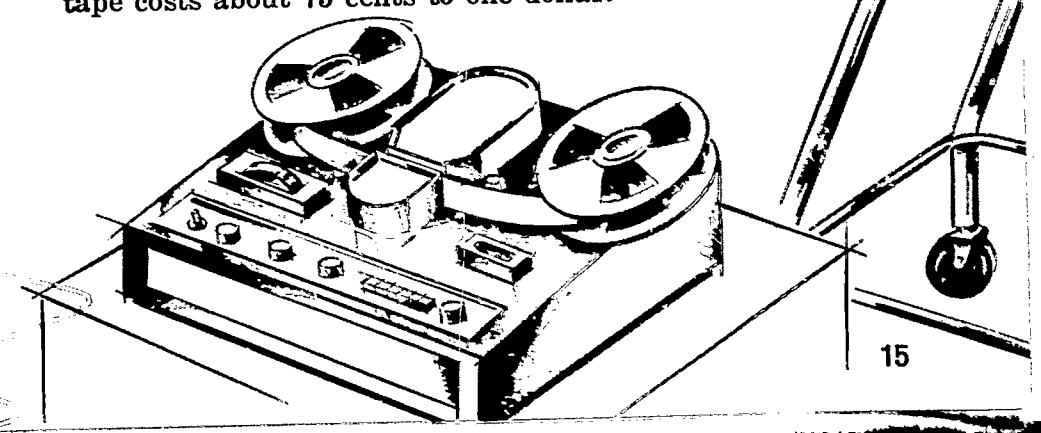
Such schools can maintain full control over their entire curriculum in both content and scheduling, while at the same time they take full advantage of television's unique ability to reach multiple audiences simultaneously.

Thus, a school which has yet to take its first step into closed circuit television can now reconsider with this significantly new point of view. Also, the school which has already had some limited experience with live programming can now start planning programs on a more ambitious basis. Apart from the vastly expanded flexibility it affords, a recorded program obviously relieves all the pressures inherent in the live performance.

The principle of operating videotape recorders is essentially the same as with the audio tape recorder. Using a standard vidicon camera and sound system, a complete program can be taped and played back instantly on any standard monitor. Tapes can be reused repeatedly, preserved indefinitely . . . and easily erased or edited to be kept up-to-date. Technical quality is on a par with live broadcasting.

At this writing, one model using 1" wide tape, offers about 1½ hours of playing time per reel. Another model, designed for use with 2" tape, plays up to 5 hours per reel. A minute's worth of tape costs about 75 cents to one dollar.





VIDEO MONITORS

The video monitor differs markedly from the more familiar RF receiver. It can be used only with cameras capable of video output, the signal it receives occupies the entire bandwidth of the coaxial cable, and it has no provision for receiving and detecting the combined audio-video signal transmitted on an RF carrier.

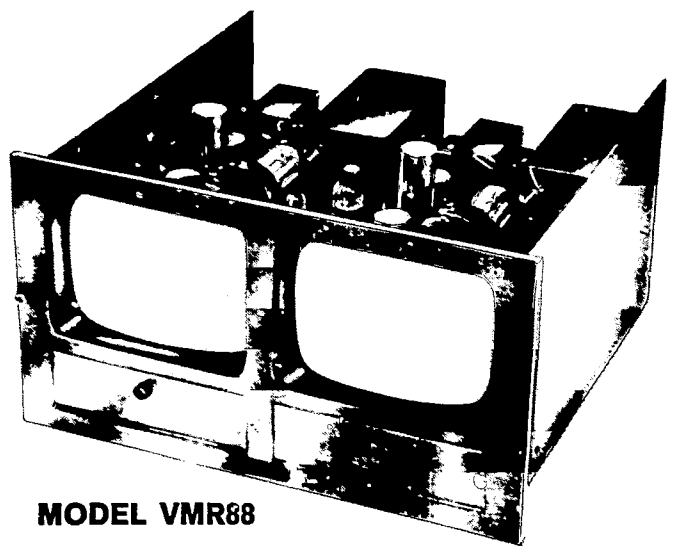
As purely professional equipment, video monitors have heavy duty internal components and use picture tubes with narrower angles of deflection than RF receivers. The resulting picture has higher brightness and contrast, and greater corner-to-corner sharpness.

Since video transmission is not limited by FCC regulations to the 350 maximum horizontal resolution of RF, it lends itself to a variety of applications where the transmission of fine detail is important.

Because of their specialized use, video monitors are made in a variety of sizes. As an integral part of a viewfinder camera, for example, a 5" screen is typical. In the control room, 8" and 14" monitors suffice. In the laboratory or medical schools, video monitors range up to 27" in size.

Sylvania's compact, self-contained video monitors are engineered for continuous duty under all normal operating conditions. Their resolution extends beyond 600 lines (800 in the center). They are available in a variety of models, tubed and transistorized, for rack mounting or in their own cabinets for portable use.

Note: also available is Model 23E02/V, a special 23" monitor capable of receiving both video and RF signals. Resolution is approximately 500 lines.



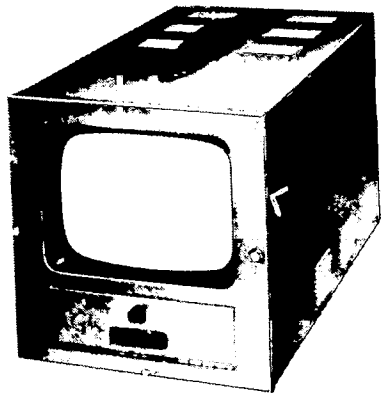
MODEL VMR88

MONITORS AND ETV RECEIVERS

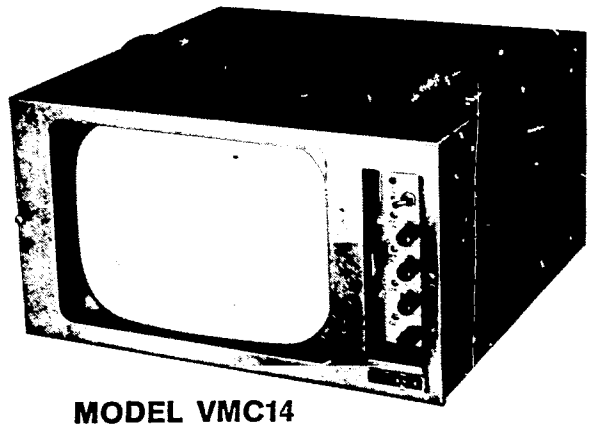
ETV RECEIVERS

ETV receivers are essentially up-graded versions of the typical home receiver. They feature a number of safety and performance factors which meet the special requirements of classroom reception. For example, they have higher audio power to permit ample sound level throughout the classroom without introducing distortion. Speakers are front-mounted for optimum dispersion. Picture tubes are shatterproof and backs are made tamperproof. Wood or plastic cabinets are most desirable, although metal cabinets that are properly grounded and isolated from the chassis are also satisfactory.

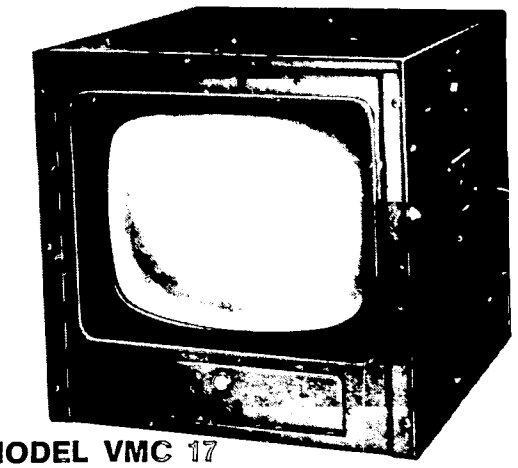
ETV receivers should also include provisions for use with external speaker systems. Inputs for tape recorders and record players are also desirable features. On the inside, the design of the circuitry should lend itself to easy maintenance, and the overall quality of construction should allow the receiver to withstand the rigors of constant use and movement from one location to another.



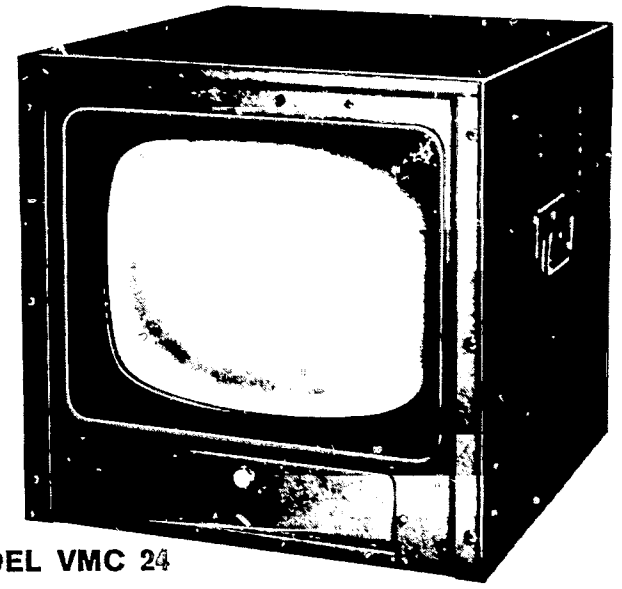
MODEL VMC8



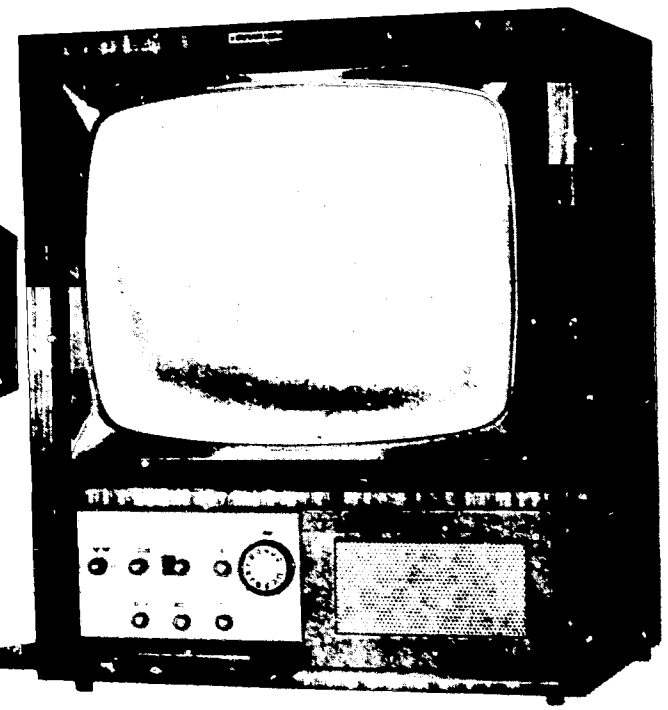
MODEL VMC14



MODEL VMC 17

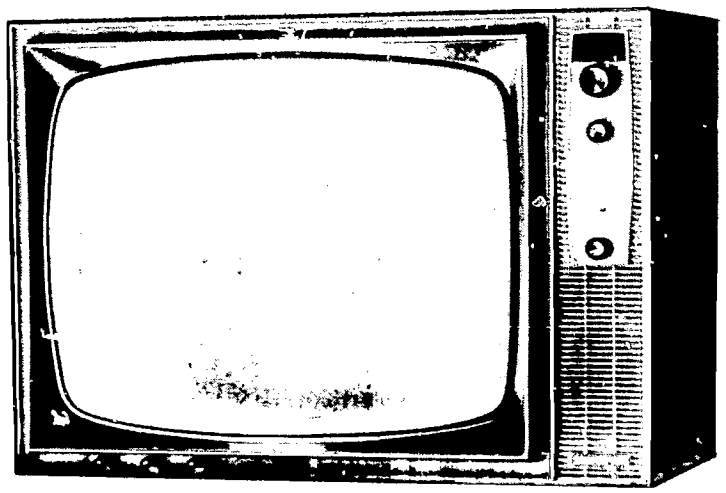


MODEL VMC 24



MODEL 23E01

SYLVANIA ETV RECEIVERS



MODEL 23E02

Compact 23" receiver (277 sq. inches) in metal cabinet engineered for complete safety in classrooms. Special chassis operates well below rated tube and component capacity in critical circuits for maximum performance with minimum strain and heat.

