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AUGUST 1954/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

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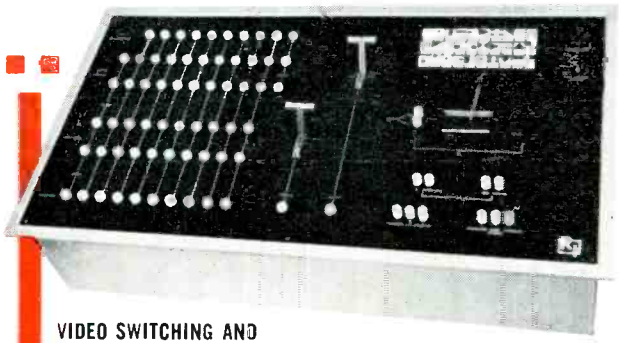
No matter where you start with Riker equipment, the unique modular structure guarantees that your studio will never be obsolete. This flexibility for expansion and ease of service is part of every product or system that we make.

New Invisible Video Switching "Systems": SMPTE Signal Generators; VITEAC Signal Generators; color and monochrome stabilizing amplifiers; black and white reference generators.

Call or write us. Our experienced staff wants to discuss your requirements with you . . . or forward equipment on consignment for any test you care to make.



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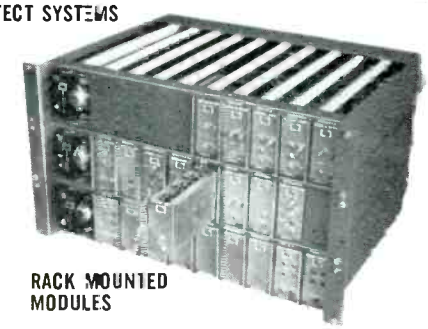

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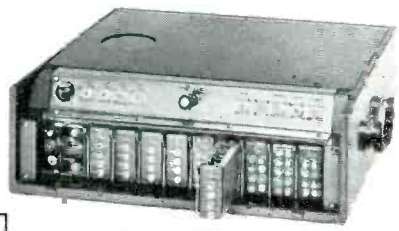

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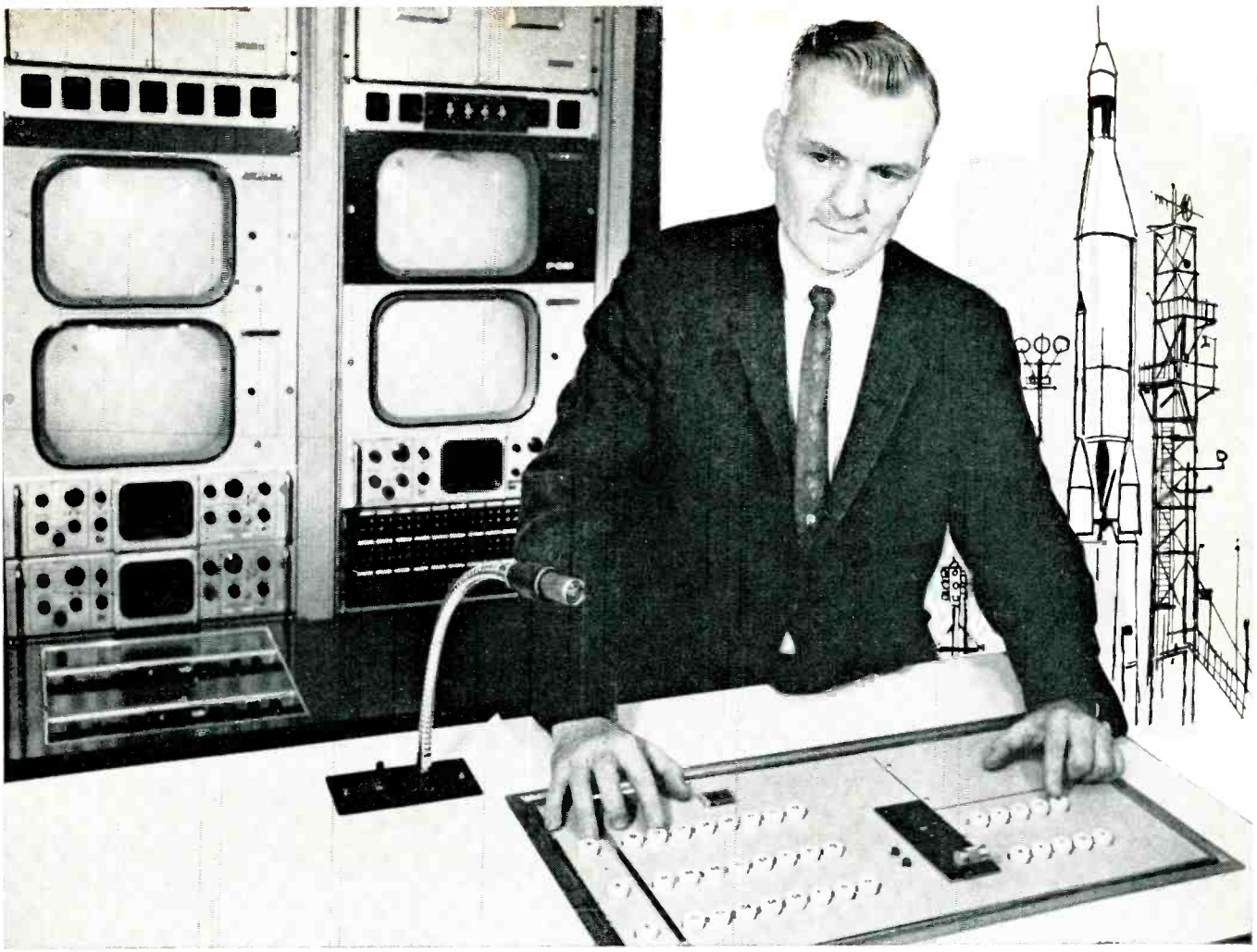

Logos Relies on Tarzian Switcher For Cape Kennedy Launch Coverage

When the Logos, Ltd. mobile unit feeds Cape Kennedy launch pick-ups to the nets, a Tarzian solid state vertical interval switcher handles the complex switching chores.

Logos, color TV consultant to NASA, enjoys an outstanding reputation for color video productions and color tape to film transfers. Credit for building and maintaining this reputation goes to a collection of highly skilled technical personnel working with the finest television broadcast equipment obtainable.

Charles Riley, Logos Vice President, says, "Our color requirements demand unusual reliability—especially with the mobile unit in remote areas where ruggedness and light weight become critical factors. With this kind of treatment and use it's nice to know we can always depend on our Tarzian VIS-88 switcher. Transmission characteristics are consistently tops. We've found virtually no degradation in differential phase . . . differential gain . . . or frequency response. Frankly, it's the best TV switcher we've ever used."

Let us demonstrate how easy it can be for you to enjoy this kind of superior switching performance. Call or write for full details, and ask for our brochure on the complete line of Tarzian solid state television broadcast equipment.

SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION BLOOMINGTON, INDIANA

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WOULD YOU INVEST $665 TO DOUBLE YOUR EFFECTIVE PROGRAM POWER?

New VOLUMAX™ Automatic Peak Controller From CBS Laboratories Outmodes Limiters

Expanded effective range, more reliable reception in fringe areas – both can add to your station's audience and both can be achieved by simply replacing your present peak limiter with a solid-state VOLUMAX.

A new development from CBS Laboratories, VOLUMAX is the successor to peak limiters. Unlike conventional limiters, VOLUMAX does not force you to choose between reducing program level or suffering "pumping" and other audible distortions.

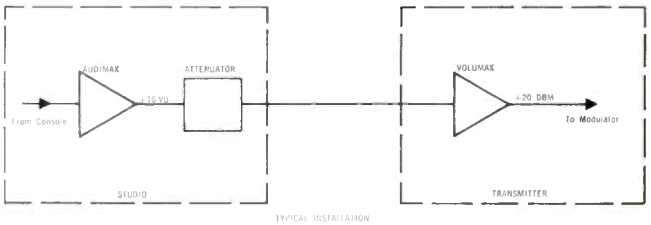
HOW IT WORKS

The secret of VOLUMAX's success is its ability to operate automatically at the most appropriate regulation speed for any program waveform.

After limiting a severe peak, conventional limiters use a long recovery time to minimize audible "pumping". Valuable modulation capability is wasted while the unit recovers from reduced gain.

VOLUMAX works in a completely different manner. Operating with dual regulation speeds, VOLUMAX analyzes the waveform and provides either microsecond or millisecond action.

The net effect is that your effective radiated program level can be doubled.



TYPICAL INSTALLATION

AUDIMAX + VOLUMAX = 8-to-1 INCREASE

When VOLUMAX is used in conjunction with CBS Laboratories AUDIMAX automatic level control, the combination permits an astounding 8-to-1 increase in effective program power. The AUDIMAX "rides gain" in the studio to provide a 4-to-1 increase. Then VOLUMAX controls modulation peaks at the transmitter to provide an additional 2-to-1 improvement.

TRY IT YOURSELF AT NO COST

Order a VOLUMAX and install it. Don't pay our invoice for 30 days; then send us your check or return the VOLUMAX.

Or, if you're still a bit skeptical, we'll be happy to send you more complete details on which to base your decision to order a VOLUMAX.

. . . Quality Products for Professional Broadcasters

CBS LABORATORIES
Stamford, Connecticut
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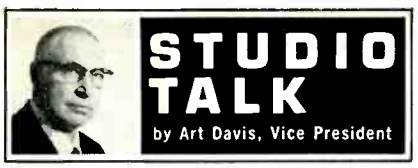


Audio Controls Division
Altec Lansing Corporation

SUPERIOR NEW INSTRUMENT SWITCHES AND ATTENUATORS

It's no longer a secret that our Audio Controls Division at Altec is well on the way to producing what we feel will be the best instrument switches and attenuators ever made specifically for the recording and broadcast industries. Without wishing to detract from my own three decades as a design engineer and manufacturer in this field, nor from the superb facilities available to me at Altec, I must admit that much of the credit goes to the fact that we are starting from scratch on all of our designs. Frankly, this is an engineer's dream—no preconceived ideas, no old designs that have to be adapted, no existing tooling that has to be used. Our only concern is the here and now, and how can we make it better.

LOW NOISE, LOW MAINTENANCE, LONG LIFE

Looks like our switches and attenuators will give you the best set of performance specifications ever available. Here are a few of the things we've done to achieve this superiority: Each brush blade is independently sprung to provide contact all the time. We predict a total absence of contact bounce. The brush springs are completely out of the circuit and will carry no current. Our brushes are made of fine silver ("coin" silver, normally used, contains copper and is subject to oxidation which reduces conductivity and raises noise level among other things). The fine silver does not oxidize—it sulfides. This has two advantages: conductivity is not affected and sulphide of silver has a lubricative quality which is actually beneficial.

MORE INNOVATIONS

As you know, most switches come in round cans. We're putting ours in square ones. You don't have any use for the space around the can anyway so we're using the corners for the wiring. The result is that our switches will give you more positions in less space. For example, most switches have 12 positions at the most. Ours have 31 positions on a 1½" switch and up to 45 positions on the 2¼" one.

To cap the whole thing off, we'll be able to gang up to 8 of our attenuators in tandem so you can operate the whole works with just one control.

NEW SOLID STATE 470A PREAMP NEARLY READY

We announced this device in our last "Studio Talk." It's the one you can use as a preamp or as a line, booster, or program amp with no internal changes needed. By the way, the 470A has a lower noise level than any vacuum tube unit on the market.

And by the time you read this, our 61A Program Equalizer and 62A Graphic Equalizer will be in full production. So give me a call or drop me a line. I'll be happy to send you the latest information on what's here now and what's coming soon.

Art Davis

Audio Controls Division • Altec Lansing Corporation • Anaheim, California

LETTERS
to the editor

DEAR EDITOR:

With considerable interest I've read the Engineer's Exchange item on monitors as well as CE Mackey's and CE Hackney's comments in April "Letters To the Editor." It seems strange to me that, with all the various makes of frequency and modulation monitors now in use, one does not see basic articles concerning the trials and troubles of same!

I can cite two cases concerning frequency monitors that may point up the situation. One monitor was quite well known to me for I had been CE at the station for ten years; a recent visit to same indicated that the monitor was reading 10 and 12 cycles deviation. Had I been a total stranger to this monitor I might have questioned the excessive deviation, but in this case I knew better from past experience. The transmitter in question rarely commenced operation any lower than minus three cycles, reached zero about midday, and climbed to two or three cycles plus by sign off. It had been doing this for ten years! Inspection showed that external measurements were normal, that is, plus or minus two or three cycles. Yet the monitor read excessive deviation at any time during the broadcast day. Malfunction of an oven thermostat caused improper heating of the crystal chamber; in fact, there were times when one could not read the inner oven temperature on the thermometer.

In another case the external measuring source telephoned me to say the deviation was some 44 cycles low! At a time like this one might wish for a "panic button" or several sticks of dynamite to correct the problem forever! Actually many things could have been wrong or defective in this case, but after much checking, testing, and swearing, the trouble was located.

It was found that the monitor crystal was returned to the factory for repairs, reason unknown. Apparently the crystal was ground for the low side of the carrier frequency, and when repaired and returned it was ground for the high frequency side of the carrier. Suitable factory instructions were included with the crystal for modifications to the monitor to effect proper operation. When the transmitter was adjusted plus the deviation became more negative, and vice versa! Tracking was not possible, and apparently each month when the external measuring report was received the transmitter and/or monitor were adjusted to comply. In this case the effective error at all times ran about four cycles; when the monitor read minus two cycles, actual deviation was something like two cycles plus!

All that was required to correct the trouble was to reverse the meter leads to make the monitor track properly (this was part of the factory instructions). Length of time this situation took place . . . nearly nine years!

In both of the above cases the monitors were of different make and actually only required general preventive, corrective, and perhaps constructive maintenance. For many years I've been keeping a book or log of maintenance work done, to be done, or should be done, including actual work completed, components used, and length of time. Prior to keeping a log book of maintenance work, I used to type same on the reverse side of that day's operating log. The new FCC law concerning maintenance logs is a good one provided personnel are truthful and thorough! Interpretation of 73.93 (c) of the rules and regulations, as well as 73.114 (e) can be taken at least two ways to my way of thinking—both could be right or wrong; in any event, the FCC would be the final word, right or wrong! Stations with a full time staff in the engineering department should not find these two sections a problem. However, stations that have an engineer on a contract basis would find these sections more to their mode of operation.

Many stations were not monitoring for EBS (revamped Conelrad plan), until a few citations were handed out. Confusion over the dropping of Conelrad and the vague wording of the new EBS rulings caused many stations to merely turn off their receivers. Many fail to conduct a weekly EBS test alert at their own station. Each CE has his own way of doing things, perhaps because they have worked so well for so many years. As Mr. Mackey stated in his letter about not adjusting a transmitter to exact zero deviation, this is plain common sense (or should be); I would rather have a transmitter start a couple cycles below and finish a couple cycles high at sign off. This does not apply to all transmitters—some are quite stable, while others drift a few cycles—this is one of the many projects each CE has to solve for himself.

Maintenance should be the prime concern of the CE, management, and owner. However, this is not the case today; expenses must be held to a minimum, especially in the engineering department, so maintenance suffers! The only advice one could give at this point is to be very disappointed, but not to get discouraged!

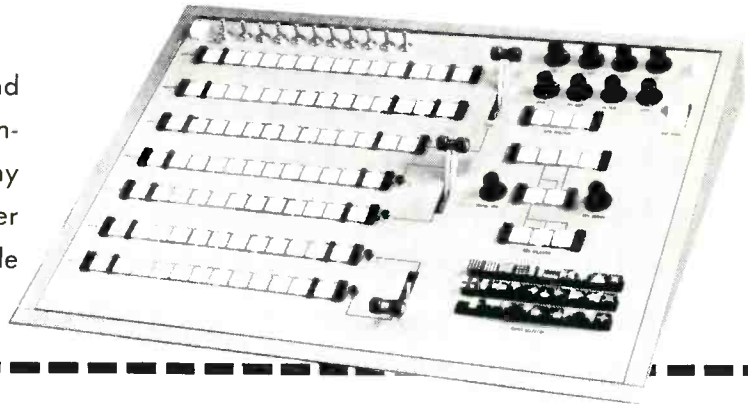
LAWRENCE L. PRADO, JR.
Chief Engineer, WWNH,
Rochester, N. H.

Your comments are very much to the point, Chief Prado, and serve to illustrate the necessity for developing and implementing a good program of preventative maintenance procedures. The subtle and accumulative deterioration to which all components are subject makes such a program advisable not only to keep all equipment operating within the tolerances demanded by FCC Rules and Regulations, but to keep the maintenance staff free from the constantly recurring breakdowns caused by component deterioration. Little things caught in time can usually prevent bigger headaches at a later date.

Readers may wish to let us know what approach to preventative maintenance is being used for their station equipment. —Ed. ▲

CDL SOLID-STATE VERTICAL INTERVAL SWITCHING SYSTEMS

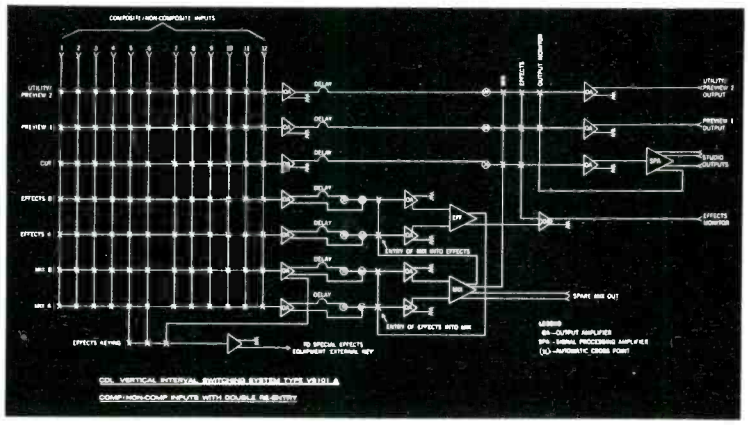
Designed for highest monochrome and color performance. Modular, plug-in construction provides flexibility for meeting any switching requirement in Studio, Master Control and Remote application . . . while facilitating future expansion.



CDL Switchers can be supplied for mixing, fading, dissolving and wipes . . . *between composite and non-composite signals.* This is significant, since there is no need now to distinguish between composite and non-composite signals when setting up program feeds, and all signals become generally interchangeable in the station. A solid state Switcher Processing Amplifier, in the output of the program bus, sets proper levels for sync, set-up, white clip, and gain. For convenience, controls for these levels can be installed on the control panel. Facilities can be provided to fade any signal on the direct take bus to black, either manually or automatically, and fade up to the next signal.

Color compensated double re-entry switching (mix into effects/effects into mix) can also be provided. Switching time is 1 microsecond, with switching occurring during the vertical interval. Loss of sync causes the switcher to revert to random 1 microsecond switching, without transients.

CDL Switchers have been selected by outstanding telecasters, including: WGBH-TV, Boston; American University, Washington, D. C.; and also supplied to CBC, Canada.



Guaranteed Performance for Both Color and Monochrome

Frequency Response	± 0.1 db to 6 mc or better ± 0.5 db to 10 mc or better
Gain	Adjustable ± 1 db
Differential Phase	Less than 0.2° per bus (10-90% APL)
Differential Gain	Less than 0.1 db per bus (10-90% APL)
Signal to Noise Ratio	Greater than 60 db
Input Impedance	75 ohms ± 1% DC to 5 mc
Output Impedance	75 ohms ± 2% DC to 5 mc
Crosstalk	Better than —55 db at 3.58 mc for all inputs and outputs simultaneously energized, except the channel under test
Switching time	Less than 1 microsecond

OTHER CDL SOLID STATE PRODUCTS:

Computer Programmed Video/Audio Switching Systems • Video Crossbar Relay Switching Systems • Video & Pulse Distribution Amplifiers • Mixing Amplifiers • Sync Adding Video Distribution Amplifiers • Switcher Processing Amplifiers

Write for complete information and specifications

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EIMAC power tetrodes have 22,000 μmhos transconductance

Eimac's new 4CX350A and 4CX350F radial beam power tetrodes have twice the transconductance of their 4CX250B predecessor — 22,000 μmhos. This excellent figure, with resultant higher gain, can eliminate an amplifier stage in practical circuit design. The 4CX350 series tetrodes are designed for linear drive applications. They have the same rugged ceramic-metal construction as the 4CX250 series and use the same socketry and other hardware. Their Figure of Merit, an important criterion of rf performance, is significantly higher. Ideal for new circuit design. Write for more details.

