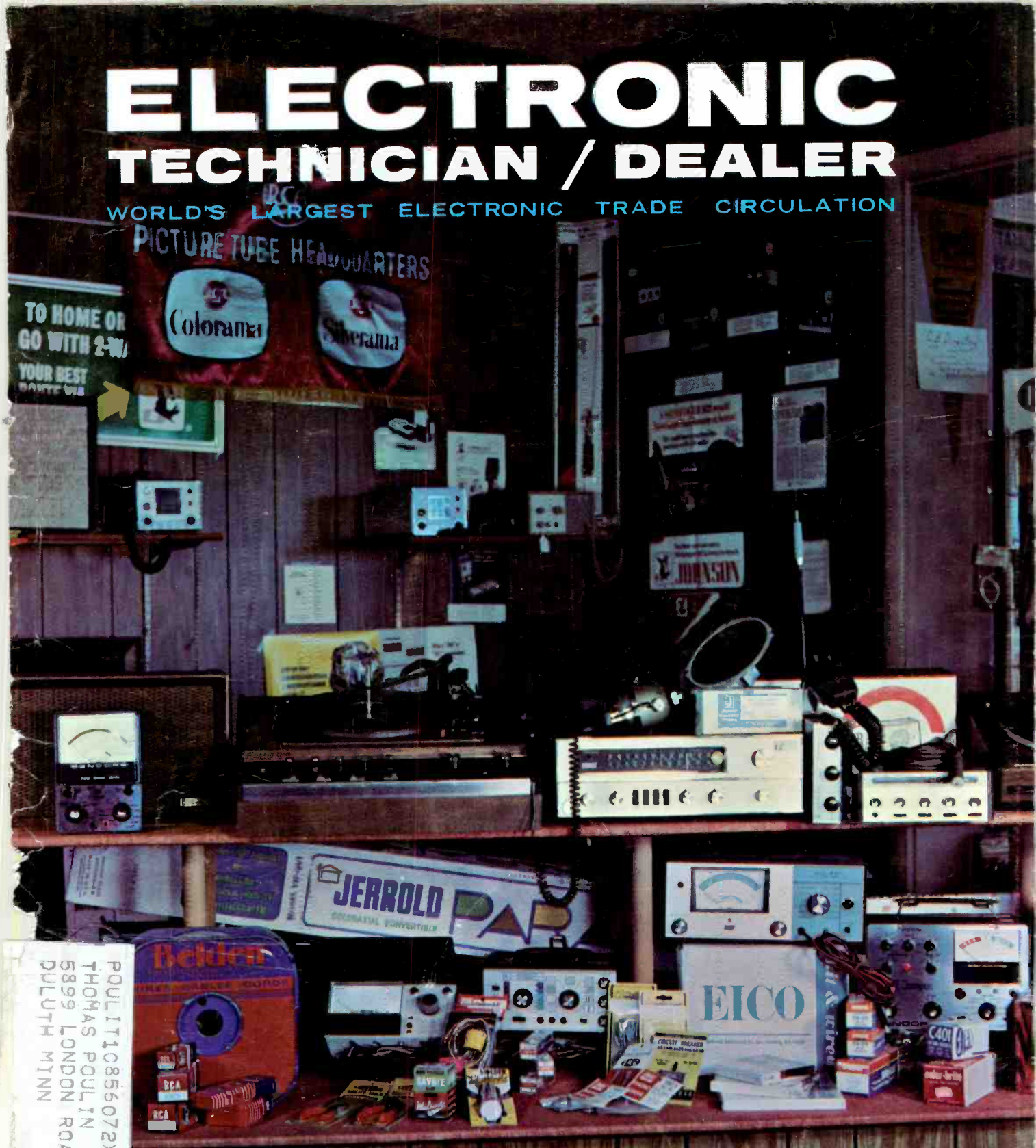
ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



HOME AUDIO EQUIPMENT ROUNDUP

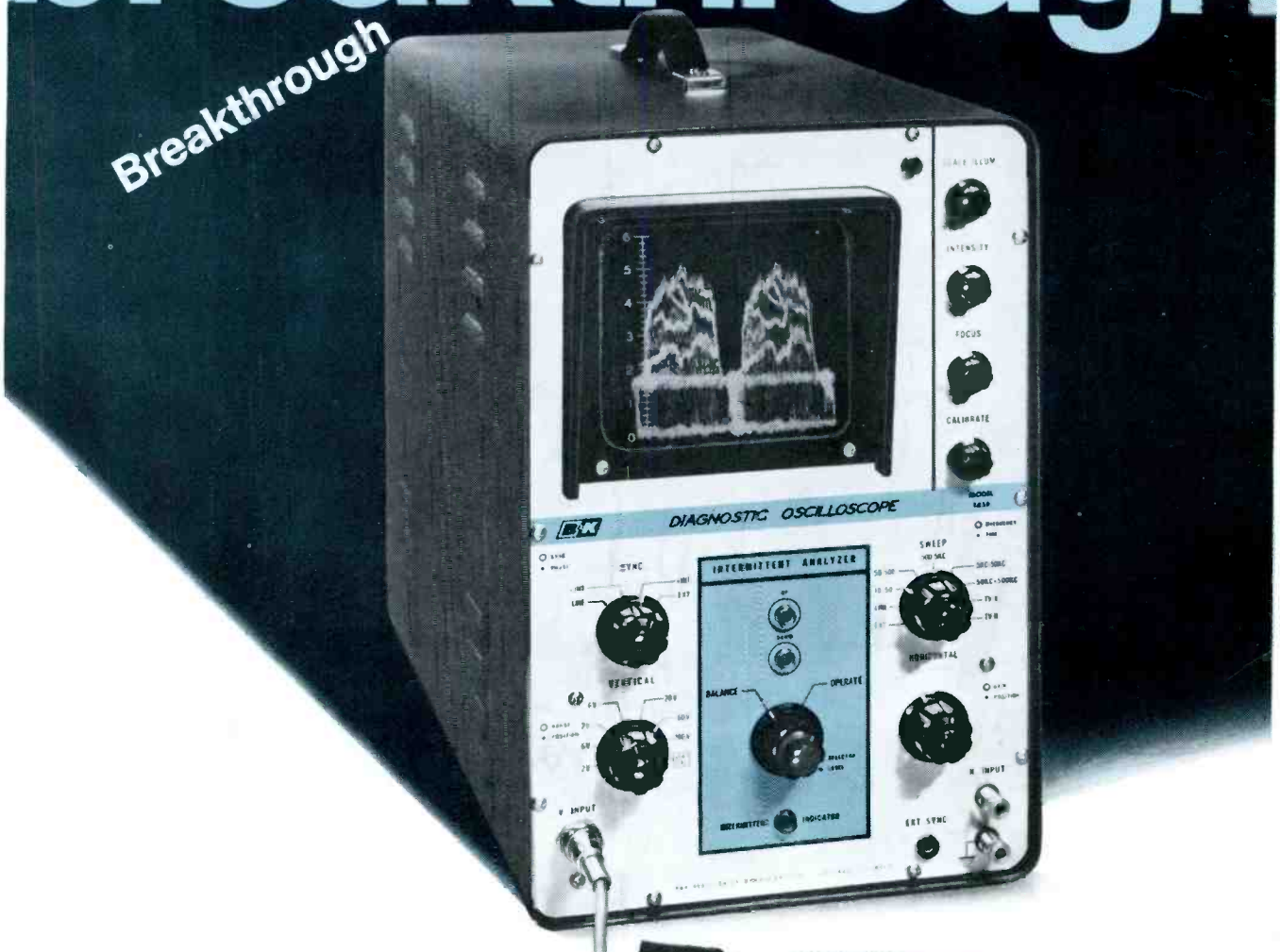
REPORT ON THE ZENITH COLOR PORTABLE

THIRTY-EIGHT YEARS OF TWO-WAY RADIO

an Ojibway publication

JUNE 1968

breakthrough



B&K Model 1450 first and only service-designed oscilloscope with "intermittent analyzer" and "electronic memory"

That elusive intermittent . . . how many hours have you spent trying to locate the source of the problem—how much time was wasted testing each circuit when you could have been doing more productive work? Now, B&K know-how and engineering genius have come through for you.

Result . . . the intermittent analyzer in the Model 1450 Diagnostic Oscilloscope. It will tell you *if* and *where* an intermittent occurs—even without your being there! The electronic memory will keep the intermittent indicator "on" until you return. Think of the time and money it saves.

The easiest to use 'scope ever built, its unique screen gives error-free direct readings of peak-to-peak voltages—it syncs automatically at any signal level—easily displays color reference signal. Convenient for use as a vectorscope too, all inputs and controls are on the front panel.

Deluxe in every respect, the 1450 is another B&K innovation that will make your time more profitable in solid state and color TV service. Years-ahead planning for present and future use . . . the best-value all-around 'scope you can buy. With probe. Net, **$279.95**

INTERMITTENT MONITOR. Designed to supplement the indicators on the 1450, this plug-in monitor can be placed anywhere in your shop. It flashes and buzzes when an intermittent occurs . . . and projects a professional image to your customer. Net, **$24.95**

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Guaranteed means a full *12-month* warranty against defective workmanship and parts failure due to normal usage. That's 9 months to a year better than others. And it's backed up by the only tuner repair service authorized and supervised by the world's largest tuner manufacturer—Sarkes Tarzian, Inc.

Four conveniently located service centers assure speedy in-and-out service. All tuners thoroughly cleaned, inside and out . . . needed repairs made . . . all channels aligned to factory specs, then rushed back to you. They look—and perform—like new.

"Prefer a replacement? Sarkes Tarzian universal replacements are only $10.45, customized replacements $18.25. Universal replacements shipped same day order received. On customized, we must have original tuners for comparison purposes, also TV make, chassis, and model number. Send orders for universal and customized replacements to Indianapolis."

Part #	Intermediate Frequency	AF Amp Tube	Osc. Mixer Tube	Heater
MFT-1	41.25 mc Sound 45.75 mc Video	6GK5	6LJ8	Parallel 6.3V
MFT-2	41.25 mc Sound 45.75 mc Video	3GK5	5LJ8	Series 450 MA
MFT-3	41.25 mc Sound 45.75 mc Video	2GK5	5CG8	Series 600 MA

Genuine Sarkes Tarzian universal replacement tuners with Memory Fine Tuning—UHF Plug in for 82-channel sets—Pre-set fine tuning—13-position detent—HI gain—Lo noise—Universal mounting

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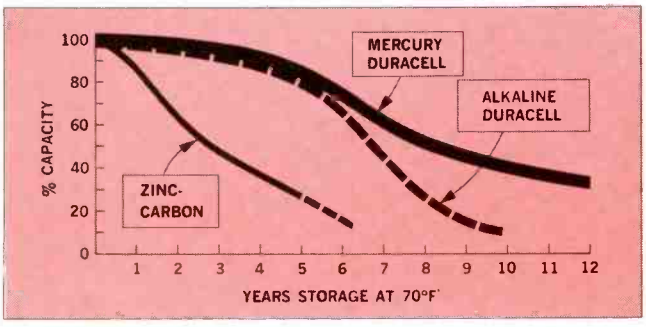
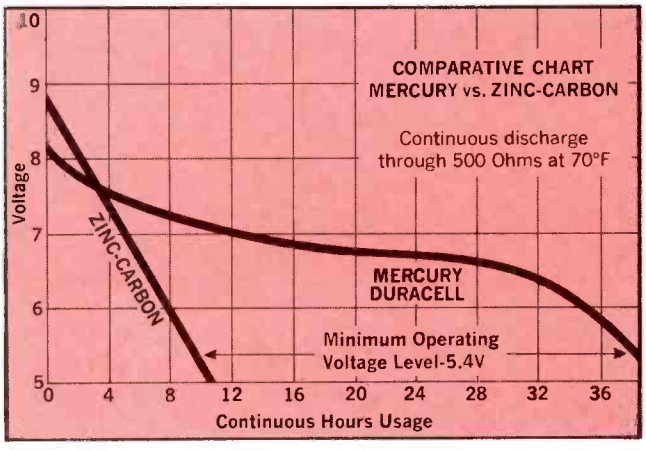
SOUTH-EAST	938 GORDON ST., S. W. Atlanta, Georgia	TEL: 404-758-2232
WEST	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION 10654 MAGNOLIA BLVD., North Hollywood, California	TEL: 213-769-2720

MALLORY **Tips for Technicians**

Tips on selling batteries





Just about every customer who walks into your shop, or whom you see on a service call, is a prospect for batteries. You can get yourself more sales and profits from battery business, by recommending Mercury Duracell® and Alkaline Duracell batteries—the *different* high energy batteries made by Mallory.

Here are some facts about batteries that can help you trade customers up to today's best values in portable power.

Which batteries are best for transistor radios? At the relatively low drain service in most radios, Mercury Duracell batteries are generally the best buy. They actually cost about 15% less per hour of service than ordinary zinc-carbon types. And they give you better listening; their output voltage stays constant throughout life, so you don't drop into the high distortion part of the transistor characteristic. Next best are Alkaline Duracell batteries. Both Duracell types have the further advantage of extremely long shelf life—no appreciable drop in power even after two years. So they can sit idle in a radio instead of dying even when not used, like ordinary batteries.

How about cameras? For the electric eye devices which automatically adjust exposure, there's nothing like Mercury Duracell batteries. They last over a year, and produce highly accurate voltage required for this job. For built-in flash and for electric drive of movie cameras, Alkaline Duracell batteries are far superior to ordinary types. They drive 4 to 5 times more movie footage, and fire about three times more flashes.

What's good for tape recorders? Motor drive is a fairly heavy drain job . . . ideal for Alkaline Duracell batteries. These outlast zinc-carbon by 2 to 5 times in portable recorders.

Flashlights? Toys? For ordinary flashlight duty, the old zinc-carbon is hard to beat. But if you're apt to use a light continuously for long periods, Alkaline Duracell batteries can give steady lighting for up to 10 times longer than zinc-carbon. And they're much safer for emergency use, because they don't die in a few months on the shelf. Toys are real high drain duty; here Alkaline Duracell batteries are a real bargain, for they outlast zinc-carbon types by 5 to 8 times.

Sell your customer on the greater value of Duracell batteries, and you'll make twice as much profit per sale. Get the story on the new Mallory battery merchandise displays from your nearby Mallory distributor. Or write Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

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DON'T FORGET TO ASK 'EM *"What else needs fixing?"*

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ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

JUNE 1968 • VOL. 87 No. 6

COVER

Electronic components and test instruments play a vital role in the economic lives of our nation's service-dealers. These and other items of interest to the service-dealer are on display at the National Electronics Week (NEW) Show in New York this month.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 190**

GENERAL ELECTRIC: Color TV Chassis G-1
MAGNAVOX: TV Chassis T927 Series
RCA VICTOR: TV Chassis KCS136ML Series
SILVERTONE: Color TV Chassis 528.72500
WESTINGHOUSE: TV Chassis V-2660
ZENITH: TV Chassis 14Y33

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LETTERS TO THE EDITOR

ILL — Will Sell

After 20 years of TV servicing I was unexpectedly laid low by a heart attack. I am forced to retire and would like to hear from a good technician interested in obtaining a reputable name. I have a new color bar generator and other test instruments, plus a complete stock of tubes which I will sell very reasonably.

PHILLIP CHEUSE
Perth Amboy, N. J.

Needs Back Issue of ET/D

I would like to obtain a copy of Bob Middleton's article which appeared in the August 1957 issue of ET/D. I enjoyed the article "Unique Test Instruments for Color TV Servicing" in the October 1967 issue. Our shop has been using the B&K analyst for several years.

T. M. KIMBALL
Savannah, Ga.

• *The article Mr. Kimball refers to is "Vectorscope Technique To Service Color TV" on page 34 of the August 1957 issue.—Ed.*

Help for Old Scott

I have a 1934 Scott receiver and I need a schematic and tuning instructions. Can anyone help me? The only information I have on it is that it is serial number P-392, according to the chassis layout. I have no model or chassis numbers.

J. DOMBKOWSKI
Floral Park, N. J.

Whoops

I have written and asked you for the address of the company that makes the Tonfunk W199K. I need a schematic for this unit and I received no answer from you. I also need a number 92 tube for a German WW2 short wave receiver. Possibly an ET/D reader can help me.

FRANCIS J. REES
2 Greebrook Dr.
Levittown, Pa.
19055

• *Sorry we goofed on not answering your letter, Frank, but we bat very close to 1000 around here when it comes to answering letters and requests from our readers. In fact, we spend a great deal of time looking up old schematics on everything from TVs to tube testers. If we can't find an item we generally let the reader know*

YOU DON'T NEED TO MAKE MORE SERVICE CALLS TO DO MORE BUSINESS

JUST ASK, "WHAT ELSE NEEDS FIXING?" ON EVERY SERVICE CALL YOU MAKE

A test program initiated by the Electronic Industries Association in a large mid-west area proved the point. Participating service dealers enjoyed a 7½% bounce in business. There's magic in asking!

You can do it too! Put the question to your customers visually as well as verbally. Apply "What else needs fixing?" stickers on your caddy and in your store. Request sticker D-200 from your Sprague distributor, or write: Sprague Products Co., 65 Marshall St., North Adams, Mass. 01247.

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LETTERS TO THE EDITOR

it. However, once in a while we slip and miss one. It helps us a great deal if the reader requesting assistance, types or prints the material on letter-size paper rather than hand written copy on a postcard. Some of the requests we receive are very difficult to decipher and lack sufficient information to enable us to locate the requested schematic or part. Many times the hand written letters we receive are so illegible that it is hard to even read the name or address. For that reason we strongly urge that any reader sending letters to us include the address label from their copy of ET/D —Ed.

Female Technician Speaks

This is my first year as a subscriber to ET/D — I want to tell you that it has been more help to me than all my other technical magazines put together. It's what the doctor ordered for technicians who want to keep up with new improvements and improve him — or herself. I never see letters or articles by female technicians. Are you prejudiced or is it a lack of such contributors? I can't believe I am the only woman who chose electronics as a career. I have a TV-radio service business which I operate part time because I have a husband and three children to look after. I don't do any advertising, but I have more service business than I can handle. I find customers are considerably more interested in good service than in the "sex" of the service technician. However, I'll bet we have problems you men never thought of! I'd sure like to see letters from other service gals. You might get a few chuckles if we service gals started airing our gripes!

Seriously, I am treated with courtesy by the men in this business. But it does take a while for people to get used to a woman appearing on the doorstep, tube caddy in hand. Acceptance comes fast, however, if the service is good.

LAURA LASSITER
Evanston, Wyo.

We enjoy receiving letters from technicians in the field — especially ones with different views of the business as Mrs. Lassiter's must surely be. Sorry to say, we do not often hear from technicians of the opposite sex, although we know there are a few around. Come to think of it, it would be rather different to find a woman standing at your door with a tube caddy in hand — Ed.

Manual for Visual Generator

ET/D has been very helpful to me for a number of years and possibly one of your readers can help me with a problem.

I have a Precision Visual alignment generator for TV and FM, Model 7008 made by Philco. The instrument works fine as far as I can tell. But it is an early unit, possibly WWII, and I need an instruction manual for it. I would appreciate a letter from an ET/D reader who might have one I could borrow or buy. As it is, the generator is useless to me without the manual. Keep up the excellent work in your fine publication.

HOWARD W. JENKINS
536 Lyding Lane
Sebastopol, Calif. 95472

Life-Long Friend

I was surprised and relieved to find a business company that was fulfilling its prime responsibility of "service to its patrons." You are in a minority group I'm sorry to say. Your policies have made me a life-long friend of ET/D.

SSGT. DOUGLAS G. CORBETT
Glasgow AFB, Mont.

How to get into

One of today's hottest money-making fields —*servicing 2-way radios!*

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R&D engineers. Topnotch licensed experts can earn $12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

He's flying high. Before he got his CIE training and FCC License, Ed Dulaney's only professional skill was as a commercial pilot engaged in crop dusting. Today he has his own two-way radio company, with seven full-time employees. "I am much better off financially, and really enjoy my work," he says. "I found my electronics lessons thorough and easy to understand. The CIE course was the best investment I ever made."

HOW WOULD YOU LIKE to start collecting your share of the big money being made in electronics today? To start earning $5 to $7 an hour... $200 to $300 a week... $10,000 to $15,000 a year?

Your best bet today, especially if you don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than *five million* two-way transmitters for police cars, fire trucks, taxis, planes, etc. and Citizen's Band uses—and the number is growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Many of them are earning $5,000 to $10,000 a year *more* than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the U.S. Government doesn't permit anyone to service two-way radio systems unless he is licensed by the FCC (Federal Communications Commission). And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A two-way radio user *must* keep those transmitters operating at all times, and *must* have them checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainer fee, such as $20 a month for a base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

Be Your Own Boss

There are other advantages too. You can become your own boss—work by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine or desk, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations.

How to Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your FCC License.
2. Then get a job in a two-way radio service shop and "learn the ropes" of the business. All CIE students can use our free employment service.
3. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move *out* and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you $5,000. Or you may be invited to move *up* into a high-prestige salaried job with one of the major manufacturers.

The first step—mastering the fundamentals of electronics in your spare time and getting an FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching electronics by mail for over thirty years. Right at home, in your spare time, you learn electronics step by step. Our AUTO-PROGRAMMED™ lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners." You'll learn not only the fundamentals that apply to all electronics design and servicing, but also the specific procedures for installing, troubleshooting, and maintaining two-way mobile equipment.

Get Your FCC License... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE-trained men pass the FCC Exam, even though two out of three non-CIE men fail. This startling record of achievement makes possible our famous FCC Warranty: you'll be able to pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Find out more about how to get ahead in all fields of electronics, including two-way radio. Mail coupon below for two FREE books, "How To Succeed In Electronics" and "How To Get A Commercial FCC License."

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All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

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EDITOR'S MEMO

Deadly Eliminator

It's a comfort to know we have some alert electrical inspectors in our country. Especially when they discover that a harmless-looking device used as a battery eliminator in transistor radios is actually a potentially lethal killer.

The device was recently discovered by an inspector in Ohio, and the results published by the International Ass'n. of Electrical Inspectors (IAEI).

The unit is manufactured and patented in Japan and sold all over the United States. It can be purchased by any unsuspecting customer to replace the 9v battery in his transistor radio. It looks like an ordinary 9v battery with an ac line cord attached, but the instruction sheet packed with the unit indicates its "special features." We quote: "This eliminator can be used as a substitute for 9v batteries, model 006P, Eveready 216, RCA VS312 or any other equivalent. It is identical in size with 006P battery and can be set in any transistor radio operated with 9v battery, 006P, or the equivalent. It operates far better than a 9v battery and always retains its good condition as to sensitivity, tonal volume, etc.

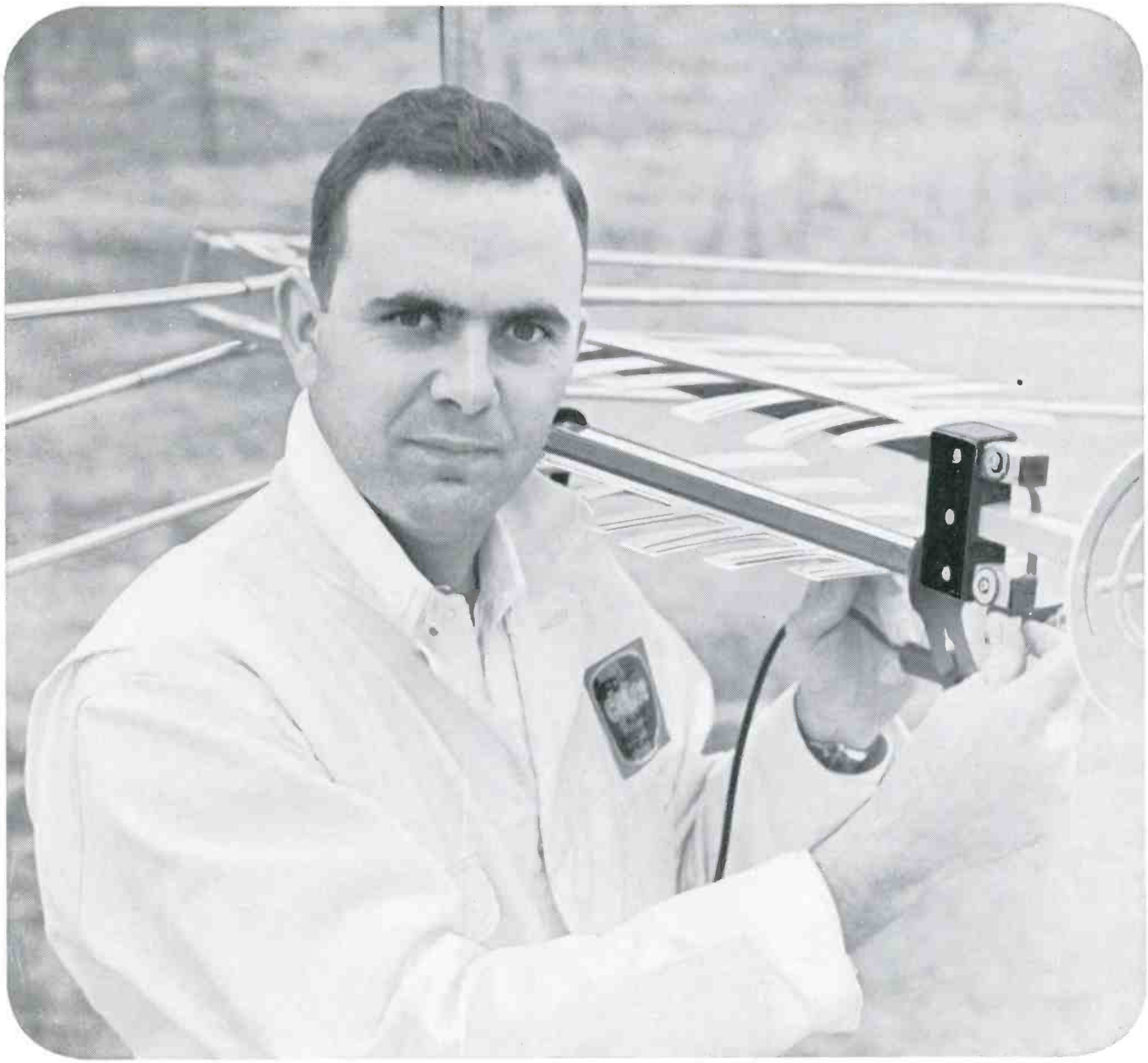
Used as a battery charger, the eliminator prolongs the life of the battery five times as much. The eliminator is made by a complete shuttered system and remains in good condition at all times."