23" receiver (277 sq. inches) with such features as all-wood cabinet, tamper-proof back, front controls locked behind door, 4 watt power amplifier, front-mounted 6" x 9" speaker, jacks for use with tape recorder, record player, external speakers.

Model 23E01 is also available with 10 watt amplifier, for use where full range high fidelity external speakers may be desirable, such as in music appreciation classes. This higher audio power is also important where several speakers are positioned throughout a large room, each driven from a single receiver.

TYPICAL ETV SYSTEMS AND THEIR EQUIPMENT REQUIREMENTS

As used in education today, television runs a broad gamut ranging from a single camera and receiver under the complete control of the classroom teacher to full scale live and recorded programs produced and transmitted through facilities equivalent to commercial broadcasting stations.

Unfortunately, much of the information on ETV published to date lays more stress on sophisticated installations than on the basic and modest approaches which many schools would find better suited to their own specific needs.

As a result, it is likely that a number of schools which would otherwise have already looked into the possible uses of television (other than occasional broadcast reception) have not done so largely because they considered even a minimum closed circuit system to be beyond their means.

Perhaps the applications described on the following pages will serve to show that television can indeed be brought into a school on a demonstrably modest scale, yet not preclude expansion when deemed advisable according to first-hand experience and results.

ELECTRONIC ENLARGEMENT

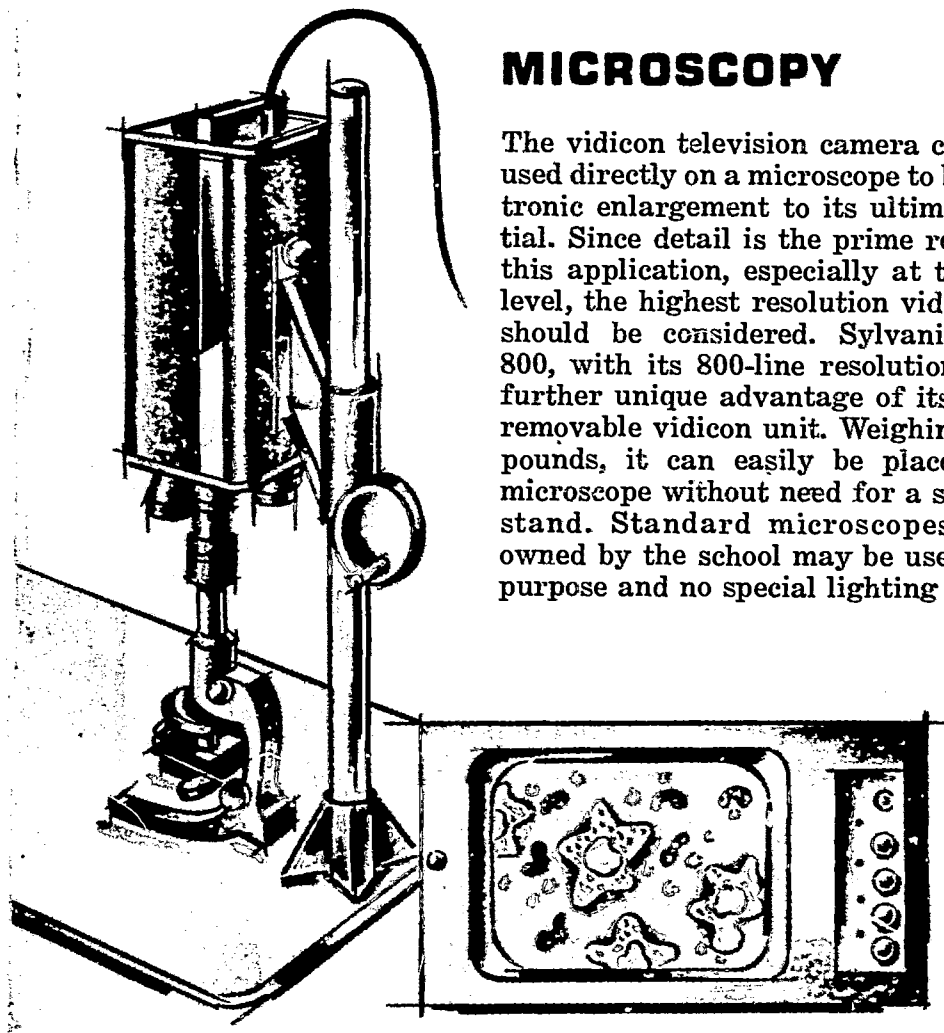
Closed circuit television lends itself readily to a wide variety of uses simply as an electronic enlarger for the benefit of students within the same classroom as the teacher. The teacher needs little training in television beyond a short introduction to the equipment, and few preparations beyond those made previously. He is sim- demonstrations and experiments as before, but now with the facilities to let all the students see an en- ply taking advantage of the opportunity to conduct larged close-up at the same time.

The equipment for this purpose consists of a camera on a convenient stand or tripod, a monitor for the teacher's guidance and whatever receivers are needed to serve the students. (In a small class, a single receiver can serve both functions simultaneously.) Installation involves no more than connecting the camera to the receiver(s) and plugging the power cord of each into an AC outlet.

SYSTEM #1 (RF only)
Camera (Model 300)
Tripod, dolly
Monitor (Model 23E01 or 23E02)

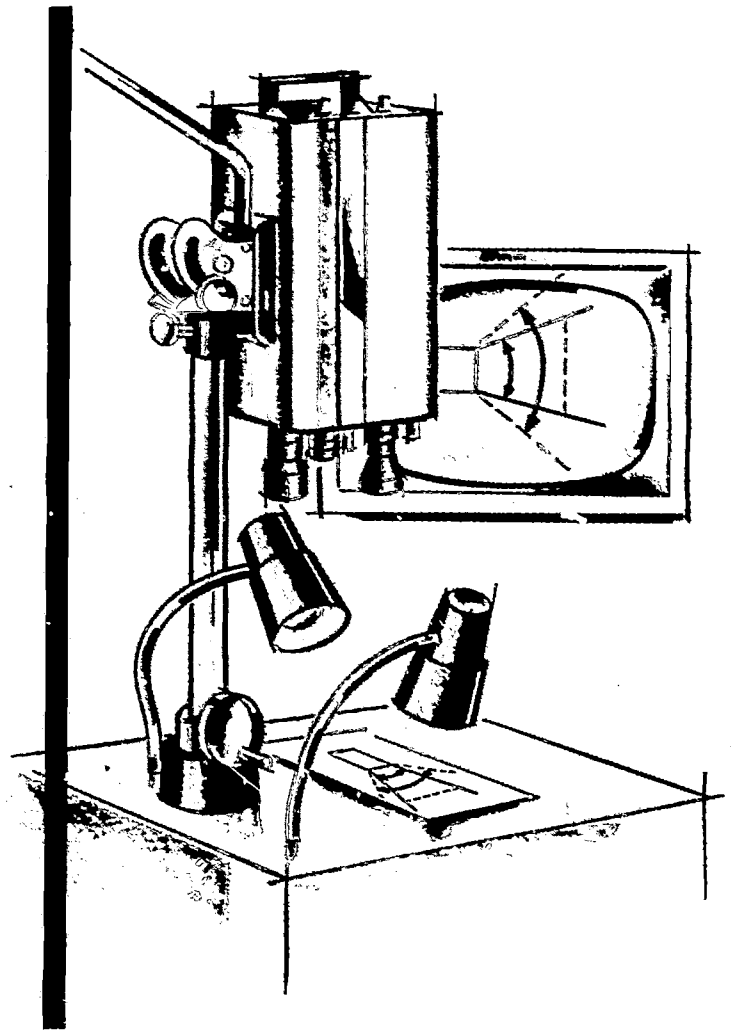
SYSTEM #2 (RF and Video)
Camera (Model 400 or 600)
Tripod, dolly
Monitor(Model23E02/V)

SYSTEM #3 (highest resolution video only)
Camera (Model 800)
Tripod, dolly
Monitor (Model VMC14 or larger)



MICROSCOPY

The vidicon television camera can also be used directly on a microscope to bring electronic enlargement to its ultimate potential. Since detail is the prime requisite in this application, especially at the college level, the highest resolution video camera should be considered. Sylvania's model 800, with its 800-line resolution, has the further unique advantage of its compact, removable vidicon unit. Weighing but 4¼ pounds, it can easily be placed on the microscope without need for a supporting stand. Standard microscopes already owned by the school may be used for this purpose and no special lighting is needed.



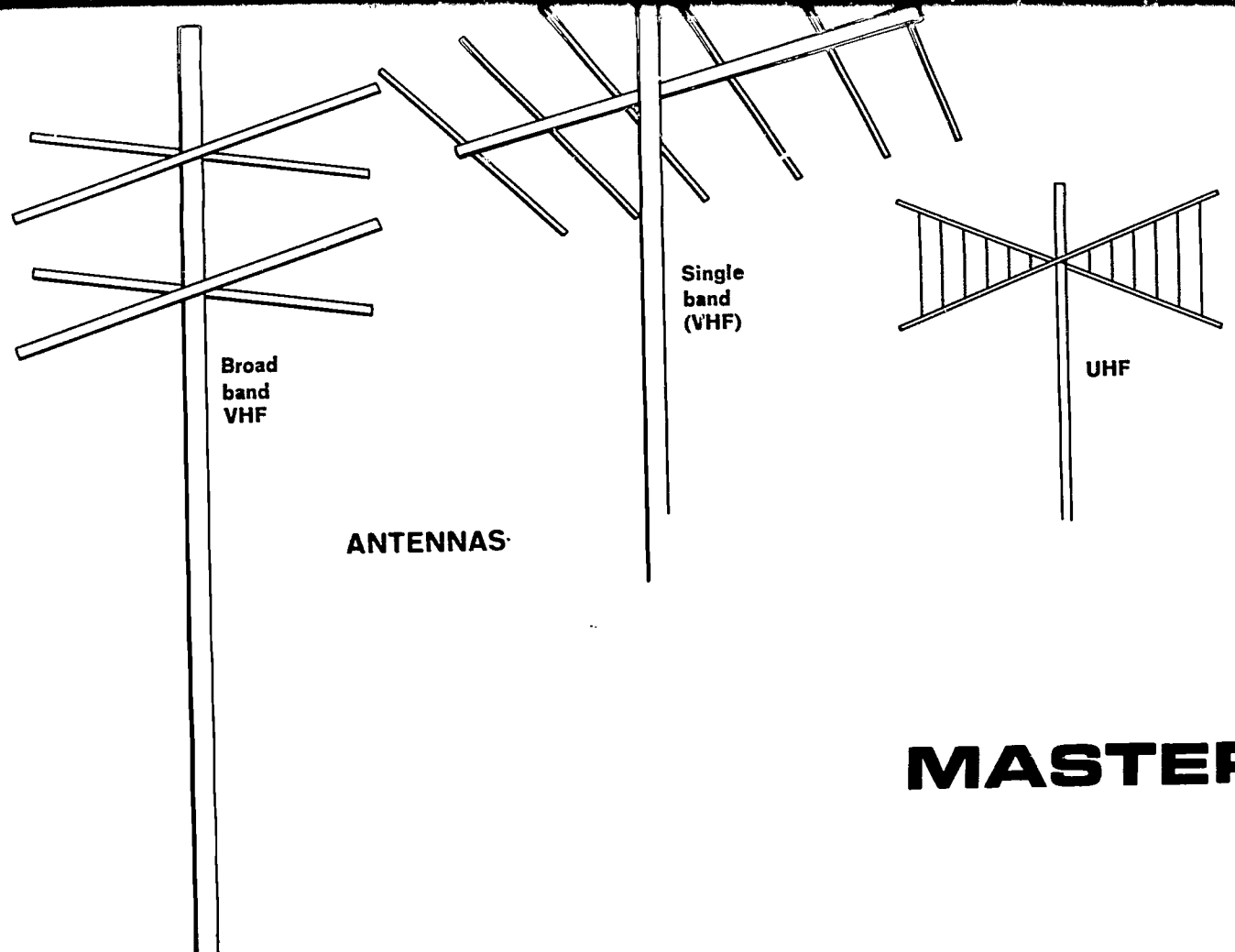
OVERHEAD TV

Another technique using the equipment already described is "overhead" television, similar in principle to the overhead projector. For this purpose, the camera is mounted on a close-up stand and used to "project" any opaque (flat or three-dimensional) object onto the television screen. Nothing has to be specially photographed, drawn, or reproduced on film.