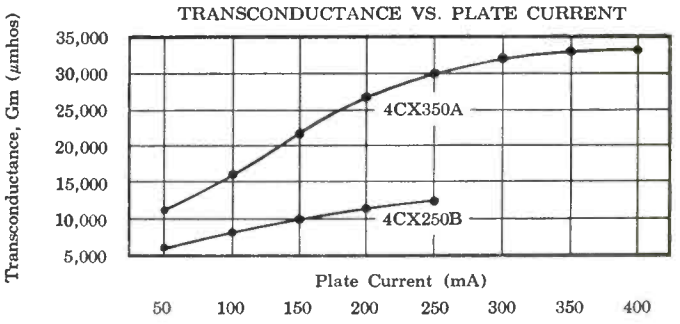
EITEL-McCULLOUGH, INC., San Carlos, Calif.
In Europe, contact Eitel-McCullough, S.A., Geneva, Switz.

COMPARATIVE RATINGS

Max. Ratings—Class AB Service	4CX250B	4CX350A
dc Plate Voltage	2000	2000
dc Screen Voltage	400	400
dc Plate Current	250 mA	300 mA*
Plate Dissipation	250 w	350 w
Screen Dissipation	12 w	8 w
Grid Dissipation	2 w	—
Capacitances (Grounded Cathode, Average)		
Input Capacitance (Grounded Cathode, Average)	15.7 μμf	24.0 μμf
Output Capacitance (Grounded Cathode, Average)	4.5 μμf	5.5 μμf
Mutual Transconductance (Eb=2000, Eg2=300, Ib=200mA)	12,000 μmhos	26,700 μmhos
Amplification Factor (Grid Screen)	5	13
Figure of Merit†	95	144

†Figure of Merit $= \frac{Gm}{2\pi Ct}$ where $Ct = Ci + Co$ and Gm = Mutual Transconductance

*In class A Service, this value may be raised to 400mA.



At Wescon Booths 2000 - 2002 Sports Arena
Circle Item 7 on Tech Data Card

Some plain talk from Eastman Kodak about tape:

base characteristics, surface smoothness and sound brilliance.

Kodak TRADEMARK

Visualize a roll of sandpaper ¼-inch wide. Now thread it into your tape recorder and run it awhile. Devastating thought? Sure is. Some poorly made tapes seem just about like that. Here's the story: Iron oxide is actually harder than many types of sand. And each particle of this destructively hard material can exert thousands of pounds of pressure, cutting a recorder head brutally. Luckily, that sort of thing can't happen here.

And for two good reasons. The first is our "R-type" binder. This resinous material has a number of unique advantages. It covers each particle of iron oxide thoroughly. It can be critically controlled, and coated to a glass-like smoothness. No other binder can be handled like our "R-type" binder. This means that Eastman tape gives you a smoother, more friction-free surface to begin with.

We take this super-smooth surface and to make certain that your recorder heads will get tender treatment, we take the extra precaution of lubricating the entire thickness of the binder.

A lubricant must lubricate, but not too well.

Here are the requirements. Tape must slip over heads (and pressure pads if your recorder has them), but there must be no slippage at all over the capstan, otherwise constant speed will suffer. The ideal lubricant has a combination of characteristics that allows it to glide friction-free (relatively, of course) in certain places and hold fast and not slip at all in others. Designing lubricants that give this sort of performance is difficult. After a few thousand tries, we hit it and got some big rewards in terms of performance.

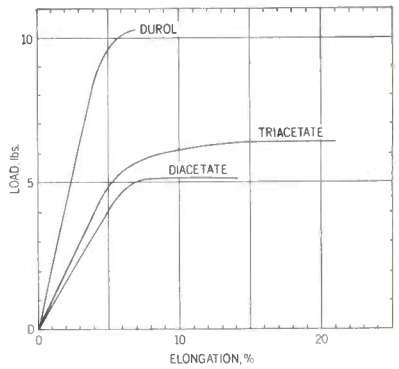
For example: The length of tape from idler to capstan, is not just in forward motion. It is in longitudinal vibration as well. About 3000 CPS in some recorders, maybe 5000 or 6000 CPS in others. This acts as a sort of mechanical AC ripple superimposed on the DC motion of the tape, if we may be allowed an electronic metaphor. The result is the generation of sidebands that destroy the timbre of the music. Lubrication does effectively control the generation of these sidebands. Trouble with sidebands is that they peak way up. Lubrication also suppresses the peaks while reducing friction.

We incorporate our lubricants into the magnetic coating. And we lubricate the base as well. In that way, all bets are covered. You might have noticed from time to time how some tapes smear their lubricants all over your equipment. Because our lubricants are stable, you'll never get that sort of "gunking" from an Eastman tape.

A dilemma: Polyester or Acetate?

Base materials have their problems too. They must not stretch, or sound distortion will result. They must be strong so that they won't break. But they must be "short" enough to break clean without necking down and losing recorded material. They must be supple enough to be head-clinging but not so floppy they behave like wet spaghetti. Basically, two different materials are used in tape bases. Acetate and polyester. These two materials are so different that they are used for entirely different applications and do give us sufficient versatility to solve most base problems.

Polyester is a really tough material. It is a first choice when it comes to superior strength in thin coatings such as ½ mil materials. Where really long play is needed, polyester is the ticket. Acetate is a different story altogether. Especially our unique type of acetate which we have named Durol. Durol base is outstanding in its yield strength and elasticity characteristics. Under emergency loads it will break clean with virtually no permanent deformation.



The above chart shows what happens when you simulate tough rewind conditions. Tape was put under sudden stress until it snapped. The end of the curve is the breaking point. Note that the Durol base samples proved out 40% stronger than the conventional acetates. How much permanent stretch remains after breaking is known as residual elongation. With Durol base tape this is less than 2%, while conventional acetates average 8-10%. This means that Durol base tapes can be spliced with virtually no loss in recorded material. Next time let's dig a bit further into general tape technology and a few of the parameter considerations.

Choose EASTMAN Sound Recording Tape, Type A303, for all general-purpose applications. Choose Type A304 wherever high output characteristics are called for. For long-play applications choose new Type P105—so thin you get 3600 feet on a 7-inch reel! EASTMAN Sound Recording Tapes are available at your local electronic dealer's and other tape outlets.

EASTMAN KODAK COMPANY, Rochester, N.Y.

Circle Item 8 on Tech Data Card

REMOTE POWER FROM THERMOELECTRIC GENERATORS

by Allen B. Smith —A preliminary report on the state-of-the-art of direct power generation using semimetals.

Less than three years ago the White House and the Atomic Energy Commission jointly announced the successful placement in orbit of the TRANSIT IV-A satellite containing a five-pound atomic-powered generator capable of delivering in excess of 5 watts of electrical power. Subsequently, in July of 1962, the AEC reported that the generator (known as SNAP III) had completed more than 6000 orbits and had produced more than 23 kwh of electrical energy to power the satellite's transmitters. At that time practical applications for similar generators seemed rather obscure, but recent advances in thermoelectric power generation have eliminated most of the initial drawbacks of the system. These advances were made following the development of more efficient thermocouples using semimetals which could be easily combined into larger thermopiles.

Basic Thermoelectric Theory

The building block of all modern thermoelectric devices is the semimetal thermocouple which consists of a P-type conducting element and an N-type conducting element connected electrically in series and thermally in parallel. While the thermoelectric cycle may be used to generate electricity from heat or to transfer heat from one point to another by means of an electric current, our immediate concern is with the first effect, and all comment will relate to generation only.

The basic thermocouple illustrated in Fig. 1 may be viewed as a thermodynamic heat engine in which the working fluid is a gas of charged particles composed of the holes or of the electrons contained within the P and N element materials. Heat is absorbed by the semimetals at the hot junction, causing the negatively charged electrons to flow down the temperature gradient in the N element; in the P element, the positively-charged **holes** flow down the temperature gradient. A potential difference equal to the sum of the Seebeck voltages generated in each element is thus created across the cold junction. Completing the circuit through the load resistance R causes current to flow, and power is delivered to the load. The balance of the heat energy absorbed must be dissipated at the cold junction.

All modern thermoelectric generators, whether their power output is nominally low as in the early SNAP III or on the order of hundreds of watts, are composed of many individual couples such as that just described. Before we examine the present state-of-the-art in generators, however, let's take a brief look at some of the historical background of thermoelectricity.

Early Thermoelectric Elements

Development of present-day thermoelectric generators rests upon well-established concepts, several of which are older than the field of electronics itself. In 1822, for example, a German physicist named Thomas J. Seebeck discovered that when the junction of two dissimilar conductors was heated, a potential was developed across the open ends. In modern thermoelectric terminology this potential build-up is referred to as the Seebeck effect.

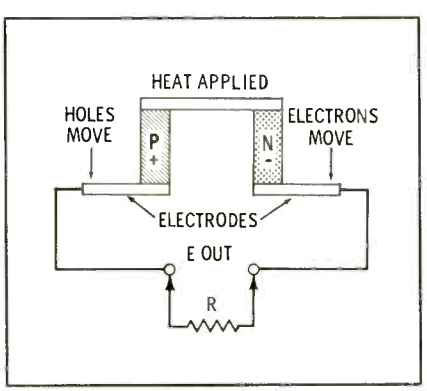


Fig. 1. Basic schematic of thermocouple.

Further, in 1834, a French watchmaker, Jean Peltier, published a paper describing an experiment in which the application of current of one polarity through the junction of two dissimilar conductors cooled that junction, while current of the opposite polarity heated it. This basic heat-pump principle is still known as the Peltier effect.

In the mid-1860's, Lord Kelvin rediscovered Seebeck's experiments, proved them by the application of thermodynamic theory, and established their relationship to Peltier's earlier observations.

Independent of other interest in thermoelectric generation in the early 1900's, Dr. Sebastian Karrer, as Director of Research for the Baltimore Gas and Electric Co., developed several bimetallic thermocouples which were used to control gas valves. Because of the low efficiency of these early couples, Dr. Karrer became interested in the development of thermoelectric materials with greater figures of merit in terms of output voltage. The first lead-telluride couples were constructed under his direction and were later used in the first semiconductor device to be used for gas-control valves, which was developed by a research group headed by Dr. R. W. Fritts.

When the military began its quest for silent self-powered sources of electricity in 1956 and 1957,

most of the engineers assigned to the project were unaware that there existed a theromelectric industry that produced several millions of dollars worth of thermoelectric couples annually. These couples produced voltages which ranged from 25 mv in the case of bimetallic units to as much as 200 mv for the later semimetal (lead telluride) units.

Upon first consideration voltages of this magnitude seem unimpressive, but the value of the work done by the gas-controls industry becomes more significant when one realizes that a large thermopile consists merely of many such couples assembled into a single complex. Had much basic research not been done on lead-telluride elements by that industry, it is doubtful that successful generators would have become available so soon.

The first SNAP III generator was produced in 1959 by Minnesota Mining and Manufacturing Co. under the direction of the Martin Co., prime contractors for Systems for Nuclear Auxiliary Power. Designed as a proof-of-principle device, SNAP III utilized a capsule of Polonium 210 as its heat source. With a half-life of 138 days, this fuel cell provided sufficient thermal activity to heat the thermopile to the required 1100° F. temperature. Each of the 27 individual couples produced 190 mv to give an output of 2.8 volts DC under full load.

In 1961 the United States Navy Bureau of Ships took delivery of a self-contained generator comprising 278 series-connected lead-telluride thermocouples which delivered 260 watts—27.1 volts DC at 9.6 amps. Called MANPACK, the generator weighed less than 40 lb, including its burner and self-contained air-cooling system, and had an overall efficiency of almost 2.5%. With an electrical heat source, the efficiency figure rose to nearly 7%.

Several other experimental self-powered generators were produced to evaluate various aspects of assembling couples into functioning units. Most of these were similar to the MANPACK, differing primarily in the arrangement of the couples. In one 180-watt unit, the P and N semimetal elements were interconnected with electrode members in a manner that allowed automated fabrication to produce low-cost components of higher-power

Fig. 2. CCTV camera with TE generator.

capability.

Since the early 1950's, when the development of thermoelectric generators separated from that of single couples, new materials and concepts have accelerated development of compact units that offer increased power output and portability. Additionally, operating costs have dropped drastically giving further impetus to a closer examination of this method of power generation for remote installations.

Thermoelectric Economics

Commercially-available TE generators are being used in various applications in which they provide savings in operating and maintenance costs compared to either of the other commonly used methods of remote power generation, i.e., batteries or engine-driven generating plants. A U. S. Forest Service radio relay on Black Butte, near Bend, Oregon, for example, has been operating successfully since the summer of 1962 from power supplied by a thermoelectric generator.

Fig. 3. Microwave link using TE power.

As a result, the use of propane-fired TE generators to power radio communications equipment in remote locations is declared "technically and economically feasible" in a Forest Service report on the project. Fuel costs averaged nearly one-tenth the cost of operating the same equipment from dry batteries during the previous year. Propane for the generating system cost an average of five cents per day while operation with primary cells had cost almost fifty cents per day.

Presently available gas-fired generators sell for between $20 and $40 per watt of output. While future developments and manufacturing economies may drop the figure as low as $1 per watt, even now the cost of thermoelectric power is less than $1 per kwh, including fuel and nominal five-year equipment amortization. This is approximately one-tenth the cost of similar quantities of power from primary cells. The high cost of feeder power lines makes TE generators generally competitive for installations requiring less than 100 watts of continuous power which are located more than a mile from main power lines.

In situations where maintenance of the engines of engine-driven generators is difficult, or where extreme temperature variations present fuel-tank condensation problems, TE generators provide distinct advantages. While the initial cost per kwh is relatively low for engine-driven units of comparable capacity, reliability demands generally dictate frequent maintenance and trouble calls. For remote applications, therefore, these ancillary costs often make the use of TE generators more feasible. Trouble-free expectancy of TE units is on the order of five-to-ten years with little or no maintenance except for refueling the burners.

Typical Applications

Increasing use of low-drain solid-state circuits in transceivers and other communications equipment for both mobile and fixed-station installations brings the power demands of these units down to a level that may be easily accommodated by currently available TE generators. Short-haul microwave links with similar transistorized characteristics may also be considered

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A CUSTOM DESIGNED MOBILE TV UNIT

by Otis Freeman, Vice President in Charge of Engineering, WPIX, New York City—Design of a completely self-contained TV outside production vehicle.

WPIX acquired its first mobile truck in 1948, when television was new and program pickup techniques were not nearly as advanced as they are today. The vehicle accommodated only a minimum of equipment (it could hold only two cameras), was not air conditioned, and had almost no working facilities for the director. When this unit could no longer meet the needs of the station, we decided that a completely new van was required, one designed around what had been learned about location broadcasting over the years and which would incorporate all of the operating conveniences necessary for a successful modern television pickup. A survey showed that such a truck could not be purchased from stock. There was no alternative but to have a new mobile vehicle custom built to WPIX specifications.

Basic Chassis

It was decided that the new mobile unit must have a clean, smooth-lined, eye-catching appearance that would serve as an advertisement for the station. Since this requirement could not be met by a conventional cab-behind-engine chassis, we chose a cab-over-engine chassis even though the custom-built front and windshield portions added to the cost.

The chassis selected to accommodate the proposed working space and equipment weight was an International Harvester Model 1843FCA Forward Control Chassis with 164" wheel base (Fig. 1). The engine is an International Harvester RD 406 six-cylinder, 175-brake-horsepower plant, which the manufacturer specified would drive the loaded vehicle at a maximum speed of 68 mph at an engine speed of 2600 rpm.

The chassis was equipped with accessories for in-city traffic, parking, and maneuvering as well as high-speed highway travel. Included were: power steering, heavy-duty shock absorbers, heavy-duty alternator and batteries, five-speed transmission, two-speed rear axle, and oversize brakes.

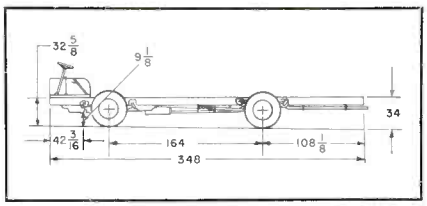

Fig. 1. Chassis before body construction.

An approximate layout of the planned equipment locations was made to determine the weights on the front and rear axles. A moment diagram and calculations proved the load on the rear axle to be well within the manufacturer's 18,500-pound specification.

Custom Body

The van design and styling resulted from the combined efforts of WPIX draftsmen and the Wooster, Ohio, based Gerstenslager Company, who did the actual construction work.

For rigidity and noise reduction, the body is constructed of sheet steel laminated to plywood panels. We felt that steel could be welded or otherwise repaired more easily than other metals, in case of an accident. The steel-plywood laminated sections are fastened to a framework of oak and metal, a standard construction technique for this type of material. Curved portions of the frame are made from steel and then filled with shaped wood for rigidity.

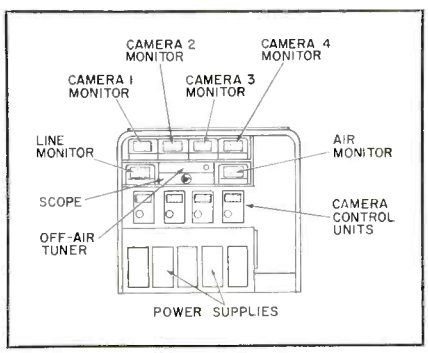

Fig. 2. Television camera monitor panel.

Equipment and Operating Area

Since the purpose of the truck is to transport technical equipment to televise events away from a fixed studio location, it must carry everything needed for any remote program. Lights, cameras, microphones, amplifiers, and a microwave transmission system are necessary. All of this equipment must be housed and secured so that it can ride at high speeds over all kinds of roads and survive sudden stops without damage to delicate parts and tubes.

The television monitors and control units are arranged across the interior directly behind the cab, facing the rear of the truck in what amounts to a picture-viewing panel (Fig. 2). A folding door screens out light that enters through the windshield.

The camera-control units rest on an operating table above the camera power supplies. A 14" monitor for each camera is located above the camera-control units. For the viewing convenience of the technical and program directors, the camera monitors are placed high enough that they can be seen over the heads of the video operators. An off-the-air tuner for cuing, to see the preceding program, and to view film or videotape commercial cutins during a remote program is also located in the panel.

The program director, the technical director, and an audio man operate at a table directly to the rear of the camera-control position. These men are seated in a row—

the program director at a table-like space and the technical director and the audio man in front of their control equipment (Fig. 3).

If a producer or assistant director needs desk space, a hinged table can be let down from the wall. This blocks an aisle but does provide temporary working space. With the table let down, the video operators have access to the truck through the front and side doors, and the audio man, director, and technical director have access through the rear door.

Storage Facilities

The camera power supplies, located at the operating position in a closed, specially ventilated compartment beneath the camera-control units, are locked down in shock-mount trays. They can be unlocked and pulled out for maintenance. The camera-control units are similarly shock-mounted.

The 14″ viewing monitors are securely locked down but not shock-mounted. Heavy components such as the can-type electrolytics stand straight up above the horizontal chassis, rather than projecting horizontally from a vertical chassis. They are not likely to break or come loose.

The video switcher is sunk into the directors' table and can be pulled up for maintenance. The light-weight, transistorized audio mixers are removed to a compartment when the truck is in motion. The synchronizing generators that control the camera scanning are located in a ventilated compartment just to the rear of the audio man (Fig. 4). These units are on tracks and can be pulled out for adjustment or maintenance. Various small compartments built into convenient and accessible spaces inside the truck are used to store spare parts, lenses, headsets, and tubes.

Cameras, camera panning heads, and tripods are located on the right side of the truck (Fig. 5). The panning heads are set in special holders to keep them stationary during transit. The cameras are stored on plywood panels that rest on 1¼″ foam-rubber pads. Positioned between two guide tracks, the cameras are held down by web straps secured to the plywood. Outside doors permit the cameras to be moved in and out of the storage compartments from street level, obviating the need

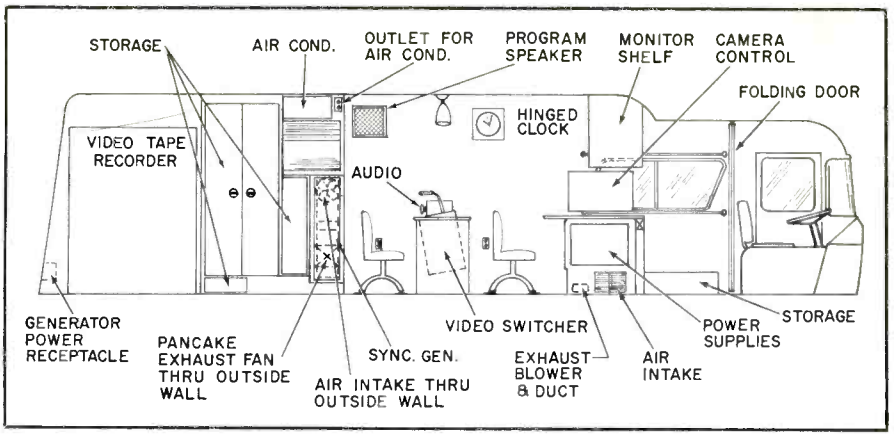

Fig. 3. Interior left side showing storage compartments and operating positions.

to lift these heavy units into and out of the truck.