What the manufacturer fails to mention is that the product can cause a radio to explode when — and if — it comes in contact with any grounded object. And worse — any person using the eliminator while coming in contact with a grounded object can be *electrocuted*.

A product of this type available to millions of transistor radio owners is a grave threat, as IAEI points out. It indicates a lack of proper testing on the manufacturer's part. One ponders how it could ever have been accepted into this country.

We should have, and need, more stringent control regulations on imported consumer goods.

This particular device was not approved by the Underwriters Laboratories, Inc. If electrical equipment manufactured in our own country must undergo exacting safety requirements — why not that of foreign manufacturers?



"Good bandwidth . . . good gain . . . good directivity: . . . on VHF, UHF and FM.

— with a single lead-in, are the reasons why we buy JFD Color Lasers," says Phillip Van Winkle of Van Winkle TV Service, Joplin, Missouri.

"We install Color Lasers in all kinds of locations: fringe, suburban, and local — and use JFD Color Shield 82 Coaxial Cable on about 95 per cent of them. That's why we can guarantee our customers top-notch color performance."

"We also like the way the Color Laser construction stands up against the high winds, ice and snow we've got to cope with."

Installing antennas? Take the advice of professional installers such as Phillip Van Winkle. If you're selling TV — there isn't a *better* way to make hay during (or between) set sales, than with JFD Color Lasers.

Interested? See your JFD distributor, or write direct to JFD for form 6828.

Remember . . .
PROFESSIONAL ANTENNA INSTALLERS KNOW — the Best Antenna for Color TV is The Color Laser by

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PEARCE-SIMPSON

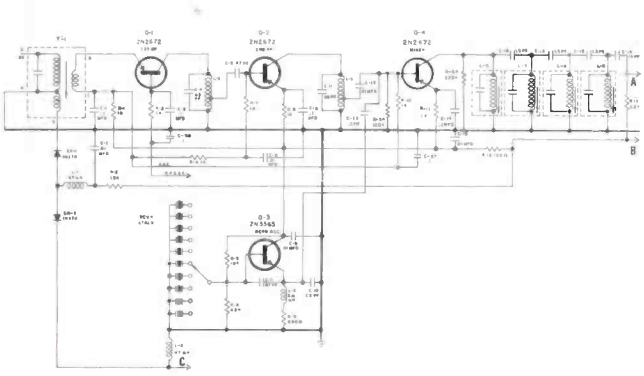
Citizens Band Radio Companion IV — Circuit Descriptions

This two-way radio is a fully transistorized, 10 channel 5w transmitter/receiver for mobile use and operates in the 26.965 to 27.255MHz citizens band.

Of interest is the rocker type channel switch which allows "touch-tap tuning." Slight pressure on the right hand button advances the switch to the next channel with each "tap" while pressure on the left hand button moves the switch in the opposite direction one channel for each tap.

Other features include: Push-pull Class B audio output stage; electronic transmit-receive switching; two RF stages in the receiver; a filter type IF amplifier mounted on a printed circuit board; the inclusion of a public address feature and using a highly reliable transmitter circuit with a TL filter output circuit.

Of the 13 transitors used, 7 are in the receiver circuit, 3 in the transmitter circuit and 3 used in the common audio circuit.

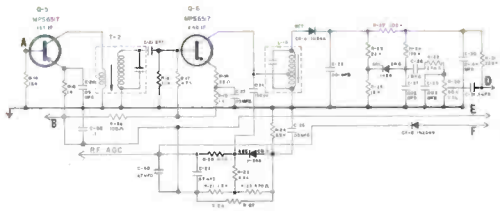


A type 2N2672 germanium transistor connected in a common base configuration is used as both the 1st RF amplifier and AGC amplifier. The high gain and low noise characteristic of this transistor makes it ideally suited for this stage. In addition, its AGC characteristic is excellent, providing good RF AGC gain control in this stage and at the same time delivers AGC for the other stages. The incoming signal is applied to the emitter and AGC voltage is applied to the base. The amplified signal appears at the collector and AGC voltage for other controlled stages results from the drop across R1 in the emitter circuit. This voltage drop will vary with change in base bias resulting from variations in the RF AGC voltage applied at the base.

A 2nd 2N2672 transistor is used in the conventional manner as the 2nd RF amplifier stage. AGC voltage is applied to the base of this transistor and its AGC characteristic is again used in this stage.

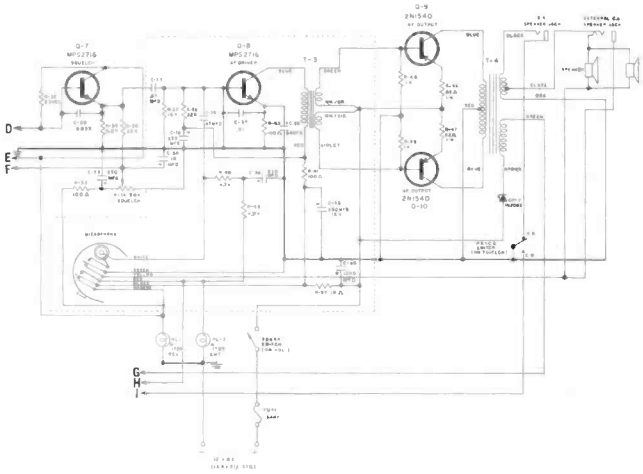
The 2N2672 transistor mixer has both the 27MHz incoming signal and the signal from the local oscillator applied to its base while the collector feeds directly into the 455kHz LC IF filter circuit. AGC voltage provides base bias.

A 2N3565 silicon transistor is used as the receiver local oscillator. The circuit is tuned to the crystal frequency by choice components and requires no service adjustments.



Two MPS6517 silicon transistors are employed as conventional IF amplifier stages. No AGC is needed in these stages as a result of effective control obtained in earlier stages.

Since the detector, noise limiter and AGC detector circuits are conventional in every respect, a description of these circuits will not be required.



Squelch action is obtained in Q7, an MPS2716 silicon transistor in the following manner: The squelch control (R36) adjusts the emitter bias of the transistor and the squelch threshold. When a signal is received, dc voltage is developed across R31, biasing the transistor into conduction. During no signal periods, R32 provides a slight amount of bias making it possible to completely unsquelch the radio. To provide better squelch control, the gain of AGC controlled stages is adjusted slightly (by the squelch control) by B+ voltage passing through squelch gate CR6 and into the AGC line. When a signal is received and AGC voltage builds up above the level of this voltage, the squelch gate closes and AGC takes control.

A second MPS2716 silicon transistor functions as the audio frequency driver. Audio from the receiver is coupled to the base of this transistor through C33 while the microphone output is coupled through C36. During transmit periods, the receiver is switched off and only audio from the microphone will reach this stage. Conversely, during receive periods, a microphone switch opens the microphone circuit and only receive audio will be present. Output from Q8 is transformer coupled to the audio output stage.

Zenith Tubes...
life-tested for greater dependability!

ZENITH TV PICTURE TUBES are rigorously tested at elevated line voltages for lengthy periods. Just one reason you can be sure of Zenith's great reliability and long life that better satisfies your customers. More than 200 Zenith quality tubes—for color TV, black-and-white TV, or special purposes—are in the complete line.

ZENITH "ROYAL CREST" CIRCUIT TUBES undergo over 1½ million hours of life-testing every month. Under actual operating conditions, they must meet the same quality standards as Zenith original parts—to perform with unrivaled dependability. Choose from a full line of more than 900 top-quality Zenith tubes.

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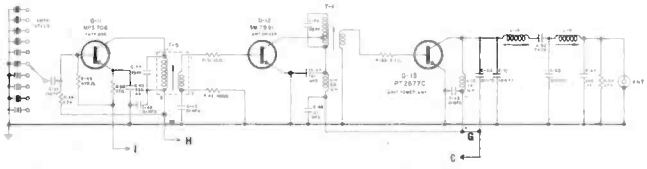
TECHNICAL DIGEST

Two 2N1540 germanium power transistors are used in the audio output circuit in a class B configuration to provide audio output signal. Using class B in this stage allows the no signal resting current to be quite low, while in the presence of signal, the current required will increase with demand.

Choice of impedances involved in the output transformer makes it possible to have the full 3w power capability available for modulation and public address operation. For receive operation, this capability is reduced to 1w, preventing damage to the smaller receive speaker. Modulator gate diode CR7 and diode action of the transmitter output transistor Q13 open the modulation winding of the transformer during receive operation. During transmit operation, a microphone contact opens, thus opening the speaker winding.



The crystal controlled transmitter oscillator circuit uses a MPS706 silicon transistor coupled to the driver stage through transformer T5. A microphone contact applies B+ voltage to this stage during transmit periods.

Another silicon transistor, a type S19386, operating in class C, functions as the transmit driver stage, delivering a signal to the power amplifier base, through transformer T6.

The type PT2677C silicon power transistor, also operated in class C, builds this signal up to provide a substantial output signal, which is coupled to the antenna through a TL network output filter.

Class C operation of the driver and output stages allows the transmitter to be cut off by switching off the oscillator. These stages do not function unless driven.

Antenna switching between transmitter and receiver is accomplished by two back-to-back type 1N270 diodes in series with the signal path from antenna to receiver. During receive operation, these diodes are biased in conduction by plus voltage through R2.

This allows the signal to pass through these diode switches. When the microphone button is pressed to transmit, this voltage is removed along with the receiver B+ voltage and these diode switches open, preventing the transmitted signal from reaching the receiver.

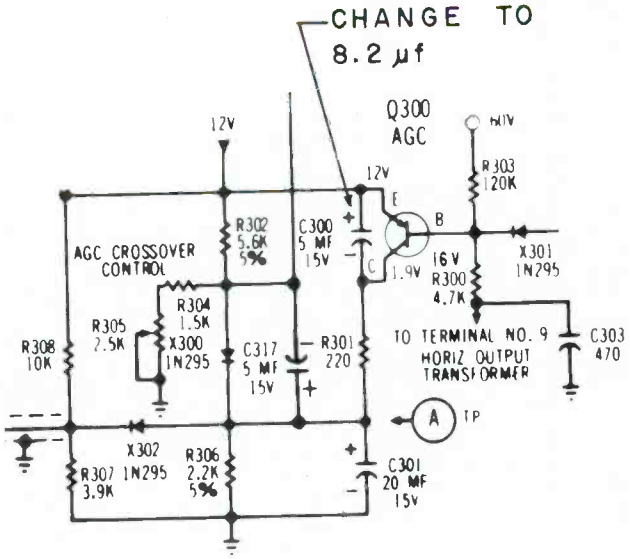
Switching between transmit operation and public address function employs a single pole, double throw switch ganged to the squelch control. In the CB position, one pole opens the PA speaker circuit while the other pole closes the B- circuit to the transmit oscillator. When switched to PA operation, this condition is reversed allowing the PA speaker to function and by disabling the transmitter oscillator preventing the transmitter from functioning.

WESTINGHOUSE

Transistor TV Chassis V-2483-1 — Vertical Jitter, Vertical Instability

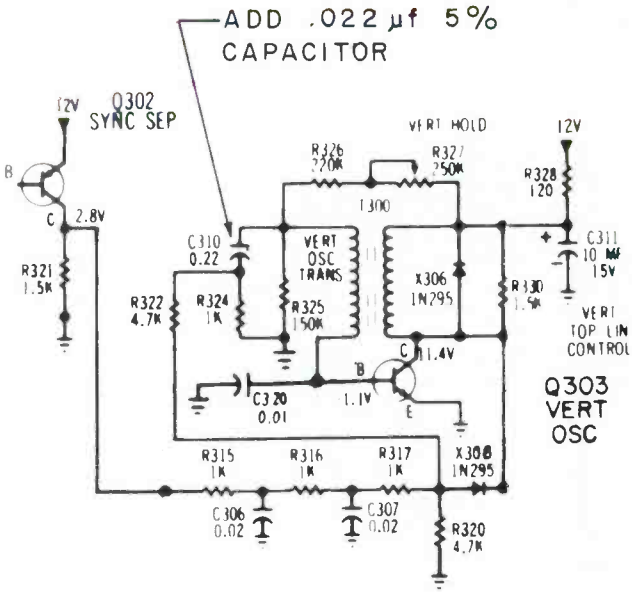
Vertical jitter can be caused by combined overloading and/or critical AGC setting. This condition may vary with signal levels and may occur intermittently.

TECHNICAL DIGEST



To correct this problem, change the 5 µf electrolytic capacitor, C300, connected collector-to-emitter of the AGC transistor, Q300, to an 8.2 µf capacitor as used in C420 application in the same chassis. In other words, substitute a new capacitor, C420, 218V063B01 in place of C300, 218V060H04. Use only C420, 218V063B01 as the replacement since it has special internal resistance characteristics.

If you encounter vertical hold instability, which may act as one-way vertical roll or the vertical hold may not lock near center range of the control, add a 0.022 µf capacitor, 5%, in parallel with capacitor, C310. This will extend the vertical lock-in range. If difficulty continues, you should check the vertical oscillator transistor, Q303.



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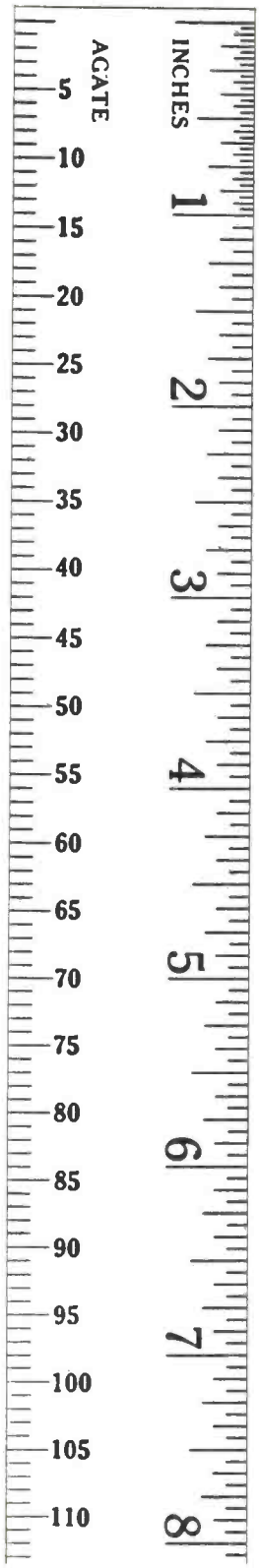

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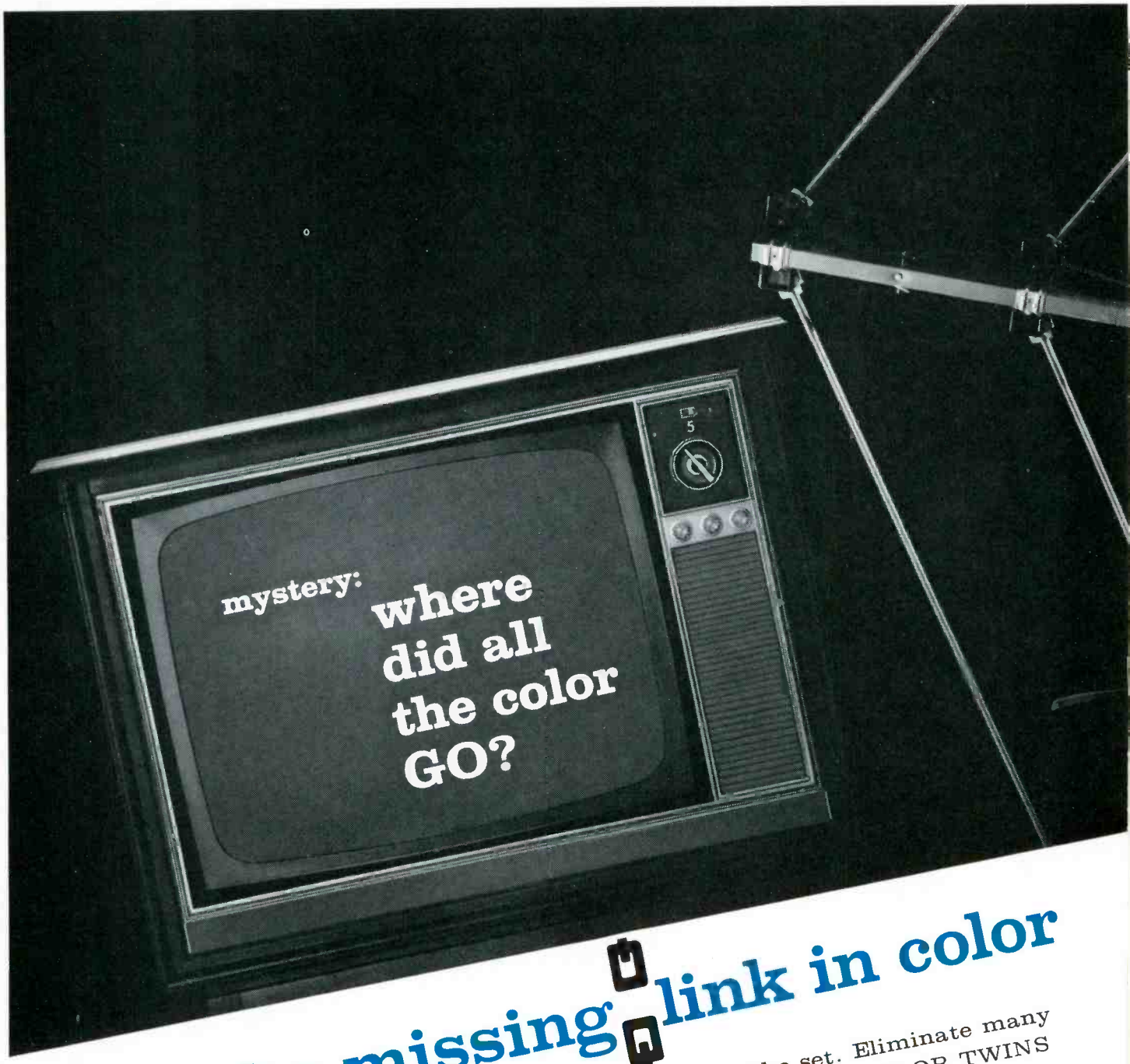

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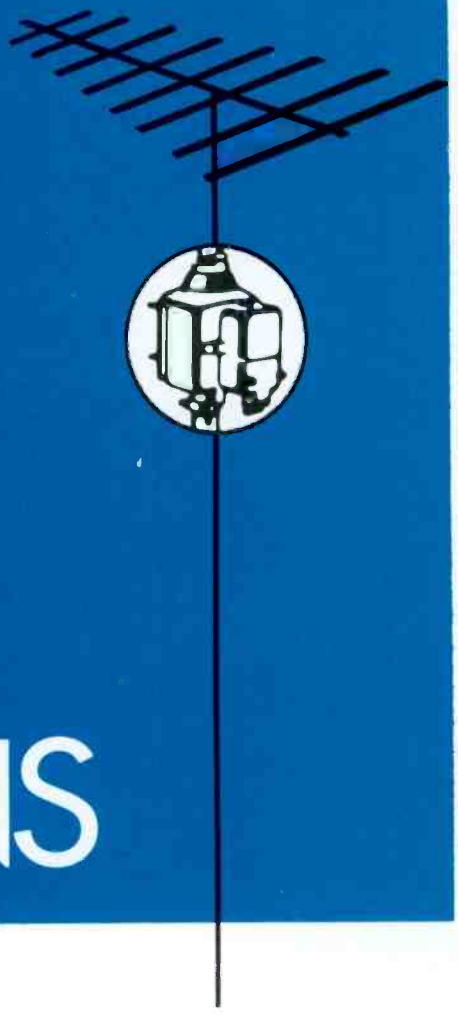

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ELECTRONIC TECHNICIAN / DEALER

JUNE 1968

The Growing Home-Entertainment Audio Equipment Market

Expand your 'acreage' and increase your cultivating efforts in this steadily advancing area of the electronics field

■ Last year an affluent American public bought over 40 million radios, phonographs and tape recorders for home use. This does not count radios and tape players used in autos nor phonos, radios and tape recorders included in TV combos.

We do not have figures to show how much this represents in retail dollars, but it has been conservatively estimated — based on figures supplied by the Electronics Industries Assn. (EIA) — to be well beyond $1 billion. The total retail value of all kinds of consumer electronics equipment sold last year, including TVs, came close to $6.5 billion. Under continuing favorable

Admiral's YF1361SA stereo phono is portable, solid-state and has AM/FM-stereo radio.

Scott's 348B AM/FM-stereo receiver uses three FETs in the front end and IC IFs. It is said to have a 1.7μv sensitivity and 40db stereo separation.

Allied AM/FM-stereo receiver employs 65 semiconductors and is said to have FM IHF sensitivity of 2μv with 35db separation at 1kHz and 40db separation at 400Hz.

Philco-Ford solid-state AM/FM table radio.

economic conditions, this figure is expected to increase yearly at a rate of about 7 percent.

The market for home-entertainment audio equipment is a big slice of the over-all consumer electronics pie (perhaps 16 percent or more).

But what seems equally important to service-dealers and technicians who sell and service this equipment, is the accumulating supply of total radios, phonos, tape recorders and tape players in U.S. homes.

It is estimated that close to 400 million radios, phonos, tape recorders, tape players and other home-entertainment audio equipment (excluding TVs) are now in U.S. homes. No matter how you slice it, this seems to represent another big pie, labeled "service revenue." And, as reported in ELECTRONIC TECHNICIAN/DEALER every month under the DEALERFAX section, it is a pie which many alert and aggressive service-dealers are now profitably slicing among themselves.

Some Growth Factors

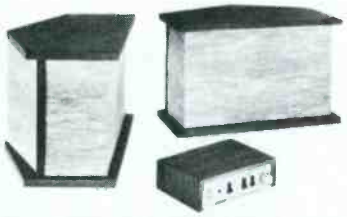
Much of the recent growth in home-entertainment audio equipment sales has been fertilized by increases in the number of FM broadcast stations, both monophonic and stereo, plus a substantial increase in programing and higher quality programs.

Developments in solid-state technology are other factors which have contributed to this growth. New circuit innovations have come about, easier-to-operate, lighter-weight, more convenient equipment has been designed. High-style, home-decor - oriented "package - type" equipment has come back in style after more than three decades. This equipment carries more substantial markups. And, of course, sales have been spurred onward by an exponentially increasing population and a Gross National Product (GNP) which results in a more affluent public.

But this affluent, younger-than-ever public, has grown more discriminating, too. It is looking for even better equipment — demanding a higher order of "listening pleasure." By and large, the R & D, the design and manufacturing departments have kept tuned-in on the "message" and seem thoroughly convinced of its urgent nature. A few, however, are still locked-in on the dead voices of yester-year. But most service-dealers, especially those located in interurban, suburban and rural areas, have caught on fast and have been capitalizing on the highly favorable objective conditions which have existed for some years now. Many have learned that it is a lot easier to "sell-up" on home-entertainment audio equipment today than it was a few years ago — especially since a wide selection of upgraded equipment is now available.

Some Equipment Developments

In addition to the strides made in developing more compact component-type, one-piece AM/FM/stereo tuner/preamp/amplifier entertainment systems, other audio equipment — from small battery-powered phonos to elaborate "theaters" to computerized-type "audiomated" record-player music cen-



Bose 901 direct/reflecting stereo speaker and solid-state equalizer.

Sherwood's S330 all solid-state FM/stereo tuner has microcircuits and FETs.

Harman-Kardon's TD3 three-head stereo deck.

Keystone 800 CR cassette tape recorder operates on 5 "C" cells.

Uher 7000 tape deck.

Norelco 2500 stereo cassette player deck for use with an existing Hi Fi system.

Jensen's PR400A speaker is rated at 40w. Uses three speakers in enclosure.

SJB's ST120G stereo tape player. Types are available for home, auto or boat.

ters that automatically play both sides of up to 50 LP (33 1/3) records — has been developed.

Although the field-effect (FET) transistor concept is older than the common junction type transistor which is now widely used in home-entertainment audio equipment, FETs have been developed in the past year or so which have contributed greatly to improving FM tuners, IF circuits and preamps. Additionally, we can look forward to smaller and smaller equipment having attending improvements as integrated circuits (ICs) are used more extensively. ICs are now being employed in a considerable amount of home-entertainment audio equipment.

A number of improvements have been made in record-player, tape recorder, tape player and speaker design. Equipment power supplies have been upgraded and refined. Much equipment, considered "professional" only a few years ago, has become "common fare" in many homes. Of course, it goes without mention, that a lot of "kid-oriented" equipment is being made which provides little service-potential to service-dealers because most of the equipment, like $5 transistor radios, falls in the "breakdown-to-ashcan" category.

Unique Approach to Stereo Reproduction

One manufacturer, primarily concerned with government and industrial R & D, has recently come up with what appears to be a unique approach to home stereo reproduction. A speaker is designed which operates on a direct/reflecting principle. An arrowhead-shaped enclosure houses nine high-compliance, long-excursion speakers. Eight speakers, mounted on two rear baffles, supply the reflected audio and one off-center-mounted speaker on the front baffle supplies the direct audio. It is said that 89 percent of the audio is reflected from a rear wall and 11 percent of the total audio is radiated directly. (For stereo, two speaker housings are placed 1 ft in front of the wall.)

The system employs a solid-state equalizer which contains over 100 components. It is used to precisely control the frequency response over the audible range. This unit has front panel controls which enable the listener to satisfy his personal taste in compensating for recording techniques and room characteristics. It is said that the system solves the long-existing, "hole-in-the-middle" effect problem. In addition to equalization that produces the flat frequency response of the radiated audio, the active equalizer system is said to provide the listener with a choice of 19 additional equalization contours that can be selected from the unit's front panel.

Although the tape-recording and tape-player segment of the home-entertainment audio equipment area is suffering some growing pains, it seems certain — whether reel-to-reel, ordinary cartridge, cassette or whatever — this segment of the business appears to be steadily growing and presents one more potential opportunity to service-dealers and technicians who take the home-entertainment audio equipment business seriously. ■

Seeburg's "audio-mated" system allows up to 40 hours of continuous listening.

LEL's tape cartridge background music reproducer provides 10 hours of music on a single cartridge.

Concord's STA12 AM/FM-stereo receiver with matching speakers.

Altec Lansing's high-style furniture cabinet is designed for housing receivers, tuners, amplifiers, record changers and tape recorders.