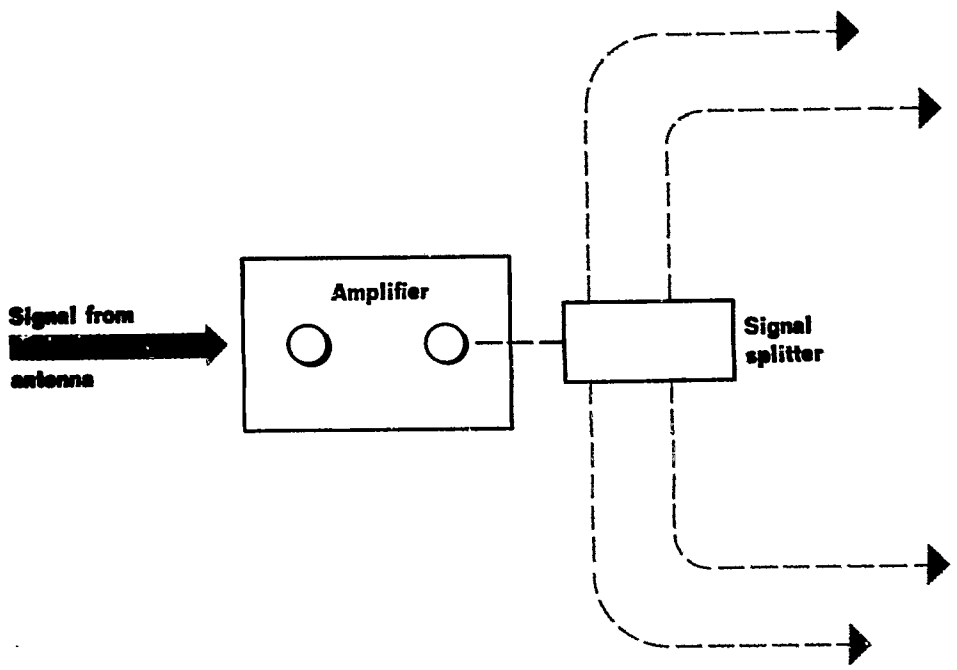
Since the materials are resting on a horizontal surface, the teacher can move them about as he pleases, write on them, drop prepared overlays and otherwise take as much advantage of his "stage" as he chooses.

Of course, the size of the over-all televised image is limited by the size of the receiver's tube, but by lowering and raising the camera (or by using a zoom lens, preferably), any portion of the original material can be selected to fill the entire screen in close-up.

With such an opportunity thus afforded to make convenient and effortless use of visual aids, a teacher is more likely to incorporate more of them in his lecture than ever before.



ELEMENTS OF THE MASTER DISTRIBUTION SYSTEM



Even though only broadcast reception may be planned initially, the inherent limitations it places upon the individual school are readily apparent. The school has no control over content or timing, but can only utilize whatever programs are available in its particular area, and must adapt its own schedules and goals accordingly. Therefore installation of a master antenna, amplification and distribution system should be given the fullest possible consideration at the very outset of a school's plans to add any form of television to its curriculum.

With such a system, a school is prepared for optimum reception of all channels in its area, UHF and VHF, and to distribute a perfect signal to every receiving location in the school. In addition, the school can utilize the same RF system for its own live and recorded closed circuit programming whenever desired and without further installation expenses.

ANTENNAS

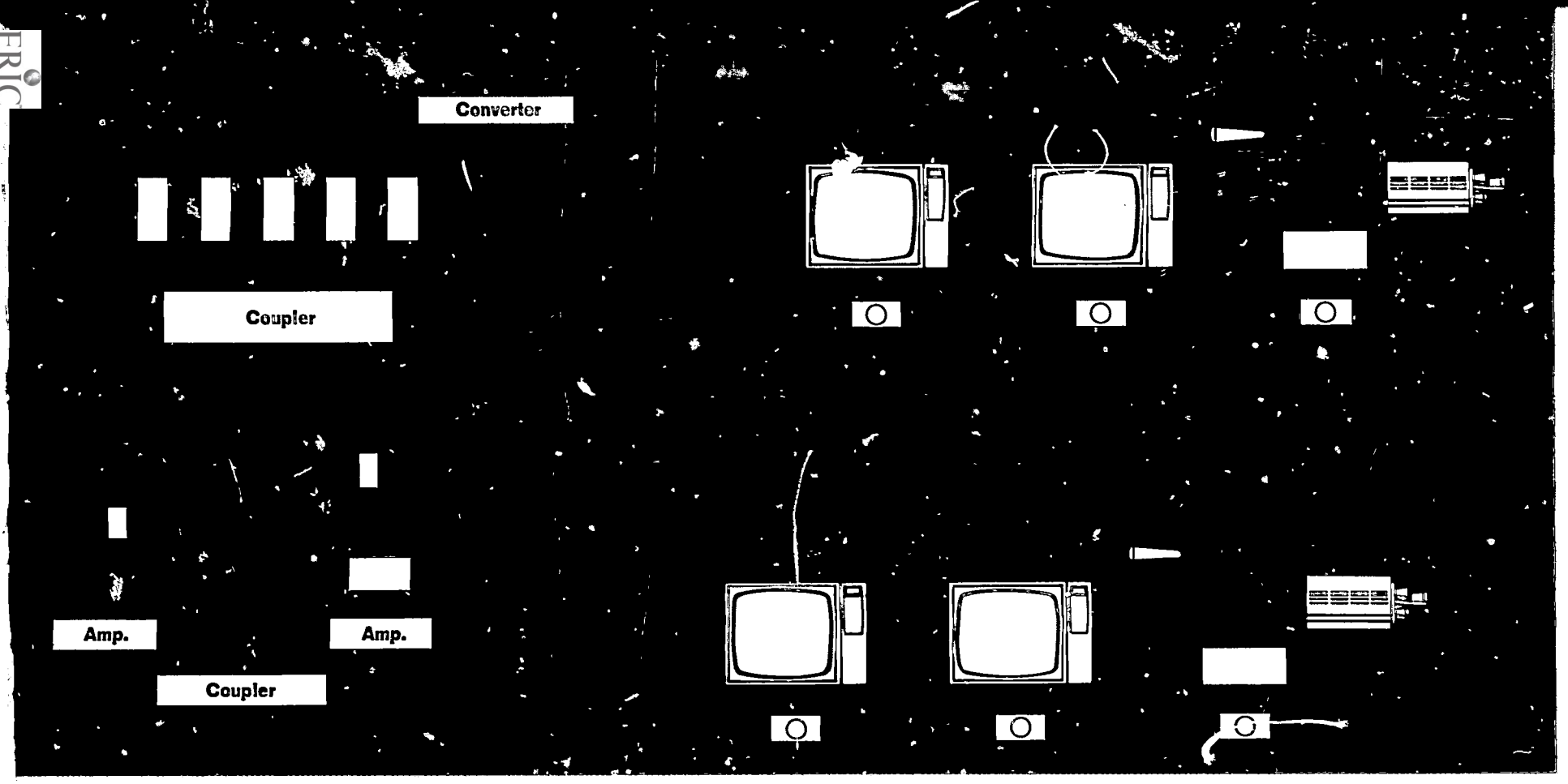
There are two basic types of antennas in general use: the broadband antenna which covers all TV channels and FM radio, and the single band antenna system with individual channel tuning.

The type to use depends upon the signal area. Where all channels lie in the same direction and are of equal strength, the broadband antenna may be adequate. In weaker areas and where channels lie in different directions, the individual antenna system is preferred.

An important component to include in the antenna system is the "balun," a transformer device which matches and transfers the signal from each antenna to the amplification and distribution system.

AMPLIFICATION

The signal strength of the channels in the school's area will also determine the type of amplifying system needed to provide the desired reception. Where all channels are of equal strength, a single



broadband amplifier would be adequate. But otherwise, individual channel ("strip") amplifiers would be required to assure that every signal transmitted throughout the school would be of equal strength.

SIGNAL CARRIER

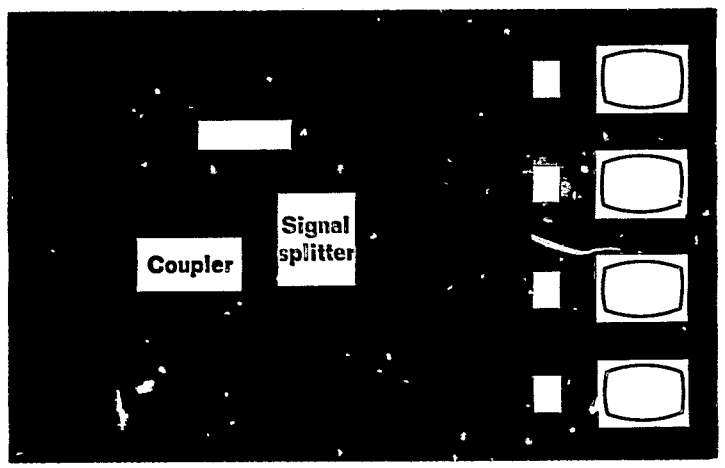
This consists of the coaxial cable (and its connectors) that carries the signals from the amplifier(s) to each receiving area. The most flexible and useful type of distribution system is the "closed loop." In this system, the trunk cable serves the entire school, with tap-off connections provided at each desired location.

With this system, each receiving area can also be adapted to serve as a program origination point by plugging in a camera instead of a receiver. The signal from this camera will then be transmitted throughout the system to every receiver tuned to the channel on which the camera has been set.

LOW COST DISTRIBUTION SYSTEMS

A less ambitious alternative to the closed loop system is the type that may be described as the non-amplified "octopus." In this system, each room connection is at the end of its own independent cable, rather than being an integral part of the total distribution system. This system is considerably less expensive than the closed loop, but has no receiving/transmitting two-way flexibility.

This type of system is recommended only when a school is in a strong signal area, does not need to serve more than four receivers from each antenna, and has no intention of ever using closed circuit television.



EQUIPMENT LIST

Single Band System

Antennas and tower
- VHF (one per channel)
- UHF (one per channel)

Converter (UHF to VHF)
Transformers (one per antenna)
Coupler (one per system)
Amplifiers (one per channel)
Cables and connectors (as required per room)

Broadband System

Antennas and tower
- VHF
- UHF

Converter (UHF to VHF)
Amplifier (one per system)
Transformer
Coupler
Cables and connectors (as required per room)

Simplified Low Cost System

Broadband antennas and tower
- VHF
- UHF

Converter (UHF to VHF)
Coupler
Signal splitter
Baluns (one per receiver)
Cables and connectors (as required per room)

Note: All the distribution systems described above are for RF transmission only, covering VHF channels 2-13 and UHF channels 14-83 as well as FM radio. For video, which requires the entire bandwidth of the cable, either a separate distribution system serving a section of the school would be needed, or a period of time set aside for the exclusive use of the video program.