Some other, larger compartments around the outside skirt of the truck provide storage space for rope, wire, small cables, heavy tools, and lights. For purposes of security, the doors can be opened only by use of a special removable handle.

Through our experience we have found that camera cables can best be handled and transported in figure-eight coils placed flat on the floor at the rear of the truck. During remotes, excess cable is laid on the ground under the truck.

Camera Platform

Since the truck is used at events where crowds of people are present, a means of elevating the television cameras must be provided. To accomplish this, the truck roof was covered by a roof deck of sheet steel known as Tread Plate, which has small ridges to prevent slipping.

The deck is also equipped with sockets for a small portable crane used to hoist the 65-pound cameras to the roof. Other sockets on the deck accept a yoke over which camera and audio cables are hooked for runs across a sidewalk into a building. Cables thus leave the truck over 13′ above the ground, well above the heads of pedestrians.

Access to the truck roof is gained by means of folding steps on one of the back doors and by a ladder attached to the inside of the other door for use when the door is opened flat against the body (Fig. 6). Because the rear of the body is inclined 8°, the weight of a man stepping on the ladder causes the door to press against the truck body, stabilizing the ladder.

The deck is equipped with 14 recessed tie-down rings to help secure cameras and prevent them from being blown over in a strong wind or accidentally knocked down.

The front part of the roof supports a rotating beacon, trumpet horns, and running lights for practical as well as decorative purposes.

Operation in Motion

Very effective and sometimes quite startling scenes can be obtained by shooting while the truck is in motion with cameras on the roof deck. For low-angle moving

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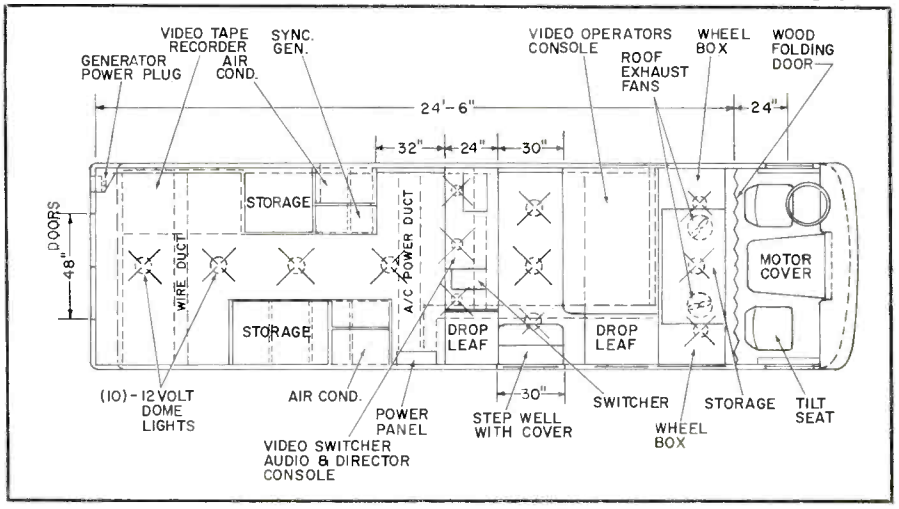

Fig. 4. Interior floor plan showing operating, storage, and equipment locations.

VERTIPOWER—Vertical Polarization in FM Transmission

by James Gabbert, Co-General Manager, KPEN, San Francisco, Calif.—
Investigations into the advantages of eliptical and circular polarization for FM broadcasting.

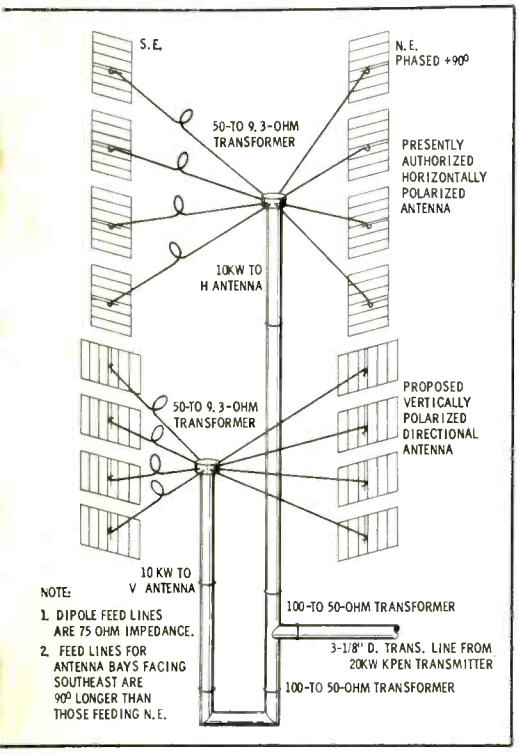

Fig. 1. Diagram of proposed antenna.

Almost two decades ago in November, 1946, the FCC released Public Notices 533 and 534, amending the Standards of Good Engineering Practices of FM Broadcast Stations. The change permits a supplemental vertical component equal to or less than the magnitude of the existing horizontal component, thus providing for either circular or elliptical polarization of FM transmissions. Previously, in early 1946, the United Broadcasting Co. in conjunction with the Antenna Laboratory of the Ohio State University Research Foundation conducted investigations in the use of such a system. A wide array of carefully controlled measurements was conducted to determine the effect of circular polarization on reception in typical homes with indoor antennas. The results indicated that substantial benefits were acquired by both broadcaster and FM listener.

Reviewing the data from this early study reveals that only 48% of the various FM receiving antenna positions tested with a normally plane-polarized signal (horizontal) were satisfactory. With circular polarization the number of indoor orientations that provided adequate reception increased by almost 100%, to a total of 82%.

Since a vast majority of home FM receivers utilize indoor antennas, circular polarization is quite important. In addition, about 90% of the FM and stereo FM receivers in use throughout the United States are packaged consoles or table radios; so far, high-grade components constitute only a small overall percentage. Most table receivers have line cord antennas capacitively coupled to the RF section. In the home, receivers are generally placed on tables or shelves with the line cord draped toward the floor to the electrical outlet. This places the receiving antenna in a vertical plane, not an ideal position for horizontally polarized signals. Unfortunately, poor reception results in many such installations, prejudicing the listener against FM. A similar situation exists with FM consoles which employ a folded dipole tacked to the rear of the cabinet. The set is located where it looks best aesthetically and not where it provides optimum reception. Circular polarization can, on the other hand, allow a greater selection of locations in the home where an FM receiver will fit in the room decor and still provide good reception.

Conditions Prior to Tests

The interest in vertical polarization at KPEN was spurred by stereo FM reception problems in the mountainous San Francisco Bay Area where rough terrain causes phase and multipath distortion of the VHF signal. Multiplexing compounded reception problems since addition of the 38-kc subcarrier increased the susceptibility of the FM signal to phase distortion and audio breakup. In some cases elaborate antenna systems solve the distortion problems, but in others there is no way to regain the coverage which existed prior to multiplex, even though the monophonic listener is affected to a lesser degree than his stereophonic counterpart. It was felt at KPEN that the addition of a supplemental vertical com-

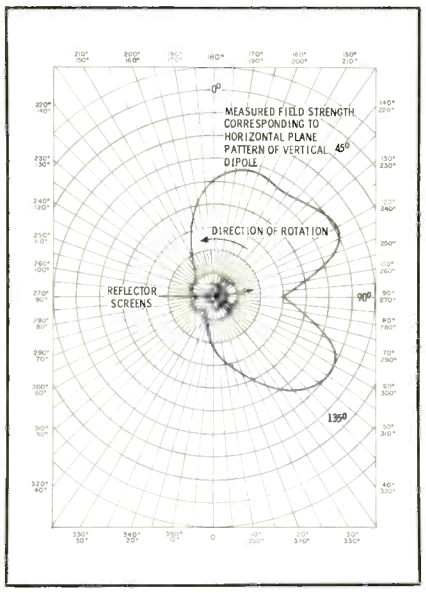

Fig. 2. A horizontal system field pattern.

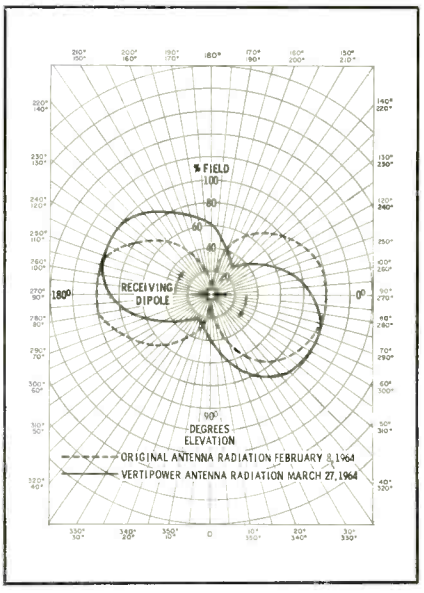

Fig. 3. Graph of radiation components.

ponent would perhaps rectify a few of the phase distortion problems, in addition to providing improved reception to table radios, consoles, FM car radios, and portables. Therefore in November 1963, KPEN applied to the FCC for authority to transmit a vertical component and thus provide elliptical polarization. This application was partially granted in March 1964.

Prior to elliptical polarization, KPEN operated with a directional horizontally polarized antenna, affording an averaged erp of 46 kw. The antenna produced maximum lobes of 120 kw erp over the populous portions of the Bay Area with a null of 1.1 kw toward the Pacific Ocean; a 2° beam tilt was incorporated for maximum penetration of the San Francisco hills. The horizontal-to-vertical radiation ratio of this horizontal antenna was 26 db.

Vertical Antenna Installation

The vertical antenna installed by KPEN is similar to but less directional than the horizontal antenna by design; an application is pending to modify the system to circular polarization with electrically as well as mechanically identical antennas (Fig. 1). The current vertical system does not have the reflector screens and is fed less power than the horizontal system.

Each array consists of two bays of four dipoles, the dipoles fed in phase by individual 75-ohm transmission lines from a 50- to 9.3-ohm impedance transformer. The north bay is 90° out of phase with respect to the south bay in both the vertical and the horizontal systems; reflector rods are installed on the vertical antenna system for electrical isolation from the tower. Fig. 2 is a field pattern of the horizontal antenna—the vertical pattern is currently cardioid in shape with its null coinciding with that of the horizontal system.

The partial grant of our original application to radiate elliptically permits a maximum average erp of 6.2 kw in the vertical plane, substantially less than the 120-kw horizontal signal. It has been the Commission's feeling that the "grandfathered" or supermaximum facilities within the newly created Zone 1 or 1-A should not be permitted to radiate more in the vertical plane than the maximum power allowed under the new rules, Therefore, while the original KPEN vertical application requested 40 kw, only 6.2 was granted. This interpretation would preclude circular polarization for almost all high-powered stations in Chicago, Los Angeles, San Francisco, Detroit, Cleveland, and other major metropolitan areas.

Measurements

When the vertical installation at KPEN was completed, we decided to thoroughly analyze the effects on reception. Of key interest were the changes in phase distortion, multipath in shadowed areas, and overall signal strength. (The signal strength gain is minute.) During initial tests conducted with 6 kw of supplemental vertical power and 120 kw of horizontal power, some definite trends toward signal improvement were noticed. The vertical power for most of the measurements was raised to 12 kw erp and directed along a radial which followed a 78-kw erp lobe from the horizontal antenna.

A comparison of horizontal and vertical radiation components measured in Berkeley, about ten miles from San Francisco, is shown in Table 1. For the measurements to be meaningful, the field strength

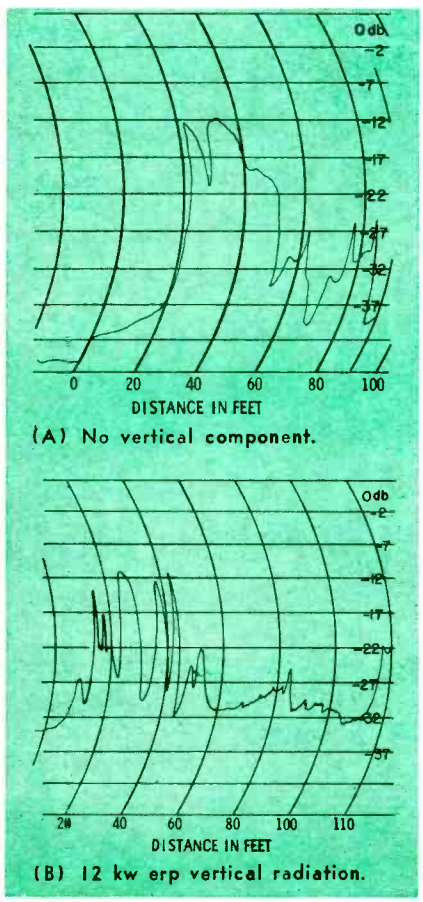

Fig. 4. Graphs of separation vs distance.

was related to radiation received from KNBR-FM, San Francisco, which radiates 45 kw from an RCA Pylon, and theirs is one of the most omni-directional FM radiators ever constructed. At the location in question 100% field from KPEN was found equivalent to an erp of 54 kw. In conducting the test, the receiving dipole was rotated 360° in a plane perpendicular to the direction of KPEN's antenna, field strength being noted for nulls and each 10° of rotation (Fig. 3). The dipole in this test was situated in a good line-of-sight position on the roof of a multistory apartment dwelling. Measurements were also made at other locations with similar results, the change in location causing only a slight change in null tilt.

With the addition of the vertical component an interesting effect is noticed—the pattern rotates with the null shifting its axis. This null was also found to rotate slightly when the test receiving dipole location was changed, but the basic results remained the same. The null depth decreased with the addition of vertical power, thus automatically improving reception at each antenna location. The measurements showed that maximum field strength originally established with the horizontal antenna system could not be exceeded with the addition of a vertical component, but the pattern shape could be changed by varying the phase and power of the transmitted vertical signal with respect to the horizontal signal. Changing these parameters shifts the graph of signal strength (Fig. 3) from a "figure 8" to a circle and an ellipse.

The next set of measurements recorded the change in multipath or phase distortion in **high density** signal areas (Figs. 4, 5, and 6). Multipath, a condition created by reflection of the VHF signal, cannot be measured directly as a quantity—field strength readings do not indicate distortion. We decided to plot separation versus antenna locations for this measurement, since separation is affected by any phase shift or distortion of the original RF signal. To insure against false readings due to transmission error, (L+R) and (L—R) components were constantly observed on an oscilloscope. The receiver was calibrated at the studio for each measurement and realigned each time it

Table 1. A comparison of KPEN Horizontal and Vertical Field Components of Radiotion.

Elevation Angle		Original Antenna			Vertipower Antenna		
		% field	erp	kw	% field	erp	kw
0° - 180°		100	54	....	86	40	....
90° - 270°		12	....	.78	54	15.6	....
95° - 275°	original antenna null	10	....	.54	....	....	....
120° - 300°	Vertipower antenna null	....	....	....	24	3.15	....
30° - 210°		92	46	....	100	54	....

The method of computation was as follows:
(1) 100/Field Strength = Field ratio at given elevation angle.
(2) Field Ratio² = Power Ratio.
(3) 1/ Ratio × 54 kw ERP = ERP at given elevation angle.

was used; chart and tape recorders were connected to the tuner output. Under these conditions, any change in the stereo separation had to be caused by a change in receiving antenna location and conditions. The left channel of the stereo signal was modulated 45% with 400 cps for the tests.

Fig. 4 shows chart recordings of separation made in an open area atop San Francisco's Nob Hill, in front of the KPEN studios; Fig. 4A is without any vertical component. The separation measured at the studio, 39.2 db, was taken as the reference. The receiving antenna was moved 100′ in the horizontal plane to a point at which the field strength was close to a maximum 200 millivolts. Within this 100 foot distance only four positions provided adequate reception: the starting point, 55′, 70′, and 90′. The chart shows the same effect that is experienced by mobile FM listeners; many times at a stop light a car must be moved a few feet in order to maintain reception. This is called the "picket fence" effect and is caused by standing wave patterns of the VHF signal. Bear in mind these measurements were in line-of-sight positions atop a 500′ hill. In terms of reception for the average FM listener, there are few locations where the receiving antenna can be located to receive a clear signal, either monophonic or stereo.

Fig. 4B is a graph of the same procedure with an additional 12 kw of vertical power providing elliptical polarization. Even with a ratio of vertical to horizontal power of only 12/82, or 1:6.8, the improvements are striking. There was such a change in the standing wave pattern that for a distance of 50′ there was now no phase distortion, indicating that a receiving antenna located any place along this line would provide excellent reception.

A terrain profile along the radial from the KPEN transmitter atop Mount San Bruno, typical of those used for the measurements, is shown in Fig. 5. The measurements shown were taken from the crest of the peak at 7.75 miles down to the 8.5 mile point, a drop of almost 400′ in just one mile. The power along this radial is 78 kw horizontal and 12 kw vertical. For these measurements the separation reference was 34.3 db.

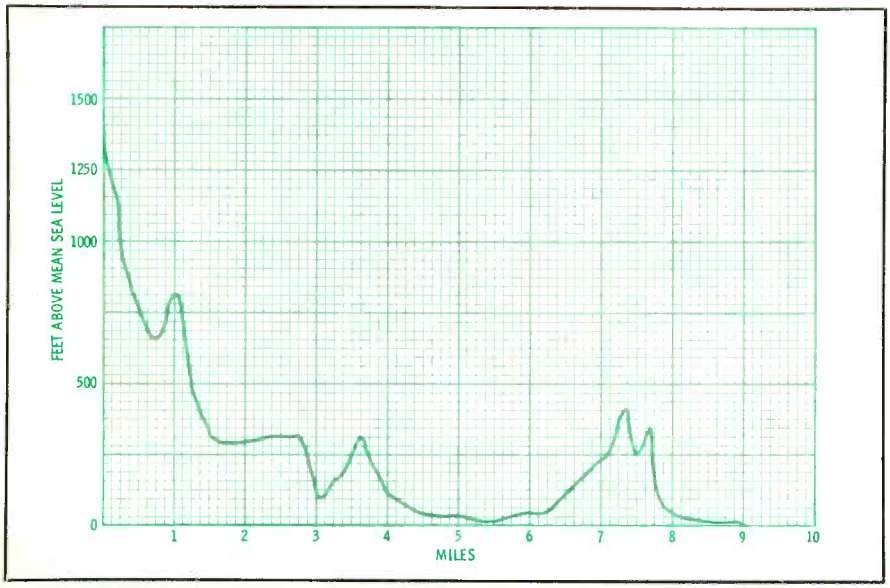

Fig. 5. Terrain profile along the measured radial from transmitter atop Mt. San Bruno.

Residents in this area receive television signals through elaborate antenna systems and CATV. The area could well be classified as a gray or white zone for reception of the FM stations whose antennas are located on the two major San Francisco VHF sites—Mount San Bruno and Mount Sutro. The test receiving antenna was placed atop an automobile which was then driven at a constant velocity of 20 mph. Fig. 6A shows the separation measured without vertical radiation; over the entire distance covered, not one location provided an intelligible signal. The stereo tape recording made simultaneously with the chart monitored variations in separation and the distortion of the modulated channel. Fig. 6B shows the great improvement with the addition of a vertical component—the right-hand third of this graph shows a clean signal over a considerable distance, free from phase distortion and noise.

Planning for Vertical Polarization

From these measurements it is quite clear that greatly improved reception can be provided to the FM listener via vertical polarization —and we strongly encourage its use. However, there are various ways in which the vertical power may be obtained, and some word of caution is due. In many installations of side-mounted FM transmitting antennas the steel tower distorts the radiation pattern. We found that one station with an 8 bay multi-V type horizontally polarized antenna had an almost equal ratio of vertical to horizontal component because of the tower radiating a vertical component. This is not desirable since the power is robbed from the horizontal plane, thus reducing the station's coverage area. Prior to installing a vertical antenna system, the radiated polar plane pattern must be checked. If the vertical component from a horizontal radiator is greater than -20 db, great care must be taken with the phase relationship of the new vertical system to the existing radiation, particularly when the original vertical component is attributable to the tower.

Additional transmitter power will be required for the modified system unless the horizontal antenna gain

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JAMPRO

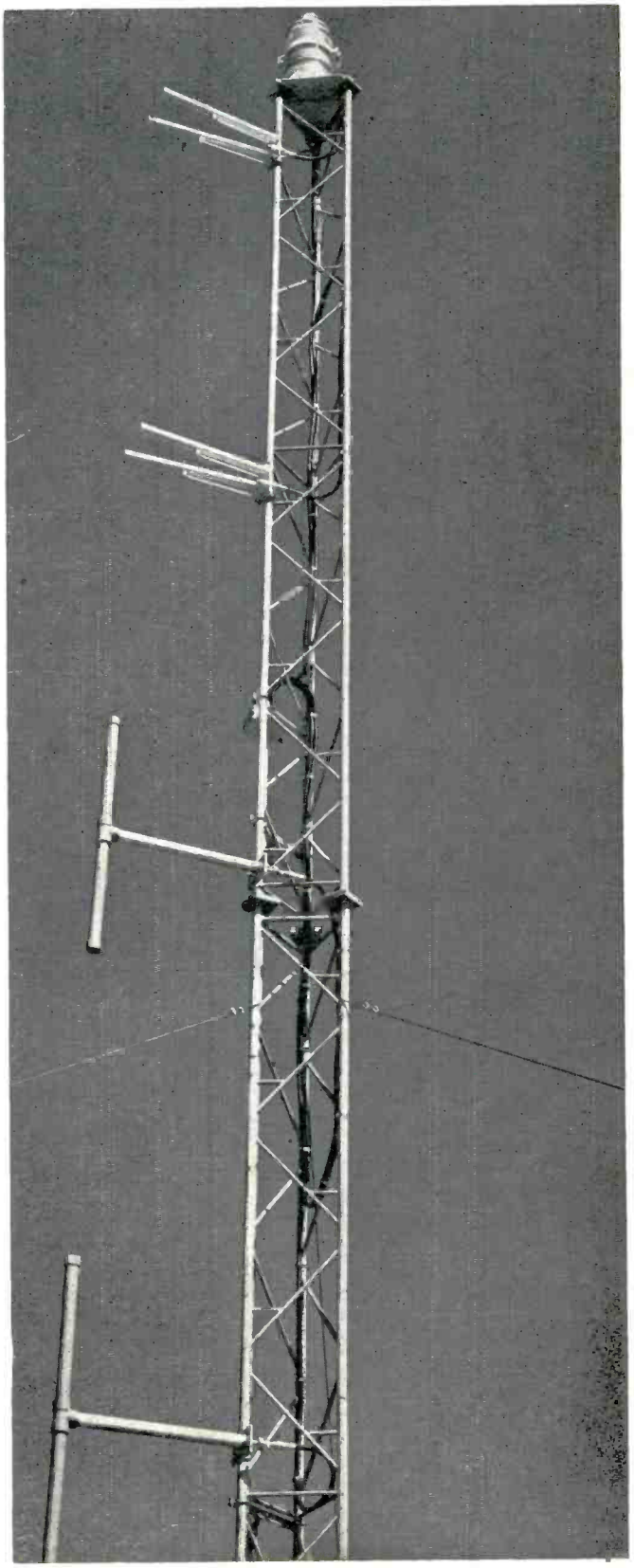
HORIZONTAL AND VERTICAL FM ANTENNAS

The JAMPRO dual-polarized* FM antenna system offers the most practical method of achieving maximum RF radiation under the 1963 FCC FM regulations. These new rules permit as much vertically polarized ERP, as authorized horizontally. Vertically polarized radiation increases the signal many times, in FM car radios, as well as in home radios using built in antennas.

The JAMPRO dual polarized antenna is available in several combinations of vertical to horizontal gain ratios. For class A stations, the equal number of horizontal to vertical is most appropriate. For class B and C stations other combinations may be more desirable.

Power ratings are equal to standard horizontally polarized JAMPRO FM antennas, and vary from 10 to 25 kilowatts. Power gains are available up to 7.0 for the horizontal and vertical.

*U.S. PATENT PENDING



EXCLUSIVE ADVANTAGES OF THE JAMPRO DUAL POLARIZED FM ANTENNA SYSTEM

MORE SIGNAL INTO CAR RADIOS

The vertical polarization puts more signal into vertical car whip antennas.

MORE SIGNAL INTO HOME FM RECEIVERS

The vertical polarization, due to reflections, puts more signal into built-in antennas found in nearly all modern console type FM radios.

EXISTING JAMPRO ANTENNAS MAY BE CONVERTED

All existing JAMPRO FM antennas can be converted to dual polarized arrays with reduced horizontal gains.

DIRECT ENGINEERING SERVICES

JAMPRO antenna engineers are available to deal directly with any antenna problem.

MORE LISTENERS IN HILLY TERRAIN

Signal levels in reflection areas are increased with dual polarization.

LOW PRICE — QUICK DELIVERY

The dual polarization FM antenna provides the highest performance at the lowest price. Customized service makes for fast delivery.

JAMPRO ANTENNA COMPANY

6939 POWER INN ROAD
SACRAMENTO 28, CALIFORNIA

Circle Item 9 on Tech Data Card

AN AUDIO CROSSBAR —TYPE SWITCHER

by Robert A. McClanathan,
Chief Engineer, KPAM-KPFM, Portland, Oregon—A versatile pushbutton-controlled system for rapid switching of audio circuits.

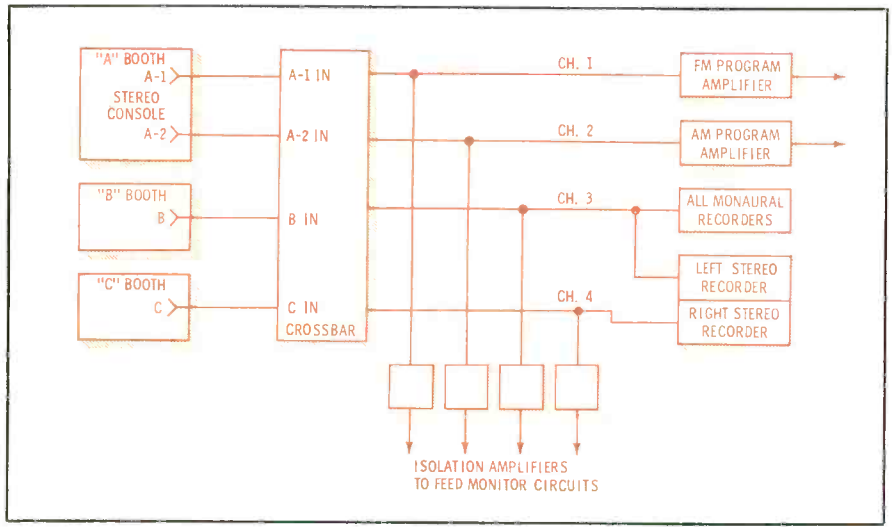


Fig. 1. Block diagram of a typical 4X4 electrical crossbar-type switcher.

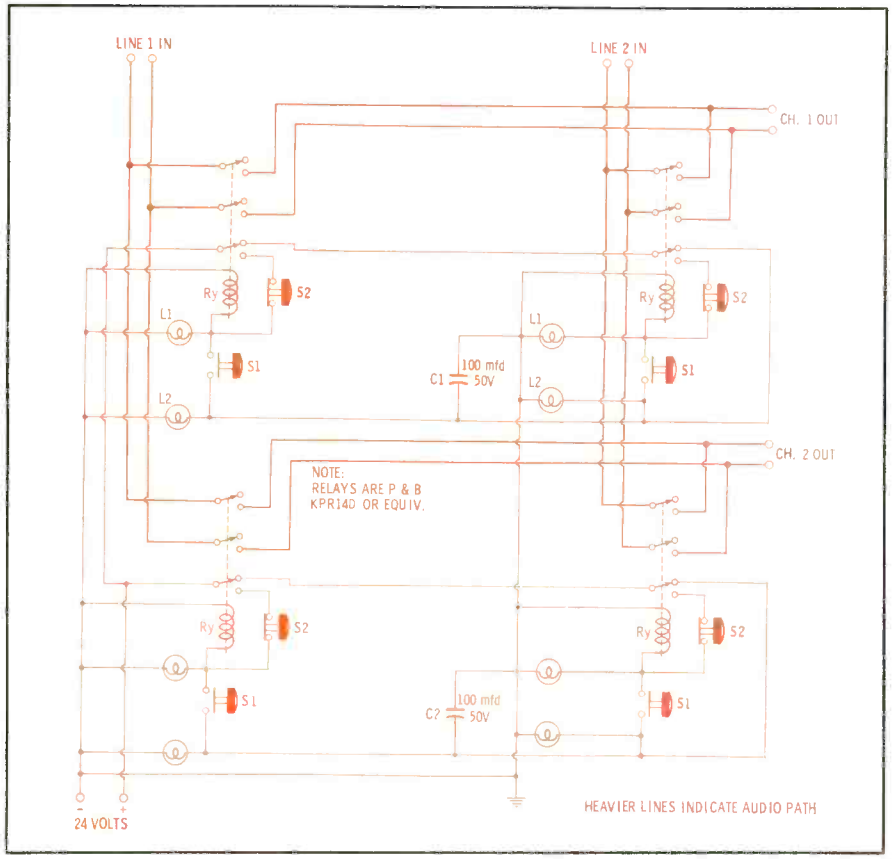


Fig. 2. Schematic diagram of a simple 2X2 electrical audio crossbar unit.

The audio crossbar switcher described in this article provides for instantaneous and noise-free switching of any audio console to any transmitter line, tape machine, or other terminus in the event of equipment failure and additionally offers increased operational flexibility. To achieve the required versatility, a control unit is located at each console (one at each single-channel console; two at each two-channel or stereo console). Through the use of pushbutton-controlled relays, the output of any console can be switched through any unused crossbar section to the desired terminal equipment. Note that when any control unit has selected an output channel, that function cannot be reversed from any other location. This interlock feature protects an on-the-air signal.

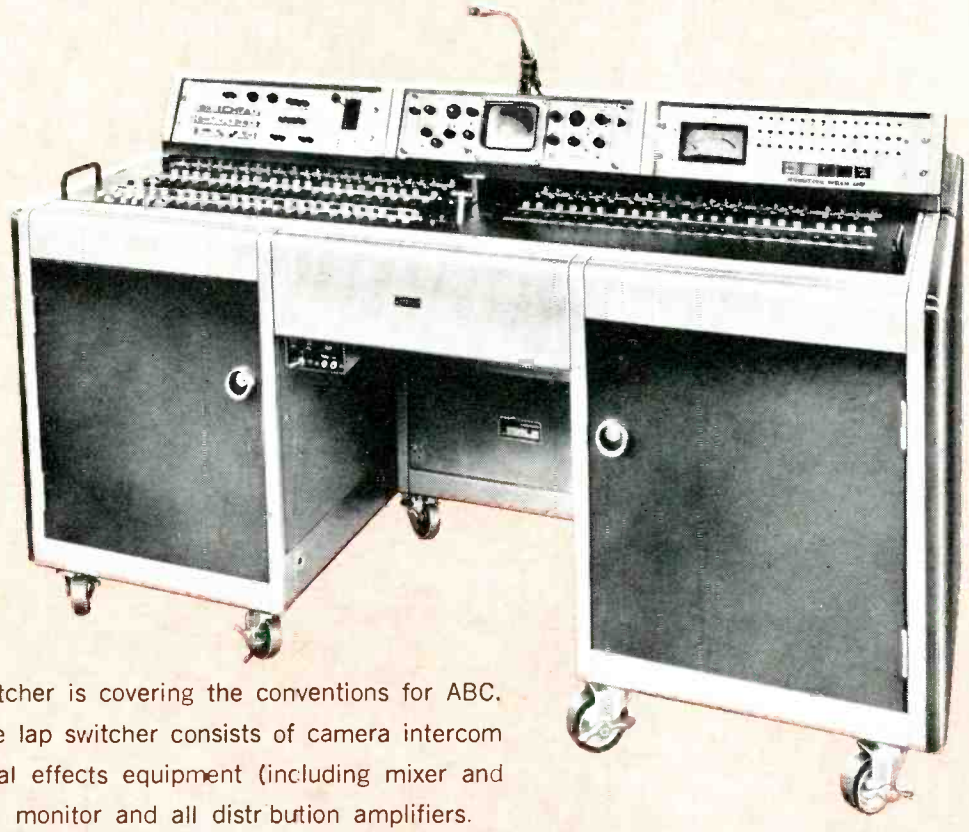
All console outputs fed to the crossbar are provided with a 600-ohm resistive load at the line terminals to maintain uniform levels when switching from source to source. For the same reason, all terminal equipment should have bridged inputs of 10,000 to 20,000 ohms. The correct bridging impedance depends on how many channels may be fed from a single input at any one time; the resultant impedance should be kept above 2500 ohms. Fig. 1, for example, shows a 4 x 4 crossbar (4 input and 4 output channels). If A-1 feeds all four channels, and the terminal inputs are all 20,000 ohms, the loaded 600-ohm console output sees 20,000/4=5000 ohms.

Operation

Using Fig. 1 as an example of a typical installation, Channel 1 feeds the FM transmitter line, Channel 2 feeds the AM transmitter line; both outputs are connected to program

PORTABLE VIDEO SWITCHER

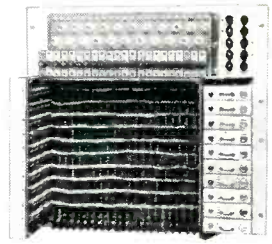
custom made by International Nuclear Corp.



This portable switcher is covering the conventions for ABC. Complete portable lap switcher consists of camera intercom equipment, special effects equipment (including mixer and fader), wave-form monitor and all distr bution amplifiers.

LET US HANDLE YOUR SPECIAL SWITCHER REQUIREMENTS

International Nuclear can build crossbar switchers with any number of inputs or outputs to suit your needs. The heart of the equipment is the new metal-contact hermetically sealed reed relays with very low capacitance. For detailed technical information on transistorized crossbar switchers see the September, 1963 issue of Broadcast Engineering for the article by John H. DeWitt, Jr., President, WSM, Incorporated; Raymond L. Weiland, President, International Nuclear Corporation and Aaron C. Shelton, Chief Engineer, WSM-TV . . . or write:



MODEL VS22-10 VIDEO CROSSBAR SWITCHER

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Circle Item 10 on Tech Data Card

amplifiers with 20,000-ohm inputs. Channel 3 is wired to the bridging inputs of all monaural tape machines, spot recorders, and the left amplifier of all stereo tape machines. Channel 4 feeds the right amplifier of the stereo tape machines. Optional isolation amplifiers bridge the crossbar outputs to enable operators to monitor each channel.

Construction

Fig. 2 shows the schematic of a typical 2 x 2 (2 inputs; 2 outputs) crossbar. For each studio, the number of inputs required will equal the number of separate program sources, and the number of output channels will depend on individual station equipment. Simplicity has dictated illustration of a 2 x 2 unit, but the same approach may be used for any combination of inputs and outputs.

The switcher is most easily built on a rack-mounted chassis with the power supply and relays in the same unit. The KPAM-KPFM crossbar has a 24-volt power supply; however, a 120-volt DC supply would have some advantages—neon channel indicators could be used to eliminate burn-outs, and the higher voltage would allow use of smaller-gauge control wire for very long cable runs.

Components for the 24-volt power supply shown in Fig. 3 are standard stock items and provide very cool operation. Smaller, less conservatively rated parts, however, could have been used. It is necessary to phase the two power transformer primaries correctly and to polarize the AC plug with the fuse in the hot side of the line. If switching clicks should appear, a diode or RC circuit across each relay coil at its socket should eliminate all traces.

Wiring of the control units to the crossbar chassis can be done with unshielded multi-pair cable. When choosing the cable be sure to consider its resistance (if very long) and allow enough pairs plus at least half a dozen spare pairs to each announce booth for future use. All control cables should be routed through separate conduits and kept away from audio lines. Fig. 4 shows the configuration for each control section.

Capacitors C1 and C2 in Fig. 2, one for each channel, are needed to insure faultless relay operation. They could, however, be eliminated if the control interlock contacts on the relays were of the make-before-break type.

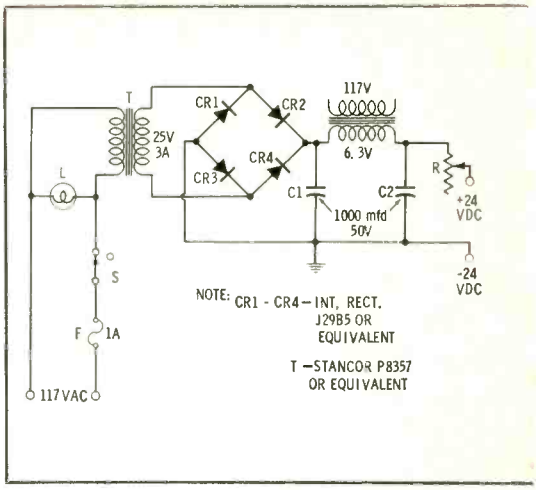

Fig. 3. 24-volt DC crossbar power supply.

Many attractive illuminated push buttons are available that can be used to save panel layout space, but separate lamps and push buttons are less expensive.

The crossbar will work equally well for balanced or unbalanced systems; however, for unbalanced operation, ground connections should be made only at console outputs to avoid ground-loop circuits.

This crossbar switcher will provide flexible control of audio signals and enable the station to make maximum use of its present equipment with a minimum of personnel. The KPAM-KPFM crossbar has been in use for four years with no maintenance required except for lamp replacement. ▲

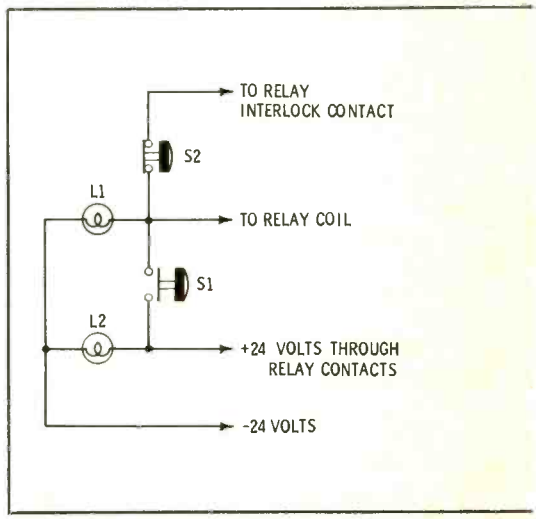

Fig. 4. One of the typical crossbar sections.

August 1964

We interrupt this magazine to bring you a ...

Late Bulletin from Washington

by Howard T. Head

Fines and Revocations

The FCC has served notice that it means business in the enforcement of the Rules and Technical Standards governing broadcast stations. An increasing number of fines have been levied in recent weeks for repeated and wilful violations of the Rules and Technical Standards. These include instances of improper log-keeping, exceeding the operating hours authorized by station licenses, and operation of an AM directional antenna by other than a licensed First-Class Operator. In one particularly serious instance, the Commission revoked the license of a broadcast station citing "numerous technical violations" which went uncorrected over an extended period of time.

FCC Control of Nonbroadcast Television

All signs point to the FCC taking steps in the near future to assert control over all forms of nonbroadcast television intended to provide service to the general public. This would include both Community Antenna Television (CATV) Systems, as well as outright Pay Television Systems, such as the Subscription Television (STV) organization going into operation in Los Angeles and San Francisco. It now seems likely that any jurisdiction over these systems assumed by the Commission will include the setting of technical standards governing picture quality to be provided by the wired systems. The National Community Television Association (NCTA) has pointed out to the Commission, however, that the setting of such standards for CATV systems presents rather complex problems, since the television signal may be degraded either in the broadcast system, or in the cable system; furthermore, neither the broadcaster nor the CATV operator has control over the propagation of signals once they have left the television transmitting antenna.

FM Simplex Operations To Be Discontinued

The Commission has amended its Rules to eliminate, effective December 31, 1964, the present provision which permits FM broadcast stations to provide background music and other subscription services on a simplex basis. After that date, operations of this type may be provided only by multiplex techniques employing sub-

carriers on the main FM carrier. Authority for FM multiplex operation must be obtained from the Commission in the form of a Subsidiary Communications Authorization (SCA).

Multiple Ownership Rules Revised

The Commission has adopted new Broadcast Rules which prohibit the construction of new AM, FM, or television stations, or the acquisition of existing stations, by a new licensee when such action would result in the overlap of specified field strength contours of stations under common ownership. In the case of AM or FM, the 1 mv/m contours of stations under common ownership may not overlap. For television stations, the overlap of Grade B contours is prohibited.

The prohibition applies to increases in height and power of stations of all classes where these changes would result in overlap or would increase existing overlap. Distances to coverage contours are to be calculated using the methods set forth in the Commission's Broadcast Technical Standards. In instances where an applicant believes that the Commission's prediction methods do not fairly represent the actual coverage, field strength measurements are permitted for AM cases, and alternate methods of coverage prediction can be used for FM and television.

Vertically Polarized FM Power

The Commission has proposed to modify the FM Rules and Technical Standards to limit the vertically polarized effective radiated power of FM stations to no more than the maximum value permitted with horizontal polarization for the three established classes of FM station. The adoption of the new FM Rules found a number of FM stations operating with effective radiated powers in excess of those permitted by the new Rules. The Commission does not propose to require these stations to reduce the presently authorized effective radiated power for horizontal polarization, but this limit will apply to the use of vertical polarization by existing "superpower" FM stations.

If you are using video tapes that foul heads, shed (particularly at splices) cause headwear in less than 1,000 hours, scratch easily, show signs of wear at 700 passes or less, STOP.

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Circle Item 12 on Tech Data Card

A B-E Extra Construction Feature

PLATE PRIMARY FAILURE ALARM

by Lawrence I. Presler, Student,
Indiana Institute of Technology—
An audible alarm to signal primary power failure.

For transmitters located out of direct view of the operator, an audible alarm to indicate primary power failure through overload or fusing action may prevent excessive delay in restoring service. Such an alarm is shown schematically in Fig. 1. The alarm consists of a dual-frequency relaxation oscillator, an AF amplifier and a simple control circuit. A 6005 tube was chosen for the amplifier because it has quick-heat filaments; in all other electrical characteristics the 6005 is identical to the 6AQ5. The neon-bulb oscillator and amplifier are straightforward in operation; output transformer T2 may be any unit that will match the 5000-ohm plate load of the 6005 to the L-Pad attenuator.

No specific recommendations are made for the relays that provide control of the system (Fig. 2), because they must be chosen to operate within the design parameters of the transmitter. In general terms, however, relay K1 is DPST pulse-latching; relay K2 has SPST contacts that are normally open when the coil is energized. Time-delay relay K3 has contacts that are normally open during the delay period and are closed upon actuation.

Operation

The design of the alarm system assumes that normal station procedure is to apply filament power at sign-on prior to the application of plate power. It further assumes that filament pre-heat time will not exceed 5 minutes.

When filament power is applied, K1 (across the filament transformer primary) operates, latching its contacts so that if all transmitter primary power fails the alarm will still operate. One set of K1 contacts energizes time-delay relay K3, and the other set completes part of the series path to the primary of T1. The delay period of K3 is 5 minutes; if plate power is not applied (energizing K2) before K3 contacts close, the alarm will sound. If, however, plate power is switched on before relay K3 pulls in, K2 contacts open, breaking the path to the primary of T1. This, of course, prevents operation of the alarm. Any subsequent loss of plate primary voltage allows K2 to drop out, completing the primary circuit of T1 which applies plate and filament voltages to the dual-frequency oscillator.

Push button switch S2, connected in parallel with the transmitter's filament switch, is used to reset latching relay K1 at sign-off. When plate power is turned off at the end of each broadcast day, the alarm will sound, providing a daily check for correct operation. Then, after the filaments are turned off, S2 is pressed momentarily allowing K2 to reset to its starting position.

Line voltage for the alarm system should be taken from a source independent of that for the transmitter.

Construction of the unit follows general single-chassis practice. The finished alarm may be mounted in any equipment rack near the transmitter, or in the transmitter itself if adequate space can be found. Audio output from the oscillator may be fed to a single speaker or to several, depending upon particular station requirements. ▲

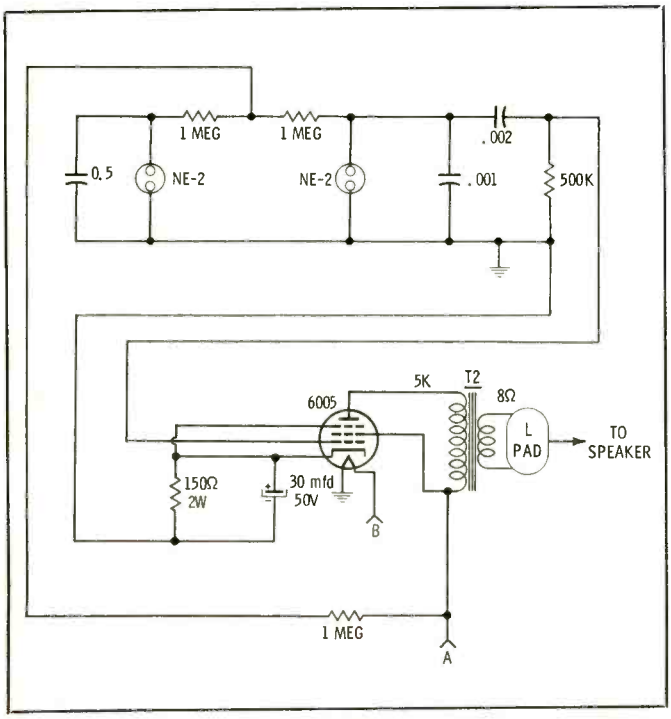

Fig. 1. Oscillator-amplifier produces tone to feed speakers.

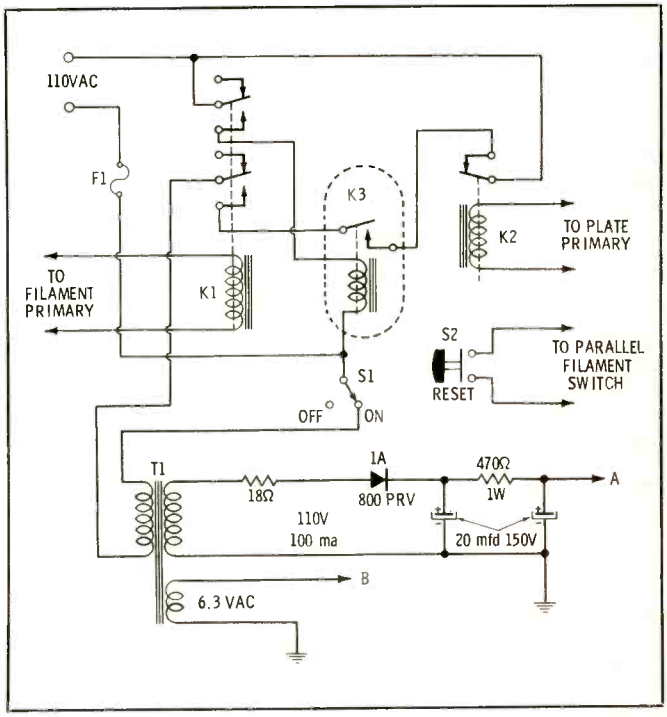

Fig. 2. Alarm control monitors power in transmitter plates.

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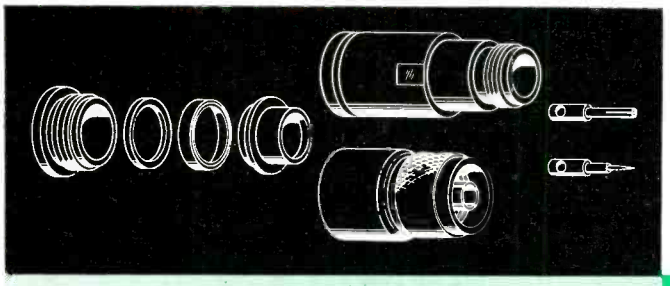
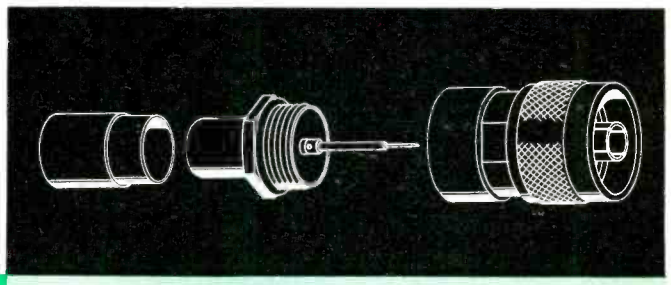


NUT RETAINER TYPE 75 OHM CONNECTOR

CABLE DESIGNATION	PLUGS			JACK
	TYPE "N"	TYPE "F"	TYPE "UHF"	TYPE "N"
4920	SC2A	SC2F	SC2UF	SC2JA
	Captive Contacts For Above Plugs* SC2CCA	SC2CF	SC2CCUF	
4930	SC3A	SC3F	SC3UF	SC3JA
	Captive Contacts For Above Plugs* SC3CCA	SC3CF	SC3CCUF	



FULL CRIMP TYPE 75 OHM CONNECTOR

CABLE DESIGNATION	PLUGS		JACKS		SPLICE
	TYPE "N"	TYPE "UHF"	TYPE "N"	TYPE "UHF"	TYPE "N"
4920	SC2CRN	SC2CRU	SC2CRNJ	SC2CRUJ	SC2CRS
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Circle Item 13 on Tech Data Card

TELEPHONE-LINE IMPEDANCE MATCHING

by John P. Tucker, Chief Engineer, KSNO, Aspen, Colo.—Measuring and correcting impedance and frequency-response characteristics of remote lines.

Almost every broadcast engineer is familiar with the frequency-response characteristics of the telephone lines connecting his studio equipment and transmitter audio gear. Too many of us, however, tend to overlook one highly important factor—the impedance of the line as seen by the audio equipment.

Users of some of the popular audio-level devices often assume that the impedance of a telephone line is always 600 ohms or that the impedance value doesn't really matter. However, be assured that it does matter. An irregularity in the impedance characteristic of the line will cause a corresponding irregularity in the amplifier frequency response due to the effects on the internal feedback circuits. We have found that the broadcast engineer can expect to encounter a wide variety of telephone line impedances.

For several years we have been using a very simple method for determining the magnitude of line impedance (without reference to phase angle), a method so simple as to be easily overlooked. By accurately matching lines and equipment, we have completely eliminated frequency-sensitive "pumping" in several station installations. In addition, audio response has been improved to create an FM-like sound on the AM band, and—for reasons we can't explain—signal-to-noise ratios have been increased. Through the use of close matching, we have eliminated the need for equalized remote lines for pickups within several miles of our studio even in the case of serious music broadcasts to our fidelity-conscious listeners. We apply the following methods to lines normally operated in a fixed mode, that is, lines that are switched from circuit to circuit only in emergencies.

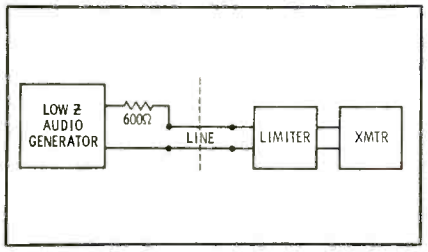


Fig. 1. Impedance measurements circuit.

Measuring Line Impedance

The equipment is arranged as shown in Fig. 1. With the limiter turned on to obtain normal operating characteristics and with the transmitter turned off, the equivalent circuit shown in Fig. 2 applies. (For the purposes of this article, the two impedances can be considered to be purely resistive.) Since the same current flows through each of two series-connected impedances, it follows that $Izk = Izu$. By using Ohm's law, the relationship can be rewritten:

$$\frac{Ezk}{Zk} = \frac{Ezu}{Zu}$$

By measuring voltages with a VTVM, either of the impedances in the preceding formula can be determined if the other impedance is known. In this case Zk is the known impedance, and:

$$Zu = \frac{Ezk}{Ezu} Zk$$

Fortunately, a high-quality, inexpensive carbon resistor contains no measurable reactance at audio frequencies and can be used as the known impedance (Zk). Connect the resistor in series with the line (Fig. 3A) and set the audio generator to the desired frequency. With the VTVM connected across the known impedance, increase the generator output until a usable reading is obtained—1.0 volt is usually easy to obtain and is convenient to use in the formula. Disconnect the VTVM from across the known impedance and move it to the unknown impedance, which in this case is the telephone line (Fig. 3B) —**do not alter the generator output.** Measure and record the voltage across the line.

Assume that the readings show a 1.0-volt drop across the known impedance and a 0.75-volt drop across the line. Substitution of these values in the formula for Zu gives a value of 450 ohms. Therefore, 450 ohms is the magnitude of the line impedance at the oscillator frequency.

Measured at the usual audio test frequencies, a well-balanced line will often yield a response such as that shown in Fig. 4. Severe nulls and peaks in a line characteristic will have adverse effects on the operation of limiting and average-gain - correcting amplifiers. Such lines should be referred to telephone-company engineers for their study and correction.

An important note: Too often broadcast engineers become impatient with local telephone companies. Remember that while you are vitally concerned with perhaps ten pairs of wires, the telephone plant engineer must worry about thousands of pairs. Broadcast requirements demand of a telephone line performance for which it was not designed, and only by miracles

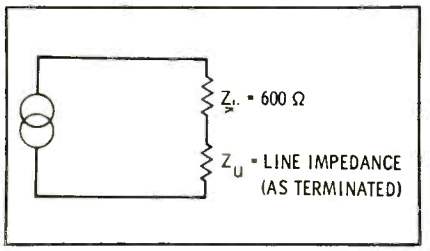
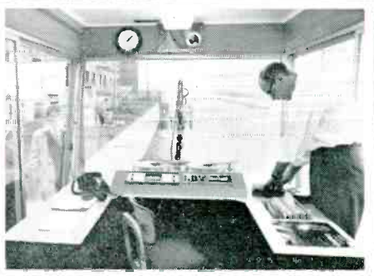
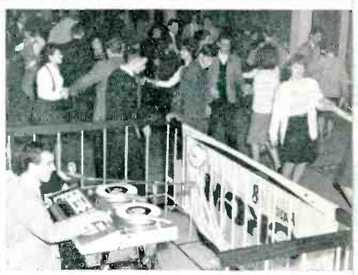


Fig. 2. Equivalent circuit of test setup.

"NOBODY SWEATS"





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"Our unit has to take a real pounding on rough roads. But when we get to a remote, we just connect up the lines, plug it in and we're in business."

"Our first unit (of two) is used in our Satellite Studio trailer. Because of its low heat output we saved the cost of extra blowers that other models would have needed."

"Northern are nuts to advertise this only as a remote unit. It would be a natural as a regular studio control room."

"Maintenance is a snap. Just undo three screws and everything is accessible."

"The only thing that can stop this unit is lack of imagination by the station."

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Capsule specs: start with an improved solid-state version of the rugged 22-type speech input console; add two 12″ turntables, full cue, monitor and switching facilities; six additional inputs with plug-in pads for high-low input options. Engineer it for people, package it properly and make it transportable.

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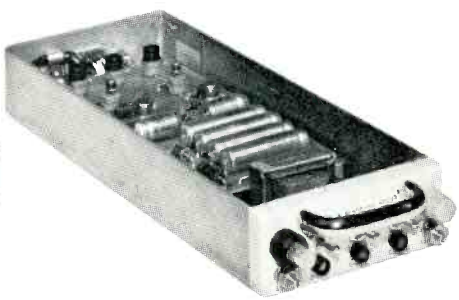

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"Our unit has to take a real pounding on rough roads. But when we get to a remote, we just connect up the lines, plug it in and we're in business."

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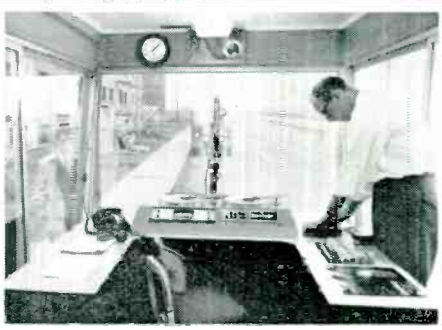

brand new transportable production centre

Capsule specs: start with an improved solid-state version of the rugged 22-type speech input console; add two 12″ turntables, full cue, monitor and switching facilities; six additional inputs with plug-in pads for high-low input options. Engineer it for people, package it properly and make it transportable.

DESIGNED AND MANUFACTURED IN CANADA BY THE SAME TEAM THAT BUILT THE VIDEO ROUTING SYSTEM FOR CBS, NEW YORK

Northern Electric NE COMPANY LIMITED

Specifications: write Dept. 9950, Belleville, Ontario, Canada.

Circle Item 15 on Tech Data Card

of engineering are wide response characteristics attained. If you prove yourself to be reasonably competent and adopt a quiet and polite approach in most instances the telephone company will bend over backward to cooperate with you.

Measuring Remote Lines

To measure a remote line not yet in use, two practical methods are available. In the first and most complete method, two sets of impedance measurements are made using the method already described. The first set is taken with the usual equipment setup in the studio and the line **shorted** at the remote site; the second is taken with the line **open**. The telephone company will have installed a 10,000-ohm resistor across the remote pair at the terminal block. Remove this resistor during testing and **reconnect it** afterward. Whether you leave it on during a broadcast depends on your practices; we disconnect it when using a remote amplifier that is turned on or off by voltages transmitted from the studio.

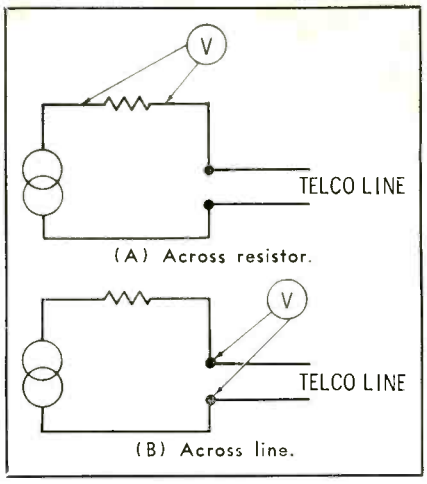

Fig. 3. VTVM positions in impedance test.

When plotted, the two sets of impedance measurements yield curves similar to those shown in Fig. 5A. At each frequency, the characteristic impedance can be found by:

$$Zc = ZoZs$$

When the calculated values are plotted, the graph should resemble Fig. 5B.

A simplified version of the above yields usable results with a single set of measurements. Simply take the readings while a 680-ohm, 5%, 1- or 2-watt resistor is connected in parallel with the telephone company's 10K terminating resistor. (Remember to remove the 680-ohm unit before the remote starts.) In several cities we have been able to furnish the telephone companies with a small box of these resistors (give them new ones to work with); they install them for us so we need not send a busy engineer out for this purpose.

Using the Data

Knowing the impedance characteristic of a line (and don't be surprised by nulls and peaks of great magnitudes), you can easily anticipate problems of attenuation and frequency response. You can forecast the need to patch in your own equalizers and anticipate the needed settings—and all this in-

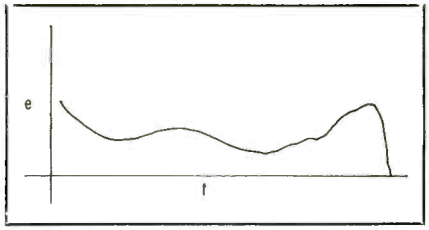

Fig. 4. Impedance curve of typical line.

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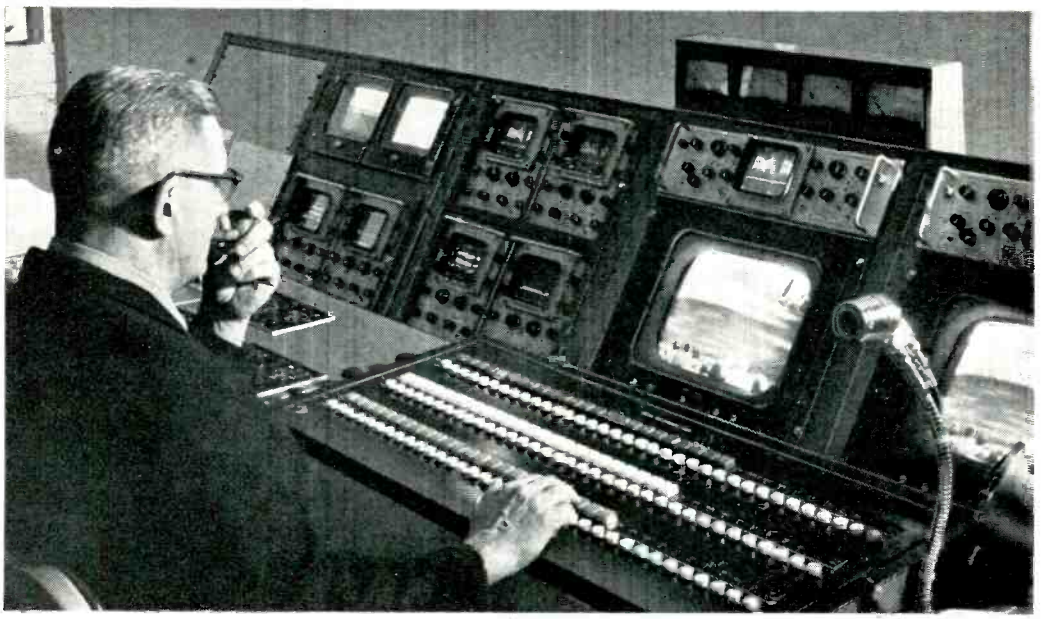
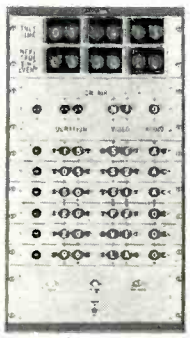
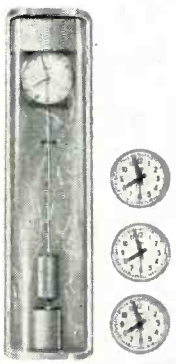




VISUAL, the leader in television program automation systems for unattended operation, smoother programming and integration with data processing equipment.



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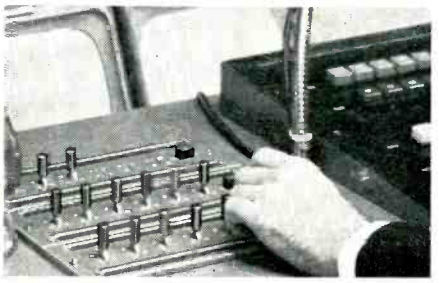

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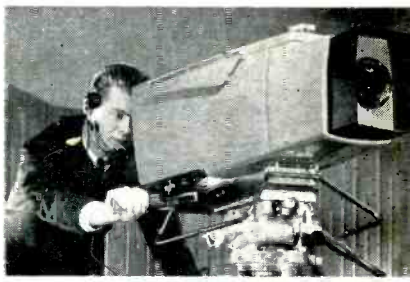

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Circle Item 17 on Tech Data Card

formation has been gathered without having to take any test equipment from the studio.

Even if one does not equalize to a flat response, the impedance information makes it easy to match the line to produce a reasonably good signal transfer to the input of the studio control gear and consequently a better air sound. Our experience has been that the so-called 600-ohm line, especially in modern cables such as the new plastic-insulated types so deservedly popular with operating companies, presents an actual impedance of anywhere from 125 to 3300 ohms. A simple switching system can be used to change transformer taps in steps depending on how closely matched the lines must be and how widely the local line impedances vary. Our practice is to require that 15 kc lines be matched all across the band and that all remote lines be matched within +100% and —50% of nominal impedance (averaged across several octaves). This means that on remote lines we must connect a 600-ohm termination to a line having an impedance between the limits of 300 and 1200 ohms; we use Western Electric 111C repeat coils for this purpose. If you are served by a non-Bell company, the local plant man can obtain complete listings of suitable repeat coils manufactured by ITT-Kellogg, Stromberg-Carlson, Automatic Electric, North Electric, Leich, and perhaps others. Appropriate wide-range input transformers can also be used.

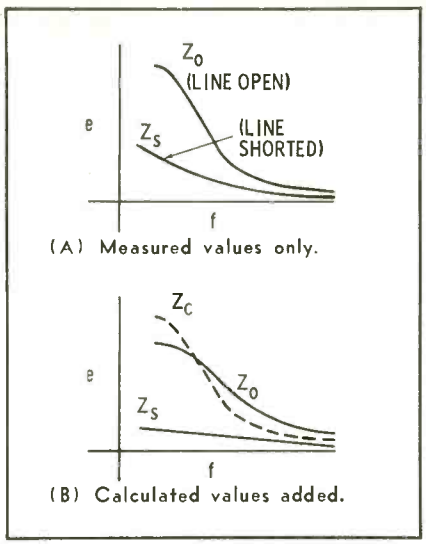

Fig. 5. Impedance curves of a remote line.

Other Considerations

Although great stress has been placed on matching impedances, don't forget that there are times when a **mismatch** may help. For example, a long cable pair that attenuates the high-frequency components or loses weak signals altogether may often be improved while "on the air" by juggling the input impedance.

After all impedance corrections have been made, one more problem may remain—power-line hum. We have found that 120-cps and 360-cps hum frequencies usually predominate when remote lines are adjacent to single-phase power lines. When the lines are adjacent to 3-phase lines, the dominant frequencies are usually 360 cps and 540 cps. Try tuning your traps to these frequencies. ▲

HELICOPTER OPERATIONS AT CFAC

by Earle C. Connor, Technical Director, CFAC, Calgary, Alberta, Canada—Problems and solutions encountered in helicopter remote broadcasting.

Helicopter operations at CFAC grew out of experiences, as early as 1941, with fixed-wing aircraft and later coverage of special events using commercially available helicopter service. Leading directly to CFAC's decision to lease a helicopter on a continuing basis, however, was the use in 1961 of a Piper Colt to provide traffic patrol information during the commuter rush period between 4:30 and 5:30 p.m. The airborne news was reported by a member of the Calgary police traffic division using a portable transceiver on 153.23 mc. So popular was the service, when poor flying weather threatened the operation in the Fall a means for continuing on a year-round basis was sought.

Initial consideration of a helicopter was complicated by the prohibitive cost for an hour-a-day, five-day-a-week schedule using large commercial machines, so the program resumed in the Spring on the same basis as before with the fixed-wing Colt. Continuing lease rates on two-place copters like the Hughes 269A and the Brantley B2, however, soon dropped to nearly one-third the cost of larger machines, prompting a decision to lease a Brantley with the thought that other promotional uses would add breadth to the operation. Portable equipment was transferred to the new aircraft, and CFAC began a new phase of its airborne coverage of events in Calgary. It was soon apparent, though, that portable equipment was impractical; battery costs mounted, and nontechnical personnel had trouble with both installation and operation, so permanent installation of a General Electric EU46-A6 transceiver in the helicopter's baggage space began.

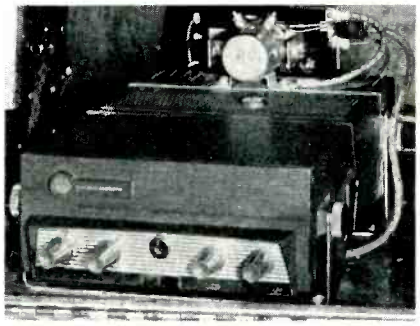

Fig. 2. CFAC's airborne remote receiver.

Fig. 1. Brantley B2 helicopter showing location of the equipment for remote use.

Installation

In Canada the Department of Transport, the regulatory and administrative agency for all broadcast and communications activity, sets forth procedures for installation and operation of airborne equipment and must approve all completed systems. Permanent installations must adhere to several conditions: If the aircraft's electrical system is used as a power source, a sufficient reserve must remain; all wiring and switches must be of an approved type; the new equipment must not interfere with safety or navigational equipment on board; maximum weight of the system must not exceed a predetermined value; the pilot must neither operate nor monitor the auxiliary unit; and power output of the transmitter must not exceed 5 watts. Since the design output power of the transceiver is 10 watts, CFAC engineers increased the value of the final-stage screen resistor to limit power to the prescribed level.

Care was required in mounting the transceiver in the Brantley's baggage compartment because the metal flooring is of lightweight aluminum alloy. Strap iron reinforcing plates 1″ x ⅛″ were used above and below the flooring to distribute the mounting bolt stresses.

Shockmounts were not deemed necessary, but, as a precaution against drifting adjustments, each ferrite core received a small drop of wax. Printed circuit boards of large, unsupported area were secured with packing of foam plastic and cork sheeting. All wires and cables were clamped, and grommets were used in all holes through metal partitions.

Several other problems were encountered during actual installation of the system. The receiver's audio amplifier was located in a separate speaker unit, and, as the high noise level in the chopper's cabin precluded use of the speaker, it was discarded. Audio amplifier circuitry was then duplicated in the main-chassis space reserved for a second oscillator (for dual frequency operation), and the emitter resistor of the output transistor was increased in value to limit the audio level to that suited for the reporter's 8-ohm headset. Squelch and volume controls were not moved from the main chassis as in-flight adjustment was judged unnecessary. So far, this decision has proved sound and eliminates two additional operations from the cabin. Primary power was drawn from the copter's master switch bus through separately fused legs, one to the transmitter and one through a switch on the instrument console to the power-control relay mounted at the rear of the main chassis. Microphone, headset, and control wiring was run through a pair of conduits accessible to the baggage compartment and terminated in a socket at the end of the cable which lies between the seats. A miniature headphone jack was mounted in the plug cover. Installation of a standard VHF mobile antenna cut to exact frequency and mounted beneath the fuselage just aft of the baggage compartment completed the airborne system. The antenna was carefully centered to minimize the effect of reflection flutter from the rotor blades.

Operation

During several months of operation in the helicopter, CFAC engineers have found that the high ambient noise level in the cabin gives rise to stringent requirements for both headset and microphone. The most successful headset has been a stereo high fidelity unit with liquid-filled plastic cushions; each cord is terminated with a miniature plug. One plug receives its input from a BC-band transistor portable used as a cue source, and the other is fed from the transceiver. The liquid cushions effectively mask much of the cabin noise. A similar headset is used by many pilots for aircraft communications. A noise-cancelling microphone is necessary for a good signal-to-noise ratio; typical dynamic units of this type are Shure Brothers' Model 488 and the Electro-Voice Model 602 in use at CFAC.

At the studio a G-E MC204 receiver converted for AC power serves as the base station. It was necessary to provide additional power supply filtering to enhance the signal-to-noise ratio, and audio bandpass was increased by using larger coupling and bypass capacitors and by removing some plate shunt capacitors. Receiver output is fed to all control and news rooms at loudspeaker levels and to jack panels through an isolation amplifier for patching to the consoles.

Helicopter operation at CFAC has, in addition to its original role in reporting traffic conditions, been used to help Santa Claus and the Easter Bunny make their rounds and to deliver dignitaries and contest

Fig. 3. Simple cabin gear aids efficiency.

queens to ballgames, rodeos, and grand opening ceremonies. The copter has been on the spot for news coverage, lost-person and missing-aircraft searches, and to give rides to the public at promotional activities and fairs. On one occasion, the CFAC helicopter rescued a horse from a mid-river sandbar! During all of this scheduled and unscheduled activity, no more than five days flying time has been lost. Additionally, a receiver at city police headquarters is used to receive emergency reports at any time the unit is airborne, and news photographers of a local newspaper are often carried to cover fast-breaking stories.

CFAC has been very satisfied with the performance of both the aircraft and the airborne equipment for service, promotional, and news applications. The problems differed from those usually encountered in remote work, but all have been satisfactorily solved. So, follow the lead of CFAC, Calgary, and take to the air—in a helicopter. ▲

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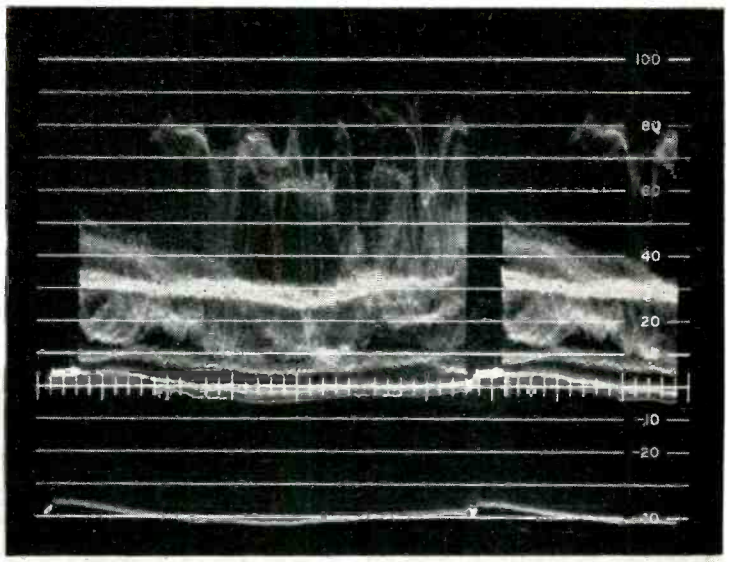
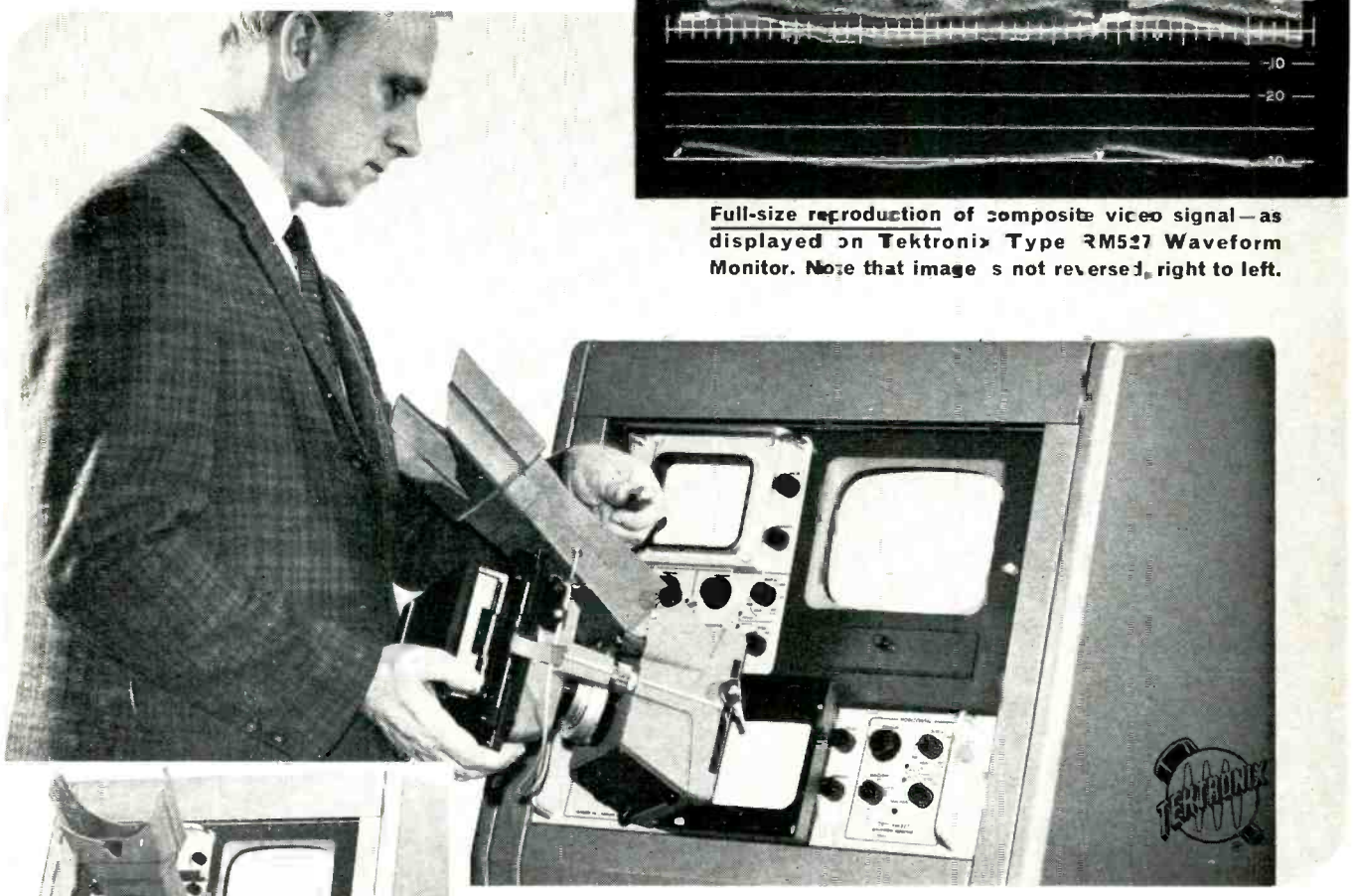


Full-size reproduction of composite video signal—as displayed on Tektronix Type RM527 Waveform Monitor. Note that image is not reversed, right to left.



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Circle Item 24 on Tech Data Card

NEWSFILM SYSTEM AT KCRA

How filmed coverage of local news receives intensive staff preparation.

Local news coverage and presentation at KCRA-TV in California's capital city of Sacramento is a significant factor in that station's growth. Forty-five minutes of predominantly local news (complemented by network coverage of national events) from 6 p.m. to 7 p.m. and an additional half-hour of primarily local news from 11 p.m. to 11:30 p.m. keep viewers well-informed about matters of specific local interest. To achieve a high level of immediacy, Manager of News and Public Affairs David Hume and Newsfilm Director Harry Sweet have developed an efficient system for handling film and coordinating all mechanical film operations.

KCRA employs 19 newsmen—9 of whom devote full time to newsreel coverage—and obtains additional film footage from a network of 14 independent stringer correspondents who cover the area surrounding Sacramento. One of the 9 fulltime cameramen operates from Stockton, a primary trade center in northern California, and another is stationed in San Francisco. These cameramen shoot an average of 2500 feet each day with their Bell & Howell 70DR cameras and have, on special occasions, shot as much as 6000 feet in a single 24-hour period. About half of each day's footage is aired, nearly 45% of which is sound-on-film. Eastman Tri-X reversal film with a prestriped magnetic track is used for most assignments.

The cameraman assigned to each story is held responsible for his own processing and editing, as well as for synchronizing and/or dubbing of sound to the final striped film as required. He will often work cooperatively with a news writer for interviews and special-events coverage. All film is processed in a Hills automatic processor which can run film as fast as 120 feet per minute.

Sound footage is prepared in either of two ways. An Auricon single-system sound camera is generally used for formal interviews, with the sound recorded directly on

Fig. 1. A processor saves valuable time.

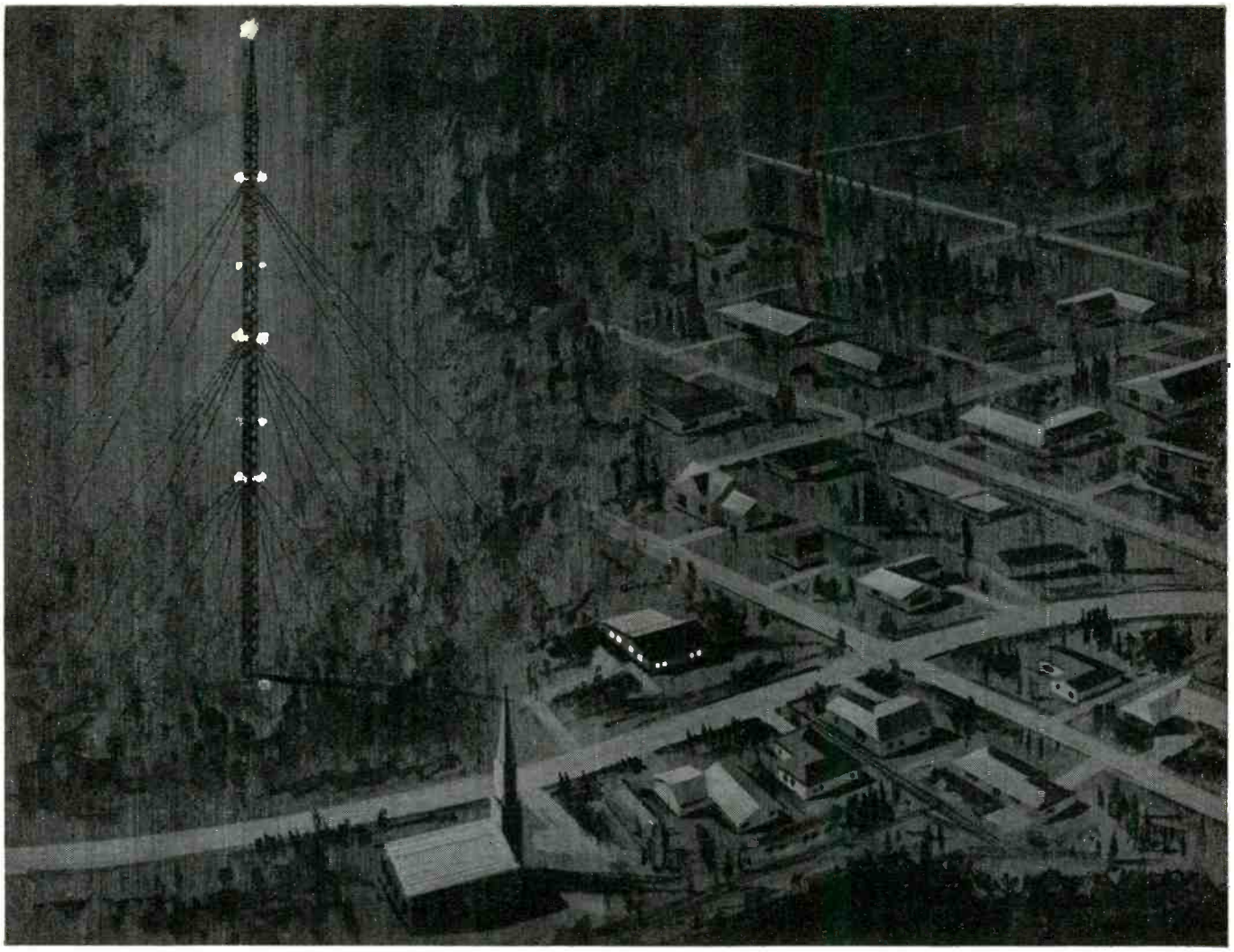
the magnetic film track using the camera's sound system and recording head. A double-system method, commonly used for news coverage and spot interviews, makes use of portable Mohawk tape recorders and the B &H 70DR's. By using short film clips and dubbing sound to each clip before final editing, the camera and tape recorder may both be run wild, or unsynchronized. Sync for spot interviews is achieved by the simple expedient of filming the interviewer as he claps his hands, facing the camera, prior to each interview. The clap sound and image are used to establish sync, then are edited from the finished film.

An ingenious method of dubbing is used when scenes related to a particular filmed interview are to be intercut. For example, during an interview with a city official concerning construction of a new public building, the entire interview will be shot in the studio. Then, particular references by the official to specific phases of construction are noted, and separate scenes relating to his comments are filmed on location with a 70DR, using striped film. The location-filmed sequences are processed and cut to a length that corresponds to the official's comment. Then, each processed clip is spooled into an Auricon recording camera, and the original interview film is loaded onto a projector, the audio output of which is fed to the Auricon recording amplifier. The projector is run until the audio comment corresponds to the action shot on location at which time the camera is started. The

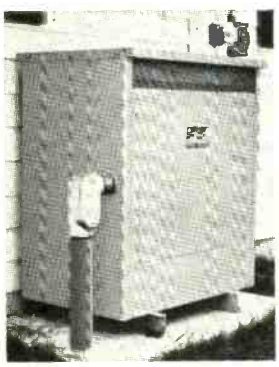
Fig. 2. Cameraman edits his own footage.

audio comment is dubbed in this way to the short film clip, which is intercut into the main interview film, replacing the picture and soundtrack of the original sequence. Thus, in effect, as the official is interviewed the camera cuts from the studio to the construction location where the action is described, then back to the studio with audio continuity uninterrupted. This direct approach to sound-over intercutting eliminates having to ask the interviewee to record comment later that will match the intercut action. The additional expense of an additional recording projector is also avoided.

The flexibly trained cameramen, fully familiar with all functions of filming and film handling, operate directly from the studio and from news cars equipped with 2-way radios. They work closely with news writers and commentators and with production and programming personnel to coordinate newsfilm production and presentation, thus providing KCRA-TV with a most successful approach to local filmed news coverage. ▲



What kept WBKV going when the lights burned out in West Bend?



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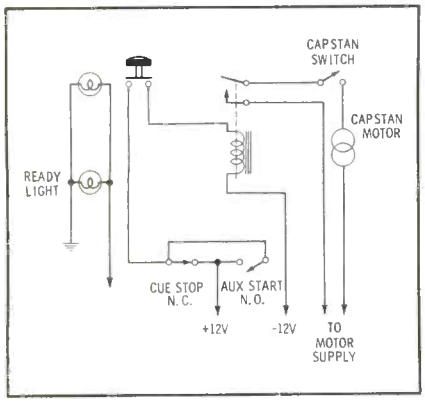


CAPSTAN MOTOR BINDING

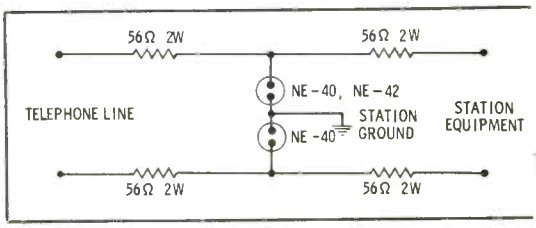
by Robert J. Corcoran,
Chief Engineer, KWBG, Boone, Iowa

Have you ever turned to use one of your cartridge units only to find that the motor was not working? We were constantly plagued with the problem of motors freezing after running for a long period. We discovered that motor heat was causing fibers in the lower bearing to bind the main shaft. We eliminated this problem by having our operators slant the cartridges in the slot just enough to shut off the capstan motor when not in use. However, this caused another problem when the men on the board forgot to straighten the cartridge, slowing down production and producing short tempers.

Smiles and efficiency were restored with a simple switching circuit. The operator now places the cartridge in as normal, and nothing happens. When he is ready for the tape, he presses a button in the center of the console. A light above the button paralled with the ready light will go on, signifying that all is ready. Then the remote start button is pressed, the ready light goes out, the announcement is aired. This system also makes it easy to keep track of which machine is running and which machines are in the standby condition.

As the announcement ends, a cue tone will stop forward motion and shut off the capstan motor. The cartridge may be replaced or used once again, but the motor relay must be re-energized with the button on the console.

The use of this technique has reduced our cartridge unit down time from one unit every other day to no failures in eight months. ▲



REMOTE-CONTROL LINE FUSE PROTECTOR

by Alfred Resnick, Chief Engineer, WACB, Ford City, Pa.

Summer is here, and with it electrical storms. Our situation at WACB used to be miserable, with the least bit of static throwing pandemonium into our remote-controlled transmitter site and causing ten minutes or more of down time until fuses were replaced or more serious repairs were made.

We had two grave problems: Static discharges backed up into the RF components, and, more

serious, fuses in the remote-control lines were lost.

The first problem was easily solved through installation of a good adjustable horn gap and series coil at the base of the tower. Copper tubing, formed into a three-turn coil about 12″ in diameter and 6″ long, connects the line terminating equipment to the tower. This coil very effectively reduces damage by aiding horn-gap breakdown and eliminating static charges from the RF circuits.

Our telephone lines (rented from a private company), an open pair from the days before cables, pick up induction hits very easily in the high terrain adjacent to the transmitter site. These strikes would never fail to destroy the low-amperage instrument-type fuses used to protect our remote-control equipment. In an attempt to help us, the telephone company installed carbon blocks, but to no avail. However, we noticed that the blocks did protect the large phone company line fuses. This was the idea that prompted the development of our fuse and equipment protector.

The unit uses four resistors and two NE-40's, a three-watt neon lamp. The lamps fire and drop the voltage through the series resistors to a value that the equipment can safely handle. The network introduces about 200 ohms of series resistance into the telephone line, but causes no change in equipment operation. Similar units were installed in all of our lines at the transmitter, just ahead of the terminating equipment, with great success. Since installing these devices we have lost no air time because of storms or lightning. ▲

CB TRANSCEIVER FOR REMOTE PICKUP

by Phil Whitney, Consulting Author, Chief Engineer, WINC, Winchester, Va.

As many broadcasters have discovered, the Citizens Band can be used by broadcast stations for gathering local news material within certain limits. Many stations use the compact five-watt CB units to get stories into the radio news desk quickly. However, the FCC regulations will not allow a broadcast station to put the voice of the news man on the air when he is using a CB rig. All CB communications come under the secrecy regulations,

Portable unit in use outside the studio.

and none are for broadcast. This does not mean, however, that a message cannot be relayed through a rewrite man.

An "on-the-spot" coverage, however, is always preferred to a written report in local news service. The announcer's voice at the scene of the event can be aired directly, or recorded for the next regular newscast, by shifting the frequency of the CB unit from the 27-mc band to the 26-mc band. Thus, many stations have retuned their CB equipment to operate on one of the assigned remote pickup frequencies and applied to the FCC for an appropriate license. This is a practical and inexpensive way to expand a station's news facilities.

On checking the Rules and Regulations on Remote Pickup Broadcast Stations, you'll find in 84.402 that there are seven groups of frequencies assigned from 25.87 through 26.47 mc, a total of 26 separate channels. These may be licensed for either A3 or F3 emission; CB equipment falls under the A3 category.

The accompanying photograph shows an all-transistor CB transceiver being used outside the studio by one of our newsmen. This unit, powered by rechargeable batteries contained within the leather carrying case, is capable of an RF output between 2½ and 3 watts, with the usual 5-watt input. A base-loaded whip is used, since a full quarter-wave antenna would be somewhat too long to manage in a crowd. The particular antenna illustrated can be tuned with a slug in its base coil for maximum efficiency at the selected frequency.

Conversion of such a unit is simple for the station engineer. Crystals must be ordered from a reliable manufacturer who must know exactly what type of circuit they are to operate in. Therefore, it is best when ordering crystals to send along diagrams of the oscillator circuits in both the transmitter and receiver.

Tuning is straightforward. A second unit or signal generator may be used to align the receiver RF and possibly the IF sections. Theoretically, the receiver IF's will not need realignment, but we found that a little peaking increased the receiver sensitivity slightly. The RF stages are fairly broad and very little change will be necessary. The transmitter oscillator plate tuning, buffer tuning, and the final pi-network will all need to be retuned for maximum RF output as indicated by a signal strength meter at some distance, or an RF power meter. When final tuneup is completed, check the frequency with a frequency meter to be sure that it is within the required tolerance. (A five watt or less mobile station operating below 30 mc is required to meet a frequency tolerance of only .02%, whereas a Citizen's band unit is required to have a tolerance within .005%.) ▲

About The Cover

The accelerated pace of news and special-events coverage by network television has led stations in all markets to re-examine their own local coverage of these two very important phases of broadcasting. Local viewers increasingly demand similarly intensive attention to events that happen in their own city; tomorrow morning's newspaper just doesn't answer their insatiable demand for immediacy. An effective means for delivering the news as it happens — at least before it gets cold — is the mobile van equipped for a wide variety of assignments from remote videocasting to videotaping to relaying.

An excellent example of what local broadcasters are doing in this area is the mobile equipment van designed and built by the staff of WPIX. This beautifully conceived and executed project is shown in operation in full color on the cover of this issue of BROADCAST ENGINEERING and is also the subject of a feature article which begins on page 12.

Thermoelectric

Continued from page 11

for unattended remote service using thermoelectric power.

At a recent Armed Forces conference on communications, for example, thermoelectric power and a portable microwave communications set were linked to carry both the image and voice of the conference director from his office in the Pentagon to delegates in a downtown Washington hotel. A single generator provided 24 volts for operation of the portable television camera as shown in Fig. 2, and two others provided power for the microwave equipment at each terminal location (Fig. 3). All of the generators utilized propane-fired heaters.

In remote locations far enough from commercially-available power to make feeder line installation impractical, many Forest Service and Conservation stations are using thermoelectric power for voice-communication equipment. The Minnesota Conservation Department, for example, was able to reduce operating costs substantially by using TE power for its radio - telephone service.

Many broadcasting applications suggest the use of remote TE power: mountain-top communications links; microwave STL equipment; remote news coverage on location; and, as TE costs are further lowered, sport remotes.

Future Developments

Although several manufacturers have thermoelectric power packages already on the market with capacities ranging from a few watts to several-hundred watts, future improvements in manufacturing techniques and in thermoelectric couples of increased efficiency promise not only increased power handling capabilities, but significantly lower cost per watt. It is not entirely improbable that in the not-too-distant future we may see standard broadcast transmitting equipment operating independently of commercial power sources by using self-contained thermoelectric power.

Whatever the future holds, it is certain to reveal increasing use of this new source of remote power. In the meantime, consideration may be given to many of the presently available thermoelectric generators. ▲

Mobil TV Unit (Continued from page 13)

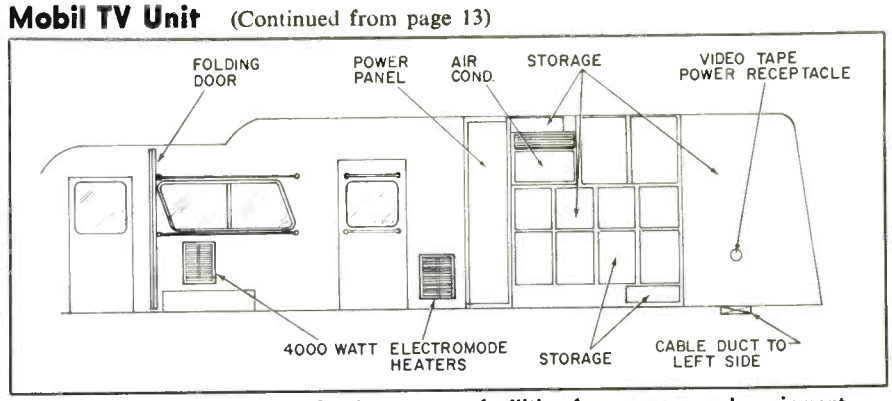


Fig. 5. Interior right side showing storage facilities for cameras and equipment.

shots, a detachable platform large enough to hold one camera was designed to be suspended from the front of the truck at bumper level.

A hitch and electrical connector for a trailer-mounted generator were installed at the rear of the truck. With this power unit hooked up, the truck can move along carrying its primary AC source with it. Inside the truck, at the rear, space is alloted for a magnetic video tape recorder, which is carried only when needed.

Thus, the truck can serve as a moving, self-contained television production unit. It can be driven up to the scene of a remote event, start shooting, and record with almost no delay.

Heating, Ventilating, and Air Conditioning

During the design stages we decided to air-condition the truck for the comfort of the personnel and the protection of the equipment. Our experience, however, showed that when electricity must be drawn from a commercial source with short notice, it is impossible in most cases to get enough power for both the technical and air-conditioning equipment.

To simplify the problem, air-conditioning equipment is installed to be used when practical, but as much heat as possible is carried away by separate ventilation systems. Equipment which generates the most heat is installed in closed compartments through which outside air is circulated. These compartments are, in effect, closed systems. The synchronizing generators and power supplies are so ventilated with separate intakes, fans, and exhausts.

The interior air of the operating areas is circulated by two large-volume roof fans located close to the monitoring and the camera-control equipment, where much heat could accumulate. This keeps the temperature only a few degrees above the ambient temperature. However, when it is hot outside it is hot inside the truck, and the air conditioning is used.

In cold weather the truck can be heated in three ways: by circulating hot water from the truck engine through a large heater, by using electric wall heaters, and by keeping the equipment heat in the truck. A damper system allows truck air to be circulated through the power-supply and sync-generator compartments.

The truck walls, floor, and ceiling are insulated with 2" of Fiberglas material to keep out noise and aid heat control. The inside walls are Masonite, and the ceiling is perforated metal to deaden sound.

Performance

The WPIX television remote truck is a self-contained control room with equipment to televise on-location events away from the main studios. It can serve as a stationary or moving camera platform.

The truck has been used for more than 100 remote programs with great success. It has received high praise from the directors and technicians who work with it and has attracted much attention as it moves through the streets of New York. ▲

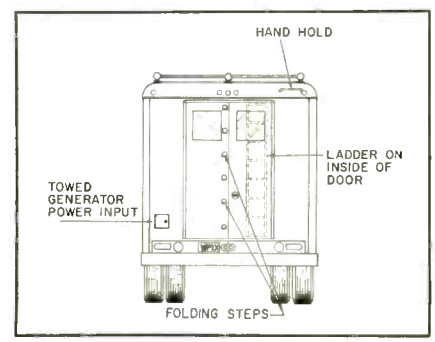


Fig. 6. Rear view showing access to roof.

Vertipower

(Continued from page 16)

can be increased and the power fed that antenna decreased to provide drive for the vertical antenna. At KPEN the possibilities of two transmitters were explored, but could not be justified. If two transmitters are to be employed they should be diplexed following the output stages and a single transmission line used to carry the power to the array, where a splitter would feed each antenna system. This method provides equal phase shift in both antenna systems, thus maintaining a constant phase relationship between the radiated horizontal and vertical signals.

Results

After all of the work of installation and measurement was completed, we at KPEN agreed that additional significant gains could be achieved through circular polarization, for which an application is currently pending. Even with the limited power that the Commission permitted KPEN, the results in multipath areas were favorable, and we decided to promote the installation of vertical radiators. The term "Vertipower" was coined to describe the new system, and display ads were run in the various newspapers hailing the inception of "Vertipower at KPEN." Listener reports have been favorable and rewarding. ▲

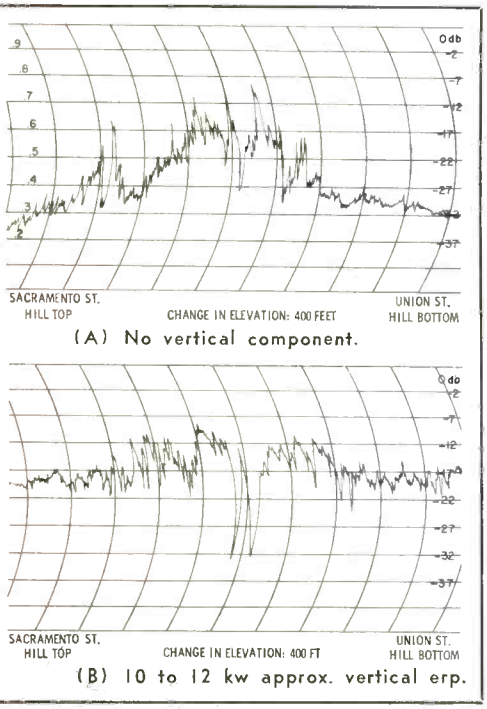


Fig. 6. Graphs of separation vs distance.

NEWS OF THE INDUSTRY

Moon-shot TV Camera

Viewers on earth may get their first "live" television close-up of the moon by virtue of a hand-held television camera being developed by the Radio Corporation of America for the Apollo manned lunar mission. A 4½ pound operating prototype, built by RCA's **Astro-Electronics Division** now is being put through tests by the Space and Information Systems Division of North American Aviation, Inc., Apollo system contractor to NASA. Smaller than a carton of cigarettes, the TV camera will use a 70-degree wide-angle lens for on-board viewing or a 9- to 35-degree zoom lens for scenes taken through a window at distant objects. It may be mounted in two positions in the Command Module, and installed in stations for different angles of the astronauts and spacecraft during liftoff, earth orbit, lunar trajectory, and lunar orbit. Television transmission from Apollo will be received at a designated earth station, video-taped, scan-converted for commercial TV, and released within minutes to the public. Much of the action will be seen as it is happening.

Venezuela Net Expands

More than $500,000 worth of television broadcasting equipment has been ordered for installation in a series of stations in the cities of Caracas, LaGuaira, Valencia, Barquistimeto, and Maracaibo, part of Color Television C.A. (COLTEVE), a major commercial television network in Venezuela. To be in operation before the end of this year are five 5-kw and 1-kw TV transmitters, eight image-orthicon studio cameras, two vidicon telecine cameras, and a specially designed VHF Zig-Zag antenna built to provide special patterns in the mountainous Caracas area.

Equipment for Tanganyika

A new broadcasting station at Dar-es-Salaam, Tanganyika, is planned as part of an extension to the Tanganyika broadcasting facilities, the first that the Government has undertaken since independence. Two 50-kw medium frequency transmitters will be supplied for this station, together with program input equipment and studio accessories. A directional array will beam the signals from Dar-es-Salaam, on the coast, to cover the whole of East Africa.

SMPTE Color Standards

Careful control in staging and photography of color films for television has been recommended by a special engineering subcommittee of the **Society of Motion Picture and Television Engineers.** Working to establish recommended practices for density and contrast range of films for color television, the SMPTE group report states, "It became evident that optimum control of release print density range could be achieved only if the original photography were carefully controlled." Chairman John M. Waner further reports: It is desirable to limit the density range of the color print and to include a "reference white" and "reference black" in each scene; recommended maximum and minimum reflect-

ances of fully illuminated picture elements that are to be reproduced with good detail are 60 per cent for whites and 3 per cent for blacks; for a fully lighted day interior scene a lighting ratio of 2 to 1 is recommended. Higher ratios may be used for special effects and night scenes; the most important, practical and effective way to control the density range of the color print is in the staging and photography, rather than in the final printing. "There is no sharp dividing line," the subcommittee reported, "between color prints that would be generally regarded as acceptable for television transmission and those that would be considered unacceptable."

Thai Visitors at NY Fair

Executives of the **Republic of Thailand** recently visited the Communications Demonstration Center at the New York World's Fair to inspect the audio-visual and communication systems employed in the showcase installation at the Hall of Education. In the photo, left to right, are: Chuan Shaweevongs, representing the Embassy of Thailand, Washington, D. C.; Miss Rapana Tanboontech, student at Teachers' College, Columbia University, New York City; Sanga Sukhabut, Counselor, Royal Thai Embassy, New York City; Nob Palakowongja, officer of the Ministry of Education, Bangkok, Thailand; Morris A. Mayers, host for Visual Electronics Corporation of New York, Systems Coordinator for all the

communications facilities at the Center; His Excellency, Mom Luang Pin Malakul, Minister of Education of the Republic of Thailand; and Dr. Leonard P. Stavisky, President of the Hall of Education.

Television in Cyprus

Construction is under way for two television broadcasting stations to cover the entire republic of Cyprus. At present, the only TV service—one station—covers only a radius of 16 miles around Nicosia.

PERSONALITIES

William J. Jones, recently appointed Chief of Engineer for **WTOP-TV,** has assumed charge of all technical matters, personnel, and operations for that station. In addition, he will administrate the technical operations of the WTOP AM and FM transmitters at Wheaton and Broadcast House. Jones has been with WTOP since March 1942 in various capacities in the engineering department at the station, including Engineer-in-Charge of general engineering for WTOP radio and television. His most recent assignment at the station was as assistant to Clyde Hunt, vice-president for engineering for Post-Newsweek stations. Before joining WTOP, Mr. Jones was assistant chief engineer at WJEJ Radio in Hagerstown, Maryland. During World War II, Mr. Jones taught the fundamentals of radar at Capitol Radio Engineering Institute in Washington.

American Electronic Laboratories, Inc., has appointed **Irving J. Chasen** as products sales manager, Solid State, and acting products manager, instruments, it was announced by **S. M. Merion,** director of sales. Products under Mr. Chasen's supervision include the wide variety of diodes, TWT, and video amplifiers, modulators, pulse generators, and test equipment by AEL.