Exploring Zenith's Small Screen Color Portable

Understand circuits used in color portables — sales hit a new high and more transistors being employed

■ We were eager to unpack Zenith's first small screen portable color TV. When placing the set on the bench for inspection it was far from a lightweight unit, but after reading the article, you will likely agree no corners were cut in quality.

The 15Y6C15 chassis has most of the features employed in previous big sets: power transformer, parallel tube filaments, automatic degaussing, three stages of IF employing transistors, keyed AGC circuit and hand-wired chassis.

Some of the new features not used in previous circuits are: HV regulation accomplished by a pulse controlling the bias voltage on the grid of the horizontal output tube eliminating the HV regulator tube, two AGC controls, AGC LEVEL and the AGC DELAY control, an additional adjustment in the color oscillator circuit, low-level color demodulation and a new HUE control location.

All customer controls are in the front panel, including the AGC DELAY, VERTICAL SIZE and LINEARITY control. These controls are hidden by a drop-down panel with magnetic catches. By having the picture adjustments up front, reaching around or using a mirror to adjust the picture is eliminated.

The 15Y6C15 chassis has a 14in. (diagonal measurement) or 102sq in. screen and contains hybrid circuitry, 18 tubes including CRT, 6 transistors and a number of diodes.

If chassis work is needed, all components can be exposed by removing the back cover, the four screws holding the bottom panel and laying the set on its side. This eliminates the need to pull the chassis for shop work (see illustration Fig. 1).

We will now go into several important circuit features which are quite different from previous chassis.

IF Amplifier

The transistorized IF section consists of a separate chassis contained in a shielded metal case to minimize radiation effects and provide isolation between stages. The IF chassis is secured within the metal case by four screws (see illustration Fig. 2). The metal case, which measures approximately 6 x 2½ x 1⅝ in., is held vertically in place by three screws. Electrical connections consist of plug-on leads.

The IF amplifier system consists of three transistorized stages (see schematic Fig. 3), TR1, TR2 and TR3. All three stages are NPN types, with the 1st stage AGC controlled using "forward" AGC voltage applied to its base. An increase in positive voltage at its base will increase the collector current and decrease the collector-to-emitter voltage, reducing stage gain.

The input circuitry consists of a double-tuned circuit formed by the 1st IF transformer and the mixer plate coil in the VHF tuner coupled through the IF cable. The 1st IF transformer is a step-down coil providing a low impedance input to TR1. Variations in electrical characteristics of the tuner and IF cable are controlled by the bottom winding adjustment of L1A and L1B trap coil (winding L1B is the 39.75MHz trap).

A full complement of traps is provided: the 39.75-MHz adjacent video, 47.25MHz adjacent sound, and two (input and output) 41.25MHz traps.

The 41.25MHz input trap (L3) and the 47.25MHz trap coil (L4) form a bridge type circuit which has minimum band pass effect. Two cores are provided in all trap coils providing adjustment for proper rejection level.

The first IF transistor (TR1) is biased through the two 470 Ω, series resistors, R2 and R3. Capacitors, C14 and C15, provide filtering.

Capacitor C12 provides dc blocking, preventing the AGC voltage applied to the TR1 base from being grounded through L2. "Maximum gain" bias is approximately 4.5v and is applied to the base of TR1 under a very weak signal condition. "Minimum gain" bias is ap-

Zenith's Model Z3508W color portable.

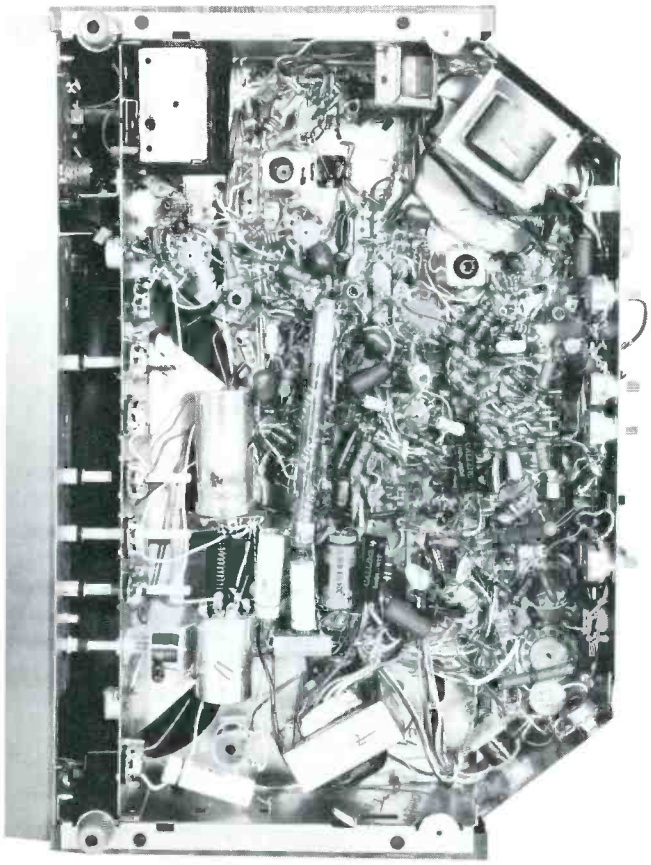


Fig. 1 — All components are exposed for servicing, by removing the back cover and four screws on the bottom panel.

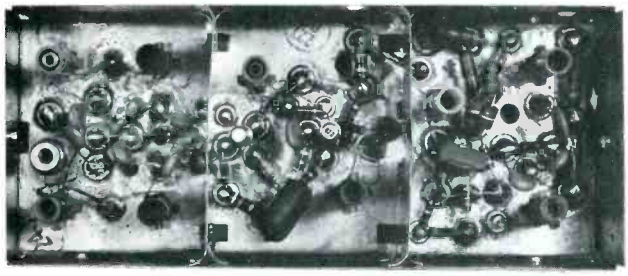


Fig. 2 — The transistorized IF section consists of a separate chassis contained in a shielded metal case.

proximately 7v and would be present at the base of TR1 under a very strong signal condition. This minimum voltage (4.5v) is then held constant by a clamp network including the AGC transistor TR5.

Transistor TR1 is coupled to TR2 by the double-tuned interstage transformer (L5) in the TR1 collector circuit. This circuit also has a unique design providing a "boost" of the sound carrier on weak signals. TR2 is coupled to TR3 through a pi-coupling network (L6, C25 and C28) providing the necessary "Q" combined with a low pass characteristic.

Coils L7 (4th IF primary) and L12 (4th IF secondary) form a slightly overcoupled, double-tuned circuit with a 41.25MHz output trap in the coupling network between L7 and L12. Resistor R23 and capacitor C42 form a partial neutralizing and dc stabilizing circuit for the TR3 base. Detectors X1, X2, provide detection for Y amplifier and sync-sound amplification. Approximately 4v peak appears at test point C1 and approximately 2v peak at test point C2. Capacitors C39 and C40 provide a three to one capacity divider which lowers the impedance coupling to the 41.25MHz trap, while capacitors C46 and C47 provide an increase in impedance for proper detection.

High Voltage Regulation

The horizontal oscillator circuit is very similar to previous chassis designs. The high voltage circuit of the

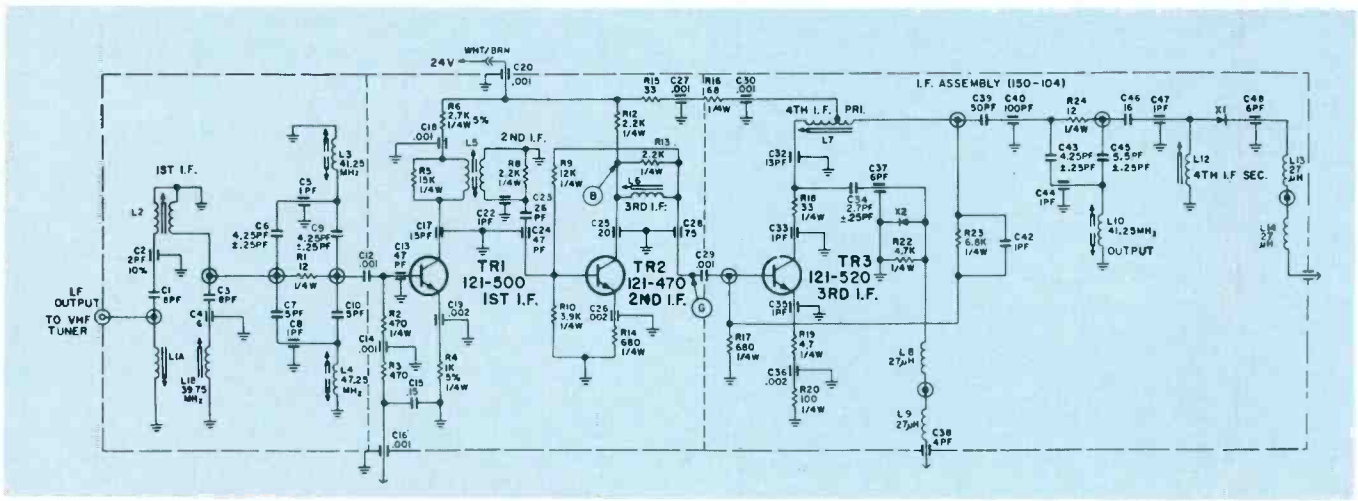


Fig. 3 — Schematic of the transistorized IF amplifier system.

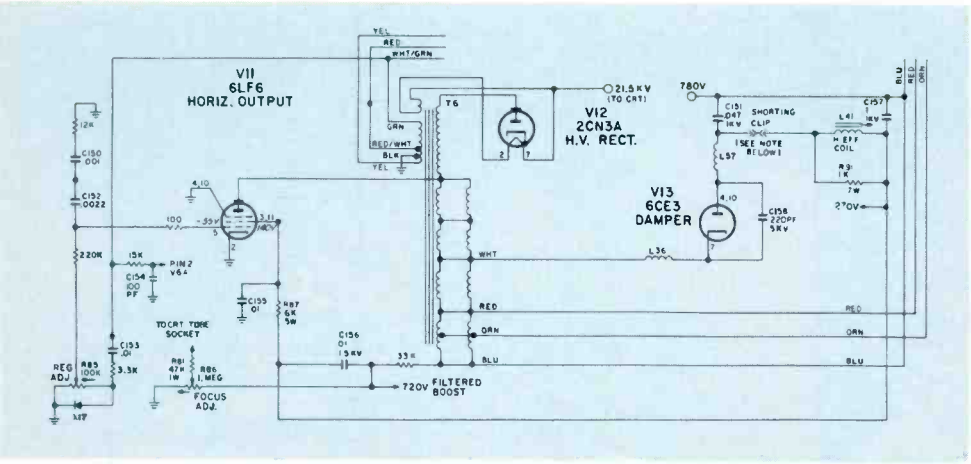
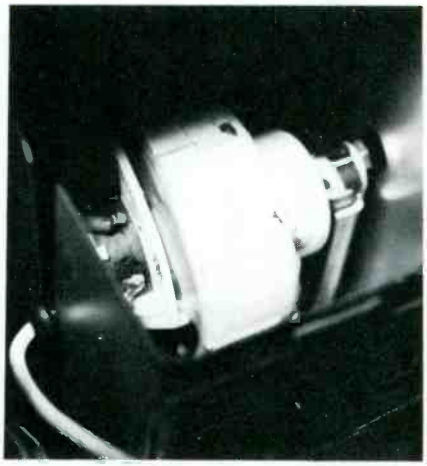


Fig. 4 — Schematic of the HV circuit with HV regulation accomplished by a pulse controlling the bias voltage on the horizontal output tube grid.



The HV sweep transformer is shielded by a metal cage and sealed in polyester resin which is protected against moisture and corona discharge.

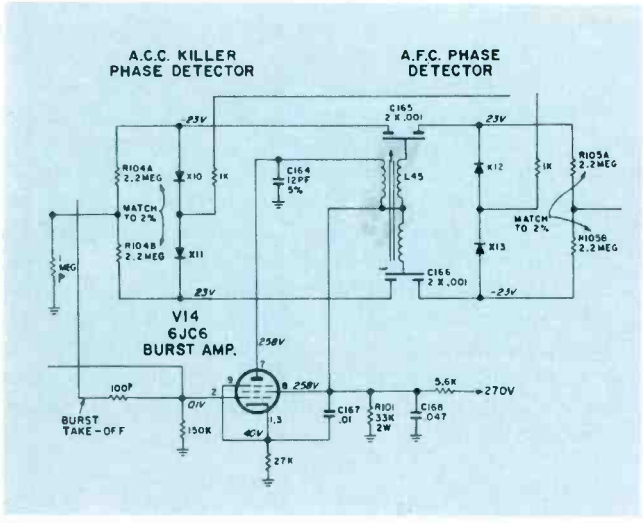
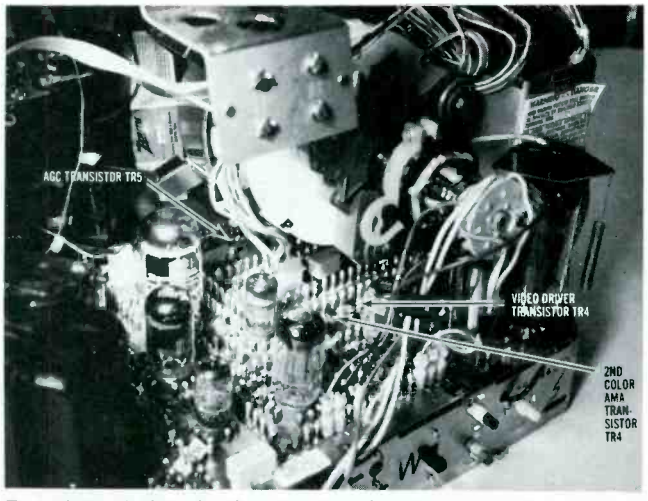


Fig. 5 — Schematic showing burst amplifier and phase detectors.



Top view of chassis showing transistors employed, except IF transistors.

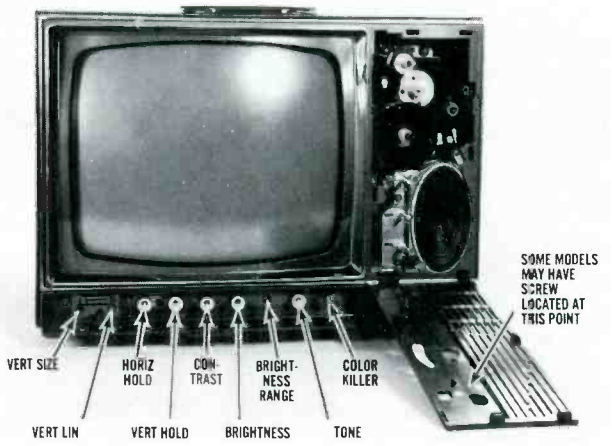
15Y6C15 chassis differs considerably from previous designs. HV regulation (see schematic Fig. 4) is accomplished by a pulse controlling the bias (drive) voltage on the horizontal output tube grid. For example, if the CRT beam current increases to cause an increase in load on the sweep transformer, the HV pulse will decrease, causing a decrease in high voltage. This decrease in pulse amplitude causes a decrease in the 200v pulse coupled to a REGULATOR ADJUST control (R85) through C153. This causes a decrease in the horizontal output tube grid bias which results in a greater output tube conduction thus increasing the HV pulse and the high voltage. The REGULATOR ADJUST control is normally set for 21.5kv. A voltage regulator is not used in this chassis.

Noise Gate-AGC-Sound-Sync Amp

With transistorized IF stages, a slightly smaller output signal amplitude is obtained from the video detector (approximately 4v peak as compared to tube IFs that produce about 6v peak). Because of this, the signal fed to the sync-AGC tube input grid (V4) is taken from cathode follower tube plate (V1A) employing the extra gain of that stage.

Noise pulses of relatively large amplitude will cut off V4, which could cause the IF amplifiers to be at full gain (lack of AGC action) and could cause "lock-up," a sustained overload condition. Under such a large signal condition, however, the video coupled to the sound-sync amplifier, V3A, will also be sufficient to cause cut-off and thereby increase the screen voltage. This sudden, momentary increase in screen voltage is coupled through C67 as a positive pulse which allows V4 to conduct and prevent "lock-up".

The negative (or positive) AGC voltage developed at the plate (pin 3) of V4 is applied to the tuner RF stage through a 2.2M resistor and to the TR5 base through a 680K resistor. The AGC voltage for the 1st



Front view showing controls and front panel removed for servicing, by simply removing knobs and prying panel off.

IF, however, must be a positive voltage since it is an NPN type. To decrease the gain of an NPN transistor amplifier, the base voltage (positive) must be increased. Thus, the AGC voltage produced by V4 must be employed in a manner that it will control a positive 1st IF amplifier AGC voltage. Under a "no" signal condition, the AGC tube (V4) is cut off. Thus, the base of TR5 is approximately 5 to 6v positive formed by a voltage divider consisting of a 2.2M resistor (from 270v, V4 plate), in series with a 680K and a 120K resistor to ground. The voltage at the tuner under this condition is approximately 1.0v positive. The 5 μf capacitor (C59) located in the TR5 base circuit is a non-polarized type since the base voltage of TR5 may be positive or negative depending upon signal strength.

Transistor TR5 is also across part of another voltage divider consisting of a 1.8K and a 560Ω resistor in series with a 250Ω AGC DELAY control. The positive base voltage of TR1 is approximately 4v depending upon the setting of R44 (AGC DELAY). Under a given weak signal condition V4 will conduct and the voltage at TR5 base will decrease (less positive) to approximately .5v or only slightly positive. Transistor TR5 will conduct less and the voltage at the base of TR1 will increase slightly, thus reducing its gain accordingly.

Under a given strong signal condition, the tuner AGC voltage may become highly negative, driving the TR5 base voltage negative causing it to cut off and resulting in a positive voltage of approximately 7v at test point E and at the TR1 base. With 7v positive at the base of TR1, its gain is substantially reduced. (The "range" of AGC control on TR1 is adjustable by the setting of R44, AGC DELAY control).

Burst Amplifier-Phase Detectors

The burst amplifier (V14) separates burst information and couples this signal to the ACC and AFC phase detector stages. The circuitry of V14 (see schematic Fig. 5) is also similar to previous chassis designs with the exception of the new HUE control location. The phase detector coil (L45) approaches a coarse hue adjustment providing a tolerance of -30deg and $+45$deg on the total tuning range. The V14 suppressor grid is returned to the cathode rather than to ground for additional stability.

The ACC phase detector employs two silicon diodes with the color oscillator phase injection voltage "in phase" with burst. The 1K resistor in series with the sample voltage injection path filters out any 3.58MHz radiation which might otherwise be caused by diode switching transients.

The AFC phase detector also employs two silicon diodes in a similar circuit with the injection (sample) voltage coupled to the diodes through a 1K resistor for 3.58MHz radiation suppression.

Color Amplifiers

Chroma (color) information is coupled to the grid of the 1st color amplifier (V1B) through a 12pf capacitor from the 4.5MHz trap (test point C1). The color signal is amplified and coil L25, 1st color amplifier plate coil is adjusted for minimum transient response. The output of V1B is also coupled to the burst amplifier, V14, for burst separation.

The chroma output of V1B is coupled to the HUE and COLOR LEVEL control circuitry, and to the base of the 2nd color amplifier, an NPN transistor. Coil L25 is tapped in the output circuit to provide impedance matching for the transistor input.

The circuitry of the HUE control provides nearly 90-deg phase shift of color throughout its range. The HUE control has a linear taper and the COLOR LEVEL control a non-linear taper. Thus, the action of the COLOR LEVEL control provides a smooth increase and decrease of color level without excessive overload or saturation at maximum color level control setting.

The 2nd color amplifier (transistor TR6) is properly biased from a regulated (Zener controlled) 24v source in the power supply.

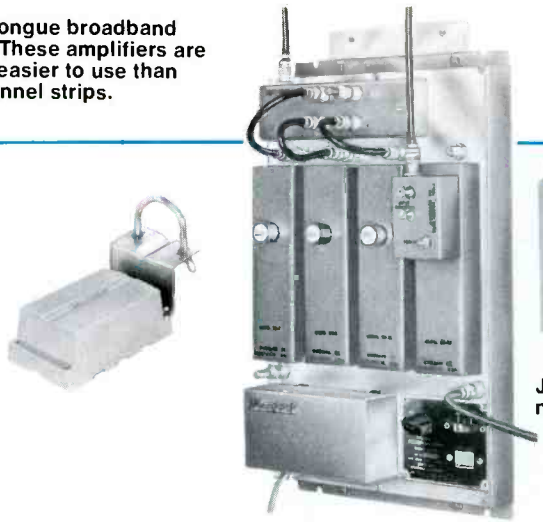
The output of TR6 is coupled to the grid of V6B (3rd color amplifier). Input tuning is fixed by L26, C107 and capacities of TR6 and input capacity of V6B. The cathode of V6B also accepts the positive horizontal pulse from the blanker stage to cut off V6B during this period providing zero color output during horizontal blanking.

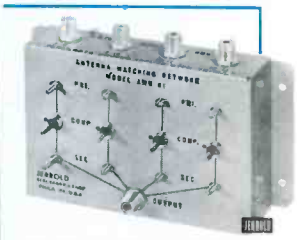
Color killer action is similar to previous chassis designs with killer voltage being applied to the grid of the 3rd color amplifier.

Color Oscillators

The color oscillator, although similar in circuitry to previous design, contains an additional adjustment (L48) which is tuned for maximum oscillator output. The tuning range is very broad and not critical. ■

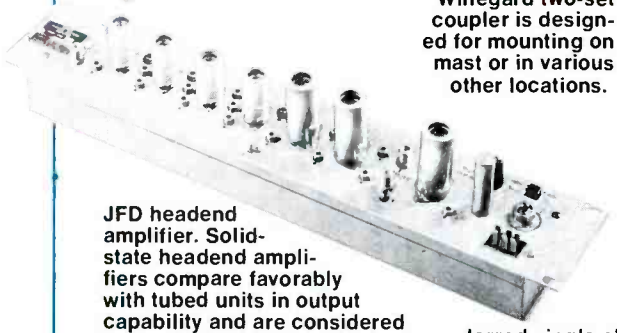
Blonder-Tongue broadband amplifier. These amplifiers are generally easier to use than single channel strips.





Jerrold antenna matching network.

Winegard two-set coupler is designed for mounting on mast or in various other locations.

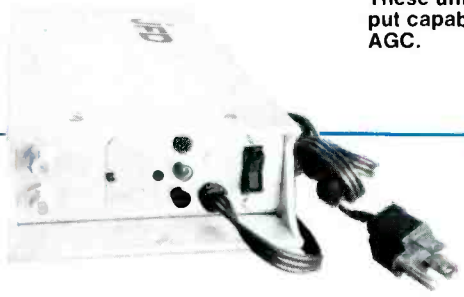


JFD headend amplifier. Solid-state headend amplifiers compare favorably with tubed units in output capability and are considered more maintenance-free.

Jerrod single channel amplifier. These units provide high output capability and may include AGC.

UHF converter may be plugged directly into single channel headend strip. *Courtesy Winegard.*

JFD mast-mounted preamp.



Blonder-Tongue transistorized UHF converter/amplifier.

Selling and Installing MATV Systems

Understand the essentials of headend design

Part three of a series

■ Part two of this series (ELECTRONIC TECHNICIAN/DEALER, April 1968), explained how to design and lay out MATV distribution systems. We will now discuss MATV headend equipment — amplifiers, preamps, mixers, splitters, filters, traps, attenuators and provide a word about antennas.

Until recently, equipment was not available for distributing UHF signals through a large master TV system. In the past the practice has been to convert UHF into VHF before distribution. This article will deal only with VHF systems. A forthcoming article will cover 82-channel systems having on-channel UHF distribution.

MATV Amplifiers

MATV amplifiers are classified into two groups: 1) single channel and 2) broadband.

Broadband amplifiers are generally easier to use, especially with broadband antennas. Single channel amplifiers, however, can provide more output per channel and simplify signal equalization.

Until recently, tubed amplifiers outperformed solid-state units. But the state-of-the-art has now advanced significantly. Solid-state amplifiers not only provide very high gain, they are more reliable.

The two main criteria for selecting an MATV amplifier are *gain* and *output capability*. Gain is easy to understand. Suppose, for example, that you put 100 μ v into an amplifier and measure 10k μ v at the output. Obviously, the signal has been amplified 100 times. According to the chart shown in part one of this series (ET/D, page 45, February 1968), 100 times voltage is 40db. This amplifier would then provide 40db gain. To express this mathematically, we can say: G (gain) $= V_O$ (output voltage)/V_I (input voltage).

Now, suppose we have a distribution system which has a 50db loss.

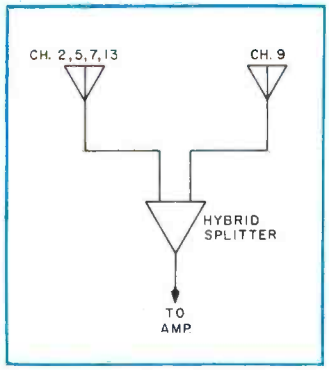


Fig. 1 — Single channel antenna combined with a broadband antenna.

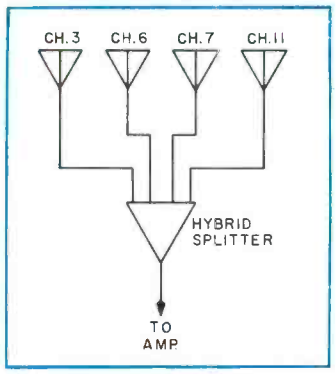


Fig. 2 — Hybrid splitter used to mix four single-channel antenna outputs.

Blonder-Tongue mast-mounted transistorized VHF/UHF preamp.

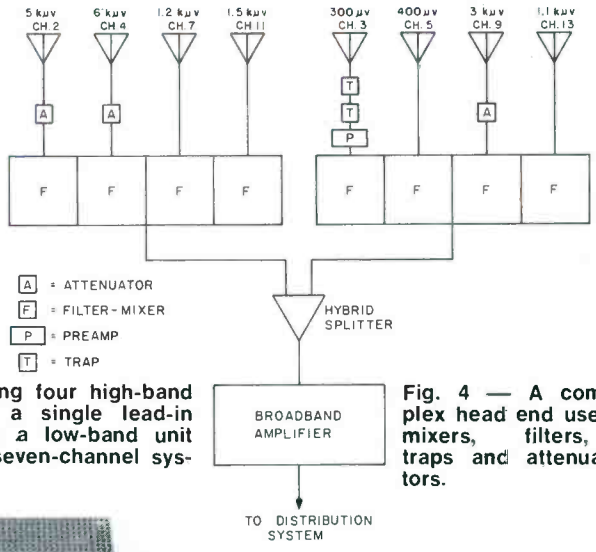


Fig. 4 — A complex head end uses mixers, filters, traps and attenuators.