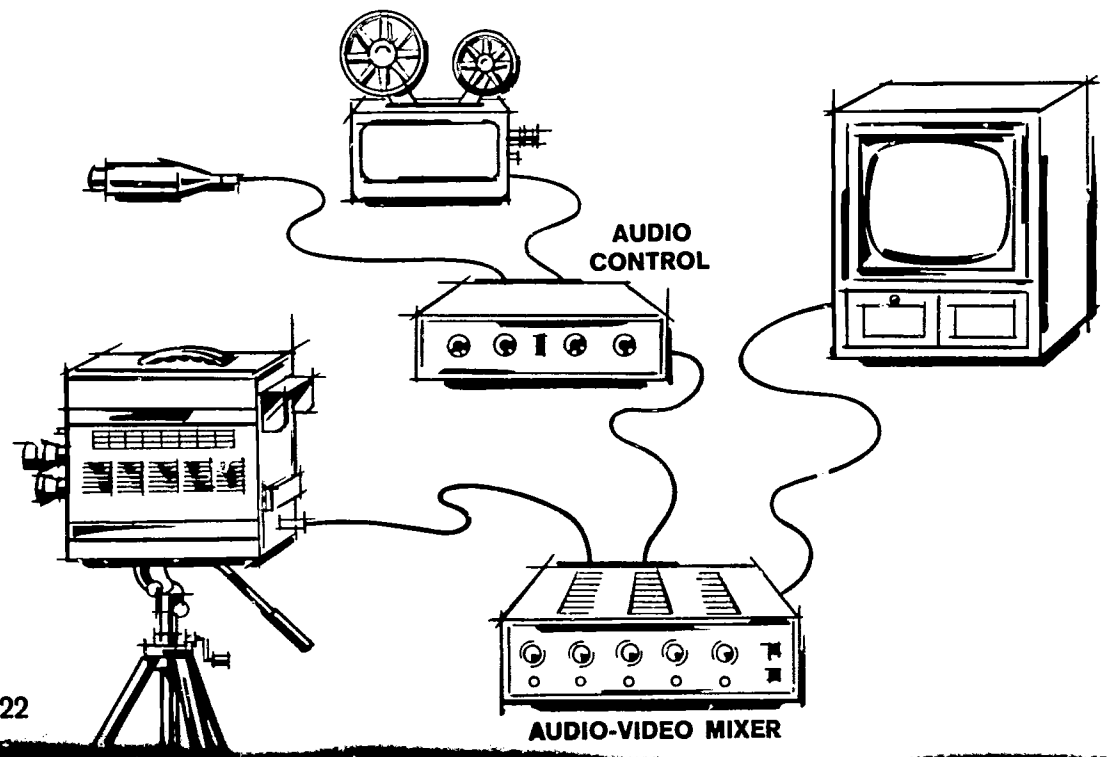
TRANSMITTING PROGRAMS THROUGHOUT THE SCHOOL

When closed circuit television is used only for electronic enlargement within a single classroom, little of its full potential as a teaching tool has been tapped. A school which is already equipped with a master distribution system need only add a sound modulator to its camera to service any number of additional classrooms.

The most fundamental difference, however, will be that all the receiving classrooms will be viewing *everything* on television, the teacher as well as his materials. Hence, the use of the television equipment as well as the planning of the lecture takes on an entirely different scope and dimension. The originating classroom has now become the studio.

How modest or how ambitious the studio facilities and the nature of the lecture should be must be determined by the school itself, based upon its own immediate and long-range plans . . . and the funds, personnel and effort it wishes to make available.

As the systems described on the following pages will show, the first step into school-wide closed circuit TV can be a modest one. If a school wishes, it can gain its early experience with television production without committing itself to a major investment. Then as the medium proves itself to be of value, the system can be expanded in carefully planned stages that keep pace with the school's own plans for it.



THE SOUND SYSTEM

The same RF distribution system that carries the **picture signal can also carry the sound** as well, just as in over-the-air broadcasting. The various sound sources such as the microphone and motion picture projector are plugged into the audio control and from there to the audio-video mixer which also receives the coaxial cable from the camera. The audio-video mixer superimposes both sound and picture signals on an RF carrier wave and sends them along the cable to the television receivers where they are again divided by the appropriate circuitry.

The quality of sound matches the sound that is expected from standard broadcast programs. In systems using Sylvania cameras, where voice transmission only is required, Sylvania's low cost Sound Modulator serves satisfactorily in place of the audio-video mixer.

Other alternative sound systems would be an existing public address system at the school, or a separate sound system planned to meet special needs, such as in music appreciation where full range high fidelity response is required. (Video installations require completely independent sound systems.)

TEACHER-CONTROLLED SYSTEMS

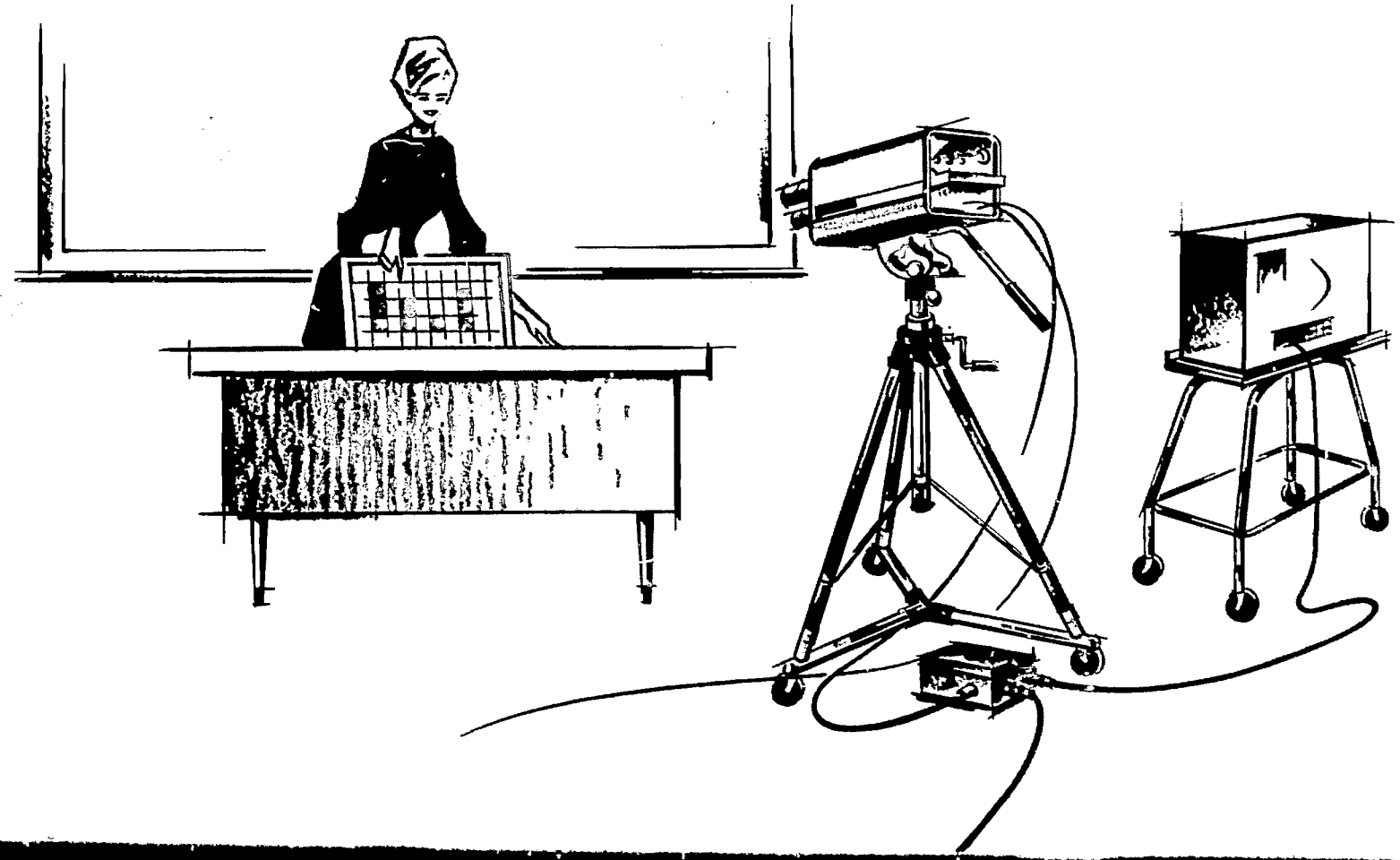
The simple operation of the vidicon camera has led a number of schools to plan systems in which the teacher puts the entire lecture . . . including himself . . . on television. Some of these are shown as examples of what can be accomplished both with a minimum of low cost equipment and equipment of a more sophisticated nature.

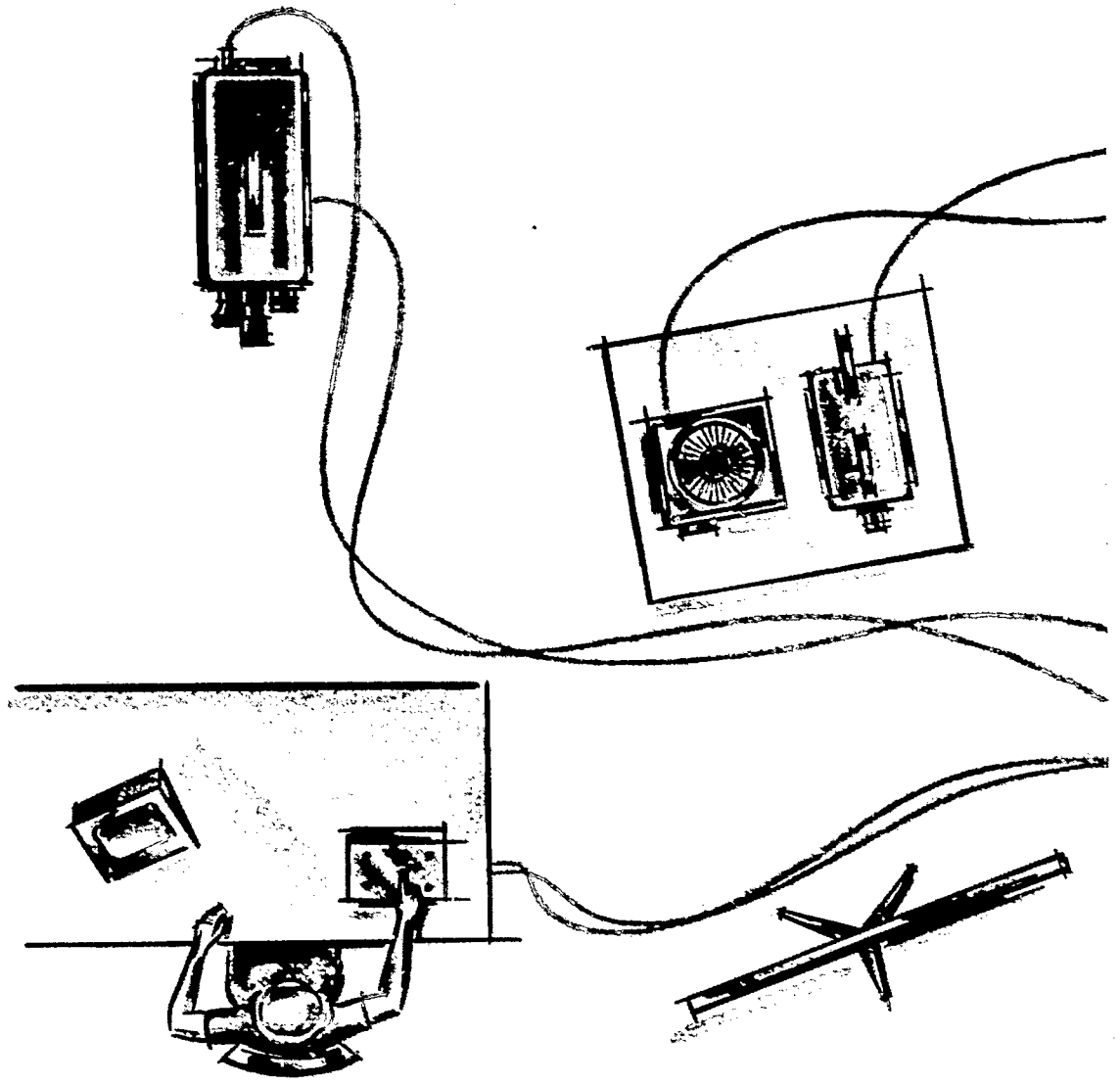
SINGLE CAMERA ON TRIPOD

The simplest possible system would be to place the camera with a single lens on a tripod and have its angle of view cover the teacher either sitting at his desk or standing at the blackboard. While on the air, the teacher views the program over a monitor placed out of range next to the camera.