Erwin Bernstein has been appointed director of marketing of **TNT Electronics, Inc.,** engineering subsidiary of TNT (Theatre Network Television, Inc.), and will be in charge of marketing for the new Color Eidophor, TNT's large-screen, color television communications system. The announcement was made by **Nathan L. Halpern,** TNT president.

NEW PRODUCTS

Disc Spot Recorder

Ampex Corp. demonstrated, at the NAB Convention, an engineering prototype of a solid-state magnetic recorder/reproducer which uses magnetic discs instead of tape for recording and reproducing sound. The disc is inserted into a slot at the front of the machine and is automatically centered and cued for recording or playback. The record/reproduce head is mounted on a carrier which moves in a straight line across the rotating disc from the outer edge toward the center. Playing time of the magnetic disc is three minutes, while maximum cue time 5 seconds. Prototype units are to be placed in service this month by radio stations across the country for evaluation. Upon completion of this field test program, product availability and prices will be announced.

Circle Item 96 on Tech Data Card

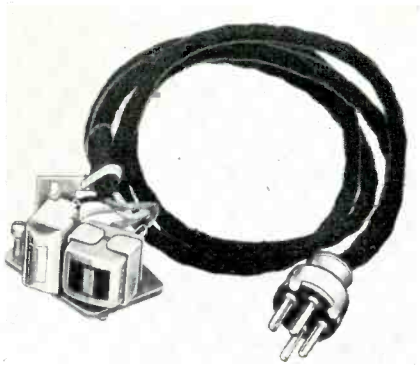
Lint-Free Cloth

Texwipe, a lint-free cloth for cleaning tape heads, camera lenses, and other polished surfaces where noncontamination is essential is offered by **Precision Products Co.** The lint-free and fuzz-free characteristics allow either dry or solvent cleaning without any subsequent effort to remove cloth produced fibers. Nonabrasive, static-free, and highly absorbent, the cloths are available in convenient 9" x 9" squares packaged 300 to a box at $16.00. Texwipe is also available 18" x 14", hemmed.

Circle Item 97 on Tech Data Card

Full-Track Head Kit

Wollensak and Revere tape recorder owners can now convert their two-track systems to full-track operation, so field

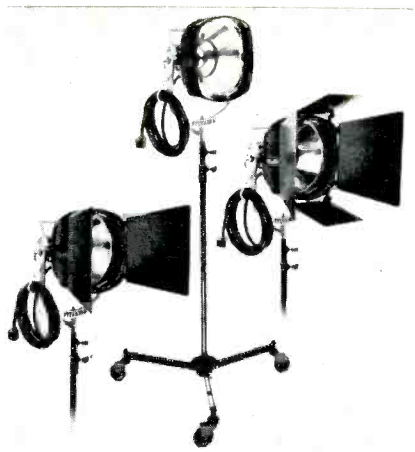


recordings can be made for ultimate use on broadcast tape handling equipment. The **Nortronics** WR-30 conversion kit has tape heads of the finest quality laminated construction, giving superior playback and record characteristics. All required parts are included in the WR-30 kit. Complete instructions with illustrated step-by-step procedures are also provided. Price is $57.00.

Circle Item 98 on Tech Data Card

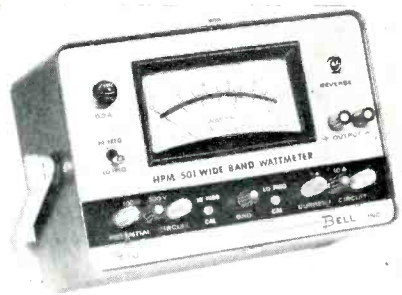
Lightweight Studio Light

A compact, lightweight, high-efficiency studio light for television and motion pictures was introduced at the 95th semiannual technical conference of the SMPTE by **Sylvania Electric Products, Inc.** Precision Light Model Q-2 is equipped with a newly developed 2000-watt lamp only 5" long and 1¼" in diameter. The single-ended, iodine-quartz lamp can be supplied with color balance of either 3200° or 3400° K.



The reflector consists of three concentric units which are adjusted by a single control to vary the beam angle from 12° through 37°. The lamp is self-cleaning—the tungsten vapors are constantly re-deposited on the filament eliminating lamp blackening — thus maintaining light output at the initial level and constant color temperature throughout the life of the lamp. Daylight color temperature of 5600° K can be obtained by use of a dichroic daylight filter which fits into the accessory holder. Other optional accessories include standard two-leaf and four-leaf barn doors, a diffusing screen, a clear glass lens, and Sylvac(TM) solid-state dimmer controls, which permit varying the color temperature to match a specific film. Over-all dimensions are: 13" D at the front, 4" D at the rear, 11" deep. Price is less than $139.00.

Circle Item 99 on Tech Data Card

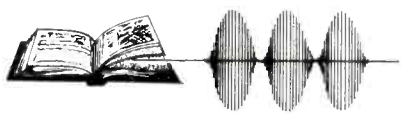


Hall Effect Wattmeter

A wideband wattmeter, the Model HPM-501, developed by **F. W. Bell, Inc.,** is a self-contained instrument designed to measure electrical power over a frequency range of 40 to 50,000 cps. A calibrated voltage at the output jacks has a DC component proportional to the real power and an AC component proportional to the volt-ampere product. These voltages may be applied to an oscilloscope or an X-Y recorder for a power vs frequency curve. Useful for audio power measurements, the Model HPM-501 measures real power regardless of the harmonic content. Other applications include transducer research and determination of power factors and phase angles. The instrument is housed in a 6" x 9" x 4¾" cabinet with handle and detachable cover; price is $300.00. ▲

Circle Item 100 on Tech Data Card

BOOK REVIEW



Basic Electronics for Engineers: Russel E. Lueg; International Textbook Co., Scranton, Pa.; 342 pages. Mr. Lueg, an associate professor in the department of Electrical Engineering at the University of Alabama, holds the view that increasing technological demands made on engineers whose primary field is not electronics require a more mature textbook for the electronics field. This text is a result of that belief.

The book is divided into three separate sections, the first of which includes Chapters 1 through 9 and deals with several basic concepts: electron ballistics, solid-state physics, vacuum tubes, and amplifiers. Because of their primary importance, transistors receive the major emphasis, although many examples show applications for both transistors and tubes. The second section, which includes Chapters 10 through 14, is designed to provide a fundamental understanding of many basic theoretical and practical concepts including propogation, masers, lasers, radio astronomy, digital computers, logic circuits, and binary arithmetic. The third and final section—Chapters 16, 16, and 17—introduces useful material on analog computers, feedback circuits, and servomechanisms with Laplace transformations added to provide another valuable mathematical tool.

This book should prove to be useful as a text in courses designed to broaden a general engineering curriculum and for individual use by engineers seeking a good, basic electronics familiarity. ▲

The CHIEF ENGINEER

Helps Solve Your Technical Problems

Readers are invited to send their questions to the "Chief Engineer"; those of most general interest will be published in this column.

Is automatic logging now permitted for AM stations with directional antennas?

The FCC Rules and Regulations permit the use of automatic logging devices not only for AM stations (with or without directional antennas) but also for FM and TV stations.

At the present time there are several types of automatic devices available for logging the operating parameters of a directional antenna system. Most of these sequentially record the transmitter plate current and voltage, common-point current, base currents, and frequency monitor deviation on a tape having a calibrated scale for each. Automatic logging of the relative phase of the current in each tower is not required. An alarm is provided for each parameter with the alarm threshold set to go off if the limits specified by the Commission's Rules are exceeded.

This leads to a practical problem which has not yet been satisfactorily resolved by most manufacturers of this equipment. The Commission's Rules specify a maximum permissible variation of 5% in base current **ratios** rather than a tolerance for the individual base currents in each tower. The alarms, therefore, should be activated when the **ratio** of any base current to the base current in the reference tower exceeds 5% variation from the licensed value. Most alarm systems do not permit alarm calibration based on variation from a known ratio, as required, and thus give the required indication only when the reference current is exactly at the correct value. However, manufacturers of this equipment are presently working on means to comply with this requirement of the Commission's Rules.

What is the blanket contour?

The blanket contour is the boundary of the area within which the field strength of an AM station is 1000 mv/m or greater. The extent of this contour depends on power, frequency, efficiency of the radiator, and soil conductivity in the area. However, as a rule of thumb, a field strength value of this magnitude is restricted to within one mile of the transmitter except for 50-kw stations.

Section 73.24 (g) of the FCC Rules places a restriction on the number of residents which may be included within this contour and limits this population to 1% of the population within the 25 mv/m contour (with a minimum of 300 persons permitted in any case).

This limitation is imposed to minimize potential problems which might arise due to the overloading of receivers in this high field strength area; results would be blocking, cross-modulation, and other forms of distortion. This problem is particularly serious in transistorized receivers. ▲

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

48. AKG—Technical specifications, application notes, and other information on microphones and microphone accessories are provided in brochure.

49. ATLAS—Illustrated catalog No. 564 contains specifications on PA speakers, microphone stands, and other commercial and industrial equipment.

50. AUDIO ACCESSORIES—Four-page specification folder gives physical and electrical data on broad line of telephone circuit jacks.

51. CALVERT ELECTRONICS—Special bulletin lists low-noise audio tubes suitable for studio sound equipment.

52. EASTMAN KODAK—Brief sheet lists availability of various types of sound recording magnetic tape.

53. ELECTRO-VOICE—An engineering specification and data sheet describes Model 668 professional microphone.

54. GOTHAM—Technical sheet describes broadcast applications of reverberation amplifier.

55. MAGNASYNC—Catalog covers magnetic film and tape recorders and accessories for motion pictures and broadcasting.

56. McMARTIN—Circular describes three-watt transistor amplifier for use from 24-volt marine, aircraft, or mobile equipment.

57. NEWCOMB—Specification sheet lists features of professional tape recorders for studio and location use.

58. NORTRONICS—Three-channel tape head for use with ¼" magnetic tape is described in brief product release.

59. QUAM-NICHOLS—General catalog lists speakers for public address, background music, high-fidelity systems, automotive uses, and general replacement.

60. SWITCHCRAFT—Product bulletin No. 140 describes molded coil-cord assemblies with straight and right-angle plugs and microphone connectors.

61. UNIVERSITY—Public-address technilog lists systems.

62. VIKING—Specification bulletin describes Model 96 tape-transport system.

COMPONENTS & MATERIALS

63. AIR SPACE DEVICES—Brochure describes safety device which provides fall protection for use when climbing vertical structures.

64. AMPEREX—Condensed tube catalog lists broadcast types.

65. CORNELL-DUBILIER—Manufacturer offers a 20-page TV-FM reception booklet and capacitor-assortment kit brochure.

66. FINNEY—Brochure illustrates bandpass filter for eliminating interference to FM reception from various external sources.

67. LAMTEX INDUSTRIES—Filament-wound, fiberglass-reinforced expoxy or polyester plastic tubing described in product report.

68. MACHLETT—Twenty-eight page catalog describes electron tubes for TV camera and other uses.

69. PRECISION PRODUCTS—Circular describes lint-free wiping cloths used for removing oxide buildup from magnetic tape heads and capstans.

70. SPRAGUE—Catalog CN 116F lists mechanical and electrical characteristics of silicon and germanium transistors.

71. STANDARD GRIGSBY—Two-page catalog sheet describes Series 500 reed relays having glass-capsule enclosed contacts.

72. STEELCRAFT—Comprehensive 95-page catalog lists more than 2000 tools of all types and describes special applications.

73. WORKMAN—Specification sheets are available describing transistorized 125-watt power converter and battery charger.

MICROWAVE DEVICES

74. LEL—Data sheets describe microwave links for portable or fixed use in business band; 2500-mc instructional television microwave system planning guide.

POWER DEVICES

75. DYNACOOL—Two-page bulletin lists specifications of Series 500 power fans for business machines, electronic equipment, and air conditioners.

76. ONAN—Various load-transfer devices and systems are described in a 16-page booklet which also gives data on automatic systems.

77. SECO—Specification brochure illustrates transistorized DC power supplies for battery-elimination and standard power uses.

78. TERADO—Product report describes Model 50-160 self-contained AC power source which contains battery, inverter, and charger in single unit.

RADIO & CONTROL ROOM EQUIPMENT

79. BROADCAST ELECTRONICS—Packet of material contains specifications and prices of various cartridge tape devices.

80. GATES—Comprehensive six-page brochure describes stereo-monaural professional cartridge-tape system.

81. SPARTA—Illustrated product sheet details specifications and operation of Model CD-15 cartridge tape time-delay and reverberation unit.

REFERENCE MATERIAL & SCHOOLS

82. CLEVELAND INSTITUTE—Booklet discusses courses in electronics for broadcast and communications.

STUDIO & CAMERA EQUIPMENT

83. ZOOMAR—Brochures describe various zoom lenses and other camera accessories including servo control and pan and tilt equipment.

TELEVISION EQUIPMENT

84. COHU—Technical application bulletin details CCTV installation and operation at JPL.

85. VITAL—Two data sheets list features of Model VI-10A video distribution amplifier and Model VI-20 pulse distribution amplifier.

TEST EQUIPMENT & INSTRUMENTS

86. F. W. BELL—Gaussmeters, Hall-effect devices, magnetic field instruments, and wattmeters are described in four-page short-form catalog.

87. BIRD—Product specification sheet outlines features of Model 4310 RF peak-reading wattmeter.

88. CROWN—Literature announces availability of solid-state tape recorders and lists prices, specifications, and accessories.

89. DELTA—Application bulletin No. 3 explains use of operating impedance bridge as a tool in measuring dynamic impedance of directional arrays.

90. H. F. PARKS—Features of Model ID-1017 diode tester are described in brochure.

91. SECO—Separate brochures give specifications and prices of color bar generator and Models 88, 98, and 107-B tube testers.

TRANSMITTER & ANTENNA DEVICES

92. BAUER—Product specification sheet describes features of Model 920 peak-limiting amplifier.

93. CARLOMA—Illustrated catalog gives specifications and features of large line of antennas for commercial applications.

94. RUST—Product sheet describes compact 1000-watt FM stereo transmitter.

95. SMITH—Brochure lists specifications and prices of antennas and antenna accessories.

Professional Services

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Member AFCCE

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Telephone District 7-1205
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Consulting Audio
and
Program Transmission Engineers
2nd Avenue — P. O. Box 117
Blackwood Terrace, New Jersey
Phone CAnal 7-0964

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RADIO ENGINEERING CONSULTANTS
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Classified

Advertising rates in the Classified Section are ten cents per word. Minimum charge is $2.00. Blind box number is 50 cents extra. Check or money order must be enclosed with ad.

The classified columns are not open to the advertising of any broadcast equipment or supplies regularly produced by manufacturers unless the equipment is used and no longer owned by the manufacturer. Display advertising must be purchased in such cases.

EQUIPMENT FOR SALE

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 1-64 tf

Ampex Head Assemblies for 300 and 400 series recorders reconditioned. Service includes lapping and polishing all three head stacks, cleaning entire assembly, readjusting and replacement of guides and realignment of stacks as to azimuth and zenith. Full track assemblies—$60.00. Taber Manufacturing & Engineering Co., 2619 Lincoln Ave., Alameda, California. 5-64 tf

COMMERCIAL CRYSTALS and new or replacement crystals for RCA, Gates, W. E. Bliley and J-K holders; regrinding, repair, etc. BC-604 crystals; also service on AM monitors and H-P 335B FM monitors. Nationwide unsolicited testimonials praise our products and fast service. Eidson Electronic Company, Box 96, Temple, Texas. 5-64 tf

GOVERNMENT SURPLUS, NEW 10 CM WEATHER RADAR SYSTEM—Raytheon, 275 KW peak output S band. Rotating yoke P.P.I. Weather Band 4, 20 and 80 mi. range. Price $975 complete. Has picked up clouds at 50 mi. Wt. 488 lbs. Radio Research Inst. Co., 550 5th Ave., New York, New York. 5-64 tf

GOVERNMENT SURPLUS. New 6 foot diameter aluminum parabolic reflectors solid surface. $175.00 ea. Radio Research Inst. Co., 550 5th Ave., New York 36, N. Y. 3-64 tf

Audio Equipment bought, sold, traded. Ampex, Fairchild, Crown, McIntosh, Viking. F. T. C. Brewer Company, 2400 West Hayes Street, Pensacola, Florida. 3-64 tf

New Gates Model M-5309A 5KW broadcast antenna coupler units. $295.00; Trimm 504 audio patch cords, $4.00; audio jack panels 19" rack mounting. 12 pair $9.95, 10 pairs $8.95; repeat coils 500-500 ohm flat, $4.00; racks, cabinets transformers, etc. Write for free list. Gulf Electro-Sales, 7031 Burkett, Houston, Texas. 8-64-3t

Urgently need copy of REL Serrasoid FM modulator tuning and set-up instruction book, as used in 518-DL transmitter. If you have or know of this publication please advise Ted Heithecker, 1409 Cooper Drive, Irving, Texas 75060. 8-64 1t

Nine U.T.C. A-10 transformers for sale. $40 for the lot postpaid (in U. S.). John DuBois, 940 Dodge Ave., Evanston, Illinois. 8-64 1t

REMOTE CONTROLS: Gates RDC-10. $500. Rust 108-OC. $600. Now in service; excellent condition. KFMU-FM, The Farmers Market, Los Angeles, Calif. 90036. 8-64 1t

Laboratory Test Equipment, microwave components, all frequency and makes at real low prices. Write or call for information. Jericho Electronic Supplies, Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N. Y. (516) WA 1-7580. 8-64 3t

Brand new surplus BC-645 Transceiver, 435 to 500mc, complete in original cartons with PE-101C dynamotor, 12/24V input, UHF antenna, control box, plugs. Limited supply, price $32.50. Slep Electronics Company, P. O. Box 178BE, Ellenton, Florida. 8-64 3t

Television/Radio/communications gear of any type available. From a tower to a tube. Microwave, transmitters, cameras, studio equipment, mikes, etc. Advise your needs—offers. Electrofind Co., 440 Columbus Ave., NYC. 212-EN-25680. 8-64 tf

We are a clearing house for all used broadcast equipment. Write us your needs. List your equipment for quick sales with Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 8-64-2t

Personnel

3rd phone—studying for 1st. Inexperienced—anxious to learn—good voice—contact Don Coss, 1001 Se. Franklin, Beaverton, Oregon. MI 4-8182. Single, 24. 8-64 1t

TRANSMITTER SUPERVISOR - MAINTENANCE TECHNICIAN - ENGINEERING ASSISTANT. 22 years electronics experience, 18 years continuous employment broadcasting, AM-FM, Directionals. Returning USA after 3 years overseas supervising installation, operation, maintenance of international short wave broadcasting transmission facilities, two 100 kilowatters, curtain arrays, quadrants. Including training of indigenous nationals. Mature, family man. Available August 15th. Write Dept. 113, Broadcast Engineering. 7-64 2t

Fifteen years. Directional. Some announcing. Capable of putting a station on the air. McClain, WHON, Richmond, Indiana. 8-64 1t

ELECTRA MET. INC.
REMOTE THERMOMETER
(Electronic)
Outside temperature from mike position. Installed in less than 1 hour. Ask about our other weather equipment. Send for Brochure. P. O. Box 6111, 1246 Shafter St., San Diego 6, Calif. 2-64 1t

- SYNCHRONOUS MAGNETIC FILM RECORDER/REPRODUCER
- MAGNETIC TAPE RECORDERS
- NEW—THE portable MINITAPE synchronous 13 lb., battery operated magnetic tape recorder for field recording.

THE STANCIL-HOFFMAN CORP.
921 N. Highland, Hollywood 38, Calif.
Dept. B HO 4-7461

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No other FM MONITORS can do so much!

McMartin TBM-4000

FM/SCA MULTIPLEX MONITOR
FCC TYPE APPROVED #3-116

This is the most versatile instrument available for monitoring all main channel modulation and SCA Multiplex operating characteristics. Compatible with FM stereo.
Direct meter readings of:

- Total Modulation
- SCA Modulation
- Crosstalk
- SCA Injection
- SCA Frequencies

McMartin TBM-3000

McMartin TBM-3500

FREQUENCY & MODULATION MONITORS
FCC TYPE APPROVED #3-113, #3-119

- The TBM-3000 is a completely self-contained frequency monitor and the TBM-3500 is a self-contained modulation monitor.
- The 3000 used in conjunction with either the 3500 or 4000 fulfills the FCC requirement for a station monitor.
- The TBM-3500 is completely compatible with FM stereo.

McMartin TBM-2500

RF AMPLIFIER FOR
REMOTE MONITOR OPERATION

The TBM-2500 will drive any combination of two monitors including other brands.

- Isolated high and low level outputs.
- Excellent stability and long tube life.
- 2 watt output with 1000 μv input.
- Complete with yagi antenna and coaxial cable.

McMartin

Originality by

McMartin Industries, Inc.

605 North 13th Street Omaha, Nebraska

Code 402 — 342-2753

In Canada Sold By: Canadian Marconi Company, Montreal 16, P. Q.

Circle Item 45 on Tech Data Card