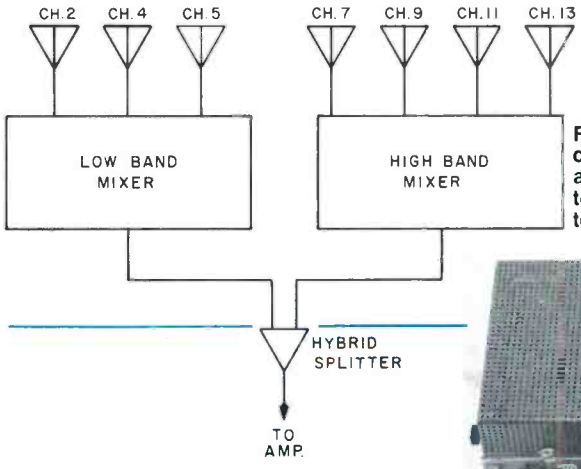
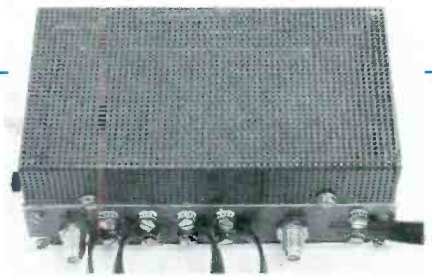


Fig. 3 — Mixing four high-band channels into a single lead-in and combining a low-band unit to produce a seven-channel system.



Winegard's transistorized VHF/FM booster/coupler/amplifier.

Will an amplifier that provides 50db gain handle this system?

Unfortunately, it's not quite that easy. To choose an MATV amplifier, we have to consider the *output factor*. For example, if we have an input to the amplifier of only 500 μv, or −6dbmv, the output will be only 44dbmv — not enough to provide good signals throughout the system.

Even if we do have an input of 1k μv (Odb) and a gain of 50db, this amplifier may not work. This brings us to the concept of *output capability*. Try to get too much signal from a given amplifier and it will overload. If a broadband amplifier overloads, you get intermodulation (between channels) and if a single channel amplifier overloads, you get sync compression. Overloads show up on a TV screen as poor sync, beats or "windshield-wiper-effect."

Manufacturers invariably specify the output capability of their amplifiers, but these specs can be confusing. Some manufacturers give you total voltage output of all channels combined. Others give you output per channel. Some give it to you in dbmv and others in microvolts. It's confusing to say the least. Today, many manufacturers give you specifications in dbmv per channel, assuming seven channel operation (three low and four high bands) and these are easiest to use.

In choosing an amplifier, make sure that it has enough gain and output capability to give you at least as much output as the distribution system loses. For example, if your system loses 54db at channel 13, you need an output of at least 54dbmv at channel 13.

Preamps

The ability of a TV signal to produce top-quality color reception depends on several factors:

1) The signal amplitude at the antenna's output.

2) The signal-to-noise ratio.

3) The amount of interference present.

Preamplifiers not only increase the signal amplitude, but they can improve the system's s/n ratio. Every antenna picks up a certain amount of noise — along with the signal. In a strong signal area, the signal is considerably stronger than the noise and you have no problem. In a weak signal area, however, the s/n ratio may be poor and the noise may be almost as strong as the signal.

It is generally agreed that a 28db s/n ratio is required for good TV reception. If the ratio falls much below 28db, you get a snowy picture. And here's an important point to remember: If the headend has a low s/n ratio, no amount of amplification directly at the distribution system input will improve it. Because the noise is in the same passband as the signal, it is amplified along with the signal.

The output of the antenna system determines the s/n ratio. But a long lead-in, or one having excessive loss, can cause signal attenuation. Unfortunately, since the noise covers a broad frequency range, it is not attenuated as much by the lead-in as the signal is. The result is a low signal-to-noise ratio.

Preamps are designed to overcome this problem. They are properly mounted on the mast directly at the antenna output. Thus the signals are amplified before they can be attenuated by the lead-in — maintaining the best possible s/n ratio. Most preamps are remotely powered — an indoor power supply sends power up to the preamp through the same lead-in that pipes the signals down.

Mixers and Splitters

You don't always have to use a broadband amplifier with a broadband antenna or single channel amplifiers with single channel antennas. There are often good reasons for mixing and splitting signals. Suppose, for example, that you have four channels coming from one direction and one channel coming from another direction. You might use a single channel antenna mixed with a broadband antenna as shown in Fig. 1. Similarly, to mix four single channel antennas into a broadband amplifier, you can use a hybrid splitter as shown in Fig. 2. A unit designed to mix four high band channels into a single lead-in, is shown in Fig. 3. It is easily combined with a similar low band unit, to produce a seven channel system as shown.

Filters, Traps And Attenuators

So far, we've assumed that all channels are received at about the same strength. This is seldom the case. In an MATV system, it is easy for one channel to interfere with another, especially if adjacent channels are included. To eliminate or minimize interference from one channel to another, we use filters, traps and attenuators.

Filters are relatively broadband. Their passbands are about 6MHz and they attenuate frequencies above and below this passband. Unfortunately, they are not too selective. For example, a channel 3 filter will generally pass channel 2 and channel 4, attenuating them only about 6db. And mixers can actually act as filters as well as mixers.

To eliminate adjacent channel interference, traps are required. Traps give you sharp attenuation, only a few kHz wide. You can buy traps for any VHF sound or video carrier frequency.

Attenuators are not frequency sensitive. Their job is to reduce strong signals.

A rather complex headend, using mixers, filters, traps and attenuators is shown in Fig. 4. The adjacent channels are 2, 3 and 4. Because it is so weak (only 300 μ v), channel 3 will cause no problems to 2 and 4. However, 2 and 4 can cause severe interference on 3. To eliminate this interference, we trap out the two carriers closest to channel 3 (two sound and four video) using two traps in series as indicated. Next, we use a single channel preamp to build up channel 3. Notice that the traps precede the preamp. This is because neither the single channel antenna nor the preamp are selective enough to reject channels 2 and 4. The traps attenuate the offending carriers by 50 or 60db before they are amplified by the preamp.

The attenuators on channels 2, 4 and 9 are used to bring these signals as close as possible to the level of the other channels. For best results, the inputs to a broadband amplifier should be equalized in this way.

Automatic gain control. Many modern single channel amplifiers are equipped with AGC (automatic gain control). AGC is used to insure that output signals remain constant in spite of fluctuations in input signals. AGC is especially important for large MATV systems in metropolitan areas where signal fluctuation may be severe.

UHF converters. Earlier, we mentioned that UHF channels can be converted to unused VHF frequencies for easy distribution. There is a danger in this, however. Conversion requires an oscillator with fundamentals and harmonics that can cause interference in a given system. Choose your converter frequencies with care. It's a good idea to rely on your manufacturer's recommendation and to use no more than two UHF channels in any single MATV system. UHF converters are available that plug directly into a single channel headend panel.

Any of the headends shown here can be combined with the distribution systems covered in part two of this series to make a complete VHF MATV system. The trend, however, is to 82 channel systems — distributing UHF without conversion.

Antennas

We already know that antennas are essential and critical components in any communications system. The antenna determines the amount of incoming signal available at the headend and MATV-type antennas differ considerably from the typical home-type TV antennas with which we are most familar.

But it must be admitted that ordinary home-type TV antennas will work in MATV systems. In fact, some antennas are specifically designed and recommended for home and various other small MATV systems.

The real difference between home-type TV antennas and those used for large MATV systems involves time and money. You can afford, for example, to spend more time and money on the antenna used for 200 sets than for one used on a single set. (For detailed information on antennas, see the article series, "Antennas — Sans 'Bafflegab' and 'Bushwa' " which began in the September 1967 issue. The second and third parts appeared in the March and May 1968 issues.)

A typical MATV antenna is usually more ruggedly constructed than home-type antennas. Large MATV systems use a separate, high gain antenna for each channel. Smaller systems can often use an all-channel broad-banded antenna. Single channel antennas are more costly and usually more difficult to install. They frequently are necessary, however, when TV signals do not all come from the same direction. Remember, you can't use a rotor in an MATV system!

Part four of this series will cover 82 channel MATV, both headends and distribution systems. ■

The 22nd article in a continuing series

Semiconductors from A to Z

Technicians must understand a new breed of semiconductors to effectively service modern power supplies and power regulating circuits

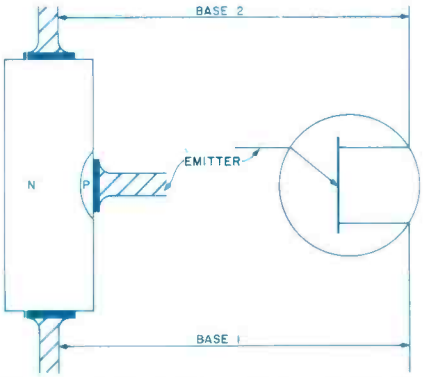


Fig. 1 — The structure of a unijunction transistor.

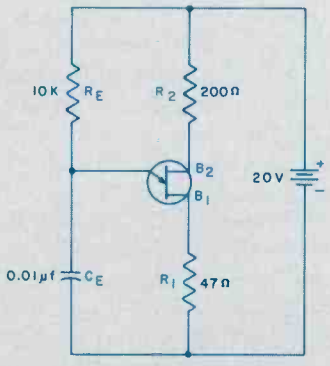


Fig. 2 — A simple unijunction transistor switching circuit.

■ All of the semiconductor circuits described in the previous articles have required dc bias supplies. Most of these circuits can function in a fairly satisfactory manner with batteries, but greater stability, and frequently greater convenience, results when they receive their bias from ac-driven power supplies.

Many of the newer power supplies and power regulating circuits require semiconductors that have not yet been described in this series. These semiconductors must be understood if new power circuits are to be effectively serviced.

Unijunction Transistors

Although the basic structure of a unijunction transistor (Fig. 1) may appear somewhat similar to that of a field-effect transistor, this semiconductor operates on an entirely different principle, somewhat resembling that of a tunnel diode.

When the two bases (B_1 and B_2) of a unijunction transistor are connected in a circuit (Fig. 2), current flows through the transistor from base-one to base-two and the resulting voltage drop between the two bases (V_{B2B1}) is dependent on the amount of current through the channel of N-type material (I_{B2}) and the total resistance of that channel (r_{BB}). Just as the voltage drop at a potentiometer tap is less than the total voltage drop across the potentiometer, the voltage drop at the P-N junction (the voltage drop in the N-type material at the junction, not the voltage drop across the junction) within the semiconductor channel is less than the total voltage drop across the channel. The junction is, therefore, more positive than base-one, while less positive than base-two.

When a capacitor (C_E) connected to the transistor's emitter (Fig. 2) is discharged (both plates at the same potential), the emitter (constructed of P-type material) is less positive than the conductive channel (constructed of N-type material), and virtually no current flows between the conductive channel and the emitter (the diode formed by the P-N junction is reverse biased, and virtually no current flows through the diode).

As a small current flows through resistor R_E, the voltage across the capacitor increases (resistor-capacitor time constants for increasing or reducing the voltage across a capacitor are described with Fig. 2 in the September 1967 article), and once the charge across the capacitor be-

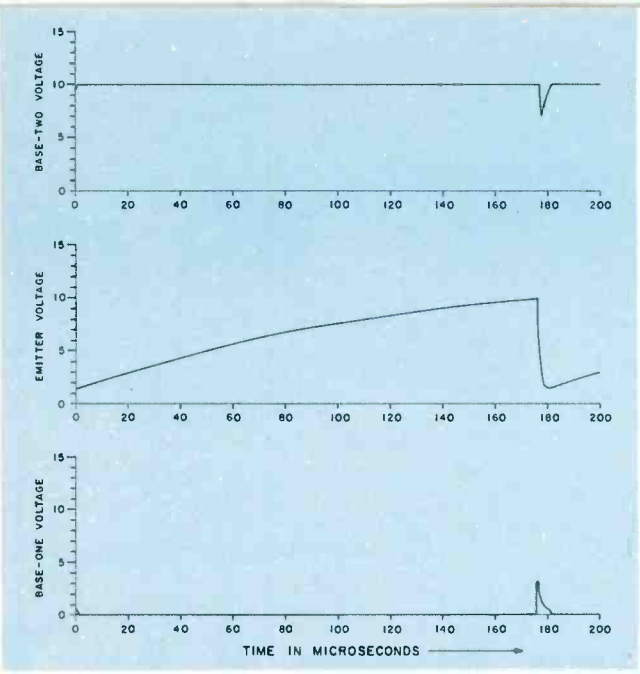


Fig. 3 — Emitter, base-one and base-two voltages present in the switching circuit.

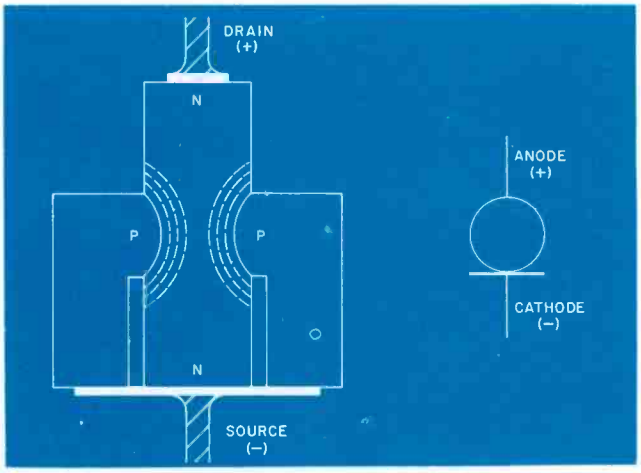


Fig. 4 — Structure of a reverse-biased field-effect diode.

comes so great that the P-type material is more positive than the N-type material, the diode formed is forward biased and current will flow from base-one to the emitter. (The emitter is still less positive than base-two, so the current must flow from the more negative base-one to the emitter.)

Once a current flows between base-one and the emitter, the semiconductor material between base-one and the emitter behaves like the material in a tunnel diode. The flow of current between base-one and the emitter reduces the resistance of this semiconductor material. The reduction in resistance reduces the voltage drop between base-one and the emitter, which in turn further reduces the material's resistance. (This condition is indicated by the negative resistance slope of a tunnel diode characteristic curve shown in Fig. 1 and 2 of the February 1967 article.) The current flowing between base-one and the emitter reduces the potential drop across the capacitor (C_E) to zero. When the emitter is no longer more positive than base-one, the current ceases to flow through the emitter, and the capacitor again becomes charged by resistor R_E.

While current was flowing from base-one to the emitter, the resistance of N-type material near base-one was reduced. As a result of this reduced resistance, more current flowed not only to the emitter but to base-two as well. The base-one to emitter current increased the base-one to base-two current.

The entire channel of N-type material conducts more current when the emitter voltage exceeds a peak-point voltage (V_p). The emitter, base-one and base-two voltages that result are shown in Fig. 3.

Field-Effect Diodes

Field-effect, or current-regulating diodes (Fig. 4), are very similar to the field-effect transistors described with Fig. 1 in the December 1966 article of this series. The basic difference is that the diodes are only double-lead components and the gate material in field-effect diodes is connected to the same lead as the end of the conductive channel designated the source. (Another difference between the two particular examples shown is that in the transistor the gates are shown as being made of N-type material, while in the diode they are shown as being made of P-type material—the type of material for the conductive channel having also been changed.

If the diode gates were not connected to the source lead and the P-type material was made more negative than the N-type conductive channel, the P-N junctions would be reverse biased. The greater the reverse bias, the greater the effective junction size and the smaller the remaining N-type channel for conducting current. The opposite condition would occur if we were to reverse the polarity of the applied bias voltage.

The December 1966 article (Fig. 2) shows the characteristic curve of a junction FET. With the gate and source connected to a common lead, there is no gate-to-source voltage ($V_G = 0$); and from the "$V_G = 0$" curve we see that as the drain-to-source voltage varies between 8.5v and 25v, the drain current remains a virtually constant 5.8ma. (The polarity of the voltages and currents for the diode are opposite those for the transistor since the arrangement of P- and N-type material has been reversed.) The current regulating diode maintains a nearly constant current as the applied voltage changes.

As indicated in the December 1966 article, the source is where current enters a FET's conductive channel, while the drain is where the current leaves the channel. The source and drain can be interchanged by reversing the applied voltage and the resulting current through the channel.

By reversing the voltage across the field-effect diode shown in Fig. 4, we are in effect changing the diode so that the gates are connected to the drain rather than the source (Fig. 5). The P-type gate then becomes positive with respect to the source and N-type channel. The P-N junctions are then forward biased, reducing the effective size of these junctions and increasing the effective

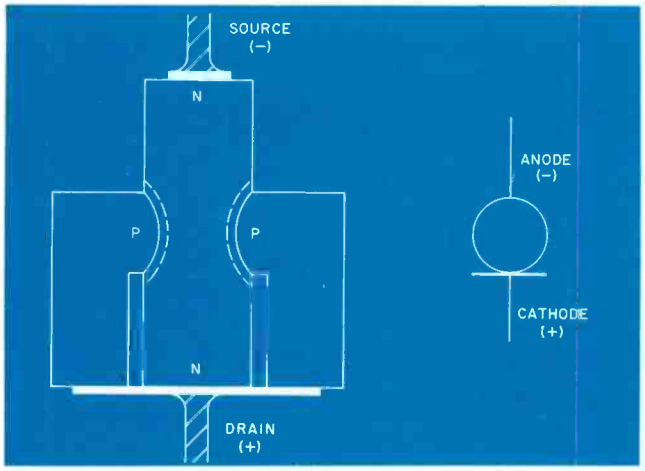


Fig. 5 — Structure of a forward-biased field-effect diode.

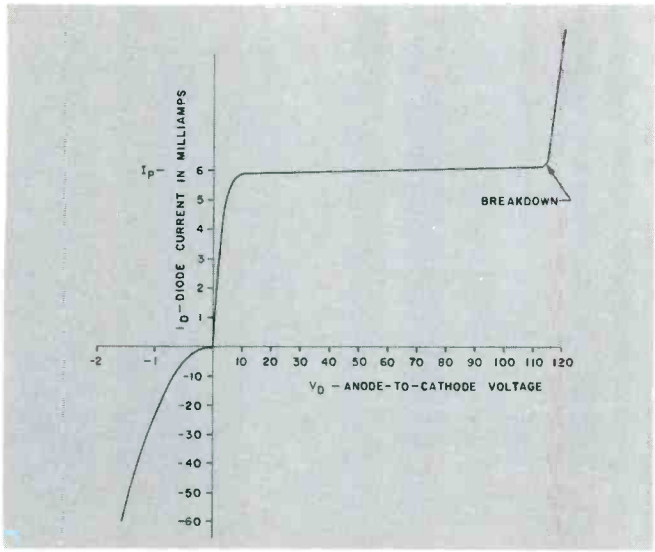


Fig. 6 — The characteristic curve of a field-effect diode.

size of the N-type channel—permitting it to conduct more current.

The curve in Fig. 6 indicates the characteristics of the field-effect diode just described. When the anode is more positive than the cathode, moderate changes in anode-to-cathode voltage results in nearly insignificant changes in diode current. When the polarity of the applied voltage is reversed, much greater changes in diode current result from changes in diode voltage.

Zener Diodes

The physical structure of a zener diode (Fig. 7) is basically the same as the structure of a conventional diode. In fact, when forward biased, both types of diodes conduct current in the same manner — both then having the same general forward-bias characteristic curve.

Within certain limits, zener diodes and conventional diodes also conduct current in the same manner when reverse biased—both again having the same general characteristic curve.

As indicated in earlier articles, when a P-N junction is reverse biased, a barrier is formed between the P- and N-type material and only a nearly insignificant amount of leakage current is permitted through the barrier and the component. If this reverse bias becomes too great, however, the barrier breaks down and the current becomes considerably greater in both zener and conventional diodes. The basic difference between these two types of diodes is the stability of this barrier breakdown voltage.

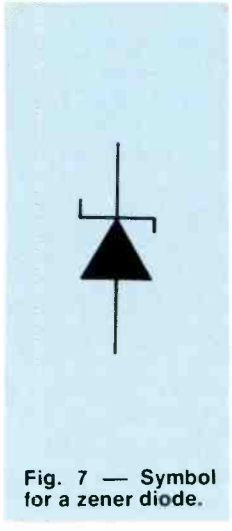


Fig. 7 — Symbol for a zener diode.

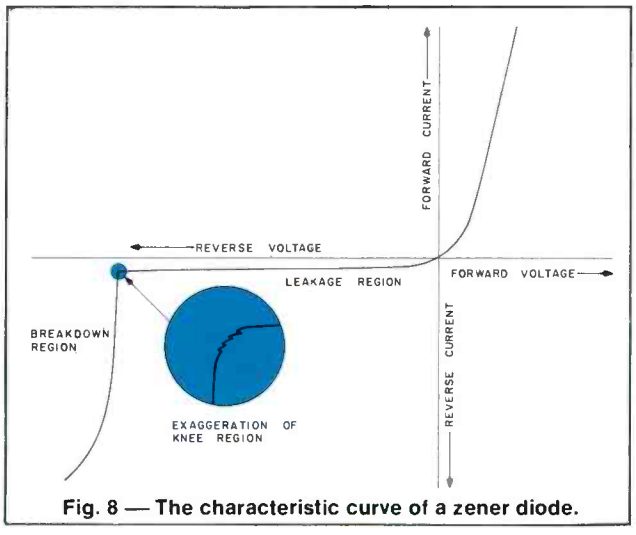


Fig. 8 — The characteristic curve of a zener diode.

The resistance of P- and N-type material in regular diodes is not as great as that of the material used in zener diodes (there is a slight chemical difference), and the resulting junction barriers formed are not as thin in regular diodes as they are in zener diodes. The electric field developed across a thin junction (zener junction) is greater than that developed across a wider junction (regular diode junction). It is the intensity of this electric field in zener diodes that is the primary cause of its junction breakdown, while in the wider junction of less resistive semiconductor material (regular diodes) the electric field is not as great and the temperature of the semiconductor material has a direct effect on the junction breakdown. (The strength of an electrical field developed across a P-N junction is the strength of the mutual attraction of positive and negative charges across the diode barrier. This condition is explained in the September and October 1967 articles.)

Zener diodes are used (instead of regular diodes) for voltage regulation since their breakdown voltage remains nearly constant—heat having very little effect on the breakdown voltage.

Many zener diodes generate noise when their reverse bias current nearly equals the current encountered during junction-barrier breakdown—the "knee" region of the zener diode characteristic curve

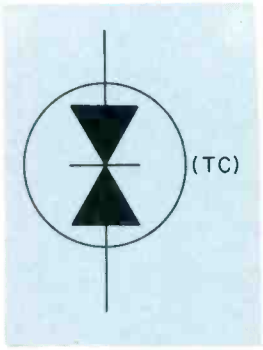


Fig. 9 — Symbol for a temperature-compensating diode (with letters TC) or a thyrector (without those letters).

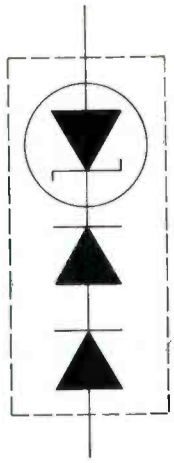


Fig. 10 — Equivalent structure of a temperature - compensating diode.

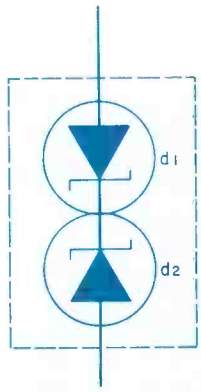


Fig. 12 — Equivalent structure of a thyrector.

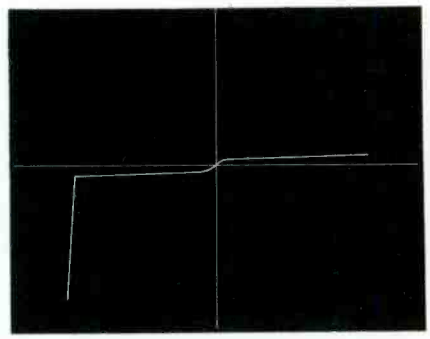


Fig. 11 — The characteristic curve of a temperature-compensating diode.

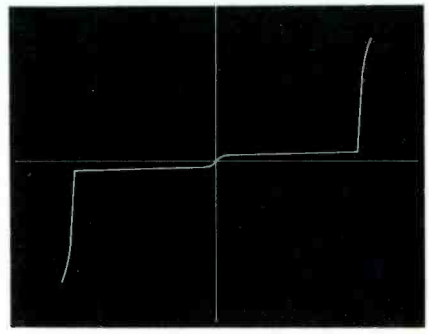


Fig. 13 — The characteristic curve of a thyrector.

(Fig. 8). This is true because the breakdown current does not increase suddenly, but increases in increments as the breakdown voltage is reached. To reduce zener diode noise, the resistance in a zener diode circuit should be low enough to permit a zener diode current greater than the current encountered at breakdown.

Complex Diodes

Just as there is no limit to the possible assortment of designs for integrated circuits, there is no limit to the assortment of stacked P-N junctions that can be fabricated to produce different types of complex diodes. Rather than attempt to describe every possible variation, the balance of this article and the following article in this series is restricted to six complex diodes most frequently encountered in power-supply and power-regulating circuits.

The characteristics of these complex diodes can be more readily understood by studying their more simple diode and/or transistor equivalent circuits. It would, therefore, be merely repetitious to also discuss the arrangement of junctions within these complex diodes.

TC Diodes and Thyrectors

Unfortunately, both temperature-compensating diodes and thyrectors are occasionally identified by the same symbol (Fig. 9). Unless the letters "TC" are shown to the right of the symbol (Fig. 9) to indicate that a temperature-compensating diode is being used, technicians must identify the component by checking the function of the circuit or a parts list.

Temperature-compensating diodes, sometimes called reference diodes, are an improved and more complex version of zener diodes. Earlier in this article it had been indicated that, compared to regular diodes, heat had very little effect on zener diode breakdown voltages. Measurements, however, do indicate that the breakdown voltage of a reverse-biased zener diode actually increases slightly as the diode's temperature increases. Similar measurements also indicate that the small voltage drop across a forward-biased regular diode decreases slightly as the temperature increases. These two opposing characteristics can be combined, and a temperature-compensating diode is formed by connecting one or more forward-biased regular diodes in series with a reverse-biased zender diode (Fig. 10). As the temperature increases, a reduction in the voltage drop across the regular diodes equals a corresponding increase in the voltage drop across the zener diode, and the total voltage drop remains nearly unchanged.

When the voltage across the temperature-compensating diode forward biases the regular diode (it then being capable of conducting current) and reverse biases the zener diode, both the regular diode and zener diode will conduct current once the zener breakdown voltage has been reached. Under these conditions the temperature compensating diode will function as though it was merely a zener diode—except for greater temperature stability (the left portion of the characteristic curve shown in Fig. 11).

When the polarity of the voltage across the temperature compensating diode is reversed, the zener diode will be forward biased (it then being capable of conducting current as indicated by the right portion of the characteristic curve shown in Fig. 8) and the regular diode will be reverse biased (it then being incapable of conducting any significant current). Under these conditions, only a very small current flows through the temperature-compensating diode (the right portion of the characteristic curve shown in Fig. 11).

Thyrectors, sometimes called surge protectors or trigger diodes, contain the equivalent of two zener diodes (Fig. 12) connected so that one is reverse biased when the other is forward biased.

When the top lead (Fig. 12) is more positive than the bottom lead, one zener diode (d_1) is forward biased while the other (d_2) is reverse

Continued on page 82

How To Make More Money and Live Better

Design a 'road-map' to better money management and increased profits

Part one of a two-part series

As a TV-radio service-dealer, you have probably never paid much attention to "marketing programs." The fact is, most of you already *have* a program, but you don't call it marketing. You merely consider it "running a business." But effective business management requires a detailed and clearly defined total basic program — written on paper.

What's a Marketing Program?

For a variety of reasons, most businessmen think of the word "marketing" as a term reserved for a production-type business. It is high time that we all realize that *any* business, regardless of its nature, must have a set of clearly defined goals and a profitable operating plan. To leave these factors to chance is to invite trouble. Far too many businesses today are not businesses at all — in the true sense — but are simply refuges for those who would otherwise be completely without work. If this statement seems strong and sharp, it is meant to be. Only one justifiable reason can exist for being in business — and that is to make money.

Of course, we all know that business provides employment, produces a useful product or provides a necessary service, and helps to distribute wealth — the basis of our economy. But a business is first and foremost a profit-making institution. To forget or ignore this fact is, indeed, to court disaster.

So, a business must make money. This, we are sure, comes as no great surprise. But, what is more important — a point you may not be conscious of — it is entirely possible that you are not moving in this direction effectively. Additionally, things being what they are in today's business world, just making a profit is not enough. Business is full of uncertainties, variables, unpredictables. Hence, we have to conduct a business to make as much profit as possible — within the framework of approved ethical practices.

Even though a business continues from one year to the next and even shows a profit, it may not be making as much profit as it should. When you get down to brass tacks, it is almost as bad to settle for a small or minimum profit as it is to settle for no profit. A businessman must do *more* than just show a net gain at the end of the year. He must continually strive for *maximum possible* gains. In short, he must seek to obtain maximum profits in every conceivable way. This is what a marketing program is for.

Marketing can be considered the science of running a business. It includes every aspect of the business and every person within the business. Because it is fundamentally a science, marketing can take a lot of guesswork out of running any enterprise. It can provide management with answers to previously unanswerable questions. It can eliminate costly errors, reduce worry, sooth the pains of many headaches. And a marketing program doesn't cost you a dime. It can be set up within the existing framework of a business and not disrupt anything. How then can a program of this type be adapted to a TV-radio sales-service business?

The answer will depend largely on the degree of confidence you have in a marketing program. If you are willing to try a few innovations and make a few changes, you can look forward to corresponding improvements in your business. Basically, what we want to do is take some of the hit-and-miss out of the sales-service business and replace it with proven, scientific — and often exacting — methods.

In a nutshell, a service-dealer marketing program should:

1. Set realistic goals for the business.
2. Establish a budget and determine the firm's break-even point.
3. Improve operational organization.
4. Provide a "service-mix" analysis.
5. Provide a cost and pricing analysis.
6. Re-evaluate the advertising and sales promotion role.

Realistic Goals

Essentially, what we want here is an outline of basic directions and objectives. This should be done in the short run, on a monthly and yearly basis. In the long run, it should be a master plan for future growth and expansion in the years to come. Every businessman should have a marketing plan and should stick to it

as closely as possible. Allowances must be made, of course, for innovations and changes in the industry and in national and local economics — but the plan must be there and it must be used.

Budgeting and the Break-Even Point

Once the ultimate goals of the business have been set down, the next job is to establish the framework for carrying out and pursuing these goals. This framework should properly be called a budget and it should be *written down* — not merely recorded mentally. This budget should set forth a schedule of expected expenses, both operating and sales, including fixed labor expenses, rent, trucks, insurance and taxes (assessments, water tax, real estate taxes, etc.).

Although a budget may seem to be unnecessary in a sales-service business, this is not so. Any business must *know* what it expects to spend in a given period, so it will be able to gage its break-even point — the point at which a business takes in enough money to cover its expenditures. Once this point has been reached, all additional money taken in can properly be considered profit.

In attempting to set up an operating budget for a TV-radio service-dealer, we are immediately confronted with a difficulty: There's no such thing as an "average operation." Variations are extremely wide, and include: Sales and service of electronic home-entertainment equipment; service only; contract service; diversified service; diversified service and sales — commercial audio, two-way radio, audio-visual. The cost, income, manpower, all vary greatly.

To come up with a significant budget example for this article, ET/D decided, considering the absence of specific facts, to confine itself to a basic budget for a service-dealer operation employing 3½ persons. (For this information, we are indebted to Mr. Frank J. Moch, executive director of the National Alliance of Television & Electronic Service Assns. (NATESA). Mr. Moch cautions that there's no such thing as a "typical" service-dealer and that variations in operation exceed by far the famed "57 varieties.")

ANNUAL BUDGET — 3½-Man Operation

Salaries (Owner)	9,160
Technicians (2)	12,480
Part-Time Office (½)	4,160
Rent	1,500
Office Supplies, Forms, etc.	360
Utilities	840
Phone	480
Vehicle Expense	2,160
Insurance	960
Taxes	460
Repairs and Maintenance (Plant)	300
Accounting and Legal	450
Depreciation	600
Advertising and Promotion	480
	$34,390

Although it is possible for a business to make money without an established budget, it seems much wiser to spend a little time and find out at what point a profit occurs. Why take a chance when you can be sure by investing a small amount of your time? This point becomes especially clear when you want to analyze why your business is *not* showing a profit. If you have a written budget, you can use it as a valuable tool to determine the cause of your problem. It can be an invaluable tool to the profit- and marketing-conscious service-dealer.

For example, suppose your operation fits this 3½-man organization and its budget; let's see what you'll have to do if you barely remain in business.

Assume that you have kept careful books on your operation, profit on TV set sales, radio sales, batteries, profit on service, etc., and you find that you are operating on an average markup of 28 percent. What must your gross yearly intake be to break even? It seems simple: You must take in $122,821.43. This is your break-even point. Twenty-eight percent of $122,821.43 is $34,390 — your total operating expenses. If your annual gross rises to $150,000 and your operating costs remain the same, you end up the year with a gross profit (before taxes) of $7610.12 on your capital investment, including what you have spent for technical education and keeping up with the technological explosion.

Operational Organization

The next step in a service-dealer marketing program should be the proper organization of everyday business activities. This includes proper delegation of responsibilities, a simple and efficient routing scheme, a schedule of the work for the day and a simple system of recording and categorizing customer service calls.

Work should be planned so little or no overlap occurs. Two men working on the same chassis, for example, put a drain on your labor price. Only *one* man is productive. Of course, consultation should take place on sticky problems, but this should only be advisory. If a technician is "stuck" on a set, it would be better for him to turn it over to another technician and go on to some other job. If two men spend half an hour each on two different sets, you get a total of one hour's worth of productivity. If two men spend half an hour on the same set together, however, you only get a half hour's productivity. You, as a businessman, should be able to take it from here. Basically, what you are striving for is maximum daily efficiency. This leads, ultimately, to maximum daily productivity.

(The second and concluding part of this article will appear in a forthcoming issue of ELECTRONIC TECHNICIAN/DEALER and will cover service-mix analysis, cost and pricing, and the role of advertising and sales promotion.) ■

38 Years of Two-Way Radio

Successful service business began in 1935 with $2000 annual gross

■ Cherry's Radio Communications Service is one of the busiest and most modern two-way radio service shops in Oklahoma City. And it is the oldest. Cherry's Radio has been in the same block of downtown Oklahoma City since 1935, but R. B. Cherry's interesting career dates back to the days of oatmeal box coils in the 1920s.

"I started my two-way radio service business in October 1935 by renting 400sq ft of floor space in an old garage," says "RB" Cherry, owner.

Our reporter, not yet born when Mr. Cherry first started in the radio business, was impressed and wanted to hear about the "old days."

In the Beginning

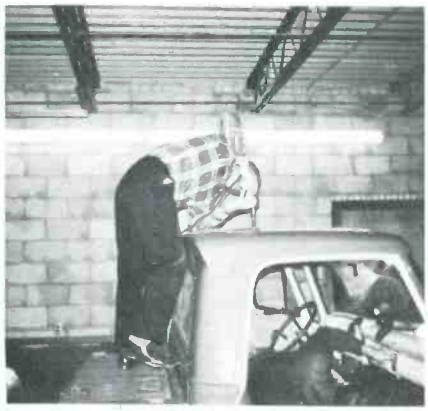
"Well," "RB" chuckles reminiscently, "let me tell you how I got started in the two-way radio business.

"It really began back in the spring of 1940. I did some two-way radio work for a pair of revenue agents who had long been on the trail of some moonshiners. When I had their gear all rigged, I remember how the agents 'bellied' their way up a sloppy, muddy hillside overlooking a small valley. The moonshiners were meeting in the valley and the agents planned to surprise and capture the entire group.

"Each agent had a walkie-talkie, a rather uncommon luxury in 1940. They had planned to go up opposite sides of the hill. And when they got into position they were to radio each other to rush down and surprise the moonshiners.

"Dragging the bulky radios with them through the mud was catastrophic. By the time they had sloshed their way to the hill top, the microphones were so clogged with mud they wouldn't key the transmitters. The only thing left to do was stand up and shout to each other to close in — which they did. Moonshiners ran off in every direction.

"Early the next morning when I arrived at work, I found two very muddy and disgusted revenue agents sitting on the curb in front of my radio shop. They looked like a couple of soldiers who had just gone through an obstacle course after a four-day rain. The outcome of my first two-way radio venture was rather disheartening."



Mobile installation of two-way radio takes team work.

Installation technician mounts transceiver bracket to dash panel.

Technician checks out mobile transceiver in shop equipped van.

Early Years

"But we've come a long way since those days," "RB" continues. Two-way radios were big then — bulky, low frequency, battery-operated tube units. They were as heavy and rugged as tanks."

"RB" was also one of the first in his area to work on TV sets when they were introduced in the late 1940s. He moved his shop to a larger building at 410 N.W. 4th in 1938 when auto radios became popular. The new place had 950sq ft of floor space.

"And I used every square inch of it," Mr. Cherry says. "In fact, before long I had to add a balcony for storage because I couldn't expand any other way."

At that time Cherry's radio had one technician and an office girl. When WWII broke out, Mr. Cherry was asked to train armed forces personnel in aircraft radio for nearby Tinker field. He worked in his radio shop during the day and taught classes from 4 to midnight for about a year. Then he was called to the East Coast as a civilian to train Army officers in the fundamentals of radar service. During his absence from the shop a local engineer took care of his business. For the duration of the war "RB" taught and serviced radar equipment. Ten days before "D" day he was sent to Eng-

land to service radar for Doolittle's 8th Air Force group. He returned to his radio business in 1946, and in 1947 became an authorized Motorola service station.

Strictly Two-Way Service

Oklahoma City got its first TV station, WKY-TV, in 1950 and Mr. Cherry took on the installation and service of TV sets because he was about the only man in the area who could do it at the time. His two-way and TV-radio business grew until 1959 when he decided TV and two-way were too much of a load. He sold the TV service business. His first love was two-way radio, so in 1959 he moved to his present location a few doors away from the old shop and concentrated on service and installation.

Cherry's Radio Communications Service grossed $30,000 the first year in its new location. He had two technicians for service and installation, and his wife took care of the office. The new location had 3800sq ft of floor space and has since been expanded by an additional 460sq ft which is used for mobile installations. The service shop area takes up about 1000sq ft with the remaining space devoted to storage and offices.

"We have parking space in the rear to accommodate 13 cars," "RB" adds. "We also have three vehicles of our own equipped with two-way radio. One is a van loaded with test instruments which we use for field service."

Besides "RB" and Mrs. Cherry, the shop has four technicians and a building maintenance man. One technician specializes in installation work. "We average about 80 to 100 service calls a month," "RB" continues. "But it's hard to really determine how many calls we get in a month because they sometimes come in batches. We also make a number of routine calls each month that are simple frequency checks as required each year by the FCC. I'd say about one-third of all our service is on contract. We maintain equipment for some local government agencies, including several FAA radio systems, the Air Force station and the Internal Revenue Service. All the government service is on contract."

Inventory and Installation

Cherry's Radio stocks enough small parts to handle the bulk of the service jobs that the shop is called on to do.

"We stock very few new system components," Mr. Cherry smiles. "Since we are not in the selling business, we only inventory the items we need for service plus a few things like mobile antennas, speakers and cabling. When a Motorola salesman sells a system, it generally includes the antennas and other necessary parts to complete the installation. The salesmen also know what we charge for a given standard installation and this is figured in the system selling price. They usually send the entire system package to us when we are to do the installation job. If the system is to be something other than a standard one, if it is to have a remote transmitter, paging system or other additional units, the salesman contacts us and we give them an estimate of installation costs.

"Towers are normally put up on a contract or bid basis," Mr. Cherry continues. "We farm out tower installations over 170ft. A normal tower installation consists of the tower, antenna and cable connected to the transmitter. If there is to be a multiple antenna system on the tower, as many of the towers over 100ft have, there is obviously an extra charge. I guess one of the reasons many businesses put their antennas on someone else's tower is because of the paper work involved in authorizing a certain antenna location and height.

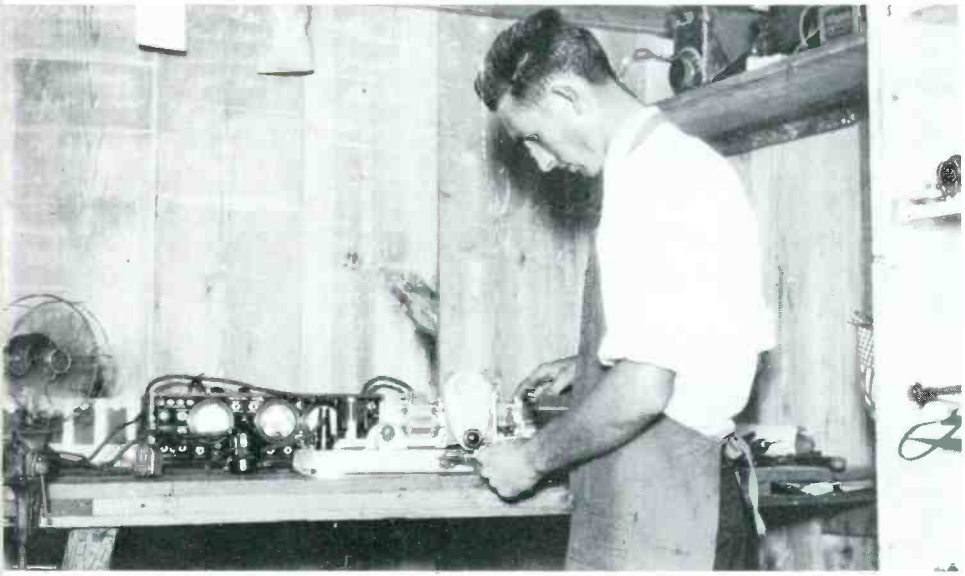
"The FAA has to authorize tower installations, and because of the nearby airfields, many of the towers are required to have marker lights. For these reasons, businesses will often rent antenna space at a cost of 20 to 30 cents per foot of tower height per month. A renter will pay at least $100 per month for space on top of a 500ft tower. (20 cents times 500)). Sometimes as many as eight or nine antenna systems are installed on a single tower and connected to transmitters operated by remote control over leased telephone lines. Two local TV towers have such antenna systems now."

Cherry's has performed many mobile and base station installations over the years. "RB" tells our ET/D reporter that "we did mobile radio installations as far back as 1938 — before they even had base stations. Then they could only communicate mobile to mobile. In those days the only ones who had mobile two-way radios were the government agencies. We installed a number of mobile radios in cars for the FBI at that time and what a job it was. We couldn't mount the antenna on the outside of the car because it would be too conspicuous. So, we made a snap-on connector on the body of the car to which the antenna could be quickly connected. When the antenna was not being used it was hidden inside the car by clips that held it in place in a horseshoe loop next to the upholstery on the roof. Remember, they had long antennas then because of the low frequency they operated on. Every time they wanted to transmit to another car they had to un-clip the antenna and rush outside to connect it.

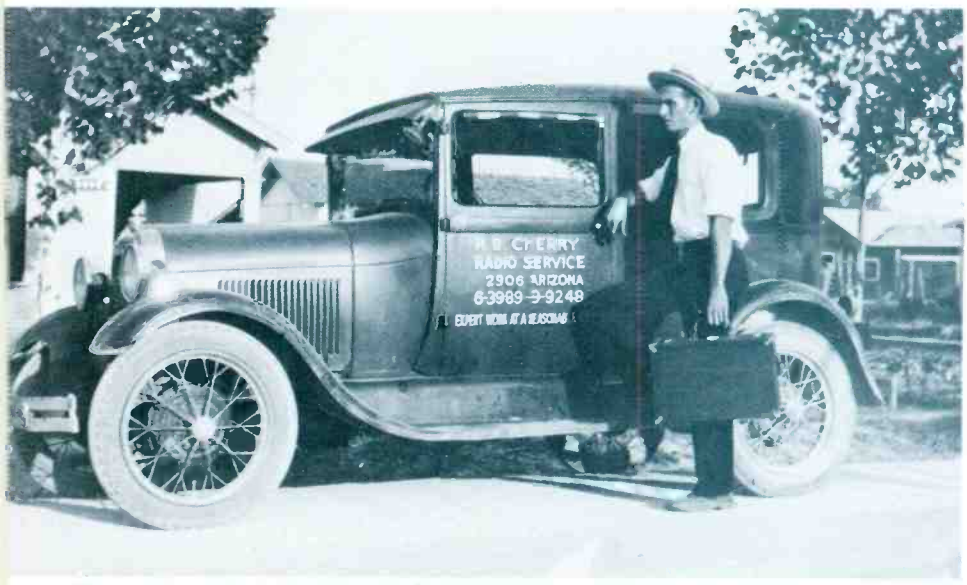
"In those days our radio service charge was $1.50 per hour and a technician had to know a lot more than just radios." Cherry's Radio Communication Service has grown over the years to an $85,000 business in 1967, with an even better outlook for 1968.

Service, Design and Training

"RB" says "our actual range of service work covers as much as a 120-mile radius from Oklahoma City, but there's hardly a county in the state that we haven't done some service in." As a service shop, Cherry's not only has some of the most modern test instruments available, but even a number of special test



Service shop bench in 1928.



First service vehicle for Cherry's Radio Service — 1929.

R.B. Cherry, owner of Cherry's Radio, figures antenna matching system.

jigs he built himself. "RB" is well known for his ability to design special systems for special jobs. He was called upon to design a remote monitoring system which would tell a maintenance engineer miles away if a pipeline valve at a petroleum pumping station was opening and closing properly. He designed the system using a single transistor-battery-operated transmitter with a relay to light an alarm lamp on the maintenance control panel. At that time transistors were still in their infancy.

"It was quite a challenge" Mr. Cherry states, "and it's still working."

He has built other units for similar applications and still gets calls for special designs from local government agencies as well as petroleum companies.

He once built a remote transmitter for the Secret Service which was used to round up a gang of counterfeiters. "That one wasn't used in the mud, however," he smiles.

Mr. Cherry is also well known for his willingness to share his knowledge of electronics. He gave up his business during the war years to train many good technicians for the armed forces, and in 1965 he was asked by the FCC in Washington to train a man from the Republic of Samali in two-way radio. Mr. Cherry readily accepted. Hassan Ali Abdisalam arrived at Oklahoma City in February 1966. He was sponsored by the Agency for International Development (AID) who paid his transportation, medical care and living expenses during the seven months he was at Cherry's Radio. "RB" taught Hassan everything he could about two-way radio from installation to service. Hassan was a Lieutenant in his country's police system when he came to the United States. When he returned to Samali he was promoted to Captain. Of all the technicians Mr. Cherry has helped to train, Hassan Ali Abdisalam will probably be his most memorable. ■

introducing the hundred dollar antenna

plus a not so short story about why Winegard's new SC-1000 is worth every penny...why it's the most powerful 82-channel antenna ever created for civilian use...and how it can change your antenna business.

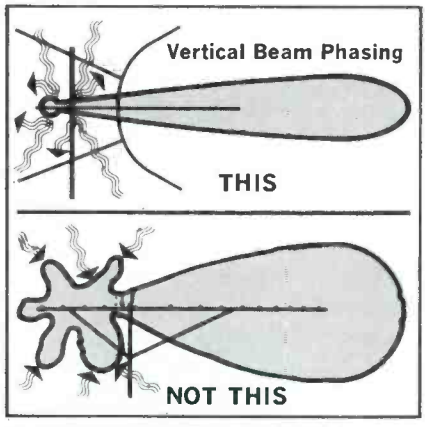
Every once in a while a new antenna comes along that's more than just "new" and "different looking" and "bigger" and "better" and "more powerful". Once in a while, maybe once in a lifetime, an antenna is created that makes all the "usual claims" and then supports every one of the claims with *performance*. That's our hundred dollar antenna. The SC-1000. The top of our Super Colortron line. The top of any antenna line ever created.

This VHF-UHF-FM super fringe antenna has undergone exhaustive testing and tuning refinements—and proved that it delivers performance worthy of its name, and it's price. Take, for example, an installation in Houston—41-feet above ground, equipped with rotor and 75 ohm downlead (no preamplifier.) The owner* writes that with the SC-1000 he is now receiving superior reception on stations ranging from 60 miles away (Bryan, Texas) to 200 miles away (Alexandria, La. and Lafayette, La.) Now that's what we call results. And it's why the SC-1000 is already being called "the long distance antenna." Because it pulls in the farthest away, toughest channels—and always better than ever before.

Yes, feature for feature and dollar for dollar (even a hundred dollars) there has never been an antenna like the SC-1000. Let's take a look at the features.

*Name supplied upon request.

Exclusive New Compact "Wedge" Design . . . Plus New Vertical Beam Phasing On Each VHF Channel. Vertical Beam Phasing on all VHF channels means there is no signal pickup from above or below the antenna. It means interference from such sources as airplanes, cars and diathermy machines are shut out. And it means that ghost signals are highly rejected. And that's not all. The VHF capture area is doubled and power gain over a conventional single bay is doubled. The vertical beam is flattened and elongated and spurious vertical lobes are eliminated. All that, and the SC-1000, with its unique "Wedge" design, is still vastly shorter and more mechanically stable than any other configurations would have to be to come close to the gain of the SC-1000.

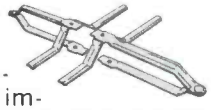


New "Constant Focus" UHF Screen. Concentrates all signal on Tetrapole collector element, provides as much signal capture area as an 8-foot parabolic, and at a fraction of a parabolic's size and weight.

New "Interlaced UHF Resonant Reflectors". Form a high density magnetic screen with all current fields in phase and working together for a new high in parabolic reflector efficiency.

Exclusive Patented* VHF Director System. Absorbs VHF signal and focuses it onto the collector elements. Helps give the SC-1000 pinpoint directivity to knock-out ghosts, smear and snow. *U.S. Patent No. 2700105, Canada No. 511984.

New "Tetrapole" UHF Collector Element. Has larger signal absorption area than standard UHF dipole. Maintains constant 300 ohm impedance and allows *no loss* coupling between the VHF and UHF operations.



Exclusive "Impedance Correlators". Provide perfect 300 ohm VHF impedance match and produce more signal gathering power per inch of antenna—and also contribute to making the SC-1000 extremely compact.

Exclusive Ellipsoidal Boom. Strongest boom ever used on a tv antenna. All elements of antenna are special aluminum alloy 40% stronger than used on most antennas.

Long Distance FM & FM Stereo Reception Bonus. Comparable to the results you get with a 10 element FM yagi.

Genuine Gold Anodized Finish. The only permanent gold finish on any antenna. Sunfast. Protects against corrosion and fading. Lasts years longer.

Exclusive Built-In Cartridge Housing. Integral part of the antenna keeps downlead connection weathertight. Accepts Winegard's solid state cartridge preamplifiers, color spectrum filter, etc. A truly great Winegard innovation.

Exclusive Winegard Gold Bond Performance Guarantee, Plus A New 2-Year Replacement Warranty.

The SC-1000 Will Change Your Entire Antenna Business. We created the SC-1000 simply because there was a glaring need for a modern 82-channel super powerful, super fringe antenna. And performance figures show that it has far surpassed even our most optimistic goals. So whenever you want to get the last ounce of clean, brilliant reception from a new color set—whenever you have a tough reception problem, install the new Winegard SC-1000. You'll have the most satisfied customers in town. And you'll have the best antenna profits in town!

Find Out For Yourself. We want you to see for yourself that "the hundred dollar antenna" is everything we say it is, and more. So try one first chance you get. Ask your Winegard distributor for details now. And write for Fact-Finder #261.

Winegard
ANTENNA SYSTEMS

WINEGARD COMPANY • 3000 Kirkwood Street • Burlington, Iowa 52601

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ET/D DEALER SHOWCASE

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly

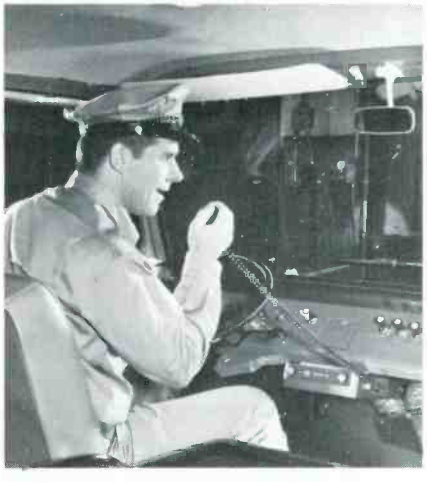
Mobile PA System 700

Introduced is a 30w mobile public address system for sports events, parades, political campaigns, civil defense, traffic safety, for general fire and police duty, outdoor promotions

and special events. The system consists of an amplifier, microphone, twin speakers and quick-fastening car-top mounting assembly. It is said to fit any hard-top car, station wagon or truck and necessitates no modifications to the vehicle. An attachment on the power supply cord leading to the dash-mounted amplifier plugs into the cigaret lighter or the cord may be fastened to the automobile's 12v battery for permanent installation. Bell.

FM Two-Way Radios 701

Built to operate in the VHF 150-174MHz range, a line of two-way FM radios employs a building-block approach to transceiver design. The basic 7w radio can be adapted to mobile or base station use or boosted in power to 60w. The basic transceiver is transistorized throughout and measures 2½ x 8 x 11in. and weighs 8 lb.



It is said to be designed in accordance with FCC regulations parts 21, 89, 91 and 93. The basic receiver is a superheterodyne dual conversion unit. It has four stages of IF, four audio stages and uses a series type coil which requires no transformer in the speaker output circuit. E. F. Johnson.

Portable Tape Recorder 702

Announced is a portable cassette tape recorder that provides convenient on-the-go recording in the classroom, office, home or car. It may be plugged into any standard ac outlet or operates from 5 C batteries. It is said the snap-

on ac adapter looks like part of the recorder when in use. The unit records up to two hours of monophonic audio on two tracks of the tape. Cassettes, sold in mailing boxes, are available for 60, 90, and 120 minute recording. Features include keyboard-type push-button operation, fast forward and rewind, level/battery meter and extension speaker jack. Unit is light weight and compact, 12 x 6 x 4. Price $59.95 with ac adapter, remote control start/stop dynamic microphone, a cassette, earphone and carrying case. Allied.

Orchestra Bells 703

An orchestra bell has been introduced which consists of 30 tuned bars which are electrically operated from any organ keyboard through additional key contacts. Ranging from G above

middle C to top C they are said to add sparkle and rhythm to all kinds of music. The attractive 12½ x 26½ x 5in. oiled walnut case can be located up to 20ft from the console. All necessary cable, contacts and installation instructions are included. Price, $197.50. Artisan.

Two-Way Radio 704

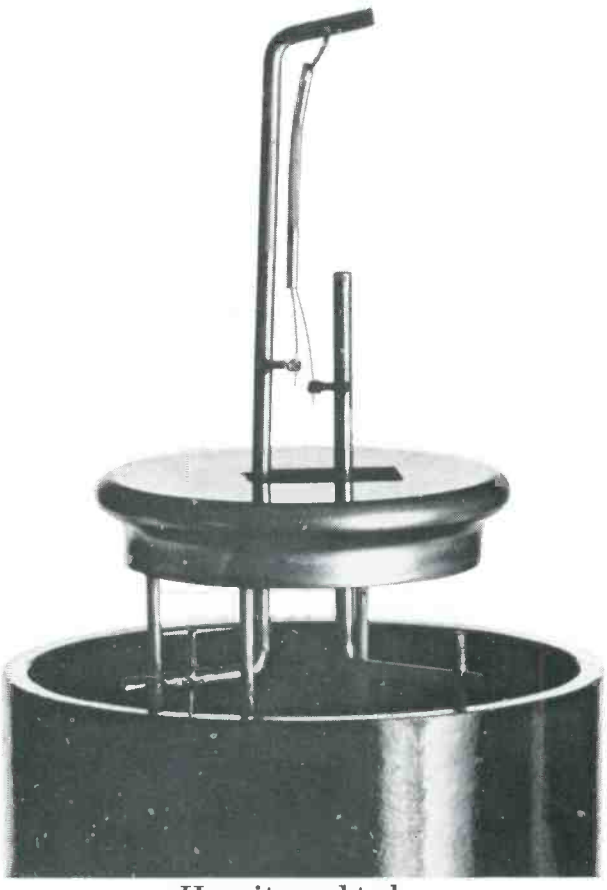
A 30w two-way radio, FCC Type Accepted and powered for AM business operation, is introduced. It is said

to provide more usable channels and greater power input with increased range in the frequency range of 25-45MHz. Radio is completely self-contained and no separate remote head or separate power source is required. Price $259. Courier.

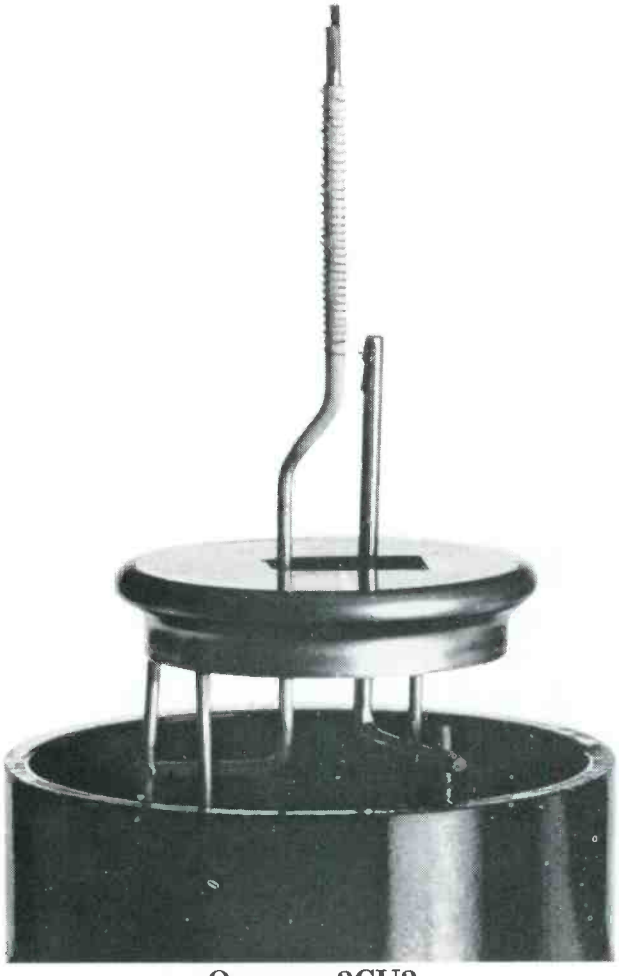
Six-Band Radio 705

A six-band ac/dc portable radio features AM/FM, marine, shortwave aircraft and police bands. Push but-

We've rectified high-voltage rectifiers.



How it used to be.



Our new 3CU3

Take a look at our new "Posted filament" design.

There's no delicately suspended heater-cathode system. There's no need to heat up a metal sleeve and then an oxide coating.

It takes less than a second for the 3CU3 to start rectifying full swing.

In case of a break, there's no way for the 3CU3's filament to fall against the anode, creating a short and knocking out other components in the circuit.

The 3CU3's filament is always perfectly centered. It emits electrons uniformly in every direction. From a much larger surface than in the old design. There's no suspension post in the way to create an "electron shadow" that cuts down the plate current.

The uniform electric field around the rigid support reduces high voltage stresses. Arcing and its resulting troubles are eliminated.

The 3CU3 is interchangeable with 3A3 and 3A3A high voltage rectifiers. And it's made exclusively by Sylvania.

The 3CU3 is just one of a new "posted filament" family which includes the new 3BL2 and 3BM2. They're designed for use in new color TV sets. These tubes are especially good for transistorized TV where their fast warm-up fits in with the "instant on" feature of solid state circuitry.

The new construction has higher reliability and longer life and should give you fewer and less troublesome callbacks.

SYLVANIA

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From the outside you can hardly tell it's changed.

tons at the top help make channel selection easy. Has 14-transistor circuitry and 5in. speaker. Complete with built-in ac line cord, batteries and earphone, the radio weighs 4 lb. Retail $69.95. Aiwa.

Two-Way Radio 706

Announced is a fully transistorized two-way radio designed for small businesses. The system uses FM (frequency modulation), which reduces interference from vehicle ignitions and power lines. These and many other noise sources make messages hard to understand on ordinary AM (amplitude modulation) radios. Audio output is said to be a full 3w to override background noise; messages come through clearly. Transmitter power — 10w input, 5w output. Units are available on frequencies from 25 to 50MHz. Motorola.

Portable Speaker 707

A solid-state portable speaker and public address system is said to be engineered for extra powerful voice projection — to be heard up to a mile away. The 30w transistorized unit does not require warmup. It uses standard flashlight batteries or may be operated from a 12v auto battery or 117vac. The unit is light weight and compact, ruggedly built of steel and injection-molded plastic to resist impact and all outdoor weather conditions. Size is 13 x 11 x 12in. List price $129.95. Hamilton.

Microphone 708

Announced is a cardioid microphone that reportedly features a satin chrome finish, ON/OFF switch and internal foam pop and blast filter. It is designed to offer a choice of high- or low-impedance output. List Price $92. Turner.

For more information on DEALER SHOWCASE See pages 83 & 84 READERS SERVICE

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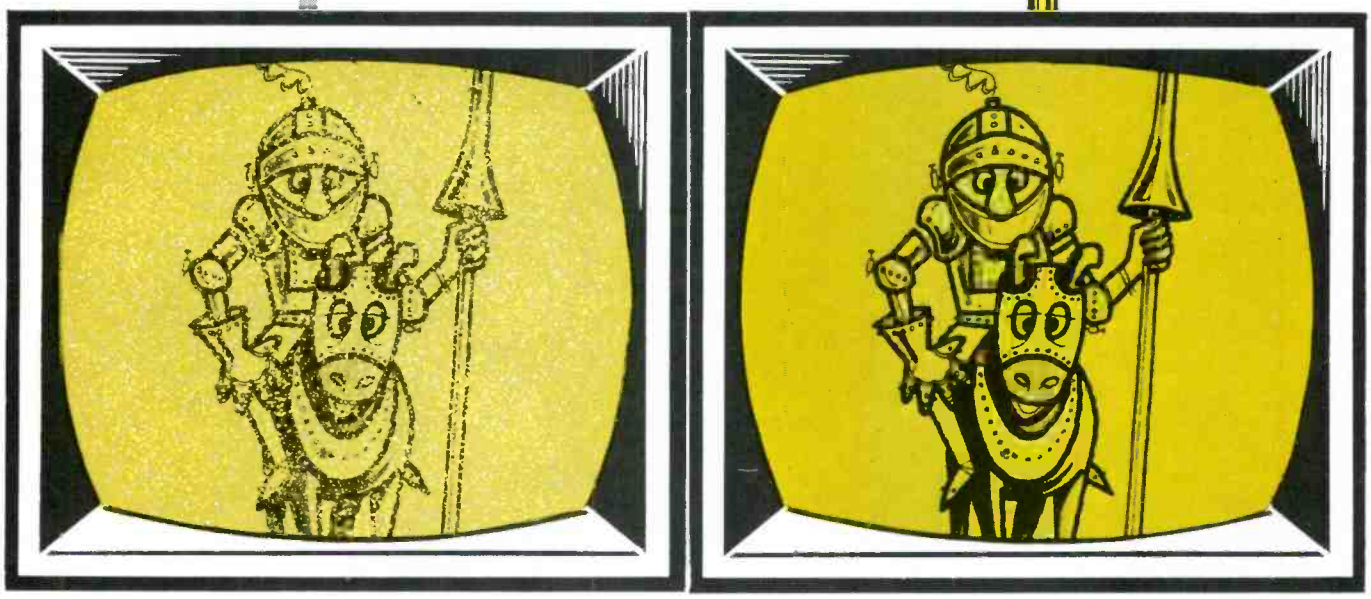

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COLORFAX

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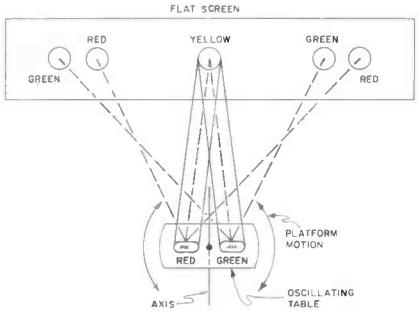
Color TV Chassis D06/D07/D09/D10 — Convergence Problems

If two parallel light beams swing back and forth at a point of rotation and scan a screen horizontally, the problem of dynamic misconvergence



can be illustrated. In the illustration, note the red and green beams coincide at the screen center and form a yellow circle of light. However, when the beams swing right or left an equal amount, the beams no longer coincide, then separate red and green light circles are formed. The farther the beams move away from the center position, the worse this condition becomes.

To correct this condition, keeping a yellow spot of light in all positions of the oscillating platform, it can be seen the most remote lamp from the point being scanned must be reduced in its swing, or the nearest lamp swing, or a combination of both of these corrective measures. If the beams are scanning a vertical screen with a vertical oscillating table, a similar type correction is required.

In the color CRT the three scanning beams must receive a similar corrective deflecting field from the convergence yoke. They can first be made to converge mechanically and statically at the center of the screen by static and purity adjustments. But as soon as they move horizontally or vertically, an increasing amount of correction is required. It is the function of the dynamic convergence waveforms and the convergence yoke to provide this correction. Correction waveforms, taken as part of the output from the horizontal and vertical deflection systems, are used to provide both vertical and horizontal beam scanning correction. The horizontal and vertical convergence voltage circuits are shown in illustrations. The typical input waveforms to these circuits are also shown. It should be noted that R/G convergence waveforms interact with the blue waveforms; these circuits are also shown. It should be noted that the R/G convergence waveforms interact with the blue waveforms through T800 (RT Blue Horiz.). Therefore, in this circuit the blue convergence should be approximately adjusted before proceeding with R/G convergence.

Horizontal and vertical convergence errors can be separated for ease of viewing while making adjustments. For example, all vertical convergence adjustments should be made on a vertical line through the screen center. Any errors appearing on left or right during this adjustment should be ignored. The only misconvergence that can occur along this vertical line is because of the horizontal parabolic waveform causing the beam to move faster or slower across the screen to cause bending of a center vertical line.

Center horizontal convergence in a vertical line is a function of the vertical sweep waveform.

The best convergence is obtained when all raster positioning controls including center and linearities have already been made. Rough setup should be made preliminary to setting purity. Then go back and make final adjustments of static and dynamic convergence. Any further adjustment of the raster positioning should not be made unless touch-up of all controls is intended.

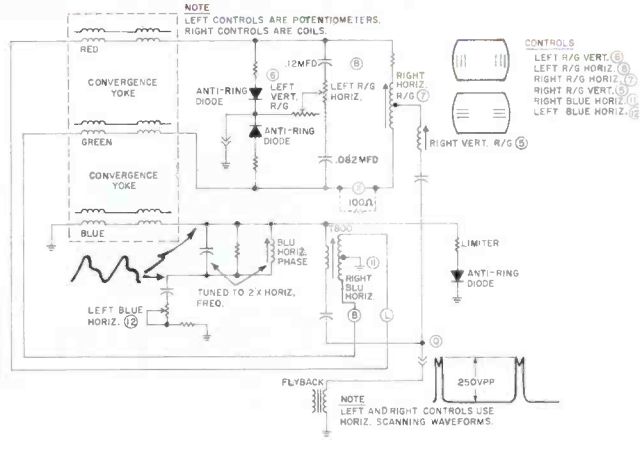
The following notes apply chiefly to Sylvania D06, DO7, D09, and D10 chassis (see illustration):

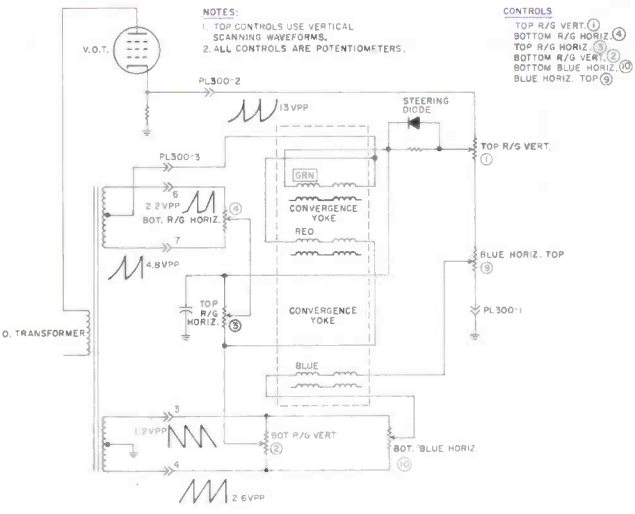
1. Left red horizontal droop may be brought up to match the green by breaking connection between the .082 μf capacitor and the RT R/G horizontal coil and inserting a 100 Ω, ½w resistor. (For less correction, less resistance may be used.)

2. A high red, left, horizontal line may be corrected (opposite problem of No. 1) by moving the yellow/green wire on convergence board from pin "L" (RT-Blue horizontal) to ground connection "G," or reverse leads from T700 primary at "B" and "L."

3. If red is high on RT horizontal, replace the .082 μf capacitor with a .056 μf capacitor.

If you make any of these changes, the convergence board should be so tagged. A touch-up of both static and dynamic controls is nearly always necessary after any of these changes.





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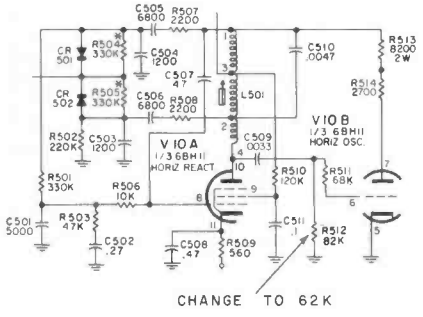
GENERAL ELECTRIC

Color TV Chassis KC — Service Hints

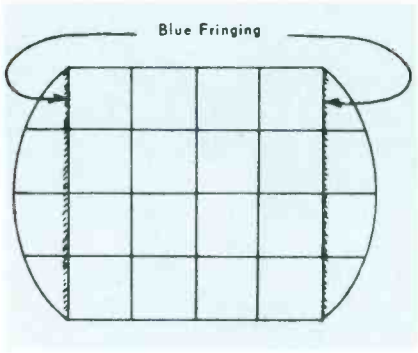
Correcting Horizontal Foldover. Change R512 from 82K to 62K. This is most easily done by shunting a 240K ½w across the existing 82K



resistor. The extra resistor may be added to the underside of the circuit board. Following this change, the horizontal oscillator should be re-adjusted for proper operation. This is not intended as an instruction to re-work sets, but is used as a correction if this complaint is encountered.

B-Fuse F101. Some early production receivers, used a slo-blo fuse in the B-line. This was found to be unnecessary and deleted in early production. If a fuse failure occurs, it should be bridged with a plain buss wire. This will avoid callbacks resulting from fuse failure.

Filament Fuse F103. If a failure of filament fuse F103 should occur, it is important that it be replaced properly. Use either an ET10X33 fuse or a length of No. 22 bare copper wire. The most important point is to be sure it is run inside the 3in. fiber-glass tubing. This fuse is intended to burn off in the event of a filament circuit short in the chassis. The fiber-glass tubing contains the heat of burnoff and prevents other receiver damage. Therefore it is important that the proper gage of wire is used and run inside the tubing.



Using the Wide Blue Convergence Corrector (ET42X59). If a wide blue raster exists, we now have available a unit to correct this condition.

Before any correctors are installed, it should be determined that a wide blue problem actually exists. This is identified as follows:

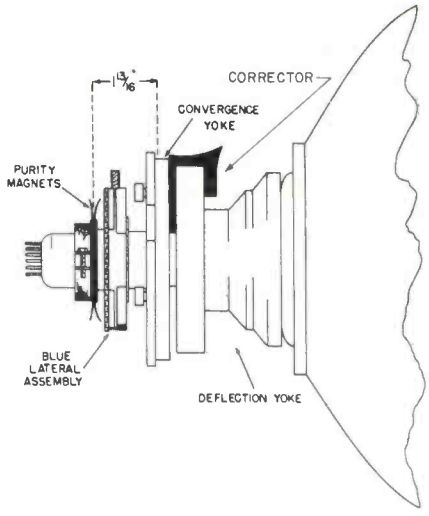
1. Adjust for proper center convergence.

2. Observe the vertical lines of a cross-hatch pattern. If blue fringing shows mainly on the outside as illustrated in drawing, this is defined as a wide blue raster.

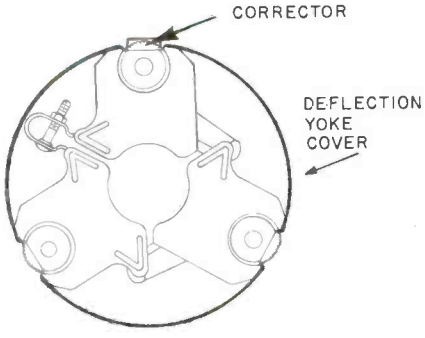
Blue fringing may be corrected as follows:

1. This condition may be caused by improper vertical positioning of the yoke, which must be corrected by tipping up the front of the yoke, to obtain a coaxial relationship with the tube neck. This may be done by loosening the wing nuts on the yoke clamp and tilting the yoke upward at the front. If this does not result in a coaxial condition with the tube neck, it may be necessary to raise the yoke retaining ring slightly on the bell of the tube.

2. If wide blue condition still exists, install corrector ET42X59 as follows: (a) Slide the corrector down vertically over the rear face of the deflection



yoke as shown in illustration. This is to be positioned directly above the blue gun and the top clip is to be pressed down firmly on the yoke body for the entire length of the clip. (b) If excessive correction is encountered (narrow blue), the clip should be raised slightly above the yoke body.



If the final position of the corrector is loose on the yoke, which might permit it to fall off and thus create a short hazard, the degree of correction required is not sufficient to warrant using the corrector. Therefore, it should not be used.

The corrector must not be used in any other position, or for any other purpose than that outlined above.

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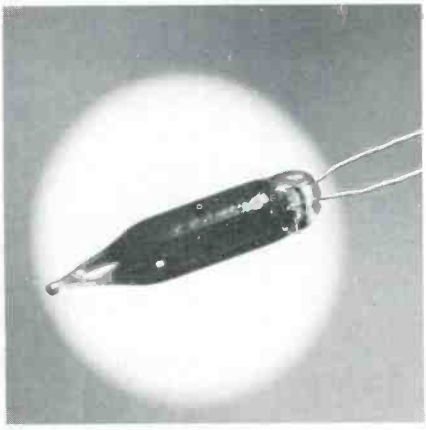
A line of gas discharge voltage regulator and voltage reference tubes is said to hold reference voltages to ± 3%. These units, designated in the "V" series, have a temperature co-



efficient of less than 15mv/°C, less than .01%/°C. Operating currents are extremely low, from a minimum of 0.1ma to a maximum of 4.0ma. Designed for typical commercial applications in reference voltage sources, regulated power supplies, timing circuits, oscilloscope calibrators, photo multipliers, digital voltmeters, and many others, these tubes cover a range of voltages from 83vdc to 143vdc. For potentials over 143v two or more tubes may be stacked to provide higher voltage regulation. Operating lifetimes are said to be in excess of 20,000 hours. Signalite.

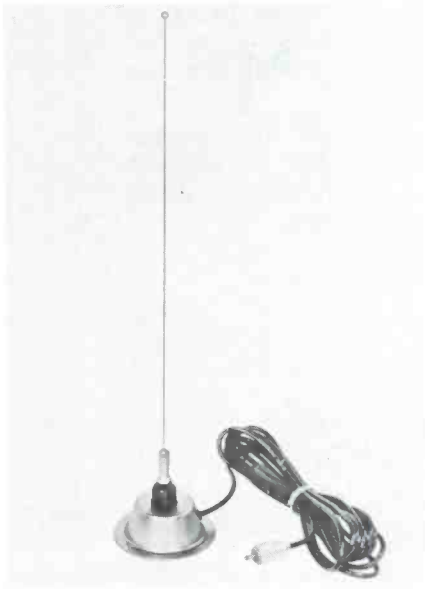
Color Alignment Generator 710

A lightweight, solid-state TV alignment generator is capable of generating the familiar 10-bar gated rainbow — plus all new single-bar and three-bar test patterns. It is said the addition-

al patterns minimize the time a technician must spend on the job making adjustments. Known as the Model 865 "Deluxe Color Commander," the generator combines extensive convergence and centering display capability with a variety of popular color-bar patterns. As a protection against obsolescence, the instrument is equipped with a unique single color-bar pattern capability. The pattern can be adjusted for any present — or future — demodulator phase angle. Another feature is the unit's three-bar color pattern provision. Serving to eliminate all but the three bars used for color demodulator alignment, it is said a scope is not necessary. The first bar, red (R-Y), is at 90deg; the second bar, blue (B-Y), at 180deg and the third bar, green (R-Y), at 270deg. A single-dot pattern can be moved vertically or horizontally to the exact center of the screen for accurate alignment of static convergence. A movable single-cross pattern for constant reference during purity adjustments is included. This feature can also be used for making center vertical and horizontal top-bottom-center dynamic and right-left-center dynamic convergence checks. The calibrated cross-hatch display provision affords a pattern with a 3:4 aspect ratio: 15 horizontal and 20 vertical lines. Other patterns featured in the generator are 10-bar gated rainbow (each bar spaced at 30 electrical degrees, for complete range of spectrum color), 300-dot multiple, multiple vertical bar and multiple horizontal bar. The generator measures 4⅞ x 9½ x 5¼ in. Fully equipped with a carry-about handle, the Model 865 weighs less than 4 lb. Price $189.95. Amphenol.

Mobile CB Antenna 711

A dual mounting CB antenna system for either permanent or "shiftable" mobile use is one of several original features of this Model M178 "Stick-Shift" 27MHz antenna. Designed for temporary mounting on trunk or rooftop, the user may employ a powerful built-in magnet, identical to that used in the A/S "Grip-Stick" antenna. A firm, permanent mount may be achieved alternatively by applying an accessory ring of double-



faced adhesive to the bottom of the base and then to the auto surface. The adhesive material is currently being used by several auto manufacturers in mounting accessories. In the permanent configuration, the cable may be fully concealed by feeding it into the bottom of the base through a small hole drilled in the roof or trunk. Antenna Specialists.

Tester/Rejuvenator 712

A tester/rejuvenator features measurement of high-voltage internal leakage. The unit can be used with almost all B/W and color CRTs. The instrument is said to permit service technicians to tell customers whether a CRT needs replacement. The unit also permits technicians to rejuvenate CRTs that are considered "beyond hope." In addition to the HV-leak feature and rejuvenating aspects, several new circuit improvements are said to have been incorporated into the instrument for maximum versatility on the job. These include a heater-adjust control, allowing for variations in line voltage and variable G1 and G2 voltages. All heater voltages are monitored on a voltmeter. A built-in pilot light alerts the user when the unit is switched on. For hookup purposes, three different socket assemblies are provided, permitting direct mating with more than 90 percent of all CRT types.

NEW PRODUCTS

Other adapters are available optionally for future types; these are continually updated. Additionally, a large storage area is included for housing cables and probes when the instrument is not in use. Amphenol.

RF Test Probe 713

A miniature RF test probe that permits dc measurements of RF signals, extending the frequency response for ac voltage measurements to 250MHz, is designed to be used with the manufacturer's 11M input impedance model 600 transistorized volt-ohmmeter (TVO). The RF probe and TVO serve as a signal tracer and gain analyzer as well as an RF voltage measuring device. The probe can also be used with an oscilloscope to observe detected modulated RF signals. The probe has a safe insulated red colored plastic body 5in. long and a 1-in.-long nickel plated metal probe tip. It is said the probe can be connected to dc high po-

tentials up to 500v safely as long as the superimposed RF voltage does not exceed the 20v limit. A spare alligator clip to place on the probe tip for monitoring purposes is provided. The probe is also connected with a 4ft long shielded connecting cable with phono plug connector and ground lead. User net price $9. Triplett.

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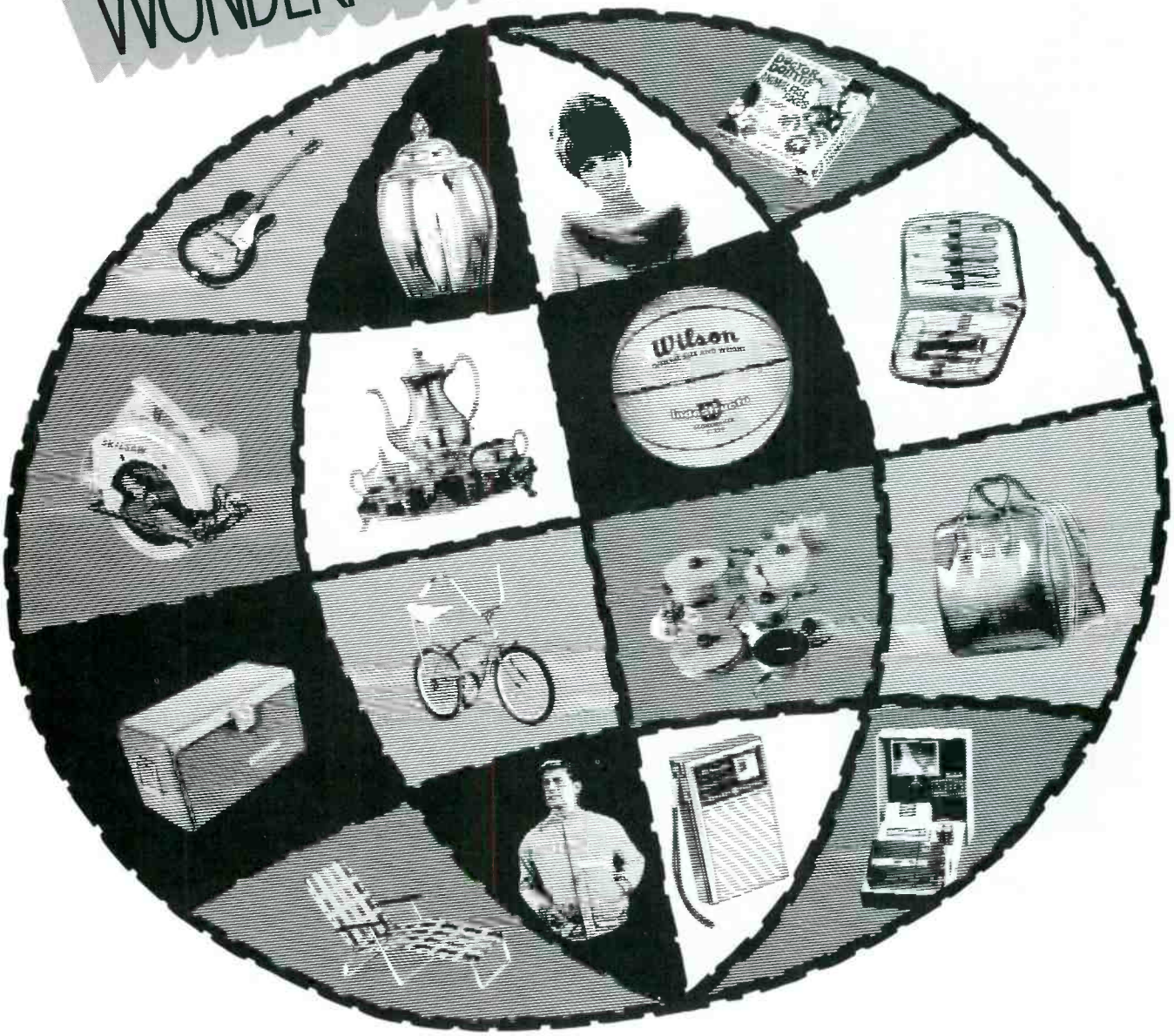

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Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680
Almo Industrial Electronics, Inc., 412 N. 6th St., Philadelphia, Pa. 19123
Alpha Wire Corp., 180 Varick St., New York, N.Y. 10013
Altec-Lansing, 1515 S. Manchester, Anaheim, Calif. 92802
American Concertone, 9449 W. Jefferson Blvd., Culver City, Calif. 90230
American Electronic Labs, Inc., Colmar, Pa. 18915
American Geloso Electronics, 251 Park Ave., New York, N.Y. 10010
American Microphone Div., see Electro Voice
American Telephone & Telegraph, 195 Bdwy., New York, N.Y. 10007
American Trading Co., Blaustine Bldg., Baltimore, Md. 21201
Amp Inc., 3822 Eisenhower Blvd., Harrisburg, Pa. 17111
Amperex Electronic, 230 Duffy Ave., Hicksville, L.I., N.Y. 11802
Ampex Audio, Inc., 934 Charter St., Redwood City, Calif. 94063
Ampex Corp., 25564 Willow Pond Lane, Los Altos Hills, Calif. 94022
Amphenol Distributor Div., 2875 S. 25th Ave., Broadview, Ill. 60153
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N.Y. 11563
Analab Instrument, 30 Canfield Rd., Cedar Grove, N.J. 07009
Anasphone Corp., 10912 La Cienega Blvd., Inglewood, Calif. 90304
Andrea Radio, 27-01 Bridge Plazza N., Long Island City, N.Y. 11101
Antennacraft, 1215 Agency St., Burlington, Iowa 52601
Antenna Designs, Inc., 802 Washington St., Burlington, Iowa 52601
Antenna Products Co., Box 110, Mineral Wells, Tex. 76067
Antenna Specialists, 12435 Euclid Ave., Cleveland, Ohio 44115
Antronic Corp., 4942 W. Div. St., Chicago, Ill. 60651
Arco Electronics, Community Drive, Great Neck, N.Y. 11021
Arcturus Electronics, 420 Kearny Ave., Kearny, N.Y. 07032
Argos Products, 600 S. Sycamore, Genoa, Ill. 60135
Arkay Int'l, 88-06 Van Wyck Expressway, Richmond Hill, N.Y. 11418
Armco Steel Corp., 703 Curtis St., Middletown, Ohio 45042
Arrow Fastener Co., 201 Mayhill St., Saddle Brook, N.J. 07662
Arrow-Hart & Hegerman, 103 Hawthorn St., Hartford, Conn. 06105
Artisan Organs, 2475 N. Lake Ave., Altadena, Calif. 91001
Arvin Industries, Columbus, Ind. 47201
Astatic Corp, Jackson & Harbor Sts., Conneaut, Ohio 44030
Astron Corp., 255 Grant Ave. E., Newark, N.J.
Atlas Sound Corp., 10 Pomeroy Rd., Parsippany, N.J. 07054
Audax, Inc. 109-01 37th Ave., Corona, N.Y. 11368
Audio Devices, 444 Madison Ave., New York, N.Y. 10022
Audio Dynamics, 1677 Cody Ave., Ridgewood, N.J.
Audio Empire Div. Dyna Empire, 1075 Steward Ave., Garden City, L.I., New York 11530
Audio Corp., 514 Bdwy., New York, N.Y. 10012
Audio-Master Corp., 17 E. 45th St., New York, N.Y. 10017
Audio Wave, Inc., 4541 Furman Ave., Bronx, N.Y. 10470
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B & B Electronic Products, 2120 S. Platte River Dr., Denver, Colo. 80223
B&K Instruments (Bruel & Kjaer), 3006 W. 106 St., Cleveland, Ohio 44111
B&K Mfg. Co., 1801 W. Belle Plaine, Chicago, Ill. 60613
BSR (Birmingham Sound Reproducers), Ltd., College Point, L.I., N.Y. 11356
Ballantine Labs, Boonton, N.J. 07005
Barber-Colman Co., Rockford, Ill.
Barker & Williamson, Bristol, Pa. 19007
Barry Electronics, 512 Bdwy., New York, N.Y. 10012
Bauchaine Sales Corp., 584 Union Ave., Laconia, N.H. 03246
Beckman Instruments Berkeley Div., 220 Wright Ave., Richmond, Calif. 94804
Belden Corp., 415 S. Kilpatrick, Chicago, Ill. 60644
Bell & Howell, 7100 McCormick Rd., Chicago, Ill.
Bell PA Products, 1209 N. 5th St., Columbus, Ohio 43212
Bell Telephone Labs, 463 West St., New York, N.Y. 10014
Benco TV Assoc., 27 Taber Rd., Rexdale, Ont., Canada
Bendix Radio Div., Industrial Electronic Prods., Baltimore, Md.
Berns Mfg., 9853 Chalmers, Detroit, Mich. 48213
Bird Electronics Corp., 30303 Aurora Rd., Solon, Ohio 44139
Birnbach Radio, 435 Hudson, New York, N. Y. 10014
Bliley Electric, Union Station Bldg., Erie, Pa.
Blonder-Tongue Labs, 9 Alling St., Newark, N.J. 07102
Bogen-Presto, PO Box 500, Paramus, N.J. 07652
Boonton Radio, Boonton, N.J. 07005
Bosco Elec. Inc., Don Littell Rd., Hanover, N.J. 07936
Bourns Labs, Box 2112, Riverside, Calif. 92506
Bozak Co., Rt. Box 1166, Darien, Conn. 06820
Brach Mfg. Corp., 899 Main, Sayreville, N.J. 08872
Bright Star, Ind., Clifton N.J.
British Ind., Port Washington, L.I., N.Y. 11050
Browning Labs, 100 Union Ave., Laconia, N.H. 03246
Brush Instruments, 37 St. & Perkins, Cleveland, Ohio
BSR (USA), Ltd., Route 303, Blauvelt, N.Y. 10913
Bud Radio, 4605 E. 355 St., Willoughby, Ohio 44094
Burgess Battery, Exchange St., Freeport, Ill. 61032
Burroughs Corp., 6072 2nd Ave., Detroit, Mich. 48202
Bussman Mfg., W. University St., St. Louis, Mo. 63107

C

Cabinart Inc., 35 Geyer St., Haledon, N.J.
Cadre Ind., Box 150, Endicott, N. Y. 13760
Calbest Electronics, 4801 Exposition Bldg., Los Angeles, Calif.
Cannon Electric, 3208 Humbolt St., Los Angeles, Calif. 90031
Castle TV Tuner Service, 5710 N. Western Ave., Chicago, Ill. 60645
Castle TV Tuner Service, 41-92 Vernon, Long Island City, N.Y. 13476
Centralab, 900 E. Keefe Ave., Milwaukee, Wis. 53212
Channellock Inc., S. Main St., Meadville, Pa. 16335
Channel Master Corp., Ellenville, N.Y. 12428
Charles Engineering, Inc., 3421 N. Kroll Drive, Los Angeles, Calif.
Chem Spray Corp., 67-27 Cadillac St., Houston, Tex. 77021
Chemical Electronic Engineering, Jackson & Ravine Drive, Matawan, N. J. 07747
Chemtronics, Inc., 1260 Ralph, Brooklyn, N.Y. 11236
Cinch Jones Div., Cinch Mfg., 1026 Homan Ave., Chicago, Ill.
Cisin Co., Harry G., Amagansett, N.Y. 11930
Clairex Corp., 19 W. 26th St., New York, N. Y. 10010
Clarostat Mfg., Dover, N.H. 03820
Clear Beam Antenna Corp., 9754 Deering St., Chatsworth, Calif. 91311
Cletron, Inc. 1974 E. 61 St., Cleveland, Ohio 44103
Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland, Ohio 44114
Cohu Electronics Massa Div., 5725 Kearny Villa Rd., San Diego, Calif. 92123
Cole Inst. Div., 2034 Placenta, Costa Mesa, Calif.
Colman Tool & Electric Products, PO Box 2965, Amarillo, Tex. 79105
Colson Corp., 395 LaSalle, Chicago, Ill. 60603
Colorgrams, Inc., 58 Old Steward Ave., New Hyde Park, L.I., N.Y. 11040
Columbia Products Co., Rt. 3, Columbia, S.C. 29206
Columbia Wire & Supply Co., 2850 Irving Park Rd., Chicago, Ill. 60618
Communications Co., 300 Greco Ave., Coral Gables, Fla. 33146
Communications Electronics, PO Box 1272, Scottsdale, Ariz. 85252
Communications Prod. Co., Rt 79, Marlboro, N. J. 07746
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y. 11520
Conar Instrument, 3939 Wisconsin Ave., Washington D.C. 20016
Conrac, Inc., 19217 Foothill Blvd., Glendora, Calif. 91740
Continental Electronics, 1050 N. Central Expressway, Dallas, Tex. 75201
Courier Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
Cornell-Dubilier Electronics, 50 Paris St., Newark, N.J. 07105
Creative Products, Inc., 8120 Blue Ash Rd., Cincinnati, Ohio 45236
Crescent Enterprises, 7301 Mission Rd., Prairie Village, Kan. 66208
Crown Int'l, Box 261 Elkhart, Ind. 46514
Cush Craft, 621 Hayward St., Manchester, N.H. 03103
Cutler-Hammer, 436 N. 12th St., Milwaukee, Wis. 53233

D

Dale Electronics, 1378 28th Ave., Columbus, Neb. 68601
Davies Molding Co., Harry, 1428 N. Wells St., Chicago, Ill. 60610

Daystrom, Inc., Archbald, Pa. 18403
DeJur-Amsco, 45-01 Northern Blvd., Long Island City, N.Y. 11101
Delco Radio Div., GMC, Kokomo, Ind. 46901
Delmonico Int'l, 120-20 Roosevelt, Corona, Ill.
DeWald Radio, 35-15 37 Ave., Long Island City, N. Y. 11103
Dialight Corp., 60 Steward Ave., Brooklyn, N.Y. 11237
Diamond Tool, 4602 Grand Ave., W., Duluth, Minn. 55807
Dickey, Inc., D.F., 4863 Rivoli Dr., Macon, Ga. 31204
Drake Mfg., 4826 N. Olcott, Chicago, Ill. 60656
DuKane Corp., St. Charles, Ill. 60174
DuMont Labs, Allen B., 750 Bloomfield, Clifton, N.J. 14431
Du Pont de Nemours, Wilmington, Del. 19801
Doutone Co., Locust St., Keyport, N.J. 07735
Dutch Brand Div., Johns-Manville, 78 S. Woodlawn Ave., Chicago, Ill.
Dymo Ind., 2725 10th St., Berkeley, Calif. 94710
Dynaco, Inc., 3912 Powelton Ave., Philadelphia, Pa. 19104
Dyna-Empire, 1075 Steward Ave., Garden City, L.I., N. Y. 11530

E

ECI Electronics Communications, 56 Hamilton Ave., Mount Vernon, N.Y. 10552
ELPA Ind. Ortofon Div., New Hyde Park, Ill.
E-Z Hook Products, 1536 Woodborn Ave., Covington, Ky.
E-Z Way Towers, Inc., P.O. Box 5797, Tampa, Fla. 33605
Eby Sales, 148-05 Archer Ave., Jamaica, L.I., N.Y. 11435
Eitel-McCullough, 301 Industrial Way, San Carlos, Calif. 94070
Eico Corp., M St. below Erie, Philadelphia, Pa.
Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y. 11207
Electric Auto Lite, 3529 24 St., Port Huron, Mich. 48060
Electric Storage Battery, 1717 E. 9 St., Cleveland, Ohio 44114
Electro Acoustic Prods., 2135 Bueter Rd., Fort Wayne, Ind.
Electro Products Labs, 6125 W. Howard St., Chicago, Ill. 60648
Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N.J. 07304
Electronic Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
Electronic Measurements, Lewis St. & Maple Ave., Eatontown, N.J. 07724
Electronic-Missiles & Communications, Inc., 262 3rd St., Mount Vernon, N.Y.
Electronic Organ Arts, 4949 York Blvd., Los Angeles, Calif. 90042
Electronic Prods. Div., Victoreen Instrument, 111 E. 3 St., Mount Vernon, N.Y. 10550
Electronic Publishing, 133 N. Jefferson St., Chicago, Ill. 60606
Electronic Technician, Ojibway Bldg., Duluth, Minn. 55802
Electrovert, Inc., 86 Hartford Ave., Mount Vernon, N.J. 10553
Electro-Voice, Inc., 629 St., Buchanan, Mich. 49107
Elgin Advance Relays, 2435 W. Naomi St., Burbank, Calif.
Elpha Marketing-Thorens, Atlantic & Steward Ave., New Hyde Park, N.Y. 11040

Eltec, 14 Alsop Ave., Middletown, Conn. 06457
EMC, 625 Bdwy., New York, N.Y. 10012
Emerson Radio & Phono, 14 & Coles, Jersey City, N.J. 07302
Empire Scientific, 1075 Steward Ave., Garden City, L.I., N.Y. 11530
Enterprise Development Corp., 5123 E. 65th, Indianapolis, Ind. 46220
Entron, 2141 Industrial Pkwy., Silver Spring, Md. 20904
Ercona Corp., 16 W. 46 St., New York, N.Y. 10036
Essex Wire, 1601 Wall St., Indianapolis, Ind.
Euphonics Corp., P.O. Box 2746 Rio Piedras, Puerto Rico, USA 00926
Eveready Batteries (see Union Carbide Co.)
Exide Ind. Div., Electric Storage Battery, 52 S. 15 St., Philadelphia, Pa. 19102

F

Fanon-Masco, 439 Frelinghuysen Ave., Newark, N.J. 07114
Fidelitone, Inc., 6415 Ravenswood Ave., Chicago, Ill. 60626
Finney Co., 34 W. Interstate St., Bedford, Ohio 44146
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio 45206
Fisher Radio, 21-2444 Dr., Long Island City, N.Y. 11101
Foxboro Co., New Ponset Ave., Foxboro, Mass. 02035
Freed Transformer, 1718 Weirfield St., Brooklyn, N.Y. 11227

G

GAM Electronics, 138 Lincoln St., Manchester, N.H. 03103
G & W Electric Specialty Co., 3500 W. 127 St., Blue Island, Ill. 60406
Gator Probe Corp., 2751 San Juan Rd., Hollister, Calif. 95023
GC Electronics, 400 S. Wyman St., Rockford, Ill. 61101
Garrard Sales, 80 Shore Rd., Port Washington, N.Y. 11050
Gavin Instruments, Depot Sq. & Division St., Somerville, N.J. 08876
General Dynamics/Electronics, 1407 N. Goodman St., Rochester, N.Y. 14609
General Electric Audio Products Div., Decatur, Ill.
General Electric Communications Products Div., Lynchburg, Va.
General Electric Receiving Tube Dept., Owensboro, Ky. 42301
General Electric Receiver Div., Utica, N.Y.
General Instrument, 65 Gouveneur St., Newark, N.J. 07104
General Precision GPL Div., Mount Kisco, N.Y. 10549
General Radio, West Concord, Mass. 01742
General Radiotelephone Co., 3501 W. Burbank Blvd., Burbank, Calif. 91505
Gertsch Products, 3211 S. La Cienega Blvd., Los Angeles, Calif. 90016
Greyhound Package Express, 140 S. Dearborn 10 S. Riverside Plaza, Chicago, Ill. 60606
Griffiths Electronics, 1301 E. Linden, Linden, N.J. 07036

H

H & H Equipment Co., Laotto, Ind. 46763
Hallamore Electronics, 714 N. Brookhurst St., Anaheim, Calif. 92801
Hallicrafters Co., 4401 W. 5 Ave., Chicago, Ill. 60624
Hallmark Electronics, 436 N. 31 St., Philadelphia, Pa. 19104
Hallmark Instruments, 2620 Freewood Dr., Dallas, Tex. 75220
Hammarlund Mfg., 53 W. 23 St., New York, N.Y. 10010
Harman-Kardon Inc., 55 Ames Crt., Plainville, N.Y. 11803
Hartley Products, 521 E. 162 St., Bronx, N.Y. 10451
Hathaway Instrument, 5800 E. Jewell Ave., Denver, Colo. 80222
Heath Co., 305 Territorial Rd., Benton Harbor, Mich. 49022
Heintz & Kaufman Ltd., 3650 Hayden Ave., Culver City, Calif. 90230
Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, Calif. 94304
Hickok Electrical Instrument, 10523 Dupont Ave., Cleveland, Ohio 44108
Hi-Lo Mfg., 1122 Newport St., Chicago, Ill.
Hitachi (see Sampson Co.)
Hoffman Electronics Consumer Prods. Div., 3761 S. Hill St., Los Angeles, Calif. 90007
Hollywood Television Wuerth Surgitron Div., 1949 Moffett St., Hollywood, Fla.
Holub Industries Inc., Sycamore, Ill.
Honeywell Commercial Residential Div., 2753 4 Ave., Minneapolis, Minn.
Hunter Sales R.N., 9851 Alburtus Ave., Santa Fe Springs, Calif. 90670
Hycon Electronics, 1030 Arroyo Pkwy., Pasadena, Calif. 91105
Hy-Gain Electronics, 8473 N.E. Highway 6, Lincoln, Neb.
Hysol Co., 322 Houghton, Olean, N.Y. 14760

I

I E H Manufacturing Co., 102 Prince St., New York, N.Y. 10012
IERC Div., Box 271, Burbank, Calif. 91503
Illumitronic Engineering, 680 E. Taylor St., Sunnyvale, Calif.
Injectorall Co., 4 N. Great Neck N.Y. 11024
Institute of Electrical & Electronic Engineers (IEEE), 72 W. 45th St., New York, N.Y. 10036
Int'l. Business Machines, 590 Madison Ave., New York, N.Y. 10022
Int'l. Correspondence Schools, Scranton, Pa. 18515
Int'l. Crystal Mfg., 18 N. Lee, Oklahoma City, Okla. 73102
Int'l. Electronics, 316 S. Service Rd., Melville, L.I., N.Y. 11746
Int'l. Rectifier, 233 Kansas St., El Segundo, Calif. 90245
IRC Inc., 401 N. Broad, Philadelphia, Pa. 19108
I-T-E Circuit Breaker, 601 E. Erie Ave., Philadelphia, Pa. 19134
IT&T, 320 Park Ave., New York, N.Y. 10022
IT&T Components, 100 Kingsland Rd., Clifton, N.J. 07013
IT&T Distributor Products, 250 Broadway, New York, N.Y. 10007

J

Jackson Electrical Instrument, 124 McDonough St., Dayton, Ohio 45402
J-B-T Instruments, 61 Hamilton, New Haven, Conn. 06511
Jensen Industries Div. Electrovoice, 633 Cecil St., Buchanan, Mich. 49107
Jensen Mfg., 6601 S. Laramie, Chicago, Ill. 60638
Jensen Tools, 3630 E. Indian School Rd., Phoenix, Ariz. 85018
Jerrold Electronics, 401 Walnut St., Philadelphia, Pa. 19132
Jersey Specialty Co., Box 576, Mountain View, N.J.
Jetronic Industries, 4312 Main St., Philadelphia, Pa. 19127
JFD Electronics, 1462 62 St., Brooklyn, N.Y.
Johnson Co. E.F., 6516 10th Ave. S.W., Waseca, Minn. 56093
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N.Y. 10463
Jones & Laughlin, 401 Liberty, Pittsburgh, Pa. 15222
Jones Div. Cinch Mfg., 1026 S. Homan, Chicago, Ill. 60624
J W Electronics, 1538 W. Jarvis, Chicago, Ill. 60626
JW Electronics, PO Box 51, Bloomington, Ind. 47401

K

KLH Research & Devel, 30 Cross St., Carnbridge, Mass. 02138
KTV Tower & Com. Equip. Co., PO Box 294, Sullivan, Ill. 61951
Karr Engineering Co., 2998 Middlefield Rd., Palo Alto, Calif. 94306
Karg Laboratories, 162 Ely Ave. S., Norwalk, Conn. 06854
Karlson Assoc., 1610 Neck Rd., Brooklyn, N.Y. 11229
Kay Electric, 14 Maple, Pine Brook, N.J. 07058
Kay-Townes Antenna Co., PO Box 593, Rome, Ga. 30162
Kenwood Electronics, 3700 S. Broadway Pl., Los Angeles, Calif. 90007

Kepco Inc., 131-38 Sanford Ave., Flushing, N.Y. 11355
Kester Solder, 4201 Wrightwood, Chicago, Ill. 60639
Klipsch & Assoc., PO Box 96, Hope, Ark. 71801
Kinematix Inc., 2040 W. Washington, Chicago, Ill. 60612
Knob Corp. of America, 469 Jericho Tpk., Mineola, N.Y. 11501
Koss Inc., 2227 N. 31 St., Milwaukee, Wis. 53208
Kraeuter Tools, 332 South Michigan Ave., Chicago, Ill. 60604
Krylon Inc., Ford & Washington St., Noristown, Pa.
Kwikheat Mfg., 3731 San Fernando Rd., Glendale, Calif. 91204

L

LA Turner Exchange, 4611 W. Jefferson, Los Angeles, Calif. 90016
Lafayette Radio Electronic, 111 Jerico Tpk., Syosset, L.I., N.Y. 11791
Lakeside Industries, 5234 N. Clark St., Chicago, Ill. 60640
Lambda Electronics, 515 Broad Hallow, Huntington, N.Y. 11743
Lampkin Labs, Bradenton, Fla. 33505
Lance Antenna, 1730 1st St., San Fernando, Calif. 91340
Lansing Sound James B., 3249 Casitas Ave., Los Angeles, Calif. 90039
Larsen Electronics Inc., 11611 N.E. 50th Ave., Vancouver, Wash. 98665
Lavoie Labs, Morganville, N.J. 07751
Leach Corp., 18435 Susana Rd., Compton, Calif. 90221
Lectrotech Inc., 1221 W. Devon Ave., Chicago, Ill. 60626
Ledex Inc., 123 Webster, Dayton, Ohio 45402
Leeds & Northrup, 4907 Stenton, Philadelphia, Pa. 19144
Lesa of America, 11 W. 42 St., New York, N.Y. 10036
Littelfuse Inc., Des Plaines, Ill.
Litton Industries, 336 N. Foothill, Beverly Hills, Calif. 90210
Los Angeles Turner Exchange, 4611 W. Jefferson, Los Angeles, Calif. 90016

M

3M, 2501 Hudson Rd., St. Paul, Minn. 55119
Macdonald & Co., 213 So. Brand Blvd., Glendale, Calif. 91204
McIntosh Labs, 2 Chambers St., Binghamton, N.Y. 13903
Magnavox Co., 2131 Bueter Rd., Ft. Wayne, Ind.
Magnecord Div. Midwestern Instrument, PO Box 7186, Tulsa, Okla. 74105
Magnetrack Box, 147 Caroline, Puerto Rico, U.S.A.
Majestic Int'l., 743 LaSalle St., Chicago, Ill. 60605
Mallory & Co. P.R., PO Box 1558, Indianapolis, Ind. 46206
Marantz, 25-14 Bdwy., Long Island City, N.Y. 11106
Marconi Instruments, 111 Cedar Lane, Englewood, N.J. 07631
Mark Products, 5439 W. Fargo, Skokie, Ill. 60076
Master Mobile Mounts, 4125 W. Jefferson Blvd., Los Angeles, Calif. 90016
Matsushita Electric Co., 200 Park Ave., New York, N.Y. 10017
Mercury Electronics, 315 Roslyn Rd., Mineola, N.Y. 11501
Mercury TV Tuner Service, 890 River, Bronx, N.Y.
Merit Coil & Transformer, Merit Plaza, Hollywood, Fla.
Metex Corp., 970 Durham Rd., Edison, N.J. 08817
Methode Mfg., 7447 W. Wilson Ave., Chicago, Ill. 60656
Metrex (UXL Corp.), 819 Blake Ave., Brooklyn, N.Y. 11207
Metritape Controls, 33 Sudbury Rd., Concord, Mass. 01742
Michigan Magnetics, Vermontville, Mich. 49096
Microflame Inc., 7800 Computer Ave., Minneapolis, Minn. 55424
Midland Int. Corp., 1519-21 Atlantic N., Kansas City, Mo. 64116
Midland Industries Inc., 8219 W. Irving Blvd., Wichita, Kansas 67209
Milgray/N.Y., 136 Liberty St., New York, N.Y. 10006
Millen Mfg. James, 150 Exchange, Malden, Mass. 02148
Miller Co. J.W., 5917 S. Main, Los Angeles, Calif. 90003
Milo Electronics, 530 Canal, New York, N.Y. 10013
Monarch Elec. Int'l. Inc., 7035 Laurel Canyon Blvd. N., Hollywood, Calif. 90028
Monitoradio Div. Idea, 7900 Pendleton Pike, Indianapolis, Ind. 46226
Mosley Electronics, 4610 N. Lindberg, Bridgeton, Mo. 63044
Moss Electronics, 2435 White Plains Rd., Bronx, N.Y. 10467

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NEWS OF THE INDUSTRY

Awards Recognize NBS WWV Radio

Transmissions from the National Bureau of Standards radio station, WWV, are used not only in the laboratories of industry, governments and educational institutions, but also by amateur radio operators around the world to calibrate their receivers and keep transmissions on-

frequency. WWV was recently honored by two awards, the WAS — "Worked All States" — given by the American Radio Relay League and the WAC — "Worked All Continents" — given by the International Amateur Radio Union. Both awards are prizes coveted by "hams" — amateur radio operators. Here David Andrews (right), recently retired chief of NBS Radio Broadcast Services, hangs the WAC award for Peter Viezbicke, Jr. (left), his successor, while Leo Honea, engineer-in-charge of WWV, positions the WAS award. Displayed in the left background of the photo are some of the QSL cards — verifications of reception — sent to WWV by hams of many countries. WWV transmits on 2.5, 5, 10, 15, 20, and 25MHz.

Distributor TV-Radio Sales Up

February distributor sales of TVs and radios moved strongly upward, the Electronic Industries Assn.'s Marketing Services Dept. reports.

Color TV sales to dealers totaled 465,236 for the month, 30.3 percent above the February 1967 sales figure. The year-to-date total thus rises to 870,989 color TV sets distributed, 29.9 percent over the figure attained at the end of February 1967.

February sales to dealers of B/W TVs rose to 459,914 units, 7.2 percent over the same month in 1967. This strong showing pulls B/W year-to-date figures up over 1967 — 837,565 through February 1968 vs 827,236 for the same 1967 period.

Home radio sales to dealers in February reached 971,321 units, 12 percent over the February 1967 performance. Year-to-date home radio sales, totaling 1,642,867, were 7.5 percent over sales for the comparable period in 1967.

Auto radio distributor sales surged 17.6 percent over February 1967 — 760,418 units compared with 646,575 in 1967. Auto radio sales for the year through February thus showed 10.4 percent greater in 1968 than in 1967 — 1,518,921 compared with 1,376,241 in the former year.

Distributor sales of phonographs were more mixed. While portable and table models showed a February rise of 7.4 percent over the same 1967 month, console models were down by almost the same percentage. Likewise, a total phonograph rise in February of 2.5 percent was paralleled by a year-to-date performance showing a drop of 2.7 percent from 1967.

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Motorola Communications Div., 4501 W. Augusta, Chicago, Ill. 60651
Motorola Consumer Prods., 9401 W. Grand Ave., Franklin Park, Ill. 60131
Motorola Semiconductor Products, PO Box 955, Phoenix, Ariz. 85001
Motorola Training Int., 4545 W. Augusta, Chicago, Ill. 60651
Mueller Electric, 1583 E. 31 St., Cleveland, Ohio 44114 Mullard (see Int'l. Electronics, New York, N.Y.)
Multicore Sales Corp., Westbury, N.Y. 11590
Multitron Corp., 309 Queen Ann Rd., Teaneck, N.J. 07666
Mura Corp., 380 Great Neck Rd., Great Neck, N.Y. 11021
Muzak Co., 220 4 Ave., New York, N.Y. 10003

N

National Radio Institute, 3939 Wisconsin Ave., Washington, D.C. 20016
Neshaminy Electronics, Neshaminy, Pa.
Newark Electronic, 223 W. Madison, Chicago, Ill. 60606
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif. 91342
Newtronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113
North American Philips (Norelco), 100 E. 42 St., New York, N.Y. 10017
Nortronics Co., 8133 10th Ave. N., Minneapolis, Minn. 55427
Nutone Inc., Cincinnati, Ohio

O

Oak Mfg. Co., Crystal Lake, Ill. 60014
Oaktron Industries, Monroe, Wis. 53566
Oelrich Publications, 4308 Milwaukee Ave., Chicago, Ill. 60641
Ohmite Mfg., 3673 Howard St., Skokie, Ill. 60076
Olson Electronics, 464 S. Forge, Akron, Ohio 44308
Olympic Radio & TV, 34-01 38 Ave., Long Island City, N.Y. 11101
Ortron Electronics, 29 Lincoln Ave., Orange, N.Y.
Oxford Transducers, 3911 S. Mich. Ave., Chicago, Ill. 60653

P

Packard Bell Electronics, 12333 W. Olympic Blvd., Los Angeles, Calif. 90064
Pace Communications Corp., 24049 Frampton Ave., Harbor City, Calif. 90710
Palmer Electronics Laboratories, Lowell Rd., Carlisle, Mass. 01741
Parker Metal Goods Co., 85 Prescott St., Wooster, Mass.
Parts Unlimited Inc., 1 State St., Bloomfield, N.J. 07003
Pearce-Simpson, PO Box 800 Biscayne Annex, Miami, Fla. 33152
Perma-Power Co., 5740 N. Tripp Ave., Chicago, Ill. 60646
Phaostron Instruments & Electronics, 151 Pasadena Ave. S., Pasadena, Calif. 91105
Phelps Dodge Communications Products Div., Route 79, Marlboro, N.J. 07746
Philco Corp., "C" and Tioga Sts., Philadelphia, Pa. 19134
Philharmonic Radio & TV, 235 Jersey Ave., New Brunswick, N.J. 08901
Pickering & Co., Sunnyside Blvd., Plainview, N.Y. 11803
Pilot Radio, 100 Electra Lane, Yonkers, N.Y.
Pioneer Electric & Research, Forest Park, Ill. 60130

Planet Mfg. Corp., 225 Belleville Ave., Bloomfield, N.J. 07003
Pocket Socket Inc., 17415 Ecorse, Allen Park, Mich. 48101
Polytronics Laboratories Inc., 900 Burlington Ave., Silver Spring, Md.
Pamona Electronics Co., 1500 E. 9th St., Pamona, Calif. 91766
Potter & Brumfield, 107 N. 10th St., Princeton, Ind. 46017
Precise Electronics, 76 E. 2 St., Mineola L.I., N.Y. 11501
Precision Apparatus Div. of Dynascan, 1801 W. Belle Plaine Ave., Chicago, Ill. 60613
Precision Electronics Inc., 9101 King Ave., Franklin Park, Ill. 60131
Precision Tuner Service, PO Box 272, Bloomington, Ind. 47401
Pyramid Electronic Co., Darlington, S.C. 29532

Q

Qualitone Industries, 102 Columbus Ave., Tuckahoe, N.Y. 10707
Quam-Nichols, 234 E. Marquette Rd., Chicago, Ill. 60637
Quan-Tech Labs, 60 Parsippany Blvd., Boonton, N.J. 07005
Quietrole Co., 395 St. John St., Spartanburg, S.C. 29302

R

Radar Devices Mfg. Corp., 22003 Harper Ave., St. Clair Shores, Mich. 48080
R C A Components and Devices Div., 415 S. 5 St., Harrison, N.J. 07029
RCA Semiconductor Dist. Prod. Div., 415 S. 5 St., Harrison, N.J. 07029
RCA Parts and Accessories, 2000 Clements Bridge Rd., Deptford, N.J. 08096
RCA Set Div., 600 N. Sherman Dr., Indianapolis, Ind. 46201
RFS Industries, 102 Harbor Rd., Port Washington, N.Y. 11050
RMS Electronics Inc., 2016 Bdwy., New York, N.Y. 10023
Radiart Co., 2900 Columbia, Indianapolis, Ind. 46205
Radio Receptor, 240 Wythe, Brooklyn, N.Y. 11211
Radio Shack, 730 Commonwealth, Boston, Mass.
Rauland Corp., 4245 N. Knox, Chicago, Ill. 60630
Rawn Co., Spooner, Wis. 54801
Ray-O-Vac Co., 212 E. Washington St., Madison, Wis. 53703
Raytheon Communications Prod., 213 Grand S., San Francisco, Calif.
Raytheon Distributor Products, Div. 55 Chapel, Newton, Miss. 39345
R-Columbia Products, 305 Waukegan Ave., Highwood, Ill. 60040
Recoton Corp., 52-35 Barnett, Long Island, N.Y. 11104
Record-O-Phone Div., Electrospace Corp., 408 Concord Ave., N.Y., N.Y. 10451
Reeves Soundcraft, Great Pasture Rd., Danbury, Conn. 06810
Regency Electronics, 7900 Pendleton Pike, Indianapolis, Ind. 46226
Rego Insulated Wire, 830 Monroe, Hoboken, N.J. 07030
Rek-O-Kut Co., 38-19 108 St., Corona, N.Y. 11368
Robert Electronics, 829 N. Highland Ave., Hollywood, Calif. 90028
Robert Bosh Corp. Blaupunkt Car Radio Div., 40-25 Crescent, Long Island City, N.Y. 11101
Robins Industries, 1558 127 St., College Pt., N.Y. 11356

Rockbar Corp., 650 Halstead, Mamaroneck, N.Y. 10543
Rohm Mfg., 116 Limestone St., Peoria, Ill.
Rustrak Instrument, 130 Silver, Manchester, N.H. 03103

S

S&A Electronics, 204 W. Florence St., Toledo, Ohio 43605
Sadelco Inc., 601 W. 26th St., New York, N.Y. 10001
Salch & Co. Herbert Marketing Div., Tompkins Radio Prod., Woodsboro, Texas, 78393
SECO Electronics Corp., 1205D S. Clover, Minneapolis, Minn. 55420
Sampson Co., 2244 S. Western Ave., Chicago, Ill. 60608
Sangamo Electric, 1301 N. 11st., Springfield, Ill. 62702
Sansui Electronics Corp., 34-43 56th St., Woodside, N.Y. 11377
Sargent Gerkhe Co., 323 W. 15th St., Indianapolis, Ind. 46202
Sarkes Tarzian Tuner Service, 537 S. Walnut, Bloomington, Ind. 47401
Sarkes Tarzian Tuner Service, 547-49 Tonnele, Jersey City, N.J. 07307
Sarkes Tarzian Tuner Service, 10654 Magnolia N., Hollywood, Calif. 90028
Schematic Library, 809 N. 7th St., Phoenix, Ariz. 85006
Schober Organ, 43 W. 61, New York, N.Y. 10023
Scott Inc., HH 111 Powdermill Rd., Maynard, Mass. 01754
Seco Electronics, 1201 W. Clover Dr., Minneapolis, Minn.
Semitronics Corp., 265 Canal St., New York, N.Y. 10013
Sencore Inc., 426 S. Westgate Rd., Addison, Ill. 60101
Sentry Electronics Inc., 707 S. Okfuskee, Wewoka, Okla. 74884
Setchell-Carlson, New Brighton, St. Paul, Minn. 55112
Sherwood Electronic Labs, 4300 N. California Ave., Chicago, Ill. 60618
Shure Brothers, 22 Hartrey Ave., Evanston, Ill. 60202
Signalite, Inc., Neptune, N.J.
Simpson Electric, 5200 W. Kinzie St., Chicago, Ill. 60644
Singer Co., 3211 So. LaCienega Blvd., Los Angeles, Calif. 90016
Slep Electronic Co., Automotive Div., PO Box 178, Ellenton, Fla. 33532
Smith Inc., Herman H., 2326 Norstrand, Brooklyn, N.Y. 11210
Snyder Mfg., 22 & Ontario, Philadelphia, Pa.
Sola Electric, 1717 Busse Rd., Elk Grove Village, Ill.
Sonar Radio, 73 Wertman Ave., Brooklyn, N.Y.
Sonotone Corp., Elmsford, N.Y. 10523
Sony Corp of America 580 5 Ave., New York, N.Y. 10036
Sorensen Prods Div., Raytheon S., Norwalk, Conn.
Soundolier Inc., PO Box 3848, St. Louis, Mo.
South River Metal Products, 377 Tpk. Rd., South River, N.J. 08882
Sprague Products, 65 Marshall St. N., Adams, Mass. 01247
Sprayon Products Inc., Bedford Heights, Ohio. 44146
Stockpole Carbon Electronics Div., St. Marys, Pa.
Stancor Electronics, 3501 W. Addison, Chicago, Ill. 60618
Standard Instrument Corp., 657 Broadway, New York, N.Y. 10012
Standard Kollsman Industries, 2085 N. Hawthorne, Melrose Park, Ill. 60160
Stromberg-Carlson Div., General Dynamics, 1400 N. Goodman St., Rochester N.Y. 14609
Sturtevant Co., PA, Addison, Ill. 60101
Superex Electronics Corp., 4 Radford Place, Yonkers, New York
Superior Electronics, 208-212 Piaget Ave., Clifton, N.J. 07011
Swing O Lite Inc., 13 Moonachie Rd., Hackensack, N.J.
Switchcraft Inc., 5555 N. Elston, Chicago, Ill. 60603
Sylvania Electronic Products, 730 3 Ave., N.Y., N.Y. 10017
Sylvania Electronic Tube Div., Seneca Falls, N.Y. 13148
Symphonic Radio & Electronic, 10 Columbus Circle N., New York, N.Y. 10023

T

Tab Books, Monterey & Pinola Ave., Blue Ridge Summit, Pa. 17214
TACO, Sherburne, N.Y. 13460
TRX Electronic Corp., 200 Park Ave. S., New York, N.Y. 10003
TV Tuner Service, 2103 W. 3 St., Bloomington, Ind. 47401
TV Tuner Service, 118 3rd St., W., Twin Falls, Idaho 83301
Talk A Phone Co., 5013 N. Kedzie Ave., Chicago, Ill. 60625
Tandberg of America, 83 Ave., Pelham, N.Y. 10803
Tap A Line Mfg., PO Box 563, Pompano Beach, Fla. 33061
Tech-Master, 75 Front St., Brooklyn, N.Y. 11201
Techni-Parts Corp., 156 Hempstead Tpk., W. Hempstead, L.I., N.Y. 11552
Techpress Inc., Brownsburg, Ind. 46112
Tektronix Inc., PO Box 500, Beaverton, Ore. 97005
Telerad Div. Lionel Corp., Route 69-202, Flemington, N.J. 08822
Telex Inc., 3054 Excelsior, Minneapolis, Minn. 55416
Telex/Aemco Div., Telex Inc., Mankato, Minn. 56001
Teleonic Industries, 60 N. 1 Ave., Beech Grove, Ind. 46107
Telvac Instrument Co., 18531 Ventura Blvd., Tarzana, Calif. 91356
Tenatronics Ltd., 1011 Power Ave., Cleveland, Ohio 44114
Tenna Mfg., 19201 Cranbrook Pkwy., Cleveland, Ohio
Tennalab, 10 & State St., Quincy, Ill. 62301
Terado Co., 1068 Raymond Ave., St. Paul, Minn. 55108
Texas Crystals, 1000 Crystal Dr., Ft. Myers, Fla. 33901
Thomas & Betts Co., Inc., 36 Butler St., Elizabeth, N.J. 07207
Thomas Electronic Organs, 8345 Hayvenhurst Ave., Sepulveda, Calif. 91343

Thordarson-Meissner, 7 & Belmont, Mt. Carmel, Ill. 62863
Thorens Div., Atlantic & Steward Aves., ELPA Mktg., Ind., New Hyde Park, N.Y. 11040
Toshiba Mitsu & Co., 530 5 Ave., New York, N.Y. 10036
Tram Electronics, Lower Bay Road, PO Box 187, Winnisquam, N.H. 03289
Trav Ler Radio, 571 W. Jackson, Chicago, Ill. 60606
Triad Transformer, 4055 Redwood Ave., Venice, Calif. 90291
Trio Mfg., Griggsville, Ill. 62340
Triplett Electrical Instrument, 286 Harmon Rd., Bluffton, Ohio 45817
Tung-Sol Electric, 1 Summer Ave., Newark, N.J. 07104
Turner Co., 918 17 St. N.E., Cedar Rapids, Iowa 52401

U

Ullman Devices, Ridgefield, Conn. 06877
Ungar Co., Sid, 1880 Rayford Dr., Los Angeles, Calif. 90045
Ungar Electric Tools, 2701 W. El Segundo Blvd., Hawthorne, Calif. 90250
Union Carbide, 270 Park Ave., New York, N.Y. 10017
Useco Div., Litton Industries Inc., 13536 Saticoy St., Van Nuys, Calif. 91402
Utah Electronics, 1123 E. Franklin St., Huntington, Ind. 46750
U Test M Mfg., 4325 W. Lincoln, Milwaukee, Wis. 53219
United Transformer, 150 Varick St., New York, N.Y. 10013
University Loudspeakers Div., Ling Temco Vought, 9500 W. Reno St., Oklahoma City.
Up Right Towers, 1013 Pardee St., Berkeley, Calif. 94710
Utah Radio & Electric Corp., 1123 E. Franklin St., Huntington, Ind. 46750
Utica Drop Forge & Tool, 2415 Whitesboro, Utica, N.Y. 13502
Utica Electronic Communications, 2714 W. Irving Pk., Chicago, Ill. 60618

V

V.M. Corp., 4 & Park Sts., Benton Harbor, Mich. 49022
Vaco Products, 510 N. Dearborn, Chicago, Ill. 60610
Valley TV Tuner Service, 5641 Cahuenga Blvd. N., Hollywood Calif. 90028
Vector Electronic, 1100 Fowler St., Glendale, Calif.
Victoreen Instrument, 5806 Hough Ave., Cleveland, Ohio 44103
Vidaire Electronics, 365 Babylon Tpk. Roosevelt, L.I., N.Y. 11575
Video Industries Co., 242 Madison Ave., Port Chester, N.Y. 10573
Viking Cable Co., 400 9th St., Hoboken, N.J. 07030
Viking of Minnesota, 9600 Aldrich St., Minneapolis, Minn.
Viking Electronics, 830 Monroe, Hoboken, N.J. 07030
Vitramon Inc., Box 544, Bridgeport, Conn. 06601
Vocaline Co. of America, 133 Colter St., Old Saybrook, Conn. 06475
Volkswagen of America, 476 Hudson, Terrace Englewood Cliffs, N.J. 07632

W

Waber Electronics, 200 N. 2nd St., Philadelphia, Pa. 19106
Walco Electronics, 60 Franklin St., East Orange, N.J. 07017
Waldom Electronics, 4625 W. 53 St., Chicago, Ill. 60623
Wall Mfg. Co., P, Grove City, Pa. 16127
Waller Corp., Crystal Lake, Ill. 60014
Wallin-Knight Industries, 3321 McKinley St. NE., Minneapolis, Minn. 55108
Walsco Electronics, S. Wyman St., Rockford, Ill. 61101
Ward Leonard Electric, 115 McQueston Pkwy, Mt. Vernon, N.Y.
Ward Products, Edsom St., Amsterdam, N.Y. 12010
Weathers Industries, 66 E. Gloucester Pike, Barrington, N.Y. 08007
Webcor Inc., 5626 Bloomingdale Ave., Chicago, Ill. 60639
Weller Electric, 601 Stone Crossing Rd., Easton, Pa.
Wells-Gardner, 2701 N. Kildare Ave., Chicago, Ill. 60639
Wen Products, 5810 Northwest Hwy, Chicago, Ill. 60631
Western Electric Co., Inc., 195 Broadway, New York, N.Y. 10007
Western Tuner Rebuilders, 1140 N. Vermont Ave., Los Angeles, Calif. 90029
Westinghouse Electric Radio TV Dept., Metuchen, N.J. 08840
Westinghouse Electric Corp., Tube Div., PO Box 284, Elmira, N.Y. 14902
Wilco Co., 4425 Bandini Blvd., Los Angeles, Calif. 90023
Windsor Electronics, 999 N. Main St., Glen Ellyn, Ill. 60137
Winegard Co., 3019 Kirkwood, Burlington, Iowa 52601
Wire Products Co., 1215 South Ave., Syracuse 7, N.Y.
Workman Electronic Products, Box 5297, Sarasota, Fla. 33579
Worner Electronic, Rankin, Ill. 60960
Wuerth Tube Saver Corp., PO Box 66, Hollandale, Fla.
Wurlitzer Co., N. Tonawanda, N.Y. 14150

X

Xacto Inc., 48-41 Van Dam St., Long Island City, N.Y. 11101
Xcelite Inc., 12 Bank St., Orchard Park, N.Y. 14127

Y

Yeats Appliance Dolly Sales Co., 2124 N. 12th St., Milwaukee, Wis. 53205

Z

Zenith Sales Corp., 6001 W. Dickens, Chicago, Ill. 60639

SEMICONDUCTORS . . .

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biased. Under these conditions, diode d_1 is capable of conducting a significant current at any reasonable voltage and diode d_2 is capable of conducting a significant current when the applied voltage exceeds its breakdown voltage.

When the polarity of the applied voltage is reversed (the bottom lead now more positive than the top lead), the conditions in the two zener diodes are reversed. Diode d_2 is now forward biased and capable of conducting a significant current at any reasonable voltage, while diode d_1 is now reverse biased and capable of conducting a significant current only when the applied voltage exceeds its breakdown voltage.

Because of the characteristics described, the polarity of the voltage applied to the thyrector is insignificant. The thyrector has a relatively high internal resistance that breaks down only when the applied ac voltage or dc voltage of either polarity exceeds its zener breakdown voltage (Fig. 13).

The next article in this series will complete the description of semiconductors most commonly used in power supplies and power regulating circuits. The semiconductors covered will include four-layer diodes, SCR diodes, diacs and triacs.

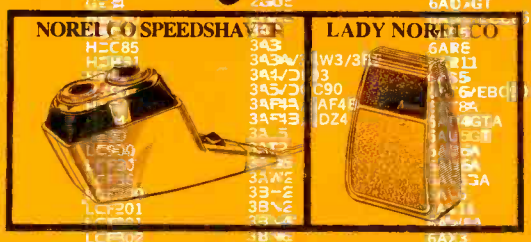
Erratum

The patent number refered to in Fig. 9 of the April 1968 Semiconductors From A to Z article was in error. The published French Patent, "Appareil Phonographique," is no. 1,502,481.

ADVERTISERS' INDEX

Look...but don't count!

Now...if you can guess (within 100 types) how many Amperex receiving tube types there are listed on this page... you'll qualify for our drawing and you may be one of a hundred winners of the world-famous Norelco Speedshaver or Lady Norelco.



Stop Counting! You're on your honor. We'll give you some clues without spoiling the fun. We can tell you that the line includes more than 650 Amperex-quality, U.S.-made tubes . . . plus the popular line of imported interchangeable types including the famous FRAME GRIDS and other Amperex proprietary tubes . . . plus the most complete line of European replacements for the imported car and home radios and hi-fi sets that you service.

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That's really all there is to it! All entries with the correct answer, (give or take 100 tubes) become eligible for drawing of prizes on August 12th. Please print your name and address legibly and include the name and address of your Distributor. Only one entry allowed per contestant. This contest, limited to TV, radio and hi-fi Service Dealers and Technicians is subject to Federal, State and Local laws and regulations and is void where prohibited by law.

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