To avoid making a completely static presentation, a student can serve as cameraman to face the camera toward a different setting . . . map, flip chart, specimen, or rear projection screen to pick up slides or motion pictures.

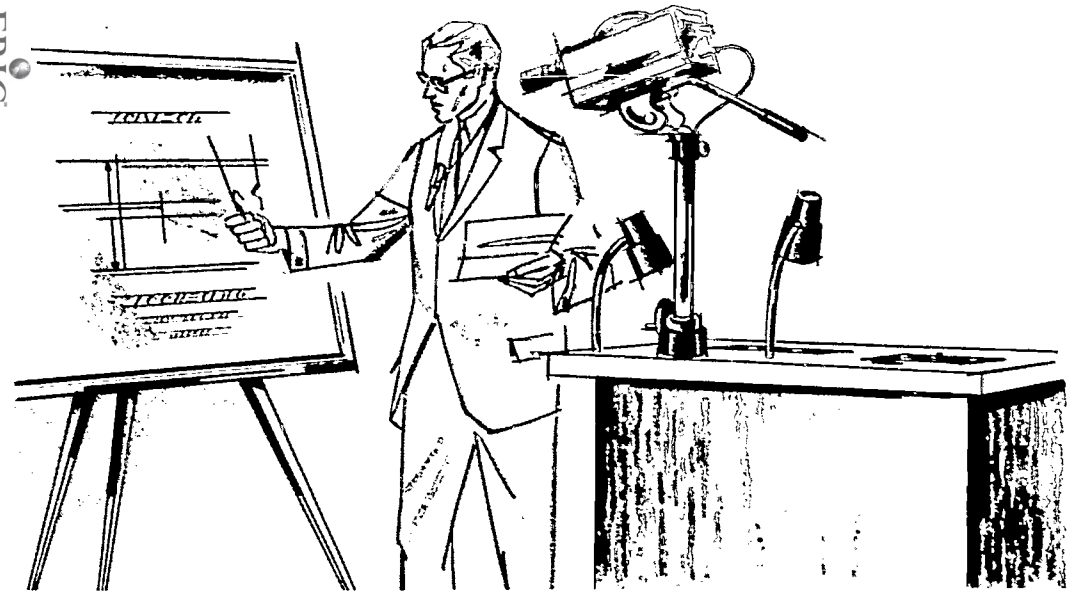
For smooth and rapid picture transition, the floor area would be marked and lens settings pre-arranged (or lens turret turned) for each planned scene change.





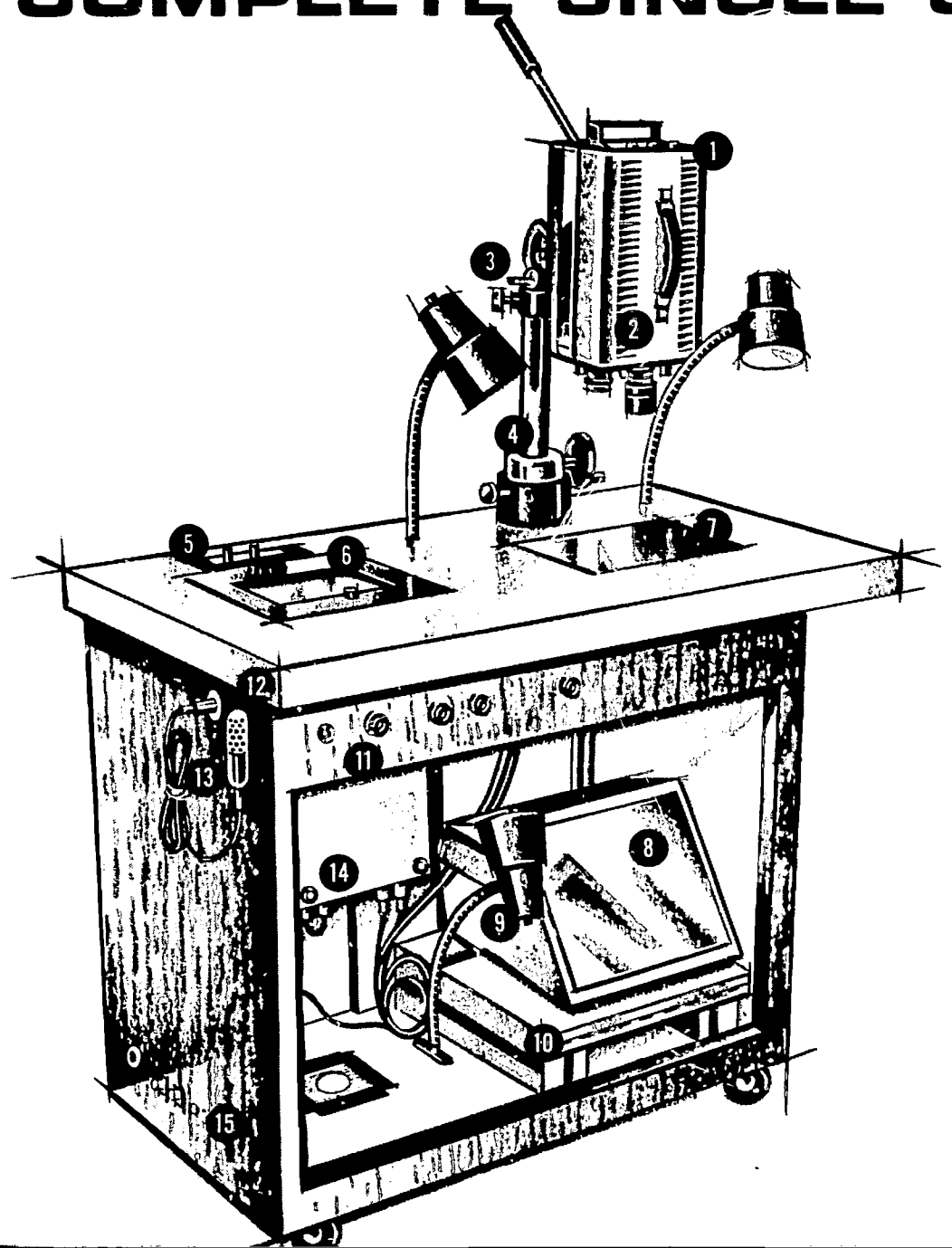
SOPHISTICATED ONE-MAN STUDIO

At the other extreme, a school could have a fully-automated one-man studio with camera equipped with remote control zoom lens and mounted on remote control pan and tilt head. Film equipment, such as 16mm motion picture projector and 35mm slide projector, would also be part of this studio. All the equipment would be controlled by a programmed control console at the teacher's desk, with push buttons used to place any pre-selected scene on the air. For example, while the teacher himself is on camera, pressing one button would do the following: blank out the picture, pan the camera to the rear projection screen, zoom the lens for the screen dimensions, start the projector, turn on picture and sound. The price for such programmed convenience is high, however, and should be weighed against what can be accomplished with orthodox equipment and the use of students as cameramen and floor aides.



Here is an example of how a complete closed circuit studio* can be designed into a single, portable unit that can be wheeled to any room in a school equipped with a master distribution system. Heart of this system is a console that contains everything needed to put a live and recorded program on the air. The camera is a Sylvania 600 camera with pan and tilt-head on a height-adjustable mount. Built-into the console is an 8" video monitor, complete sound system with 10 watt amplifier, close-up lighting system, ground glass screen and special stand for use with accessory projectors, digital read-out clock, input/output panel, and a number of additional features.

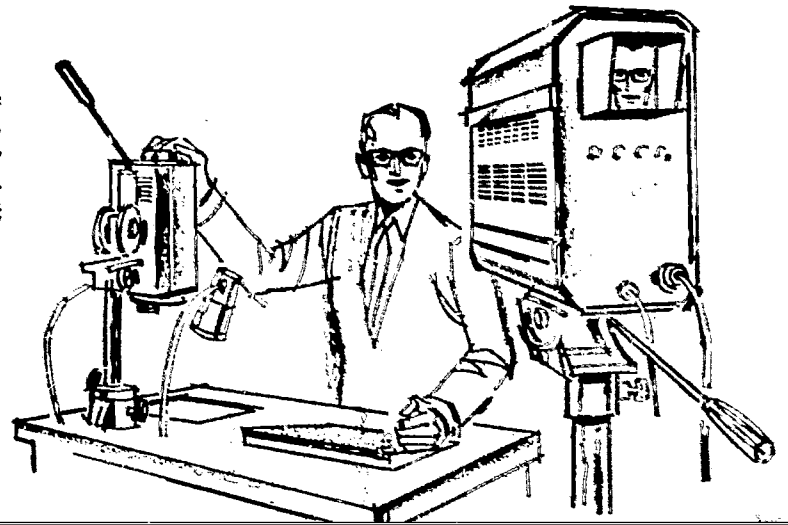
COMPLETE SINGLE CAMERA PORTABLE STUDIO



TV EDUCATOR FEATURES

1. **TV CAMERA** sends pictures to TV monitors within the same room, anywhere in the same building or other buildings as far distant as several miles with accessory equipment.
2. **CHOICE OF LENSES** (zoom with close-up attachment or 3 fixed lenses up to 6 inches in focal length and closeup kit) enable coverage of various depths of fields and distances.
3. **PAN AND TILT HEAD** allows flexibility in live image televising.
4. **ADJUSTABLE CAMERA MOUNT** moves camera to the desired height.
5. **DIGITAL READ-OUT CLOCK** with large numerals, permits instructor to easily keep track of time.
6. **BUILT-IN MONITOR** enables instructor to see exactly what the student sees. By this means he can check and control the picture being viewed.
7. **GROUND GLASS SCREEN** transmits diffused light for projecting slides, film-strips, microfilm and other transparencies into the TV system. It is also used as a screen for movie and automatic slide projection.
8. **REFLECTOR MIRROR** throws image from projector to ground glass screen where it is picked up by the TV camera.
9. **INTERIOR LIGHTING** with dimmer control is housed inside the cabinet for projection of transparencies.
10. **PROJECTOR STAND** permits proper positioning of projectors.
11. **REAR CONTROL PANEL** includes master AC switch, master volume control, audio on-off and microphone volume, internal speaker volume, interior light control.
12. **AC PLUGMOLD** inside and outside provides outlets for all accessory and demonstration equipment. A master on-off AC switch controls all equipment hooked up to the system.
13. **LAVALIER MICROPHONE** permits instructor to move freely while talking to his audience.
14. **SPEAKER** projects sound for large audience.
15. **SIDE PANEL** includes jacks for microphone input, AC interlock, video output, RF output, audio output.

The "TV Educator" is also available as a two-camera system with viewfinder camera, dual built-in monitor and remote control that enables instructor to switch cameras without moving.



**The "TV Educator," designed and constructed by Video Engineering Co., Inc., Washington, D.C.*

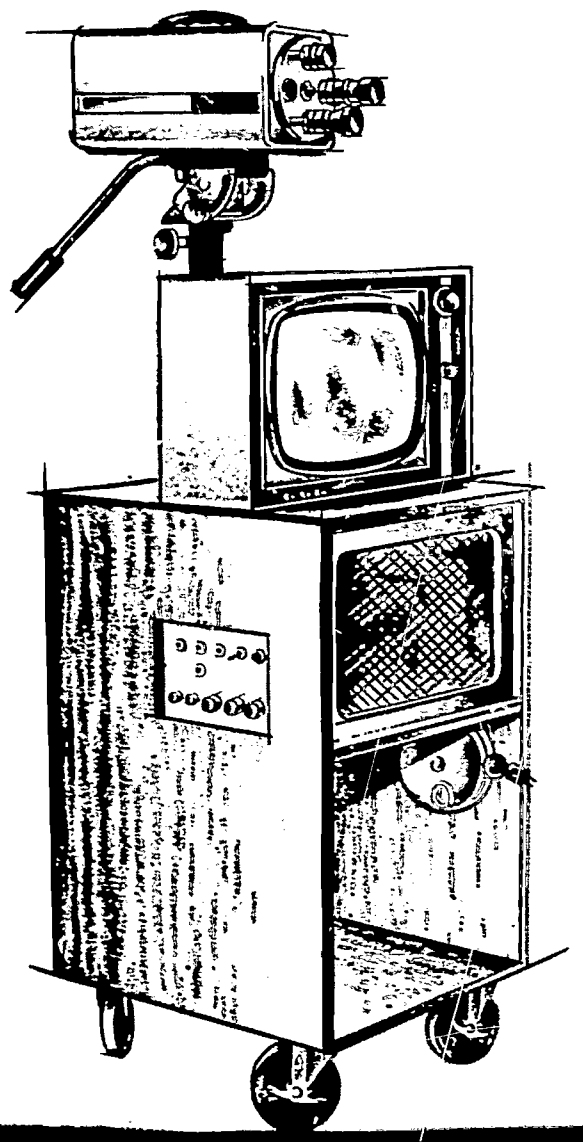
TWO-CAMERA PORTABLE STUDIO

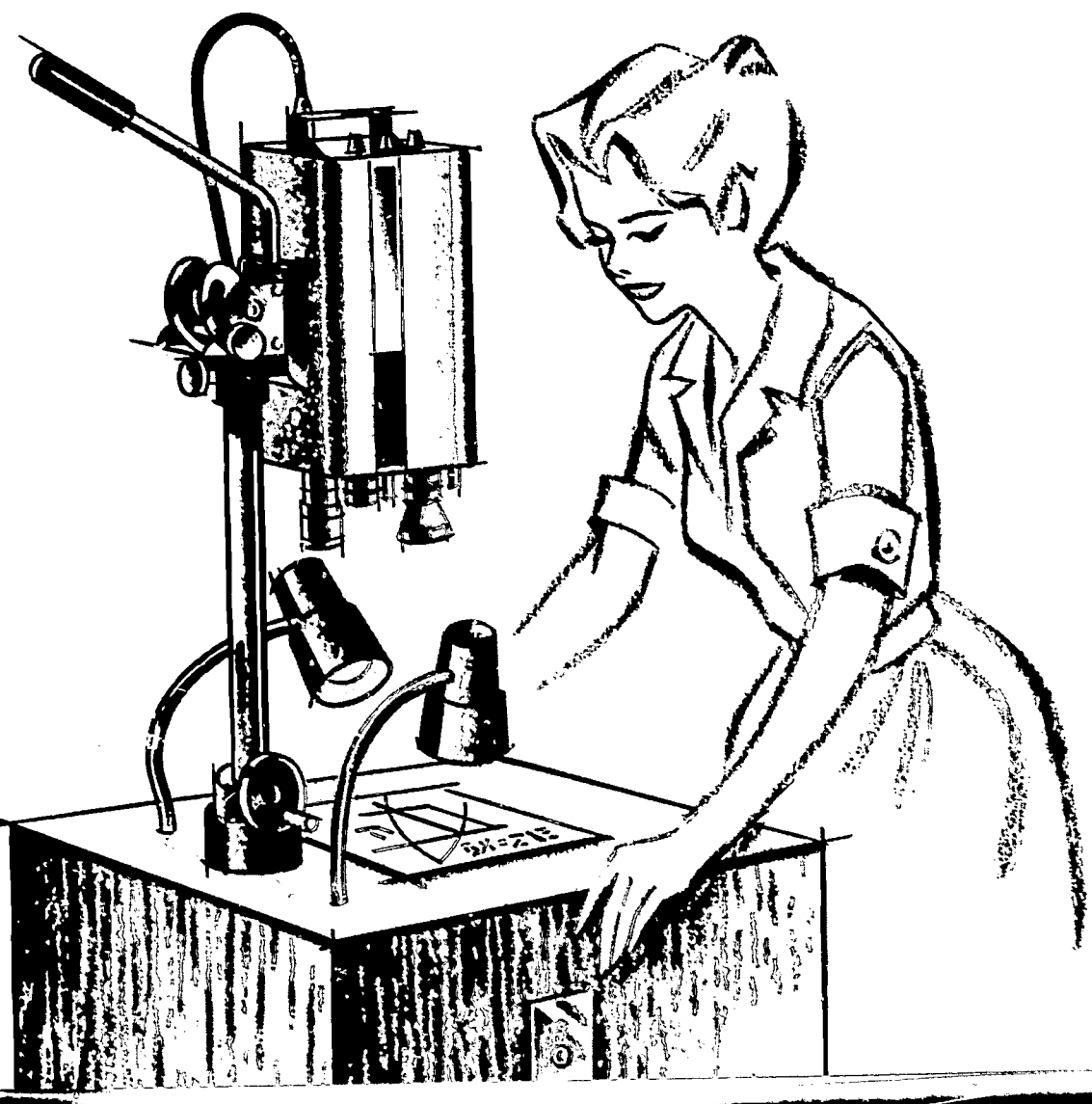
Teacher-controlled systems are not limited to single cameras, as shown by this two-camera teaching assembly.* The equipment consists of two Sylvania 400 cameras, each mounted on pan and tilt heads, and using wheeled cabinets instead of tripod and dolly. One of the cameras is planned for use as a close-up unit, with adjustable lighting brackets. The cabinet contains the microphone input jack. The other cabinet houses the monitor (17" RF) and the audio-video mixer for the sound system.

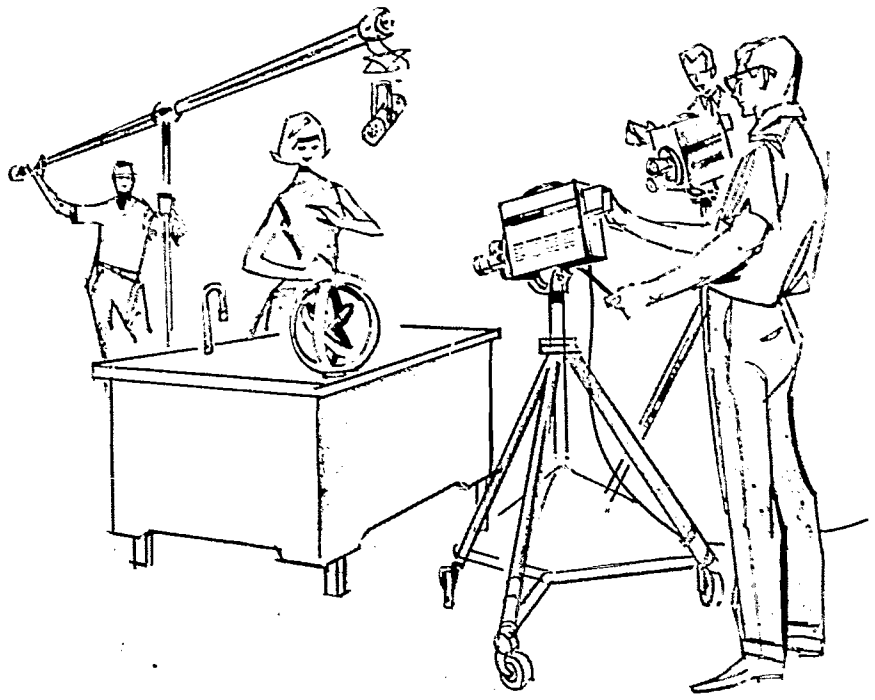
In planning a typical lecture for transmission to remote classrooms, the teacher sets up both cameras in advance to cover the first two scenes to be televised. The close-up camera, for example, will have the various visual materials stacked in position from top to bottom.

The lecture would normally start with the teacher on camera at her lectern. When it was time to show a visual, she would switch on the close-up camera and continue the narration while stepping over to it from the lectern. When the last visual is on, the teacher returns to the lectern while completing her comments related to the visual and then switches herself back on camera. Of course, she may also turn the second camera toward the blackboard or flip chart, if preferred.

**Designed and constructed by I. J. Kayle and Associates, Chicago, Ill.*







THE STEP BEYOND THE ONE-MAN STUDIO

The installations described on the previous pages, while practical and requiring a minimum of equipment, do limit the scope of presentation that can be made. Even though a teacher may have mastered the technique of manipulating one or two cameras while delivering a lecture, his prime responsibility remains that of teaching itself.

As for the students, they need not concern themselves with the production techniques being employed. Their concern is with learning, and the only justification for television being used is its contribution to the learning situation. Assuming the initial experience with television has been a positive one, the next step for the school would be to consider expanding the facilities and assign personnel to form the teaching-television production team.

This staff would now carry out the *functions* of producer, director, technician and cameraman, whether the staff itself comprises a single person or individual specialists. This, of course, represents the beginning of a higher standard of television production, for which the additional investment is not only in equipment, but in the time and effort required of the educational staff to plan and produce lectures of a more ambitious and complex nature than previously attempted.

THE LOW COST STUDIO

This three-camera installation takes the same low cost equipment, such as may have been used in teacher-controlled systems, and brings it into a former classroom that has now been modified (acoustics, lighting, ventilation, background drapes, flooring, etc.) for full-time studio use.

A viewfinder camera has been added for live pick-up, while the two non-viewfinder cameras are employed in the film chain and close-up stand respectively. Switching controls for audio and video are now grouped at the control center, together with four monitors, one for each camera and one for the program being transmitted.

EQUIPMENT LIST

Cameras

400/M viewfinder
400 (for film chain)
600

Lenses

½" wide-angle
3" telephoto
(1" lens supplied with cameras)
manual zoom (alternate to above)

Camera Accessories

Tripod, dolly
Close-up stand with lights

Monitors

VMC8 (8" video) for cameras
23" RF monitor for line

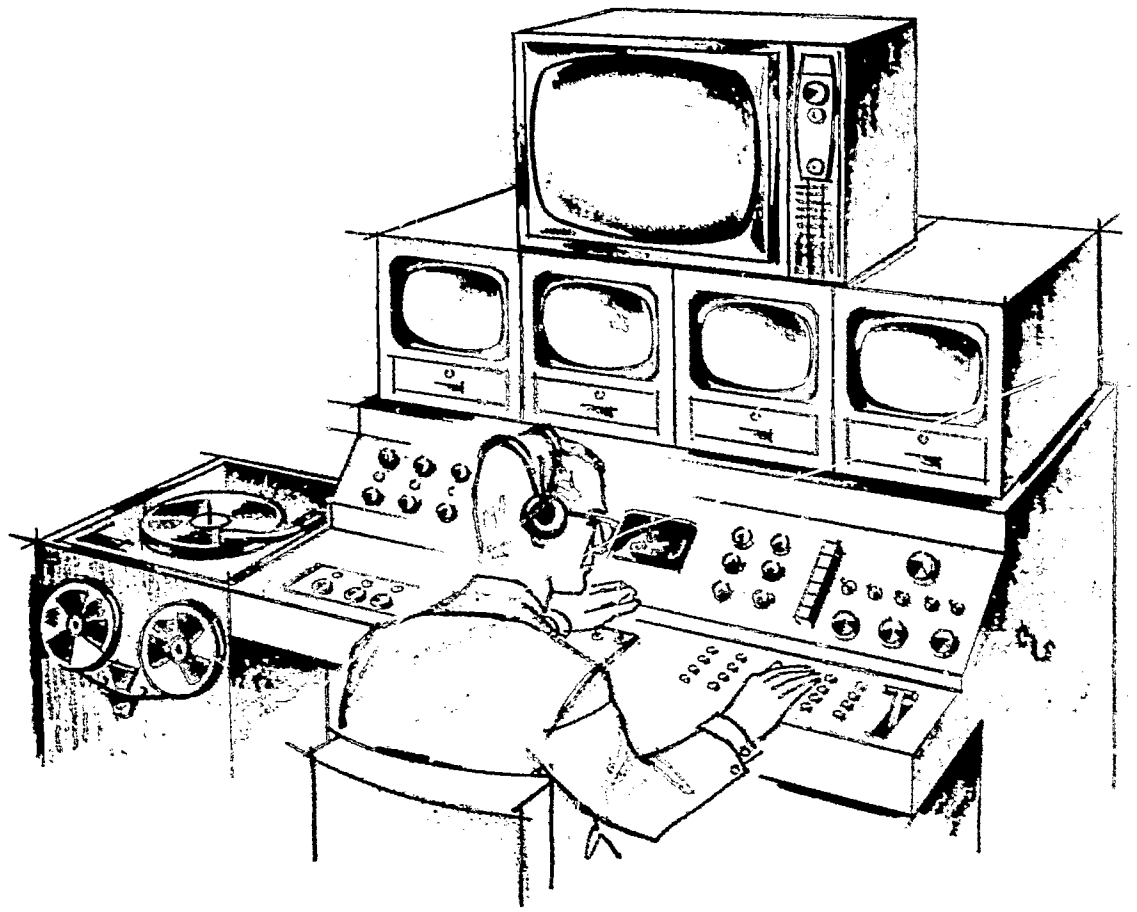
Film Chain

16mm projector
35mm projector
Rear screen adapters (2)

Sound System

Microphones, lavalier
Audio-control
Headset (for cameraman)
Turntable
Tape Recorder
Control switching console
Sync generator
Audio-video mixer
Crystal control transmitter
Hardware, connectors, cable

(Lighting system as required)



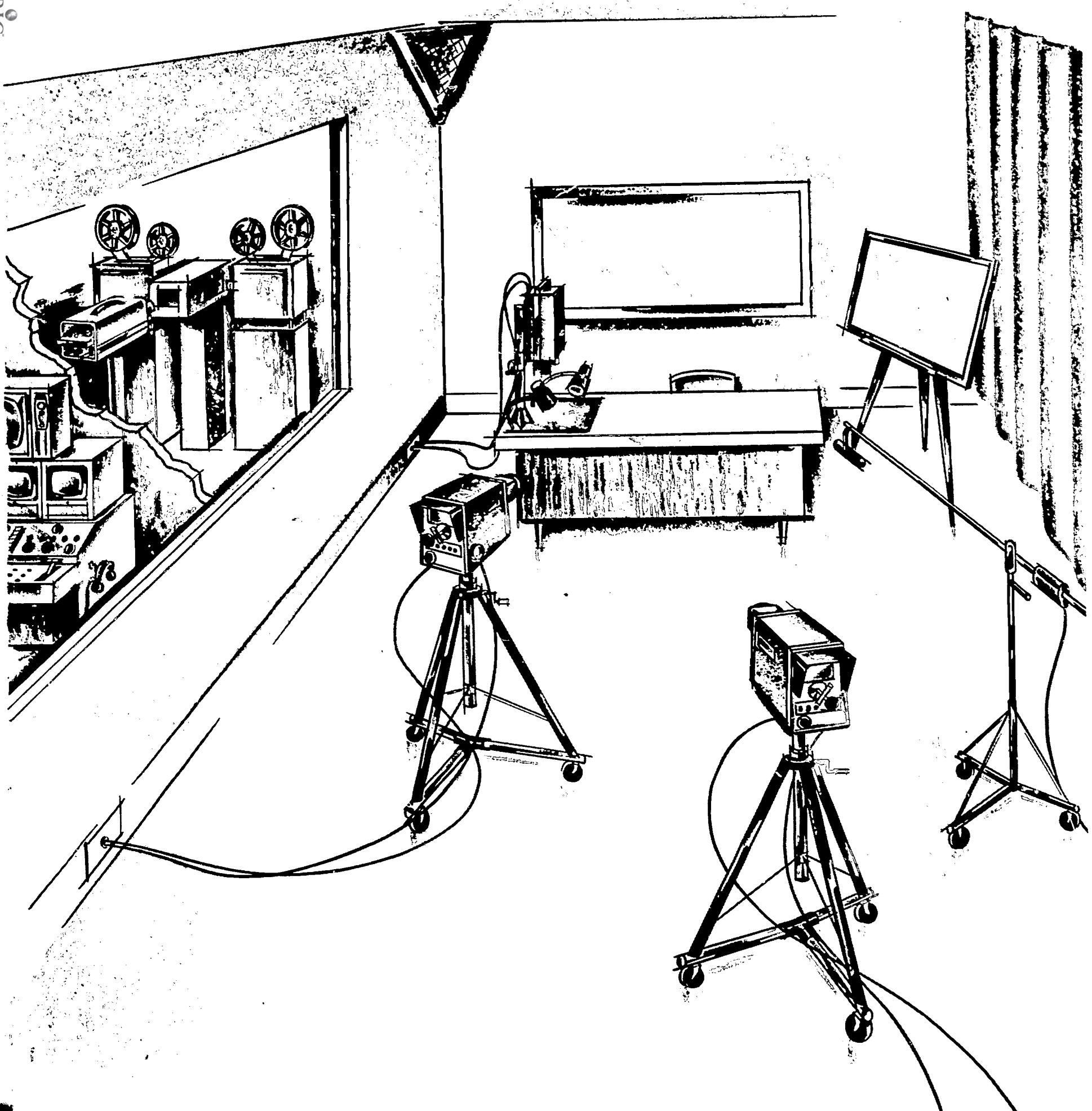
STUDIO CONTROL CONSOLE

This is the heart of the studio operation, containing every provision for controlling the signals from the cameras and sound sources. From the console, the director can see each picture being transmitted from each camera, balance them for brightness and contrast, switch from one to the other, or fade out from one as he fades in another. One section of the console would contain remote controls for operation of the film chain. Facilities are also provided for communicating with the cameramen through their headphones and the studio in general through a loudspeaker. One "line" monitor, video or RF depending upon the operation, is provided for each camera, plus a monitor for the program going out over the distribution system.

THE PROFESSIONAL-TYPE BROADCAST QUALITY STUDIO

This installation is a substantial undertaking, to be considered only by a school whose staff and advisers include professionally trained experts in every aspect of educational television. It is equipped to produce both live and taped programs of full broadcast quality, both in the studio and on location for over-the-air transmission to other schools.

The control console and film chain (s) are in separate rooms, isolated from the main studio itself. The complete list of equipment for such a studio operation is an extensive one, and of concern only to the professional engineer. But the major items, as listed on the opposite page, indicate the range of equipment required.



EQUIPMENT LIST

Cameras
400 (for film chain)
600 (for close-up stand)
800/M (2)

Lenses
½" wide-angle
3" telephoto
(Models 400 and 600 supplied with 1" lens)
Motorized zoom (2)

Camera accessories
Tripod, dolly
Close-up stand with lights

Film chain
16mm projector
35mm projector (2)
Multiplexer and field lens assembly

Audio equipment
Audio control
Turntable
Tape recorder
Microphones, lavalier (2)
Microphone boom
Headsets (2)

Videotape recorder

Control/Switching Console
Completely equipped with sections for controlling and switching all audio and video signals for all equipment in studio; also, necessary test equipment. (Monitors: VMC8(4), 23EO2.)

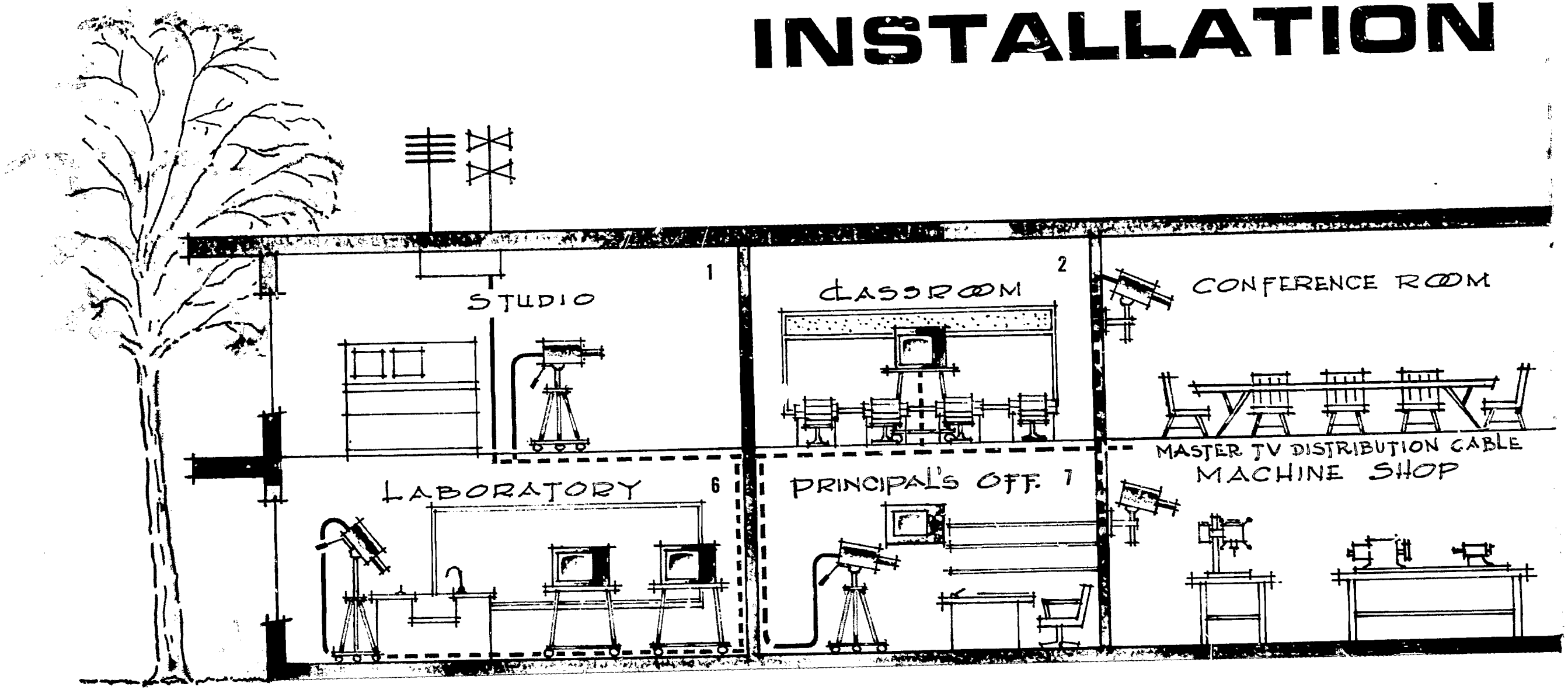
Audio-Video mixer

Crystal controlled transmitter

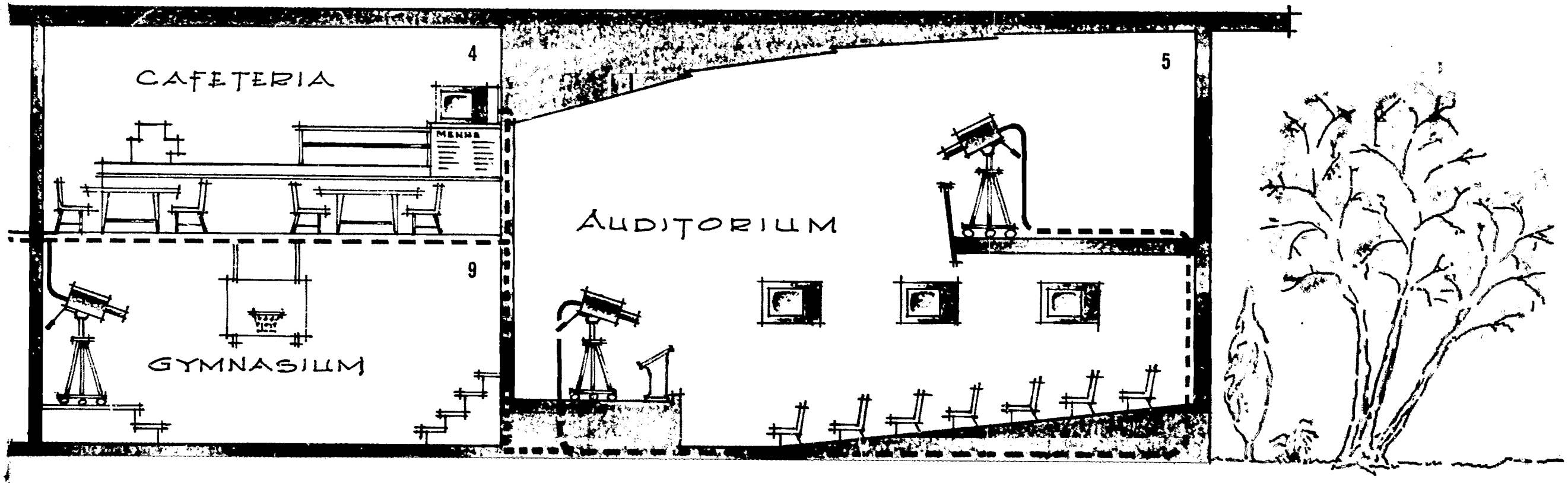
Hardware, connectors, cable

(**Lighting System** as required)
(**Over-the-air transmission system** as specified)

THE COMPLETE ETV INSTALLATION

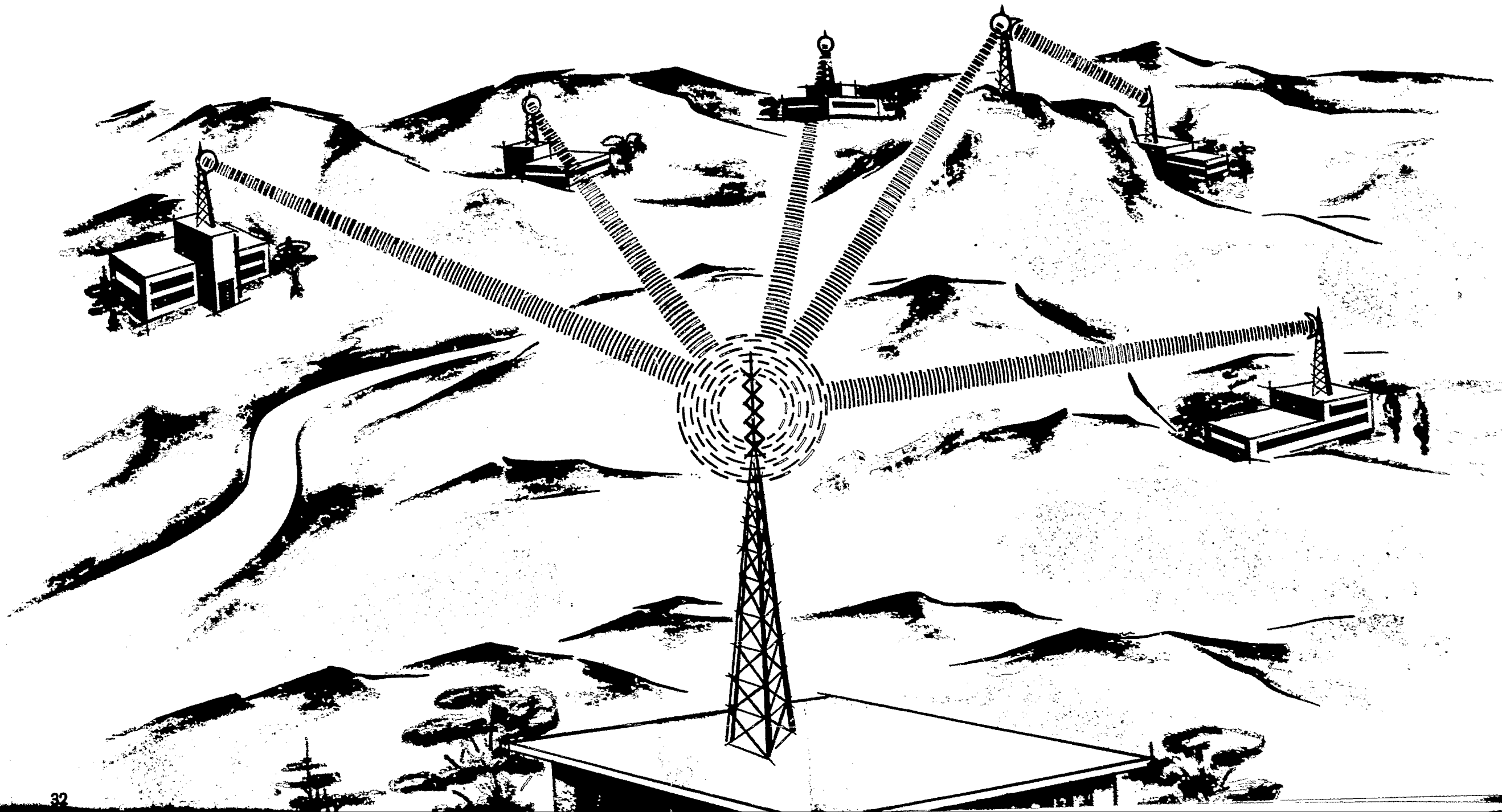


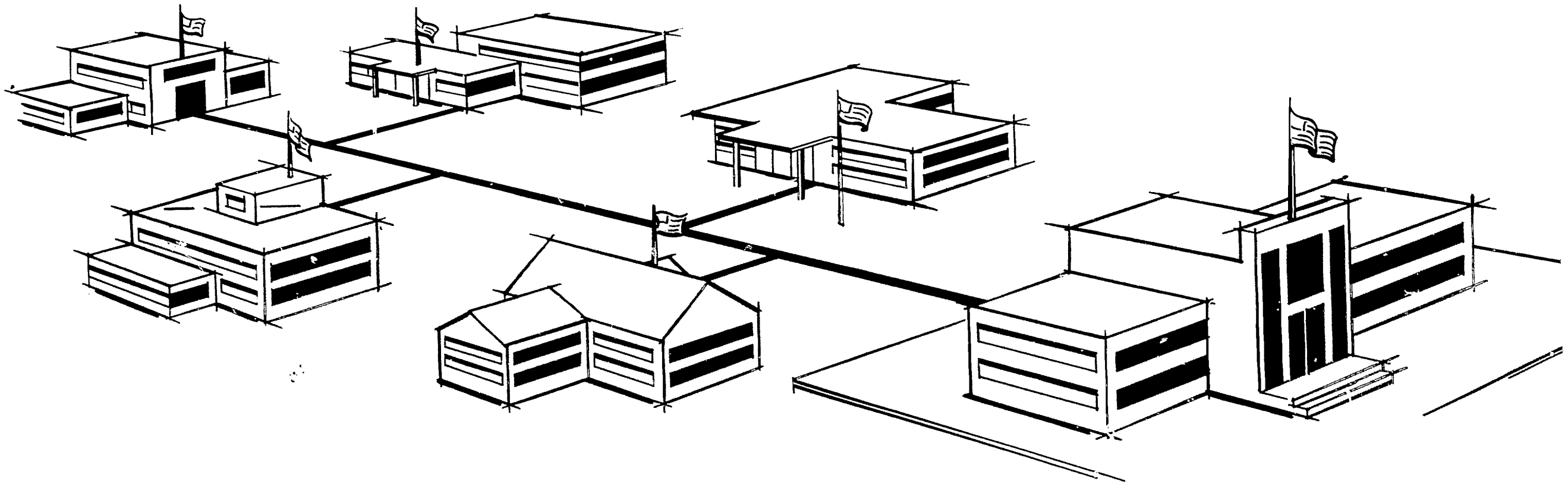
Here are the various elements of an educational television system brought together within a single school building. From the main studio and control center (1), every form of broadcast and closed circuit television can be distributed over the master distribution cable to every classroom (2) plus a number of other special receiving areas such as the cafeteria (4). With the closed loop master distribution system, a camera can be plugged into the principal's office (7), the conference room (3), the machine shop (8) or gymnasium (9) and transmit throughout the school. The main auditorium (5) is also equipped for program origination, with camera inputs located on both the stage and on the balcony. The laboratory (6) is wired with its own high resolution video system and can also transmit and receive over the school-wide system when no RF channels are in use. Note: the distribution system for such an installation must be the closed loop type, including special two-way wall outlets, proper amplifiers and terminating equipment. Needless to say, the planning and engineering of a system as elaborate as this must be done by competent professional personnel.



SCHOOL-TO-SCHOOL TRANSMISSION

A closed circuit distribution system may be planned not only to service a single building, but a group of buildings on the campus, neighboring school systems, or even to extend throughout an entire state. The signals may be carried either over-the-air via microwave relay, or via coaxial cable installed by and leased from the local telephone company or other common carrier. The choice depends upon a number of factors, such as distance and terrain, both of which determine the relative cost and level of performance.





LOW POWER MICROWAVE

Just as the development of the low cost portable videotape recorder may be expected to give a fresh new impetus to program origination within the school, so may the development of the low power over-the-air transmission system do the same for school-to-school communications.

Strictly speaking, this is a form of microwave transmission, in that each channel is beamed on a direct line of sight from point to point. However, the equipment is considerably less expensive to purchase and maintain, and signals can be easily directed in so many directions from the transmitting facilities that for practical purposes it may be thought of as omni-directional.

The channels allocated by the FCC for this purpose are in the 2500-2690 megacycle range. At the studio, the same VHF signal is generated as in any coaxial cable system. Then it is converted to the allocated "super UHF" channel in the specified range, and sent over the air in as many directions as necessary according to the location of the receiving schools.

Each receiving school is equipped with a simple antenna and frequency converter which sends the signal through its distribution system over any unused UHF or VHF channel.

LEASED COAXIAL CABLE

Whereas the school purchases and maintains its own microwave transmission system and assumes all responsibility for it, the leased coaxial cable system is installed by and remains the responsibility of the telephone company. The cost for a cable system is determined essentially by the mileage requirements and is paid for on a monthly basis over the period of time contracted for, usually ten years.

Obviously, the number of schools to be serviced and the distances involved will have much to do with determining which of these two alternative systems would be more feasible from a cost standpoint. Besides not requiring an initial capital outlay, the leased cable system also relieves the school of concern with maintenance, replacement, obsolescence, insurance and the effects of the weather upon the consistency of signal.

CHECKLIST FOR ETV

As you have seen, there is no single "typical" television system for education, but a whole range of possibilities that can meet the various needs encountered in different schools. This checklist may be of help as you consider the kind of television system your school might utilize. As you read through it, check off as many items as you consider applicable.

USES FOR TELEVISION IN THE CURRICULUM:

- ☐ Electronic enlargement
- ☐ Direct instruction
  Courses: .....
  .....
  .....
- ☐ Enrichment
  Courses: .....
  .....
  .....
- ☐ Team teaching
- ☐ New courses to be added through NET or other sources
- ☐ In-service teacher education

SYSTEM TO PROVIDE

- ☐ Close-ups
- ☐ Broadcast reception
- ☐ Live CCTV origination
- ☐ Videotape recording
- ☐ Central distribution of filmed and recorded programs
- ☐ Special sound system (e.g., for music appreciation)

TYPE OF TRANSMISSION

- ☐ RF only
- ☐ RF and Video ☐ Video only
  - ☐ 400-line resolution ☐
  - ☐ 600-line resolution ☐
  - ☐ 800-line resolution ☐

POINTS OF

ORIGINATION	RECEPTION	
☐	☐	Studio
☐	☐	Auditorium
☐	☐	Conference room (e.g. Board of Ed.)
☐	☐	Gymnasium
☐	☐	Superintendent's office
☐	☐	Special rooms (lab, machine shop, etc.)
☐	☐	Stadium
.....	.....	Small classrooms (number)
.....	.....	Large classrooms (number)
.....	.....	Other

SPACE TO BE PROVIDED FOR

- ☐ Studio
  - ☐ Separate control room
  - ☐ Separate film chain room
- ☐ Graphic arts
- ☐ Storage and maintenance
- ☐ Offices (number.....)
- ☐ Rehearsal

DISTRIBUTION

- ☐ School-wide master antenna system with amplification
  - ☐ Single band
  - ☐ Broad band
- ☐ Limited system, no amplification
- ☐ Single building
- ☐ Multiple buildings

PERSONNEL REQUIRED

- ☐ Teacher(s)
- ☐ Cameraman
- ☐ Graphic artist and photographer
- ☐ Technician
- ☐ Subject matter consultants
- ☐ Producer-director(s)
- ☐ Administrative director

QUESTIONS YOU MAY WISH TO ASK: