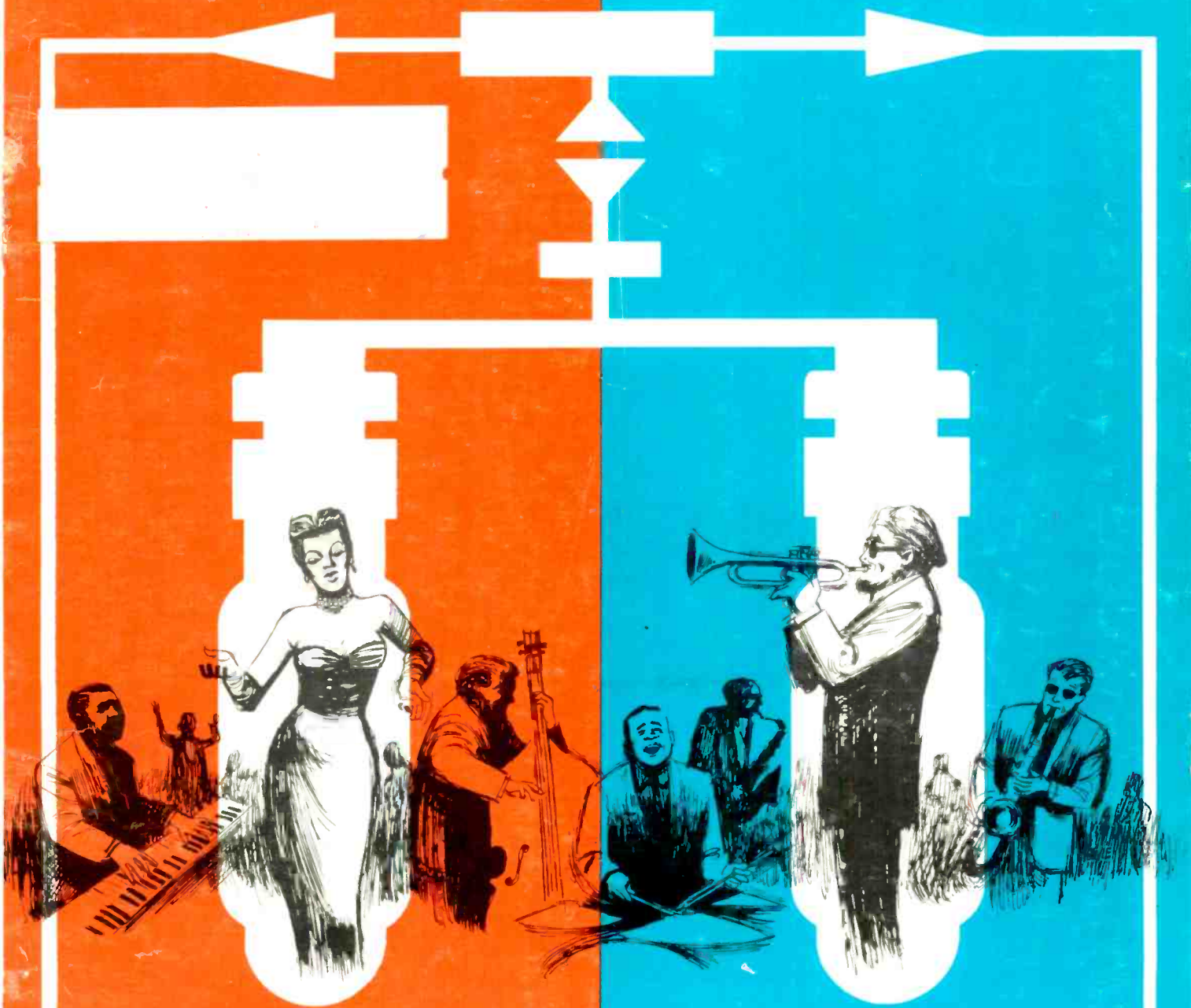


# ELECTRONIC TECHNICIAN



STEREO '63

SEPTEMBER 1962

Look for these signs at your participating Distributor

YOU GET

**S&H**

GREEN  
STAMPS  
WHEN YOU

**BUY**  
SYLVANIA  
RECEIVING  
**TUBES**

HUNDREDS  
OF GIFTS  
FOR YOU  
AND YOUR  
FAMILY  
WHEN YOU  
**BUY**  
SYLVANIA  
RECEIVING  
**TUBES**

FOR THE

**S&H**  
GIFT  
CATALOG  
**BUY**  
SYLVANIA  
RECEIVING  
**TUBES**



**SYLVANIA**  
ELECTRONIC TUBE



Get in on

## Sylvania's big, new Service 'n Save Stamp Plan

S&H Green Stamps add up in a hurry when you buy Sylvania tubes. So does customer good will when you stay with Sylvania quality.

That's why we say you can profit and save at the same time through the many Sylvania distributors offering S&H Green Stamps with Sylvania Receiving Tubes.

Select gifts from a big, new 144-page S&H Catalogue. Ask your Distributor for a copy.

# SYLVANIA

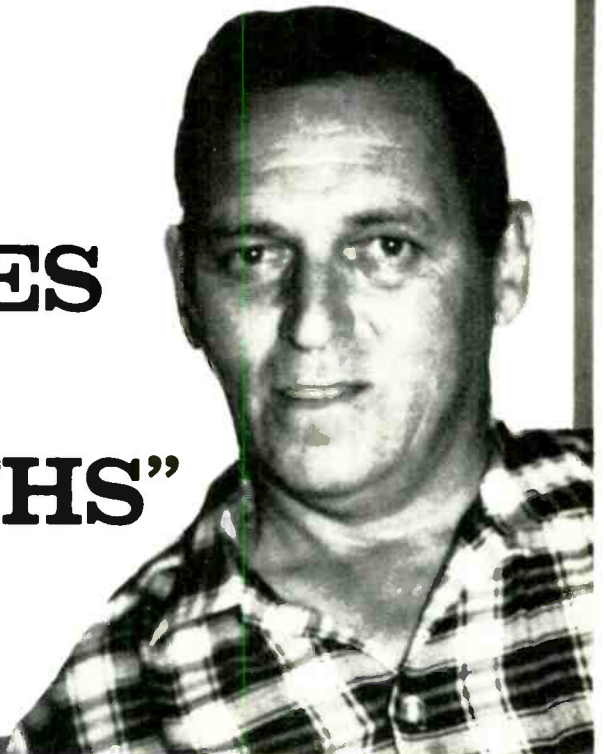
SUBSIDIARY OF  
**GENERAL TELEPHONE & ELECTRONICS**



# "WE SOLD \$3000 WORTH OF POWERMATES DURING THE 'SLOW' MONTHS"

**CHRIS MARCOTTE**

Capeway TV Service Co., Harwich Port, Mass.



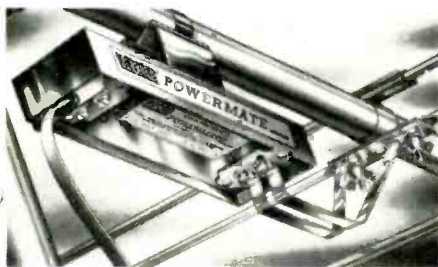
## POWERMATE's unexcelled performance plus Jerrold's powerful LOCAL promotions achieved this for Chris...

Chris Marcotte worked closely with his Jerrold distributor on a powerful promotion program that appealed *directly* to his Cape Cod customers. Jerrold newspaper mats pre-sold the POWERMATE where it would do the most good—in Chris's service area. Jerrold also supplied store banners, counter displays, envelope stuffers—in short, a complete package that helped Chris tell the POWERMATE story most effectively to his neighbor-customers. This well-

planned LOCAL promotion, plus an unbeatable product, turned the trick for Chris.

Here's what Chris says: "The Jerrold POWERMATE outperforms all other transistorized antenna amplifiers we've tested under actual reception conditions. Boston and Providence, both 70 air miles away, come in free from any snow 90% of the time. We're watching Portland, Maine, a distance of 180 miles . . . in *COLOR*—very acceptable."

Chris Marcotte's success story is being repeated over and over throughout the country. So get on the POWERMATE bandwagon now! Let Jerrold set up your LOCAL promotion. Write now for the name of your nearest Jerrold distributor.



**JERROLD**®

**TRANSISTOR  
POWERMATE  
ANTENNA AMPLIFIER**

**\$3995**  
LIST

**JERROLD ELECTRONICS CORPORATION**  
A subsidiary of THE JERROLD CORPORATION  
Philadelphia 32, Pa.

Jerrold Electronics Corporation  
Distributor Sales Division, Dept. IDS-254  
Philadelphia 32, Pa.

I want Jerrold to promote the POWERMATE in my LOCAL area. Send me the name of my nearest distributor.

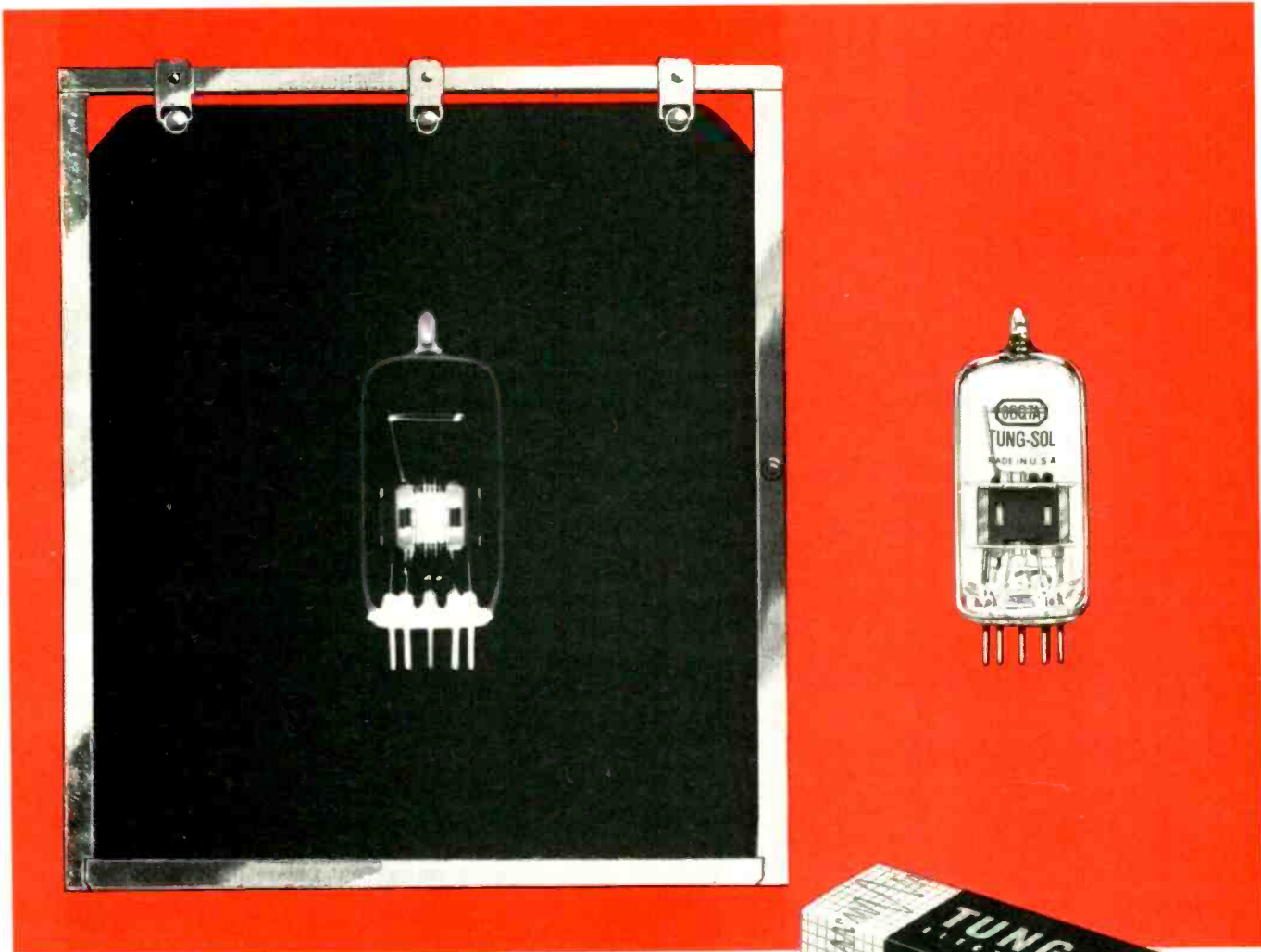
Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

— for more details circle 48 on post card

## HIGH GAIN AND LOW CAPACITANCE OF FRONT END TRIODES EXPLAIN ABSENCE OF SNOW ON PICTURE TUBES



**S**NOWY or hazy pictures are symptomatic of tv front ends that transmit input noise infections to the video stages. The wideband RF amplifier triodes manufactured by Tung-Sol for tv tuner service are immunized against this disease by abnormally close spacing of grids and cathodes, boosting power gain and allowing transconductance to increase faster than input capacitance. Isolation of tube elements is maintained by three-part formula: clear mica spacers and rigidized construction to prevent thermal warping and microphonics; high-purity materials prevent gas generation and the formation of leakage paths; extreme cleanliness during every step of manufacture avoids contaminants. Shot noise caused by uneven cathode emission is prevented by using finely dispersed cathode materials.

### PRESCRIPTION FOR PROFIT

Customers appreciate fair weather tv pictures. To keep customers and their sets sunny, specify Tung-Sol front end tubes.

 **TUNG-SOL®**  
**RF AMPLIFIER TUBES**

TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.

--- for more details circle 79 on post card

ELECTRONIC TECHNICIAN

**WORLD'S LARGEST  
ELECTRONIC TRADE  
CIRCULATION**

# ELECTRONIC TECHNICIAN

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September • 1962

Vol. 76 • No. 3

**COVER** Whether we like it or not we now find ourselves in the business of selling, installing and maintaining modern Hi-Fi stereophonic equipment, in addition to TV and radio. Every realistic TV-radio technician, from the one-man basement operation to the largest service-dealer combine, will recognize the difficulties of attempting to swim against the stereo tide. Only a few will possess the rare capability of assuming an aloof attitude toward stereo. One or more of the articles beginning on page 64 of STEREO '63 may help you break the barrier to new and profitable frontiers.

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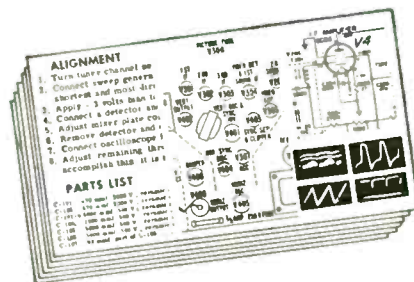
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## CIRCUIT DIGESTS



## PRECEDING BACK COVER

DUMONT: Stereo Amplifier Chassis 120509-B

MOTOROLA: TV Chassis TS, QTS, RTS, STS, & WTS-436, Models 19T5, 7, 11, 12, 13, 14, and A19T8 Series

RCA: TV Chassis KCS 140A, B, Models 193-A-542-MV, MU, 546-VM, MU-549-MV, MU

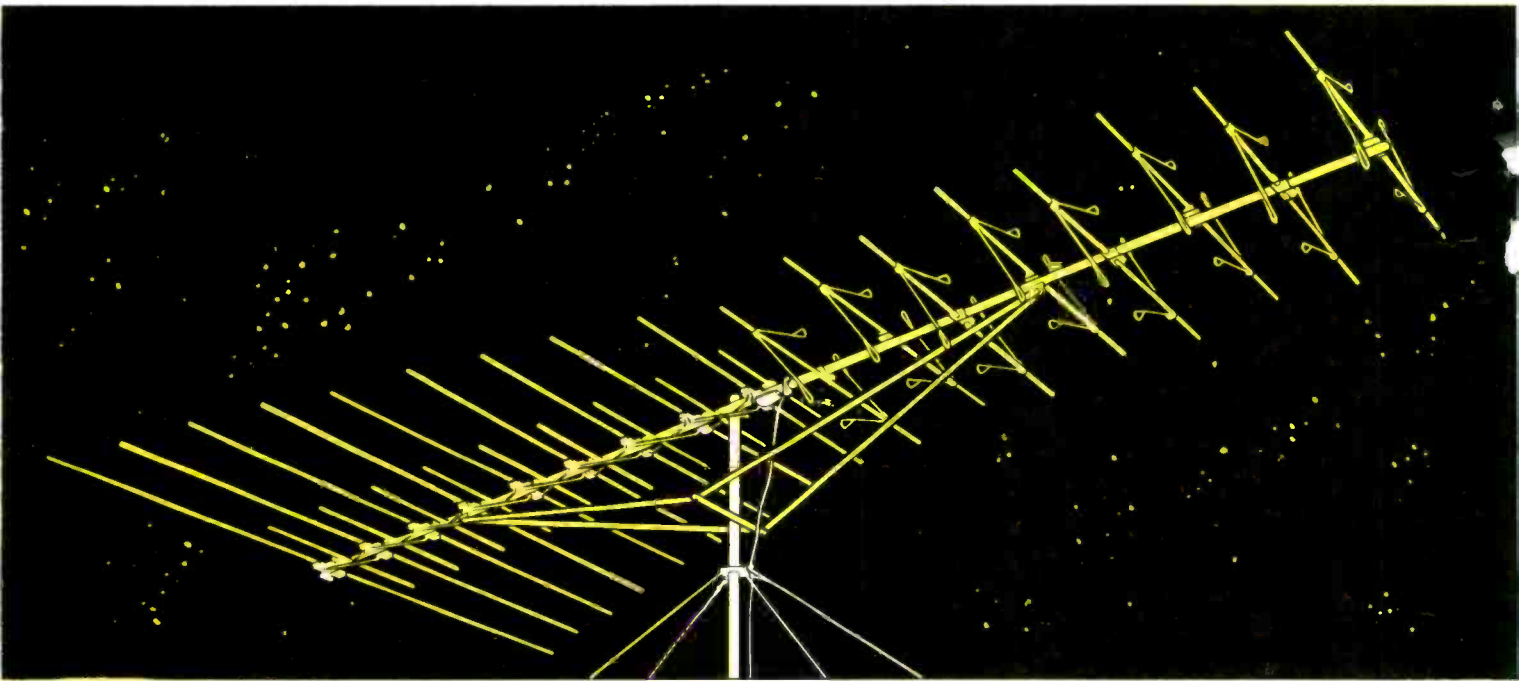
SPARTON: Stereo Phonograph Model 12M5-P

WEBCOR: Stereo Phonograph Models 1376 & 1377

WESTINGHOUSE: Phonograph Chassis V-2515-2 Models H-M1800, 01, 03, H-M1900, 01, & 03

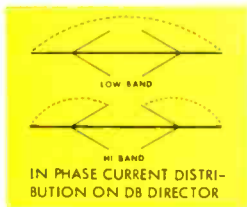
# 6 NEW SPACE- *CHANNEL MASTER*

BY



## All new Telstar Crossfire

**Electronic Antenna combines unequalled performance of new Super-Crossfire Antenna with new built-in Telstar Booster**



World's most powerful antenna features exclusive, advanced DB Director System with "Phase Control." Gives up to 82% more gain —plus tremendous added gain of Telstar Booster.

In the Crossfire Antenna, Channel Master gave you Proportional Energy Absorption—the most effective principle yet for achieving top picture power in picture-poor areas. Now, in the **Telstar Crossfire**, we've teamed this principle with two new exclusive developments—to make this far and away the most powerful antenna in the world.

Basically, the Telstar consists of our brand new Super-Crossfire—an antenna with a brand-new Director system. The DB (Dual Band) Director System—exclusive with Channel Master—enables each DB Director to receive both low and high bands on a single element. Thanks to a unique Phase Controller, each director—on the high band—functions as 2 half-wave co-linear elements with in-

phase current distribution. In effect, simplified directors make it possible to use more directors—for increased effectiveness. Result?

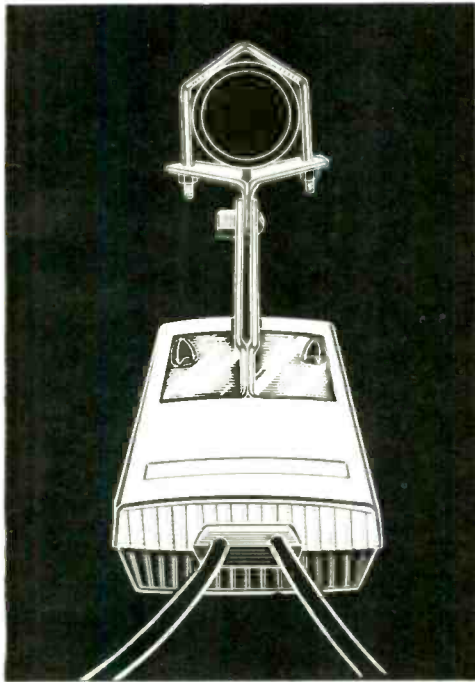
... In the Super-Crossfire Antenna (Model 3607... available separately) ... you get up to 82% more gain than the 28-element Crossfire, plus the same high front-to-back ratios.

... In the Telstar Crossfire Antenna (Model 3606) ... you get all the outstanding features of the Super-Crossfire ... plus the extra-powerful gain and low noise-figure of the brand new Telstar Booster (see right). No other antenna even comes close.

- **Exclusive New!** Both Telstar and Super-Crossfire feature still another Channel Master first: New 2-way boom bracing ... stops cross-arm bounce and horizontal wind-whip.
- **Exclusive!** All Channel Master outdoor antennas are fully protected against corrosion by E.P.C. "Golden Overcoat."

# AGE TRIUMPHS

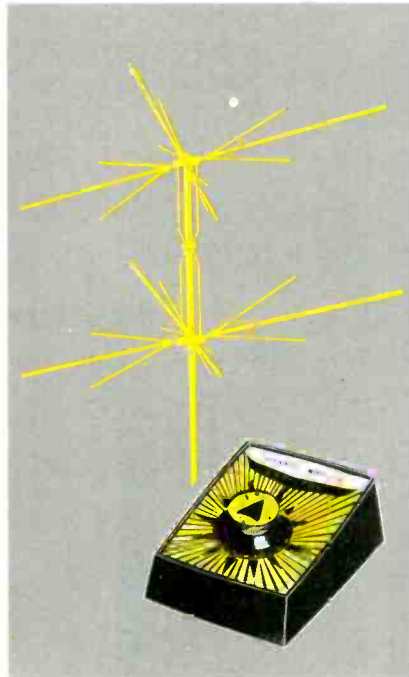
**BEST-PERFORMING OF ALL ANTENNAS AND BOOSTERS!  
AND MOST PROFITABLE FOR YOU! BEST FOR BLACK-  
AND-WHITE AND COLOR TV. FM STEREO, TOO!**



## **NEW Telstar BOOSTER-COUPLER** *features peak-power plus lightning- resistant circuit!*

TV and FM Stereo get the biggest performance boost yet with a booster that is miles ahead of the "second best" booster. The Telstar Booster is especially engineered to pour more usable power than any other booster to 1, 2, 3, or 4 sets! The latest circuitry and advanced low-noise transistor result in highest gain and highest signal-to-noise ratios yet.

Lightning-resistant, too—because circuit utilizes the lightning rod principle to prevent transistor burnout caused by induced atmospheric lightning. Laboratory-tested by 250,000 lightning volts! Beautifully styled in blue-and-white. **Model 0023**

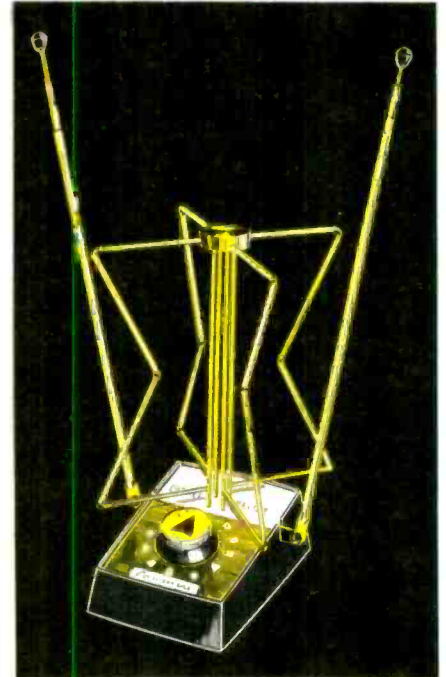
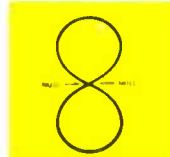


## **New OMNI-RAY TV/FM STEREO ANTENNA** **GHOST-KILLER EXTRAORDINARY!**

A brand-new outdoor antenna with directivity electronically controlled by an indoor switch. (No rotator needed). Solves most common problems of metropolitan and secondary signal areas with these important exclusives:

1. Perfect figure-8 reception pattern, electronically rotated in 22½ degree steps.
2. Deep side nulls; 10:1 rejection ratio.
3. "Aim the beams" for top power; "aim the nulls" for top ghost and interference rejection.
4. Special "Duo-Twin" Transmission lead prevents mutual coupling.

A completely preassembled stacked antenna. **Model 3622**



## **Handsome New CANAVERAL** **FIRST INDOOR DIPOLE ANTENNA WITH TRUE ELECTRONIC CIRCUITRY.**

Unique "Pix-Power" switch and impedance-compensating circuit give you these exclusive advantages:

1. **On low band**—resonates on all channels (even 2 and 3) by electronically lengthening or shortening elements—without need for manual dipole adjustment.
2. **On high band**—Greatly increases gain by functioning as 2 co-linear half-wave dipoles—without manual adjustment.

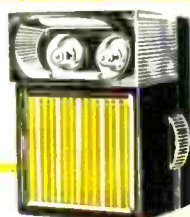
3. Has balanced system with 300-ohm impedance-matched output to eliminate standing waves.

Has the longest elements anywhere (96" tip to tip) for greater pull-in power.

Smartly-styled, with tremendous merchandising possibilities. **Model 3720**

## **NEW! Rechargeable BRIGHT-MITE.**

The revolutionary tiny miracle light that outshines big flashlights. Powered by the Permanent Energy Cells that power the Satellites. Ask about our terrific Display Pack deal.



**See your Channel Master distributor for literature on all these products.**

- - - for more details circle 23 on post card

**"I've got  
satisfied  
customers  
and  
profits..."**



**by improving communications equipment reliability with  
IERC Heat-dissipating Electron Tube Shields!**

Extra profits in contract servicing are yours with TR type heat-dissipating tube shields — at installation, of course, and from the 2 to 12 time increase in tube life and reliability they provide. Electron tube failures, caused by heat, account for almost 70% of equipment failures. Service profits go out the window when valuable work, other service calls or "off hours" time must be given to meet service contract requirements just to change a tube! You can eliminate this problem by increasing the tube life and reliability of your customer's communications equipment with TR's — time-proved in vital military, aerospace and precision electronic equipment applications. A complete installation of TR's in almost any equipment takes only a few minutes — reliability and profits are immediate!

patented



**SERVICE TECHNICIANS —**  
Write today for complete data on  
IERC TR shields.

**IERC**  
heat-dissipating

**DIVISION**  
electron tube shields.

**International Electronic Research Corporation**  
135 West Magnolia Boulevard, Burbank, California  
heat-dissipating tube shields for miniature, subminiature, octal and power electron tubes

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**EDITOR'S  
MEMO**



Nobody knows the troubles my readers have seen.

You promise to have a set repaired by a certain date, and something turns up to cause delay. Perhaps a part is hard to get. Maybe that simple job turns out to be a tough dog. Could be you were out sick a few days. It makes no difference. Chances are the customer will hawl the dickens out of you. So you promise the set for the next day, work until midnight to finish it, and deliver it on time.

What happens? Why the customer goes to a different dealer next time. To avoid this kind of problem when delivery date is uncertain, we should consider the advice which a shrewd service dealer reportedly gave to his son.

"Son," he said, "two things are necessary to operate a successful business. They are responsibility and wisdom."

"What do you mean by responsibility?" queried the offspring.

"Well, suppose you promised a customer to install a new antenna on a given date. The day comes, and it's snowing. The roof is slippery and the wind is howling like a banshee. Should you make the installation that day or not? Responsibility means that you are obligated to do it."

"And what about wisdom?" asked the lad.

"Wisdom," replied the father, "means that you have enough sense not to promise in the first place."

Suppose deliveries are not a problem with you. Perhaps collections are. Don't let unpaid bills sit around. Set up a program to dun overdue customers consistently and with tact. As the squeaky wheel gets the grease, the loud creditor gets the payment. You must be firm, but if you get too tough too soon, you might get this type of letter, said to have been received (I don't believe it) by one merchant:

Dear Sir:

*How dare you send me a threatening letter. I pay my bills in the following manner. Each month, all bills are put into a hat. Then I pull bills out at random up to the amount of money I have in the bank. These bills, fairly picked, are paid.*

*If you insist on writing nasty letters, I won't even put your bill in the hat!*

*Al Forman*

ELECTRONIC TECHNICIAN



# The **HIDDEN 500\*** wrote these **6 SUCCESS STORIES...**

## Service Technicians supply the happy endings!

Capacitor success stories are no novelty at Sprague. The "Hidden 500", Sprague's behind-the-scenes staff of 500 experienced researchers, have authored scores of them! And customers add new chapters every day. But none has proved more popular than the 6 best sellers shown here. Developed by the largest research organization in the capacitor industry, these 6 assure happy endings to service technicians' problems.

### 1 **DIFILM® BLACK BEAUTY® MOLDED TUBULAR CAPACITORS**



The world's most humidity-resistant molded capacitors. Dual dielectric—polyester film and special capacitor tissue—combines best features of both. Exclusive HCX® solid impregnant produces rock-hard section—nothing to leak. Tough case of non-flammable phenolic—cannot be damaged in handling.

### 2 **DIFILM® ORANGE DROP® DIPPED TUBULAR CAPACITORS**



Especially made for exact, original replacement of radial-lead tubulars. Dual dielectric combines the best features of both polyester film and special capacitor tissue. Exclusive HCX® solid impregnant—no oil to leak, no wax to drip. Double dipped in bright orange epoxy resin to beat heat and humidity.

### 3 **TWIST-LOK® ELECTROLYTIC CAPACITORS**



The most dependable capacitors of their type. Built to "take it" under torrid 185°F (85°C) temperatures—in crowded TV chassis, sizzling auto radios, portable and ac-dc table radios, radio-phono combinations, etc. Hermetically sealed in aluminum cases for exceptionally long life. Withstand high surge voltages. Ideal for high ripple selenium rectifier circuits.

### 4 **ATOM® ELECTROLYTIC CAPACITORS**



The smallest dependable electrolytics designed for 85°C operation in voltages to 450 WVDC. Small enough to fit anywhere, work anywhere. Low leakage and long shelf life. Will withstand high temperatures, high ripple currents, high surge voltages. Metal case construction with Kraft insulating sleeve.

### 5 **LITTL-LYTIC® ELECTROLYTIC CAPACITORS**



Ultra-tiny size for use in transistorized equipment. High degree of reliability at reasonable price. All-welded construction—no pressure joints to cause "open" circuits. Withstand temperatures to 85°C (185°F). Hermetically sealed. Extremely low leakage current. Designed for long shelf life—particularly important in sets used only part of the year.

### 6 **CERA-MITE® CERAMIC CAPACITORS**



Tiny, tough, dependable in practically every application. Low self-inductance of silvered flat-plate design gives improved by-pass action in TV r-f circuits. Higher self-resonant frequency than tubular ceramics or micas. Tough moisture-proof coating. Designed for 85°C operation.

\*The "Hidden 500" are Sprague's 500 experienced researchers who staff the largest research organization in the electronic component industry and who back up the efforts of some 7,000 Sprague employees in 16 plants strategically located throughout the United States.

Handy Hanging Wall Catalog C-457 gives complete service part listings. Ask your Sprague Distributor for a copy, or write Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts.



# For The Independent Serviceman Who Wants To Be Truly Independent

## The New Lafayette Associate Store Program Offers You A Most Unusual Opportunity To Own Your Own Business

If you have a basic knowledge of radio, television or electronics, and if you have ambitions for true independence and security, a Lafayette Radio Electronics Associate Store can be the beginning of a profitable and respected career.

■ Within the past year, Lafayette Radio Electronics began to explore the possibility of expanding on a nationwide basis. Fifty men such as you (some with established stores, some with little or no business experience) were granted associate store franchises. They have been given the benefit of Lafayette's many years of experience selling stereo kits, citizen band radios, recorders, science and electronics kits, tools, components, hobby supplies, television repair equipment and all the other things that make this the fastest-growing industry in the country. Today, every one of these men is the owner of a thriving business and is well on his way to a better way of life. (A list of these successful associates is available on request.) ■ As a result of this success, Lafayette has decided to expand the program. We are now looking for a limited number of men who are willing to invest from \$10,000 to \$20,000 to get the things they've always wanted out of life: travel, new home, new car, education for the children, security of their own business. ■ For more information on how you can own a profitable business, fill out and mail coupon below. Find out more about Lafayette's:

**Protected Territory** Yours will be the only franchised Lafayette Radio Electronics Associate Store in your marketing area. This means that when your customers want the advertised and branded merchandise supplied by Lafayette, they'll come to you. **Marketing Direction** With the knowledge gained from past successes, we will help you set up a complete program, from choosing the right location, to designing your store for maximum profits, to setting up your inventory. **Executive Guidance** Our program will help you function effectively in the day to day operations of your store. We'll show you how to deal with customers, how to establish a large, loyal following, how to build public relations. In short, Lafayette will show you how to be the kind of responsible executive who is a success in business, a leader in the community. **Advertising Support** Millions of dollars have been spent to establish Lafayette Radio Electronics and its franchised dealers as the primary source for electronics radio and science equipment. The Lafayette sign in front of your store will indicate to everyone that you are associated with a multi-million dollar organization, one of the largest of its kind in the world. Furthermore, all-year 'round advertising, public relations and promotion campaigns will continue to send customers to your store. ■ Fill out and mail this coupon today. This can be the beginning of a new way of life.

Lafayette Radio Electronics Corporation  
111 Jericho Turnpike, Dept. ET-92, Syosset, L. I., New York

Mr. Robert Laub: Please send me full information on how I can own my own profitable business. I understand there is no obligation.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

--- for more details circle 52 on post card

## LETTERS TO THE EDITOR

### Electronics Schools

EDITOR, ELECTRONIC TECHNICIAN:

Please give me the name and address of a good school for electronic technicians.

SCOTT CROSS

Winfield, Tenn.

• *A list of Electronics Schools appeared in the May issue of Electronic Technician. — Ed.*

### Wants FCC License

EDITOR, ELECTRONIC TECHNICIAN:

How do I get started for a FCC License? Are there any books I can study?

EUGENE BRACH

Amsterdam, N. Y.

• *The simplest license available for servicing transmitting equipment is the second class phone license. To obtain this license you must pass an FCC examination. The nearest examining office to you is in Schenectady, N. Y. There are several good question-and-answer books available which can be used as study guides. For more information write to the FCC District Examiner, 748 Federal Bldg., New York City. — Ed.*

### It's Wonderful

EDITOR, ELECTRONIC TECHNICIAN:

I am a new subscriber to your wonderful magazine, having received only a few copies. I am well pleased with the articles which have appeared in each issue. Keep this fine magazine going and off the news stands.

NELSON RADIO & TV

Santee, Calif.

### Japanese List Incomplete

EDITOR, ELECTRONIC TECHNICIAN:

Congratulations on your listing of Japanese Radio Manufacturers. This is an excellent service. I note, however, that you have not listed at least one type I know of, i. e., Matsushita—possibly there are others.

EVANGELINE ELECTRONICS

Cheticamp, Nova Scotia

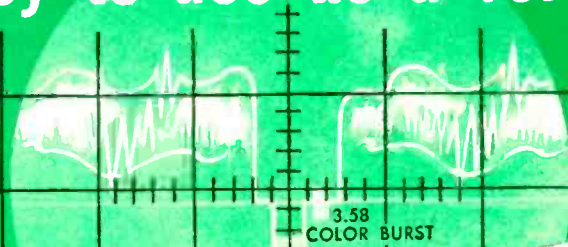
• *There are a number of Japanese transistor radio manufacturers who make sets under their own and under individual distributor trade names which are not included in this list. Details are difficult to obtain.—Ed.*

ELECTRONIC TECHNICIAN

NEW, MODERN, PORTABLE... FOR THE MAN ON THE GO...

as easy to use as a voltmeter

- A new 3 inch Extended View Portable Scope with New Features and Performance Unmatched by even the most Costly 5 inch Oscilloscopes



# NEW

## SENCORE PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

Lowest priced Wide Band 3 inch Scope anywhere. All hand wired.

Only 124<sup>50</sup> net

Here it is, the scope that technicians, engineers and servicemen from coast to coast have been demanding. A portable wide band scope that can be used on the job anywhere, yet has the highest laboratory specifications for shop or lab. Cumbersome color TV sets, remote audio and organ installations and computers are just a few of the jobs that make owning a scope of this type so essential. Why consider a narrow band scope, when for only a few dollars more, this professional wide band sensitive scope equips you for any job.

- The PS120 provides features never before offered. Only two major controls make the PS120 as easy to use as a voltmeter. Even its smart good looks were designed for functional efficiency. New forward thrust design, creating its own shadow mask, and full width calibrated graph increase sharpness of wave form patterns. A permanent chromed steel carrying handle instead of untidy leather strap and a concealed compartment under panel for leads, jacks and AC line cord make the

PS120 the first truly portable scope combining neatness with top efficiency.

- Electrical specifications and operational ease will surpass your fondest expectations. Imagine a wide band scope that accurately reproduces any waveform from 20 cycles to 12 megacycles. And the PS120 is as sensitive as narrow band scopes... all the way. Vertical amplifier sensitivity is .035 volts RMS. The PS120 has no narrow band positions which cause other scopes to register erroneous waveforms unexpectedly. Another Sencore first is the Automatic Range Indication on Vertical Input Control which enables the direct reading of peak-to-peak voltages. Simply adjust to one inch height and read P-to-P volts present. Standby position on power switch, another first, adds hours of life to CRT and other tubes. A sensitive wide band oscilloscope like the PS120 has become an absolute necessity for trouble shooting Color TV and other modern circuits and no other scope is as fast or easy to use.

### SPECIFICATIONS

#### WIDE FREQUENCY RESPONSE:

**Vertical Amplifier**—flat within 1/2 DB from 20 cycles to 5.5 MC, down—3 DB at 7.5 MC, usable up to 12 MC.  
**Horizontal Amplifier**—flat within —3 DB from 45 cycles to 330 KC, flat within —6 DB from 20 cycles to 500 KC.

#### HIGH DEFLECTION SENSITIVITY:

	RMS	P/P
<b>Vertical Amplifier</b> —Vert. input cable	.035V/IN.	0.1V/IN.
Aux. vert. jack	.035V/IN.	0.1V/IN.
Through Lo-Cap. probe	.35V/IN.	1.0V/IN.
<b>Horizontal Amplifier</b> —	.51V/IN.	1.44V/IN.

#### HIGH INPUT RESISTANCE AND LOW CAPACITY:

Vert. input cable	2.7 Meg. shunted by approx. 99 MMF
Aux. vert. input jack	2.7 Meg. shunted by approx. 25 MMF
Through low cap. probe	27 Meg. shunted by 9 MMF
Horiz. input jack	330 K to 4 Meg.

#### HORIZONTAL SWEEP OSCILLATOR:

Frequency range—	4 ranges, 15 cycles—150 KC
Sync Range—	15 cycles to 8 MC—usable to 12 MC

#### MAXIMUM AC INPUT VOLTAGE:

Vertical input cable—	} 1000 VPP (in presence of 600 VDC)
Aux. vert. jack—	
Lo-Cap probe—	
Horiz. input jack—	approx. 19 VPP (in presence of 400 VDC)

#### POWER REQUIREMENTS:

Voltage—	105-125 volts, 50-60 cycle
Power consumption—	On pos. 82 watts
	Stroy. pos. 10 watts

**SIZE:** 7" wide x 9" high x 11 1/4" deep—weight 12 lbs.



The PS120 is a must for color TV servicing. For example, with its extended vertical amplifier frequency response, 3.58 MC signals can be seen individually.

# SENCORE

ADDISON 2, ILLINOIS

... for more details circle 69 on post card

# TV MANUFACTURERS TECHNICAL DIGEST

## AIRLINE

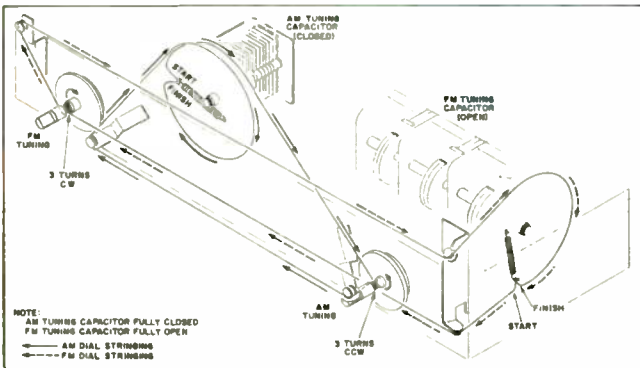
TV Models WG-5277A, -8A, -9A, 5377A, -8A, -9A — Poor Linearity

Poor horizontal linearity in these models can usually be traced to capacitor C-417 after tube substitutions fail to correct trouble.

## DUMONT

Tuner Chassis 120482B, C — Dial Alignment

To align the dial pointers, prior to stringing, turn both a-m and f-m tuning controls fully counterclock-



Dial stringing guide for Dumont tuner 120482B, C.

wise and position both pointers at the scale's low end (gold marks). Follow the stringing outline in the accompanying drawing.

## MOTOROLA

Chassis M579 — Buzz in Sound

Sound buzz in this set may be traced to the lead dress of the blue and yellow leads from the vertical hold control. In repairing these sets, be sure to dress the lead as far as possible from the audio circuits. Buzz caused by these leads being poorly dressed will vary in frequency as the vertical hold control is rotated.

Chassis M579 — Video Load Replacement

When resistor R-172, video load resistor, is replaced in these sets special care should be taken in mounting. This resistor is a 7 w unit. Heat generated by the resistor may damage the PC board if the resistor is not located at least 3/4 in. from the board.

## SYLVANIA

TV Chassis 546-1, -2 — Production Changes

To center the operation of the vertical hold control, R-330 should be changed from 6.8 megohms to 8.2 megohms. The new designation for the resistor is R-330-1.

Chassis 705-1, -2.

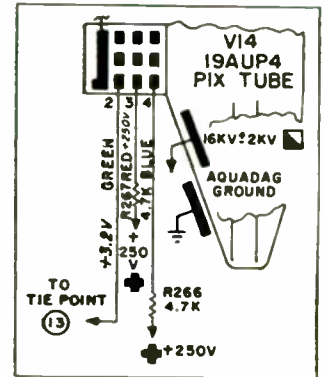
The following changes have been made to improve the performance of the set:

1. R-4 and R-6 are changed from 180 k to 100 k. Their new designations are R-4-1 and R-6-1.

2. C-4 and C-5 are changed from 470 pf to .005  $\mu$ f. Their new designations are C-4-1 and C-5-1.

Chassis 546-1, -2, code 10.

Circuit now appears as shown in drawing.

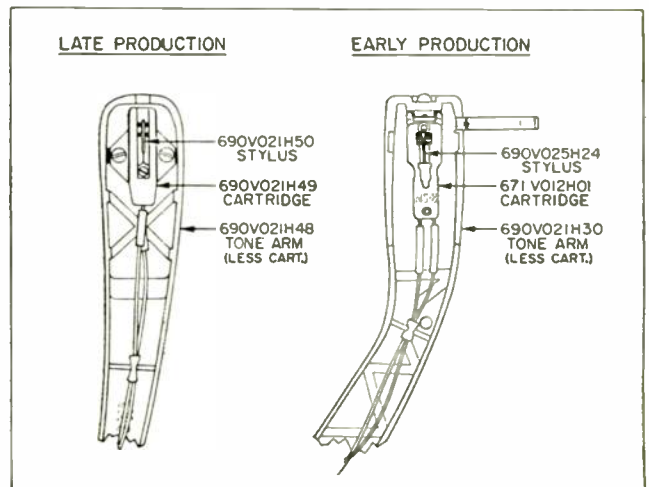


Focus circuit of Sylvania TV chassis 546-1, -2, code 10 should be altered as shown.

## WESTINGHOUSE

Phonograph Model H-71MP1 — Cartridge Production Change

Different tone arms were used in late and early units of this model. Parts, including styli, are not interchangeable. The accompanying drawing should be referred to when ordering parts.



Early and late production tone arms showing part differences.



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good sense to display this emblem in your other advertising, on your business vehicles, at your place of business. And if you aren't advertising in the Yellow Pages yet, it's high time you did. Call the Yellow Pages man at your Bell Telephone Business Office for details on how you can put this emblem to work.

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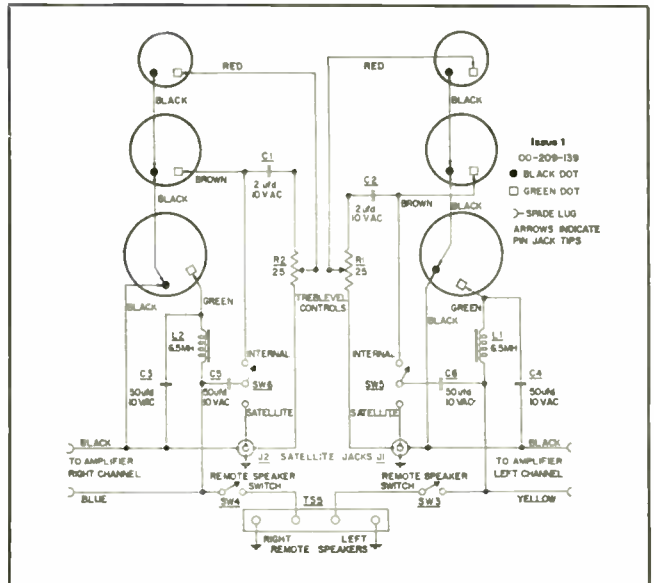
NRI is America's oldest, largest home-study school for Electronics, Television, Radio.

--- for more details circle 59 on post card

### ELECTROHOME

Stereo Phonograph Model Sierra MK I — Speaker Connections

Improperly connected speakers will result in poor quality sound in this system. The accompanying dia-



Wiring diagram for speaker system used in Electrohome's Sierra MKI.

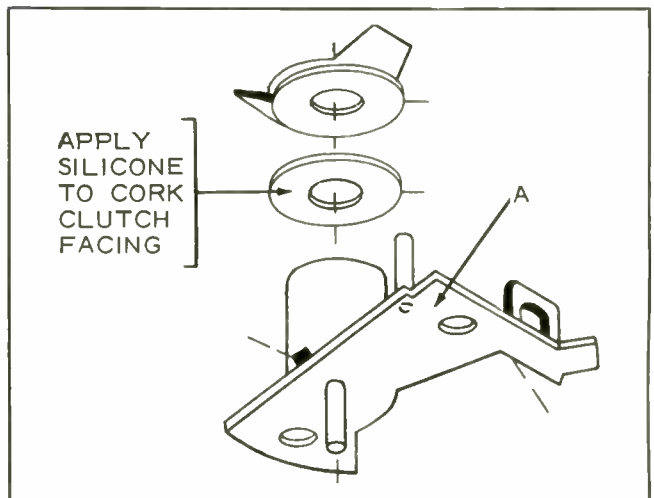
gram shows the proper phase relationship between the speakers and crossover network.

### WEBCOR

Record Changers — Damping to Prevent Record Groove Skip

Record groove skip or glide conditions in Webcor changers can be alleviated by providing a damping force to act against tone arm inertia.

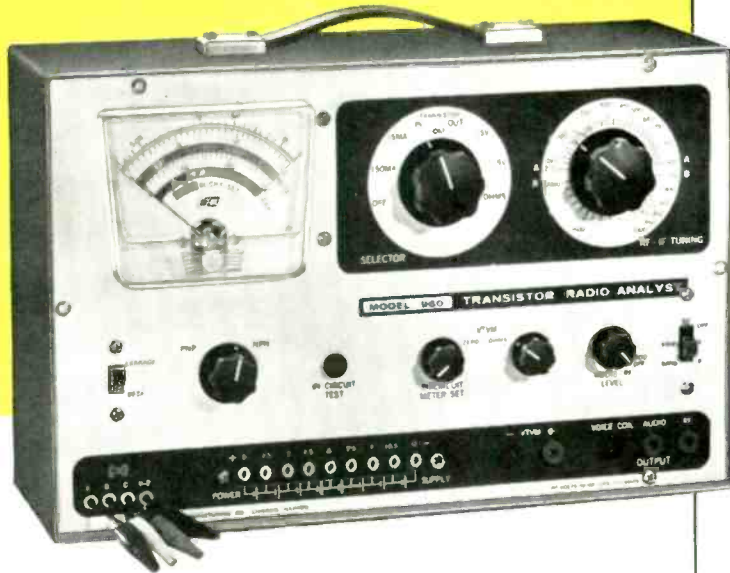
A silicon damping fluid is available from the Webcor Service Center. The fluid should be applied to the cork clutch facing directly above the tone arm bracket (A). Apply fluid with artists brush.



Silicon fluid applied to cork clutch facing alleviates record skip.

# New TRANSISTOR RADIO ANALYST

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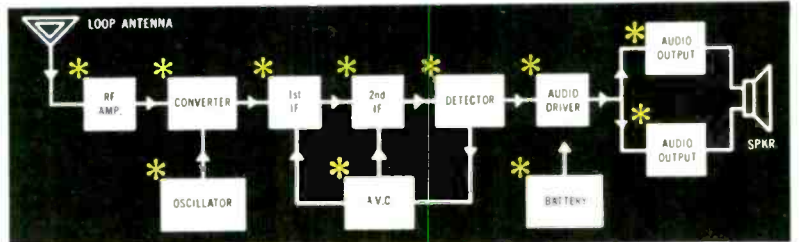
**B&K** Model 960  
**TRANSISTOR RADIO ANALYST**  
*with Exclusive DYNA-TRACE  
 Single-Point Probe—and Built-in  
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**Complete Transistor Radio  
 Service Shop in One Instrument**

*Signal-Generator, Power Supply,  
 Milliammeter, VTVM,  
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*Check all circuits - Pinpoint any trouble ... in minutes*

Now you can profit from transistor radio servicing! This amazing new B&K "960" ANALYST gives you *everything* in one complete easy-to-use instrument. Makes transistor radio servicing *quick and easy*. Nothing else is needed except the transistor radios themselves waiting to be serviced. Brings you new customers for service, parts, and batteries. Makes this new business *yours*.



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Supplies modulated signals, with adjustable control, to check r.f., i.f., converter, and detector. Supplies audio signal to check audio driver and audio output. Provides unmodulated signal to test local oscillator. Provides separate audio low-impedance output for signal injection into loudspeaker voice coils to check speaker performance.

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Makes it easy to operate radio under test, while you inject your own signals. Provides from 1 to 12 volts in 1½ volt steps. Supplies all bias taps that may be required.

**SIMPLIFIES IN-CIRCUIT TRANSISTOR TEST  
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Unique single-point probe needs only the one contact to transistor under test. No longer are three wires required to connect to emitter, base, and collector. Gives fast, positive meter indication. Saves time. Makes trouble-shooting simple and easy.

**BUILT-IN VTVM**

Includes high-input-impedance vacuum-tube voltmeter, which is so necessary for transistor radio servicing.

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Meter has "Good-Bad" scale for *both* leakage and beta. Also has direct-reading Beta scale, calibrated 0-150. Assures quick, accurate test. Also automatically determines whether transistor is NPN or PNP. Meter is protected against accidental overload and burn-out.

Model 960. Net, **\$99<sup>95</sup>**

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# The little-known facts about

# FM STEREO ANTENNAS

## AND WHAT THEY MEAN FOR YOU AND YOUR HI-FI CUSTOMERS

FM stereo is the greatest profit opportunity in home entertainment since the development of television.

Over 75 FM stereo stations are already operating and 55 more will go on the air as soon as their new multiplex equipment is installed.

This represents new profits for alert service-dealers not only in the sale of FM stereo equipment but in the installation of FM stereo antennas as well.

FM stereo systems need a properly designed outdoor antenna for high fidelity stereophonic reception. FM authorities agree that this is a "must". Wires, built-in antennas and rabbit-ears fail to deliver a satisfactory stereo multiplex signal, even where they have been giving acceptable monophonic results. These substitutes lack the gain necessary to overcome the inherent power loss of the suppressed carrier and subcarrier of the stereo signal which shrink the station's stereo range to approximately 52 per cent of its monaural coverage.

In addition, the severity of reflections and other signal disruptions is multiplied in stereo transmission and unbalances the signals. As a result, the owner condemns the station, his dealer and/or his equipment for his reception troubles.

By selling or installing a JFD stereo-engineered FM antenna with each FM stereo system, you protect each sale by:

1. Assuring *flawless high fidelity FM stereo (and monaural) reception from the maximum number of stations on the air.*
  2. Reaffirming *your customer's faith in your technical know-how.*
- And, last but by no means least, all at a tidy profit for you!



JFD Electronics Corp.

*Edward Finkel*

EDWARD FINKEL  
Vice-President-Sales

# JFD has the most complete line of electronic and non-electronic FM stereo antennas for your profit and progress!

Stock up now on the JFD antenna line that brings you high-powered electronic FM Stereo antennas with built-in transistorized amplifiers for long-distance FM

...handy FM antenna kits for town or country. Regardless of the JFD model you choose, you get more power, more features, more profit per dollar.

FOR THE FIRST TIME... UP TO 100 MILE YAGI-QUALITY RECEPTION— FROM ANY DIRECTION— WITHOUT A ROTATOR



ELECTRONIC FM STEREO-CONE ANTENNA KIT  
Attaches to any TV mast

- Built-in transistorized amplifier boosts FM stereo gain.
- Exclusive 360 degree Stereo-Cone all-directional design captures more stations.
- Attractive, Anti-Corrosive, Gold Bond Alodized aluminum.
- Mounts on same mast as TV antenna.

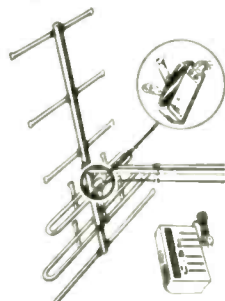
No. **TNTFM175G-AC** (Complete kit with antenna shown above) **\$47.95**, list  
No. **AFM175G** (Same as above less amplifier) **\$13.95**, list

WORLD'S MOST POWERFUL DEEP-FRIDGE FM ANTENNA DELIVERS BRILLIANT PERFORMANCE UP TO 200 MILES DISTANT

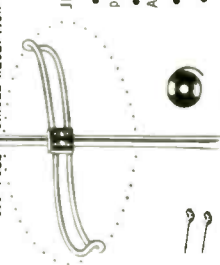


- Built-in transistorized amplifier provides highest signal-to-noise ratio ever achieved in FM antenna design.
- Wide-spaced 6-element beam (including twin-driven dipoles) pinpoints far-away stations.
- Attractive, Anti-Corrosive, Alodized aluminum.

(Shown above) **\$54.95**, list  
No. **TNTFM350G** (10-element non-electronic Twin-Driven Yagi) **\$32.50**, list  
No. **AFM350G** (6-element non-electronic Twin-Driven Yagi) **\$23.50**, list  
No. **AFM325G** (3-element non-electronic Yagi) **\$12.50**, list



360° FULL CIRCLE RECEPTION



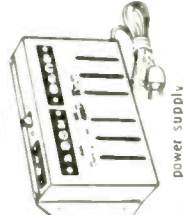
- Picks up excellent FM stereo from any point of the compass.
- Attractive, Anti-Corrosive, Gold Bond Alodized Aluminum.
- Budget-priced for easy tie-in sales.
- Mounts on same mast as TV antenna.

Attaches to any TV mast

No. **AFM475G** (Complete with kit) **\$8.95**, list  
No. **AFM450G** (Antenna only) **\$6.95**, list



transistorized amplifier



No. **TNT106FM** **\$36.95**, list

- Adds up to 25 db gain to any FM antenna.
- Mounts directly on any antenna's terminals for maximum signal-to-noise ratio.
- So much power to spare, it can operate 2, 3 or 4 FM systems with greater signal strength.

AND NOW... YOU CAN MAKE ANY FM ANTENNA ELECTRONIC— WITH THE REVOLUTIONARY NEW FM



HIGH FIDELITY EXPERTS AGREE— YOU NEED AN FM STEREO-ENGINEERED ANTENNA FOR TRUE STEREO PERFORMANCE

"One Long Island station reported that more than 95 per cent of all calls complaining of poor reception were traced to poor antenna setups.

What one station learned about FM stereo. From listeners' complaints that a faint difference between FM and conventional radio installation is need for far better antenna system.

Indoor antennas are prone to pick up many reflected signals, which can be fairly well tolerated in monophonic FM stereo because of the selective cancellation at different modulating frequencies.

Popular Science  
Weekly Television Digest

Radio Electronics

PF Reporter

SEE YOUR JFD DISTRIBUTOR OR WRITE FOR BROCHURE FMI DESCRIBING JFD LINE AND SALES HELPS

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## Stereo 1963

Four years ago, when stereo first became a meaningful commercial reality, we published our first annual stereo reference issue. That pioneer publishing project contained an industry-wide component catalog of 13 pages covering 11 stereo products. Only 27 percent of phonos sold in 1958 were stereo; all the rest were monophonic.

A stereo component catalog today would run hundreds of pages. More than 75 percent of all phonos currently sold are stereo; most of the mono units sold are inexpensive types for the juvenile market.

Back in 1958 we strongly urged electronic service dealers to get into stereo sales and service. We foresaw stereo's broad market appeal which would sell literally millions of stereo units.

If you did get into stereo work early, chances are you've benefited nicely from your enterprising efforts. If you were more cautious about taking the plunge, don't despair. The opportunities are greater than ever. The majority of phonos in use are monophonic since they are holdovers from an earlier era in sound. However, almost three million stereo units are being added

or are replacing mono units each year. So the future will see a majority of stereo work for service dealers.

Hi-Fi stereo components, once the province of a small group in the know, are being purchased by hundreds of thousands of music lovers with no technical skills. These people, too, will continue to turn to electronic technicians.

Just as previous annual stereo issues were helpful references for service dealers already in or getting into the stereo area of the electronics business, we hope you will find Stereo 1963 useful. In particular, may we call your attention to the section on broadcast stereo f-m programs. This multiplex phase of stereo has really taken off commercially in the past year. Over 80 stereo f-m stations now cover 70 million people, though many have no f-m sets yet.

All different elements of the stereo system are explored, starting on page 64. Much additional information may be obtained from manufacturers by using the inquiry card on page 107, or by writing to the individual companies listed in the stereo directory starting on page 96.

## Timetable for All-Channel TV Sets

Two months ago, President Kennedy signed a bill which is now Public Law 87-529. This law authorizes the Federal Communications Commission to require all manufacturers who ship TV sets in interstate commerce—and that essentially means all producers—to make receivers capable of receiving all 12 VHF and 70 UHF channels. The same rules will apply to imports.

Though we have expressed certain reservations about this legislation, it is now the law of the land and should be obeyed promptly and effectively.

Because a number of steps must be taken before the law can be implemented, it will probably take two years before all sets reaching dealers are VHF-UHF.

As we go to press, the Electronic Industries Association is gathering together the recommendations of 21 set makers and four tuner companies for submission to the FCC. First, the company presidents will suggest a schedule for switching over. Then the chief engineers will meet to come up with technical proposals.

By the start of September, the FCC engineering

staff will have considered the industry's technical recommendations and will submit a standards proposal to the full Commission.

The FCC will then hold hearings preparatory to issuing rules on performance standards and cut-off date. Interested parties can express themselves at that time. These hearings will probably be held during the fall of 1962, and the rules issued around January 1963, possibly a bit later.

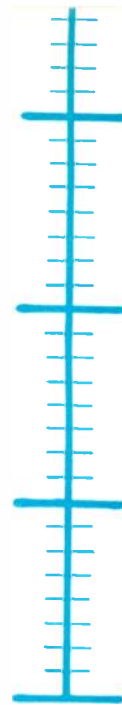
It will take at least one year for manufacturers to change over production lines. This would indicate that all-channel sets will likely become mandatory by the summer or fall of 1964 when the 1965 models are introduced.

If the FCC will adopt reasonable standards on noise level and sensitivity, chances are the switchover will come about at the earliest possible date. If FCC attempts to specify too many or too stringent performance characteristics, further opposition and delays may be expected. However, it is widely believed that excessive requirements will not be imposed.

Measurements of non-sinusoidal waveshapes can be made quickly and accurately by using standard chassis voltages as references

# Measuring P-P Voltage With The Scope

by C. B. Zackman



■ Most service shops are equipped with an oscilloscope, but few are calibrated to measure p-p voltages. Those that are calibrated have probably not been checked since the scope was new. Calibrated scopes can be checked and adjusted in a few minutes with the help of an accurate a-c voltmeter. And non-calibrated scopes can, in many instances, be used to accurately determine p-p voltages with no additional equipment.

The principle used for waveform p-p measurement is the mathematical relationship between the p-p voltage of a sine wave and its rms (root mean square) voltage.

### Converting RMS to P-P

Since a sine wave is always as handy as the nearest a-c outlet, and there is a direct relationship between rms and p-p sine wave voltages, it can serve as a convenient calibrating source.

For example, by multiplying the rms voltage (standard meter reading) by 2.828 an accurate p-p voltage for any sine wave source is obtained. Thus, the common 115 v line voltage (rms) is actually 325 v, p-p. This relationship is illustrated in Fig. 1. If it is necessary to determine the peak voltage (from 0 to maximum), the rms voltage can be multiplied by 1.414 or one half the p-p figure.

To convert p-p sine wave voltages to rms, the p-p voltage may be multiplied by 0.707. The graph in Fig. 2 may be used to convert p-p voltages to rms and vice versa.

### Using the Principle

The principle just described can also be used in many instances without the aid of a voltmeter. The modern TV set uses many voltages which are accurate enough to be used for scope calibration. Most TV sets, for example, use 6.3 v in the filament circuits. If 6.3 v is converted to p-p voltage;  $6.3 \times 2.828 = 17.8$  v, p-p. Or in round numbers 18 v. Setting the scope's centering and vertical gain controls up, as shown in Fig. 3, produces a 20 v

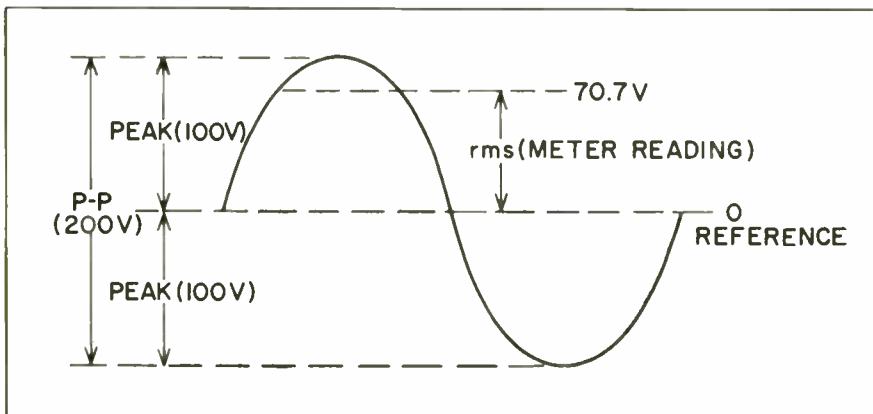


Fig. 1—Relationship of p-p, and rms voltages in the sine wave.

scale on the top or bottom half of the scope or a 40 v scale using the entire scope screen, with each calibration mark representing 1 v. After the controls are set, however, the vertical gain control should not be moved.

If the filament voltage is set up to sweep the entire screen, an expanded 20 v scale is produced for greater reading accuracy. When a scope is calibrated at 60 cps, it will be accurate for frequencies throughout its "flat-frequency" range.

The 115 v line and single or multiple combinations of series filament voltages can also be used to "spot calibrate" the scope to a variety of different voltages. When filament voltages are not available or desirable for scope calibration, the setup shown in Fig. 4 may be used. Any voltage between 0 and the line can be quickly set up. The line isolation transformer is not absolutely necessary, but should be used for safety from shock or possible damage to the test equipment.

Larger (B+) transformers can also be used for very high p-p readings, but the scope's maximum input voltage should first be checked to insure that the maximum rating of the input is not overloaded. For maximum safety, however, voltages of this magnitude should be measured with a voltage divider.

Small calibrating voltages can be used with a voltage divider by first calibrating the scope directly and then inserting the divider using the divider's ratio to find scope sensitivity.

### Using Voltage Dividers

The resistive divider is the most common divider and should be understood by the TV technician. Although the resistive divider can be used with a-c voltages, the capacitive divider will not allow d-c potentials found in some circuits to interfere with the reading when taken on d-c scopes.

Two series capacitors are generally connected across the potential to be measured. The scope is then connected from ground to the center of the network. The voltage found at the scope is inversely proportioned to the ratios of the values

of the capacitors. This is illustrated in Fig. 5.

When using the scope with this type divider, the capacitance and resistance of the scope's input can usually be disregarded. In TV service work, this measurement is usu-

ally confined to checking the horizontal output plate waveform and voltage.

Other methods of accurately stepping down voltages for measurements may be made using the ratio transformer, however.

Fig. 2 — The relationship between any rms and p-p voltage can be found as shown by the dotted lines. For small voltages the numbers can be integers or decimals. Larger figures can be found by multiplying both rms and p-p numbers by 10, 100, etc.

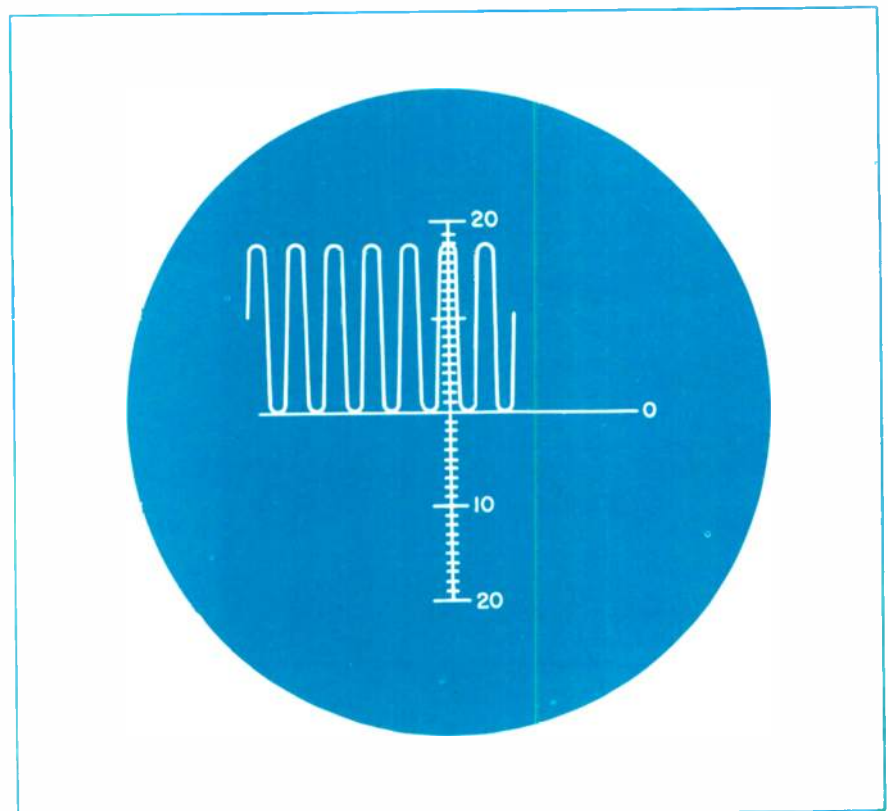
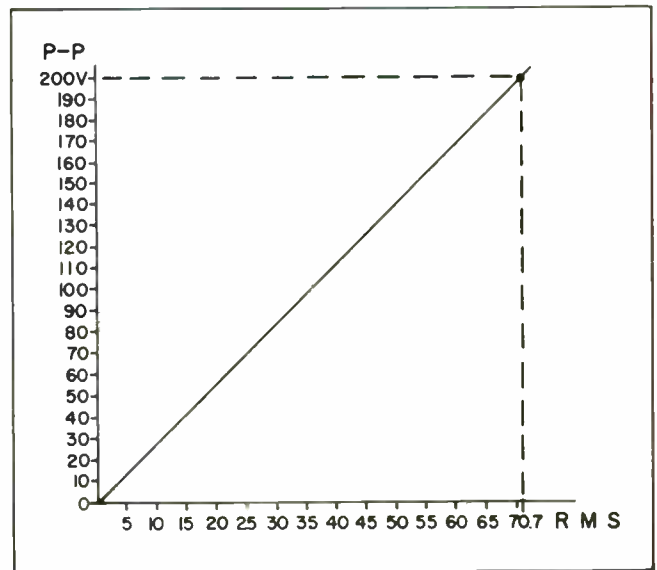


Fig. 3 — The scope waveform should appear as shown for a 20-0-20 v scale when using 6.3 filaments for calibration.

# Measuring P-P-Voltage

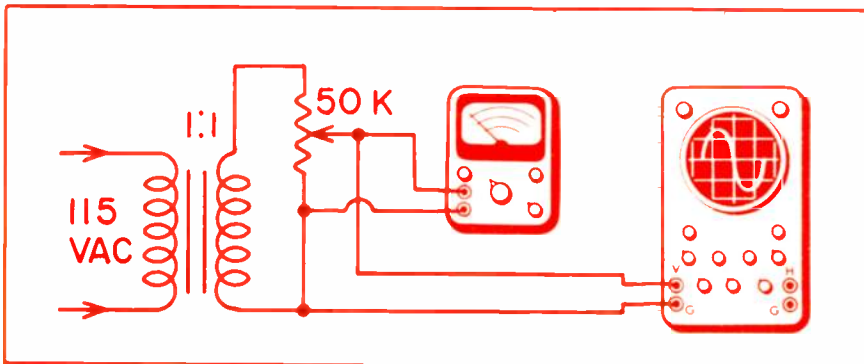


Fig. 4—Setup for calibrating scope when known standards are not available.

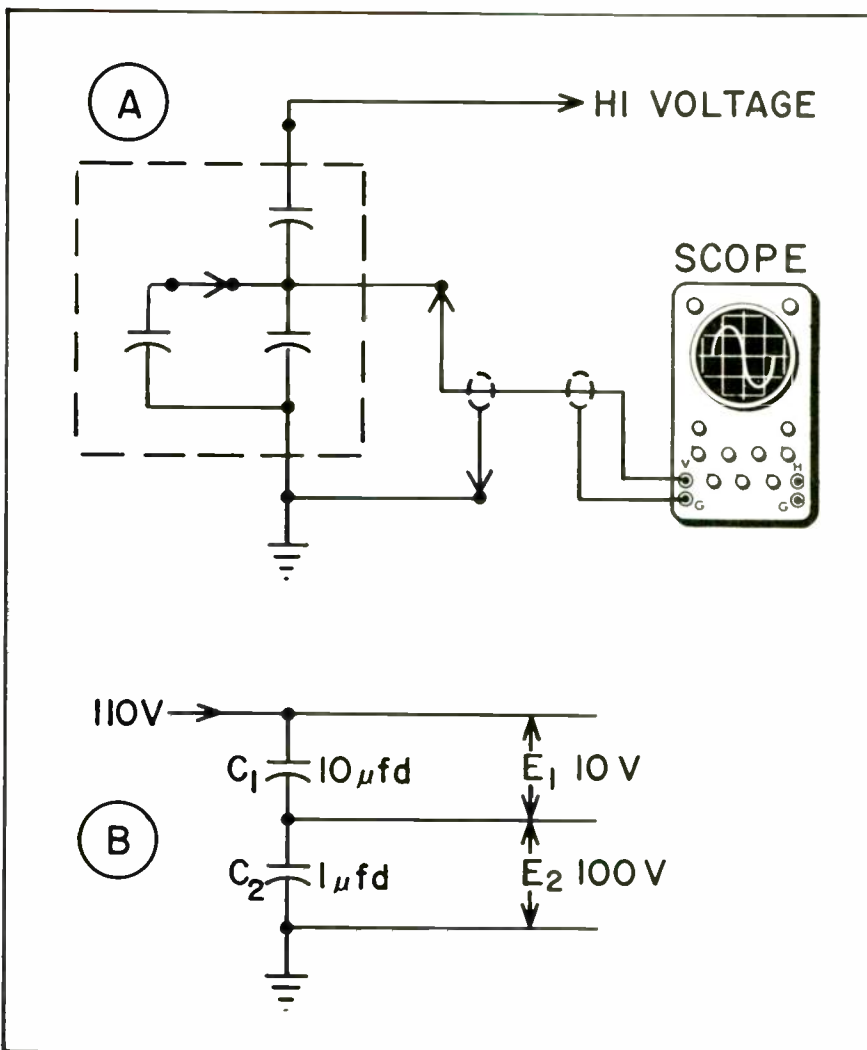


Fig. 5 (A)—Schematic of a capacitance voltage divider for measuring p-p high voltage with a scope. (B)—Division ratio of the capacitance divider is inversely proportional to the capacitor values.

## More Flexibility

A single voltage can be used with most scopes to measure a wide range of voltages. Since scopes are usually calibrated in even multiples, the coarse vertical gain control can be used to increase the calibrated range.

Assume that the filament voltage is the only known voltage in a particular chassis and we need to check a 0.5 v p-p signal accurately. If the scope is calibrated for full deflection with an 18 v p-p signal, a 0.5 v signal could not be measured accurately. Depending on the calibration of the coarse gain used with your scope this can be done easily. Most scopes are calibrated .5, 1, 5, 10, and 100. These figures are only proportionate to one another, however, since the fine gain control varies the over-all gain. In other words, a waveform present on the screen when the coarse gain is set at 1—if the fine gain control is not readjusted.

Now back to the problem: Set the coarse gain control to 10 and the fine gain and centering controls to produce a 20 v full sweep on the CRT screen. Turn the coarse gain control to 1 and the sweep is now calibrated for 2 v full deflection, or 1/10 of the original sweep. The 0.5 v reading will cover one-fourth of the full deflection area originally established. Turning the coarse gain to .5 will increase the sensitivity again by two times, and the 0.5 v signal will then take up one-half of the calibrated area.

If, on the other hand, when a 125 v amplitude waveform must be checked, the filament voltage may be used as with the 0.5 v signal but the coarse control must be turned to 100. The full screen deflection then becomes 200 v or ten times the original sensitivity so that larger waveforms to 200 v can be easily measured.

Many field engineers use the method described because the portable scopes they carry are frequently not calibrated. The accuracy obtained by using filament voltages is excellent since variations on the line are reduced through stepdown in the filament transformer. ■

# D-C RESTORATION

VS

# D-C COUPLING

■ TV-radio technicians who serviced sets made in the late '40's and early 50's will recall that d-c restoration circuitry enjoyed a high degree of popularity among TV design engineers. Then it gradually gave way to direct coupling systems employed today.

Proper d-c restoration in color TV is even more important than B/W. Increasing sales of color TV points up the importance of understanding d-c restoration. We would do well to reacquaint ourselves with the subject. Our memories can probably be easily refreshed by simply answering the question "What is restoration?" Without making an engineering "big-deal" out of it, restoration is the reinsertion of the d-c component (lost in the detector and video amplifiers) back into the video signal. This is

Color TV hues depend on restoration of black level; trends show direct coupling is favored

*by Frank Salerno*

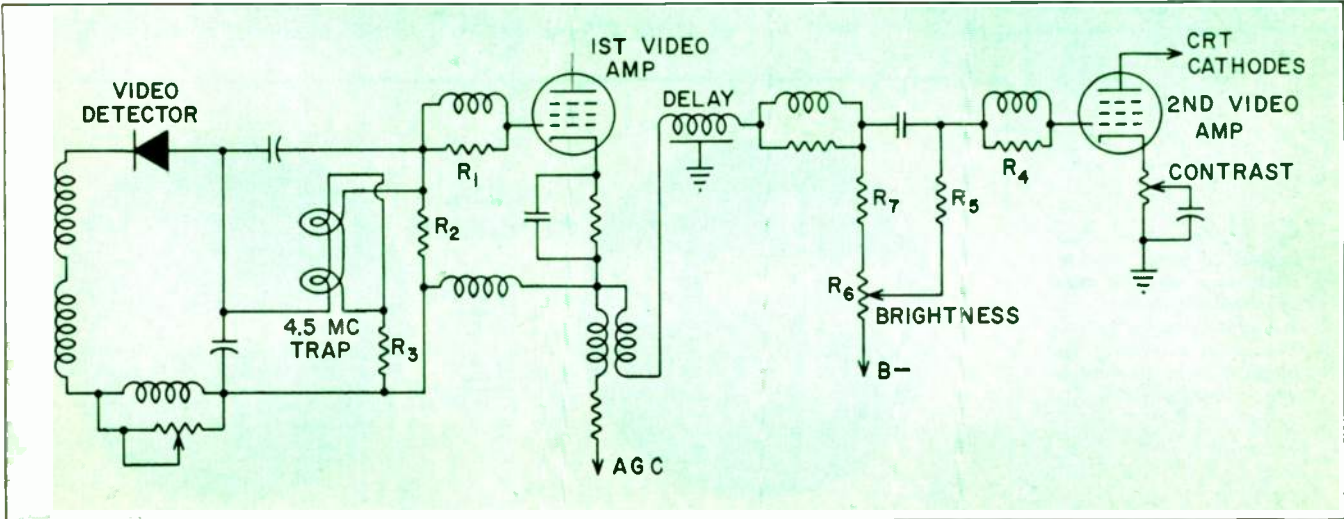


Fig. 5—Color TV uses direct coupling throughout to maintain proper relationship to original signal. Simplified circuit is from RCA color TV.

# D-C Restoration VS D-C Coupling

applied to the set's CRT grid or cathode. Let's see how the d-c component is lost in the first place, why we need it and how we retrieve it.

## Effects of Restoration

Assume that a broadcasting station is televising and transmitting a signal similar to that shown in Fig. 1(A). Blanking pulses represent CRT grid cutoff level and the white reference level represents maximum possible brightness. The first scanning line is a brightly lit scene, for example, an outdoor baseball game

in bright sunlight. The video information high up on the brightness level, will yield a picture with a generally bright background. Let's assume the next scanning line Fig. 1(B), is the same scene televised after sunset. The video information is exactly the same as that in the previous line, but being closer to CRT cutoff level it will give a picture with a dark background. The difference between the operating levels of both scenes establishes the difference in operating bias on the CRT. This bias difference in turn establishes the difference in overall brightness (or darkness) between the two scenes.

Both of the aforementioned televised scenes are picked up by and pass through our TV receiver. They appear at the receiver's detector with the same d-c relationship as when they left the transmitter. If the signals are coupled into the video amplifier grid through a capacitor the d-c component is lost. (See Fig. 3).

The capacitor as we all know, is an a-c coupling device. Video (a-c) information easily passes through the capacitor, but it blocks the d-c which, in effect, establishes signal operating level. The capacitor "sees" the d-c level of any single

scene as an average of all its a-c signals, which is zero. This is true because all a-c signals alternate above and below a zero reference level. Consequently, after passing through the capacitor, the two scenes shown in Fig. 1 may appear like those shown in Fig. 2.

Since both scenes have basically the same a-c signals, being images of the same subject, the capacitor will see the same average voltage and place both scenes on the same bias level. The net result is two scenes which have very little difference to the TV viewer, although in reality there should be a difference of night and day between the two scenes. This condition exists in many present day TV receivers. Viewers tolerate it because they don't know the difference. Fundamentally, the viewer does not seem to object to or even realize, for that matter, that a dark scene is lighter or a bright scene is darker than it should be.

Many of the older TV receivers corrected this condition by using a d-c restorer stage. Briefly they worked as follows:

Although both of the original televised scenes of Fig. 1 have been reduced to the same average level, the sync pulse of the originally brighter scene acquires a greater amplitude than that of the dark scene as can be seen in Fig. 2.

A simplified d-c restorer circuit as used in the RCA TS630 is shown in Fig. 4. The video signal, with its unequal sync tips, enters the d-c restorer through C which charges to an amount corresponding to the

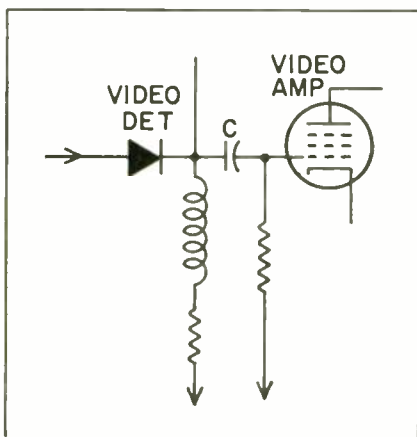
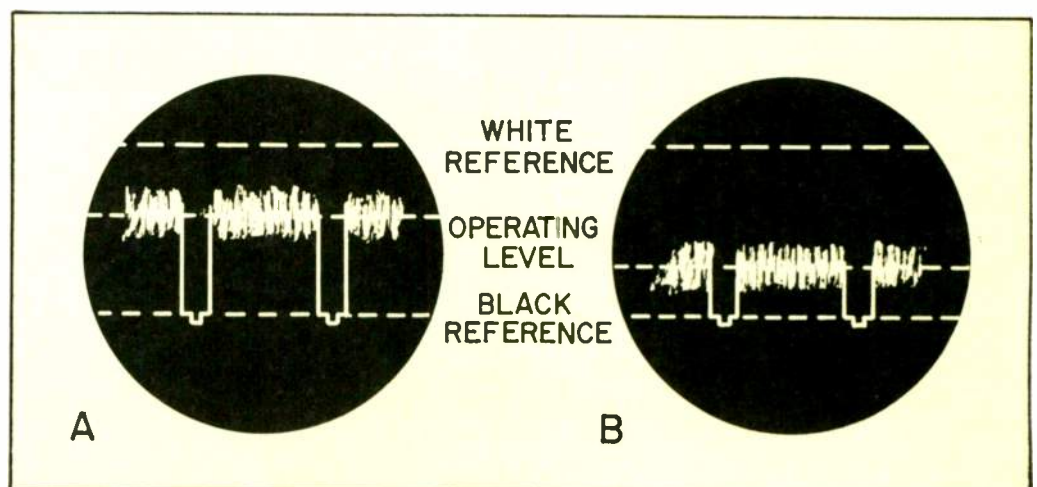


Fig. 3—Coupling C, beyond the detector, causes the video signal to average on an a-c axis and lose its reference (see Fig. 1).

Fig. 1 (A)—Video from brightly lit scene. B)—The same scene televised under lower lighting. Blanking pulses remain clamped to fixed d-c black reference and white changes its relationship to blanking.



different sync amplitudes. When C discharges through R a negative voltage is developed across R. This negative voltage, which is transferred over to the CRT grid, varies in accordance with the unequal sync tips and ultimately restores them all to the same cutoff level. In this way all the video information is brought back to the original operating level and the d-c has been restored.

The d-c restorer, as mentioned earlier, has given way to direct coupling. If the video detector output is directly coupled to the video amplifier whose output is in turn directly coupled to the CRT, there is no loss of d-c component because the signal never passes through a capacitor. This is the key. So long as the information does not pass through a coupling capacitor the d-c level is retained.

Many manufacturers design their sets using this principle. Each succeeding tube in direct coupled stages must have a cathode that is at least as positive as the preceding plate. When only one video amplifier is used this is easily done but where more than one video amp is necessary the demands on a power supply become very stringent.

#### Black Level in Color TV

What role does all this play in color TV? Consider, for a moment, that any desaturation of a color tends to change its hue and intensity. If a televised scene calls for a red of a specific brightness level and the receiver reproduces it at an altogether different brightness level,

then the red will not assume the true shade at which it was intended. This can play havoc with a color receiver even though it may pass unnoticed in a B/W set. Maintaining the proper d-c level for all scenes becomes imperative in color receivers.

The early RCA color sets employed a separate restorer diode for this purpose at each CRT grid. Basically they worked the same as the restorer in the TS630 chassis. With the development of the art and the simplified circuitry of today, again d-c coupling has taken over.

Fig. 5 is a simplified version of the new RCA color receiver. A quick glance seems to indicate capacitor-coupling between stages

but a close examination reveals that d-c coupling is in fact maintained throughout.

Although the a-c component of the detected video signal is capacitively coupled to the first video amplifier grid the d-c component is transferred from the detector to the amplifier through the bifilar winding, R3, R2 and R1. Similarly, in the next stage the a-c component is capacitively coupled but a d-c path is maintained between the first amplifier cathode and the second amplifier grid through R4, R5, R6 and R7. The second amplifier plate is directly coupled to the kine cathodes and so, d-c coupling is retained throughout. ■

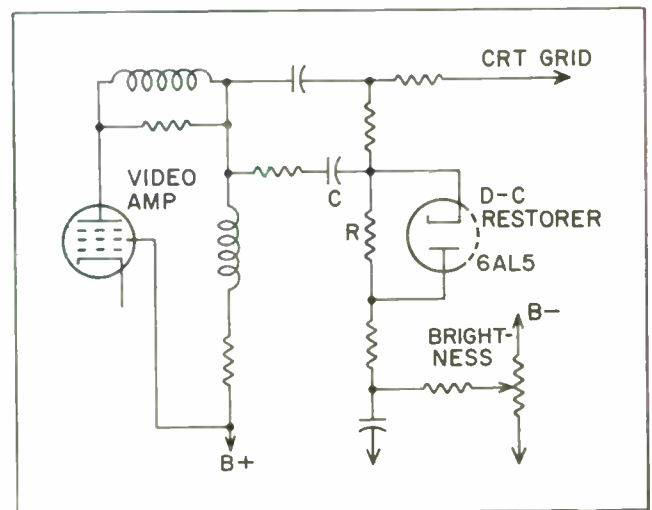


Fig. 4—Restorer in older chassis utilized sync pulses to develop a clamping voltage for the video.

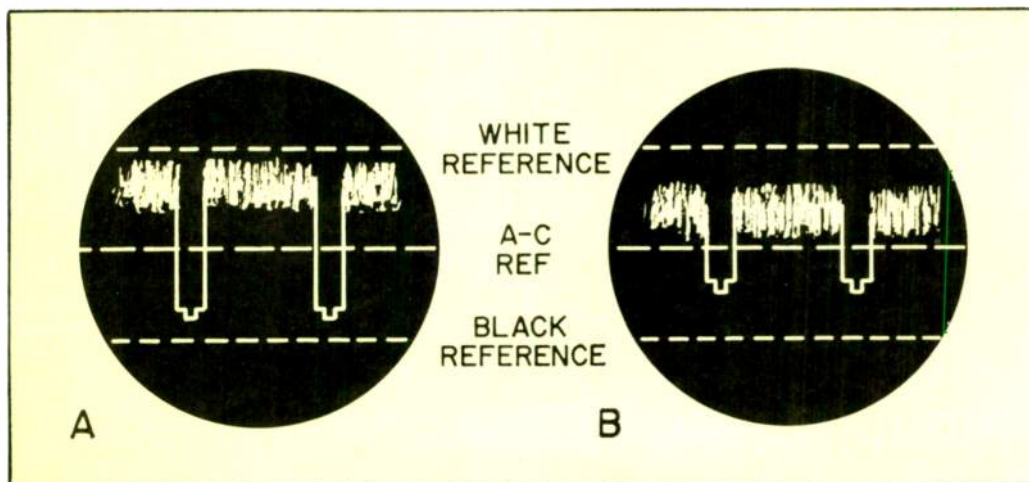


Fig. 2 (A)—Little difference may be noted between the normal clamped signal and one which floats without restoration when video amplitude is high. (B)—Small video signals also average on a zero axis producing a more noticeable loss of reference.

# PRACTICAL



■ TV-radio technicians who do side-line industrial electronic work can frequently learn new tricks in equipment problems.

For example, a TV-radio technician in a midwest city was recently called upon to solve a problem in a lithographing plant. The lithographer had just moved into a new building and was having trouble maintaining proper color temperatures for lamps used in the lithographing process. There was insufficient voltage control to the lamps.

The technician's preliminary examination revealed that power to the auto-transformer supplying the equipment was between 240 and 242 v under normal load. And at

Solve a-c power problems rapidly and inexpensively by simple transformer winding arrangements

by M. G. Goldberg

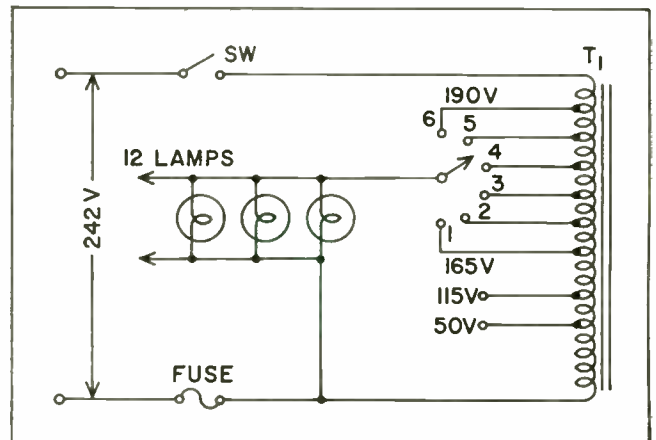


Fig. 1—Autotransformer designed for 230 volt operation was altered to operate satisfactorily with 242 v input.



# 'TRICKS' WITH TRANSFORMERS

the lowest variable voltage tap on the 6-tap transformer (approximately 165 v) the color temperature was still too high. A replacement for the special transformer would have been very expensive since it had other desirable features, including remote control, timing control and special low voltage windings for focusing. The problem was solved in a highly satisfactory and relatively inexpensive manner by the TV-radio technician. The basic approach employed in this situation can be used to solve a wide variety of transformer problems, including some TV-radio "dogs."

## Doing The Job

A skeleton schematic of the auto-

transformer employed in the lithographing plant, T-1, is shown in Fig. 1. It is rated at 2600 v/a. With an input of 242 v, approximate output voltages available from the transformer are shown at the switch taps.

An inexpensive step-down transformer, T-2, rated at only 190 v/a, was added to the circuit, as illustrated in Fig. 2. The secondaries of T-2, after being paralleled, are placed in series with one leg of T-1. Here is how it works:

The 12 v heavy duty secondary of T-2 *subtracts* from the line voltage applied to the auto-transformer — reducing it 12 v.

A check at this point showed that T-2 had 229 v across it and

the voltage at the lowest voltage-tap was 157 instead of 165. If a further reduction had been necessary the two secondary windings of T-2 could have been connected in series, instead of parallel, resulting in a reduction of 24v—or 10 percent. But what does all this have to do with TV-radio? Let's take a look.

## Manipulating Transformer Windings

Suppose you need a 12.6 v heater supply at 1.5 amp in a hurry. If you have a transformer with two 6.3 v secondaries the two windings can be connected in series to obtain the needed 12.6 v (see Fig. 3A). Care must be taken to select a transform-

*Continued on page 54*

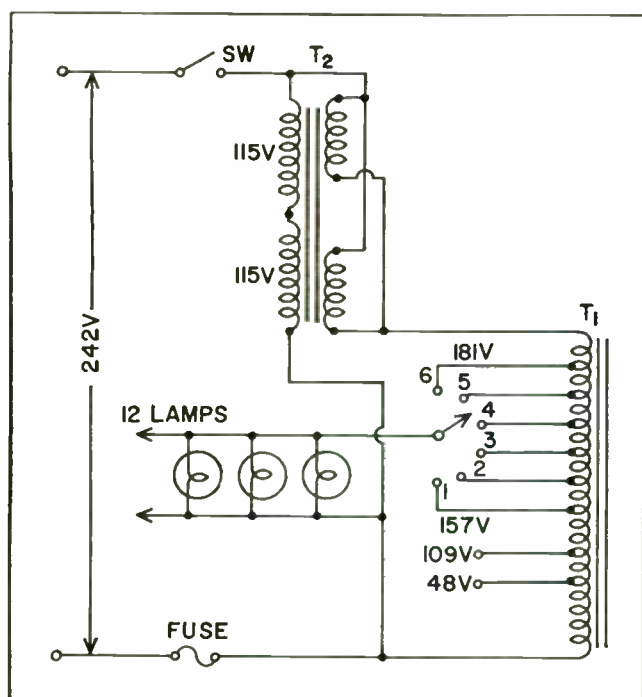


Fig. 2—A low-current step-down transformer, T-2, was added to this circuit to obtain proper voltage from T-1 for accurately controlling color temperature of lamps in lithographing plant.

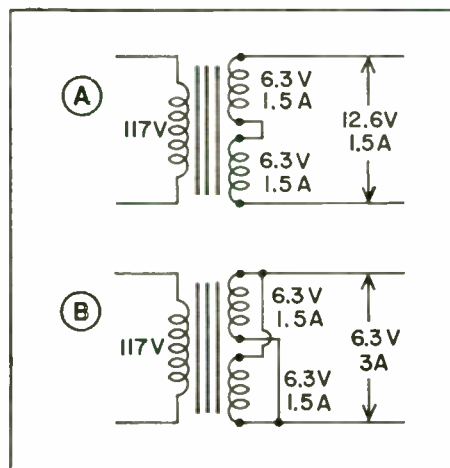


Fig. 3 (A)—Two 6.3 v heater transformer secondaries are connected in series to obtain 12.6 v at 1.5 amp. (B)—A 6.3 v 3 amp heater supply is obtained by connecting the two 1.5 amp heater sections in parallel.

# Servicing Two-Way Communications Receivers

Techniques for maintaining peak sensitivity and selectivity of double-conversion 2-way superheterodyne receivers

by Don Dudley

■ In all 2-way communications systems it is generally agreed that the receiver determines the effective working range of the system. As the old saying goes, "If you can't hear 'em, you can't work 'em." If a receiver's sensitivity drops 3 db, for instance, this is equivalent to a 50 percent reduction in transmitter output power. And a loss of one-half the sensitivity in a receiver is far more serious than a loss of half the transmitting power.

Most commercial 2-way receivers employ double conversion superheterodyne circuits (Fig. 1). This design provides good image rejection and improved sensitivity. Image

frequencies are suppressed by using a high first i-f frequency. This high i-f, however, will not provide good receiver selectivity. A low i-f is also needed. Good selectivity demands a narrow bandpass. In general, the lower the i-f frequency, the easier it is to design a receiver with a narrow bandpass.

The first i-f frequency of commercial 2-way f-m receivers operating in the 30-50 Mc range may fall somewhere between 3 and 6 Mc. For sets operating in the 140-160 Mc range, the first i-f is generally around 10 Mc. The second i-f may be 290 kc.

This low second i-f frequency

makes it possible to establish greater receiver selectivity. By increasing the second i-f circuit "Q" it is possible to narrow-band f-m receivers sufficiently to allow transmitter deviation in these systems to be reduced from 15 to 5 kc. Hence, it was possible for the FCC to issue licenses for additional stations to operate in this frequency area.

Oscillators in double conversion type receivers are crystal controlled and some sets have the first oscillator crystal mounted in a temperature-stable oven to prevent oscillator drift. Where two separate crystal controlled oscillators are used, the second oscillator crystal is gen-

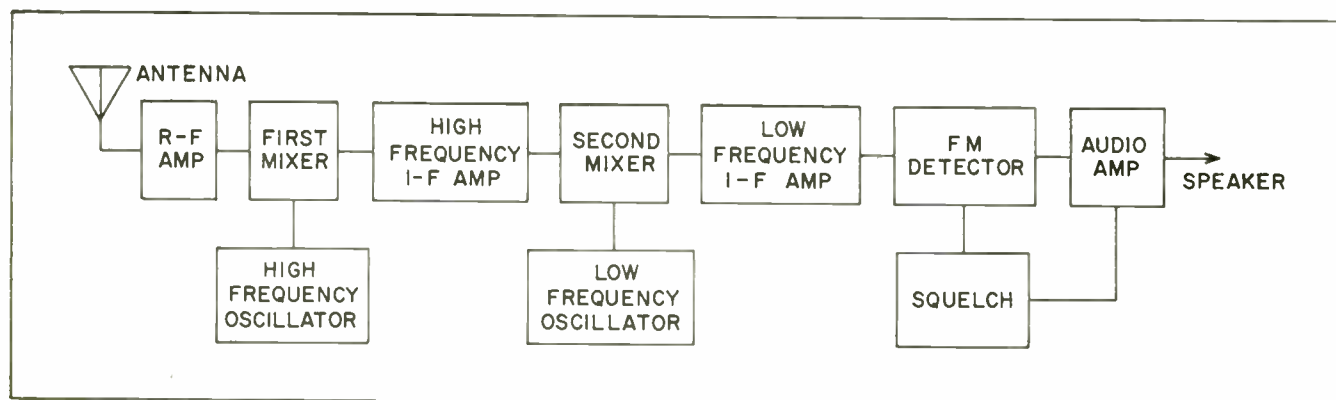


Fig. 1—Block diagram of a double-conversion 2-way f-m communications receiver.

erally not temperature stabilized. Most manufacturers maintain frequency stability within .001 to .003 percent of the assigned frequency. The tolerance will depend on the frequency band in use.

Since the first oscillator crystal fundamental frequency is too low to develop the first i-f signal, a harmonic of the crystal is used for this purpose. Some receivers employ one crystal to develop both first and second i-f signals. While a harmonic is used for the first i-f, the crystal fundamental is utilized to develop the second i-f. (See Fig. 2). This method has proven reliable. When two separate crystal controlled oscillators are used, the second oscillator crystal fundamental beats with the first i-f signal in the second mixer to produce the second i-f signal.

### Receiver Operation

If a 40 Mc harmonic of the first crystal oscillator is mixed with an incoming 45 Mc r-f signal, for example, a 5 Mc difference-frequency signal is produced. This signal establishes the high first i-f frequency. The image, which falls below the oscillator, at 35 Mc, would also pass through the receiver if a high i-f was not employed. The high i-f causes the image to be 10 Mc away from the 45 Mc received signal. Thus the high-Q r-f coils of the receiver can easily discriminate against the image frequency.

The second conversion produces a 290 kc or some other low i-f. The high-Q first i-f circuits can discriminate against all incoming signals from about 5 kc upward. Signals approximately 18 kc each side

of the received signal will be down about 100 db.

Signals from the final low i-f stage pass through a limiting circuit, usually two stages, and then to a Foster-Seely detector or other f-m type discriminator stage.

Some form of squelch circuit is also designed into the receiver. This circuit generally employs a noise-rectifier system as shown in Fig. 3. The circuit's input accepts frequencies from 3000 cps and up from the discriminator output. Signals are amplified by a noise amplifier and rectified by two diodes. One diode places a negative voltage on the limiter grid when no carrier is present—reducing stage gain. The other diode applies a positive voltage to the squelch tube grid. This causes the squelch tube to conduct heavily, placing a negative voltage on the audio amplifier grid, cutting it off. Thus no noise appears in the speaker output.

### Equipment Maintenance

All commercial 2-way receivers contain a rather large number of tuned circuits which must be kept in perfect adjustment if the receiver is to retain sensitivity necessary for efficient operation. Vibration, humidity, temperature variations and changes in interelectrode capacitances of tubes can cause resonant circuits to drift off center. If alignment becomes necessary, adjustments should be made in proper sequence.

The first and most important tuned circuit to be checked is the discriminator transformer secondary. This adjustment must be made carefully on an accurate zero-center reading meter because other alignments will be based on the accuracy of this zero adjustment.

An output signal from a highly accurate signal generator, preferably crystal controlled, should be injected into the second mixer tube grid. The generator signal should be set to the receiver's second i-f frequency. Inject sufficient signal to saturate the second limiter, as indicated by a meter connected across TP-1, (Fig. 4).

Now disconnect the meter and set

*Continued on page 35*

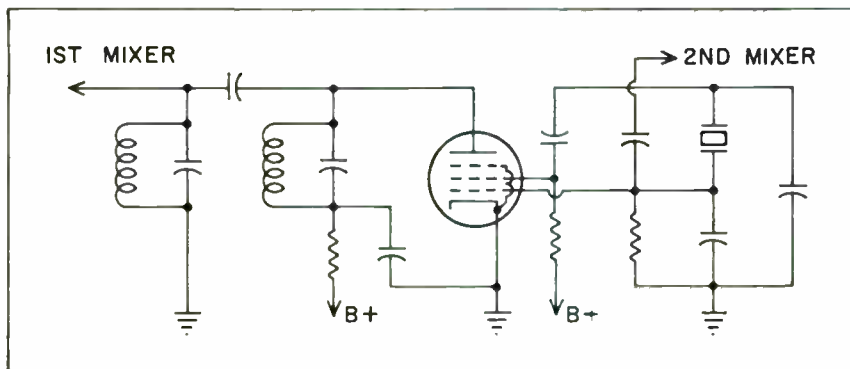


Fig. 2—Basic circuit of single-crystal controlled oscillator employed in some 2-way receivers to generate both first and second i-f signals.

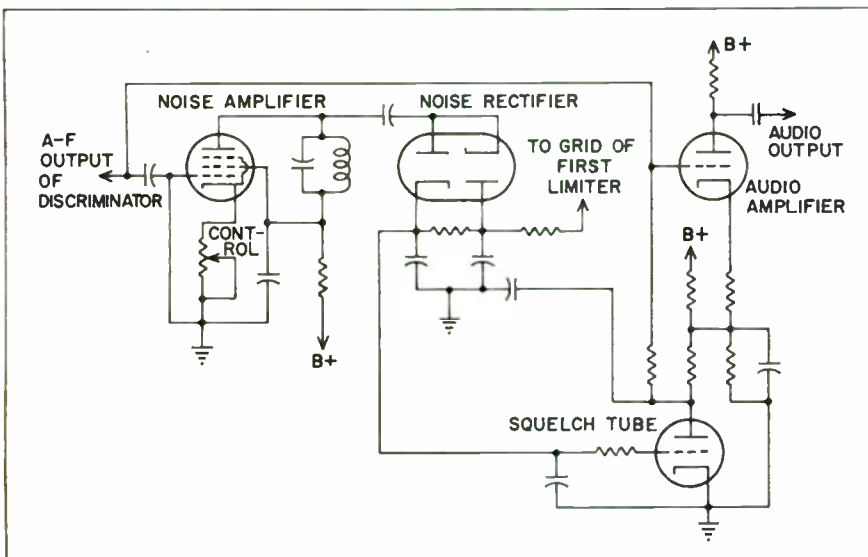


Fig. 3—Schematic of noise-rectifier squelch circuit employed in many 2-way communications receivers.

# TEST INSTRUMENTS for Bench

## MULTIPLEX GENERATOR

*Fisher Multiplex Generator, Model 300, at \$495*—This is the first stereo f-m instrument checked by ELECTRONIC TECHNICIAN editors. The generator's output is a stable and accurate composite stereo signal. In addition to stereo output, the unit provides a 100 Mc output which is factory adjusted but can be changed to another frequency in the event local stations or other signals interfere.

In addition to its normal test facilities, the generator has a stand-

ard broadcast output. This output may be used for actual stereo listening tests when the instrument is supplied with a stereo signal from a preamplifier.

Accurate alignments on stereo tuners and adapters are relatively simple with this generator. The only additional instrument needed for stereo alignment or tuner troubleshooting is an oscilloscope.

The instruction manual supplied with this instrument contains accurate reproductions of symmetrical

patterns obtained under normal test or check-out conditions. Both horizontal and vertical inputs to the scope are used to obtain Lissajous patterns.

A description of the different demodulating methods used by manufacturers is included. Unlike much of the equipment available today, the model 300 generator is simple to operate and does exactly what it is supposed to do without imposed gimmicks and "except when . . ." conditions. The 19 kc base frequency is crystal controlled for optimum stability. The entire generator weighs 17 lb and measures 8 x 10 x 12 in. A handle is provided for portability.

## PRECISION VTVM

*Precision VTVM, Model 48, at \$55.95.* Paco's VTVM is a well designed professional meter. One percent resistors are used as multipliers to obtain an accuracy of three and five percent on d-c and a-c scales respectively. All functions, a-c, d-c and ohms, have seven ranges.

A 1.5 v battery is used for the ohms function which allows meter use for "rough-checks" on most transistors without fear of damaging them by application of too much voltage. The meter's scale

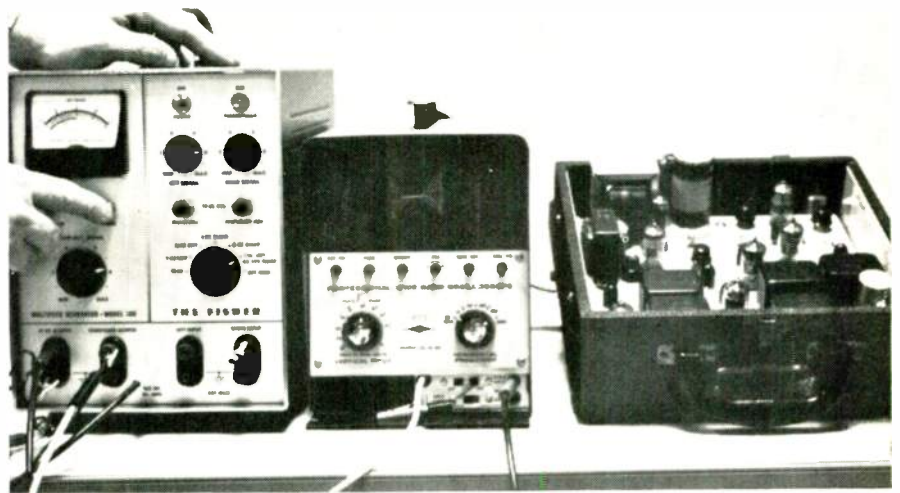
is calibrated for d-c, a-c (rms and p-p), db, and ohms. A rugged 400  $\mu$ a meter movement with a 4½ in. face is used in the instrument.

Two tubes are used in the unit: a 12AU7 in the bridge circuit and a 6AL5 to rectify alternating currents. An a-c/d-c probe is supplied with the meter and a high voltage probe is available at extra cost. The unit operates from 105 to 125 v, 50 to 60 cps. A flat black plastic case houses the meter which is equipped with a handle.



ET editor checks output phase of composite signal against 19 kc crystal controlled signal. Equipment tested this month includes the Fisher Multiplex generator, Sencore's PS120 scope and Hickok's model 660 color-dot-bar generator.

## and Caddy



*Sencore Oscilloscope Model PS 120, at \$124.50*—As more technicians discover the advantages of making certain color TV checks in the customer's home, small light-weight test equipment will continue to gain popularity. The Sencore PS120 scope is worthy of the technician's consideration if he is looking for this type of equipment.

Arrangement of controls on the scope makes it particularly easy to use. Concentric controls are used for coarse and fine vertical gain as well as horizontal frequency. Six

### OSCILLOSCOPE

controls in a row are used for focus, position, intensity,  $\pm$  sync and horizontal gain.

A small hinged door extends across the bottom edge of the front panel. The on-off switch and horizontal input are located here with a storage compartment for probes and cables.

The scope's vertical sensitivity is 0.035 v/rms or 0.1 v/p-p per in. The scope is said to be usable

to 12 mc, though it is down three db at 7.5 Mc. From 20 cps to 5.5 Mc the scope is within  $\frac{1}{2}$  db. Maximum sweep frequency range is 150 kc. When using the low capacity probe provided with the instrument, resistance and capacity of the vertical input is 27 meg shunted by 9 pf.

Over-all measurements of the unit are 7 x 9 x 11 $\frac{1}{4}$  in.; total weight is only 12 lb.

### COLOR BAR GENERATOR

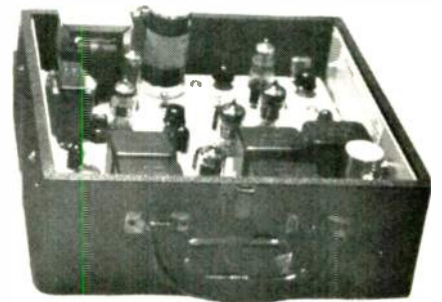
*Hickok Color Bar Generator, Model 660 at \$170.* — The model 660 generator is an extremely stable unit capable of generating precise small dots and bars as well as a rainbow type color display.

The test set can be used through the antenna terminals of the set on channels 2 through 6 or can be fed directly into the video if desired. The timer used for sync and dot-bar generation is supplied with regulated B+ and is crystal controlled.

Ease of maintenance and port-

ability are stressed in the generator. When the test set is opened for use (it is built in suit case style) all tubes and adjustments are visible. Since the timer is crystal controlled, the timer can be adjusted with only the aid of a scope. An instruction manual covers this procedure in detail.

Color generation is accomplished by a separate crystal controlled oscillator. The oscillator's frequency is 3.563795 Mc—15.750 cps below the color burst frequency. Since this acts as the subcarrier,



during one horizontal line, there will be a 360 degree phase shift. This phase shift produces all the colors in a regular fashion across the screen. An exceptional unit.

The test generator weighs 15 lb and measures 10 $\frac{1}{2}$  x 10 $\frac{1}{2}$  x 5 in.



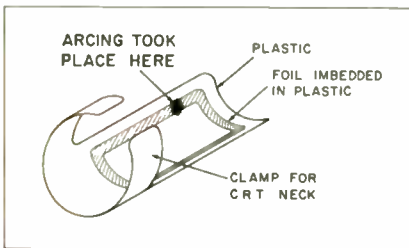
# TOUGH DOG CORNER



## Difficult Service Jobs Described by Readers

### Arc Upsets Sync

We were called to a motel to service a Westinghouse "Host," model HP9000, which is a special made TV for hotels and motels. The complaint was loss of horizontal sync. The suspected tubes and the dual afc diode unit were substituted at the motel, but the trouble remained. The set was brought into the shop for further testing. The voltages around the sync separator were normal and the waveform at the plate had suf-



Width imbedded in plastic arced to yoke causing loss of horizontal sync.

ficient amplitude. Waveforms around the afc diode, however, were full of "trash." A close check of circuit components revealed nothing.

In order to have more working room the set was moved to the bench and connected to a test yoke and CRT. When the set was fired up this time everything was normal. A careful inspection revealed that the foil width-shim around the neck of the CRT, which is imbedded in plastic, had a burned spot where the yoke was arcing to it. Removal of the width shim cleared up the interference and returned the set to normal operation.—*Charles W. Parrott, Charleston, S. C.*

### Factory Fault

One of my customers has an RCA CTC5 color set which I have repaired for several years. With the exception of a few defective tubes and an occasional adjustment, the set has performed reliably.

Recently, however, the owner complained that color sometimes appeared in B/W pictures. I made several calls to the house and found nothing. Finally, I caught the set acting up. The set was going out of convergence. With a dot pattern on the screen I found that the

vertical dynamic convergence was not too bad but the horizontal dynamic convergence was way out. I tapped on the convergence yoke and manipulated its plug but couldn't find any bad connections. In an effort to troubleshoot the set, I tried reconverging. It was soon obvious that none of the horizontal tilt or amplitude controls were having any effect. I then took the set to the shop.

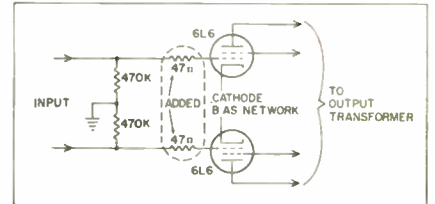
Checking the schematic, I found that the only common relationship between controls was through a horizontal output transformer winding from which the correction voltage is obtained. A close inspection showed that one end of the winding which should have been grounded was never soldered at the factory. When the lead was soldered the set returned to normal.—*Reg. Bartlett, Windsor, Ontario, Canada.*

### Variable Short

A Hickock tube tester model 538B which had socket savers installed, developed a trouble which caused it to indicate shorts on all octal base tubes. Several tubes were tried, so we knew it was the tester. When the last tube was pulled out, shorts were still indicated. We opened the tube tester and turned it upside down. When we checked with an ohmmeter, the only short indicated was the filament connections which were normal. When the tester was turned right side up again, only two shorts were indicated on the tester. By chance, we took out the "socket saver," and found it full of solder particles. The particles had accumulated over a year's period and had built up to a depth of 1/8 in. Each time the checker was inverted, the particles changed position, the nature of the short varied.—*W. Harder and E. Brandt, Lansing, Michigan.*

### Stereo Intermodulation

An avid stereo kit-building customer with sensitive ears called me recently with a complaint that the right channel of his stereo amplifier was acting up. I gave the equipment a listen-test in his home and concluded that he was being entirely too critical (according to my own ears). It sounded excellent to me. Knowing by experience that most customers are gen-



Intermodulation in stereo amplifier was eliminated by inserting a 47-ohm carbon resistor in the grids of each of the 4 6L6 output tubes. (Only one channel shown here.)

erally the best judges of what their equipment can do at any particular stage of its existence, I took the set to the shop for an instrument checkup. A check indicated that the right channel had a small amount of IM distortion—but an amount greater than observable on the left channel. This distortion increased in the highest frequency range of the audio spectrum. Further checks isolated the distortion in both channels to the 6L6 power output sections. The tubes were operating AB1 but the grid drive was higher than specifications called for. Efficiency of the right channel amplifier was lower than the left channel. Also, when a pure sinewave was fed into the amplifier at a frequency of approximately 15,000 cps, there was -8 v grid bias on one of the 6L6s in each channel. Exchanging tubes in both channels resulted in little change. A wide band scope showed no trace of oscillation. Acting strictly on a hunch regarding parasitic oscillations, I connected a 47-ohm carbon resistor into the control grids of all four 6L6s. The IM dropped very low and the customer's sensitive ears no longer frustrated.—*George P. Oberto, Richmond, Va.*

### TOUGH DOGS WANTED

\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

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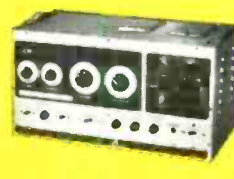
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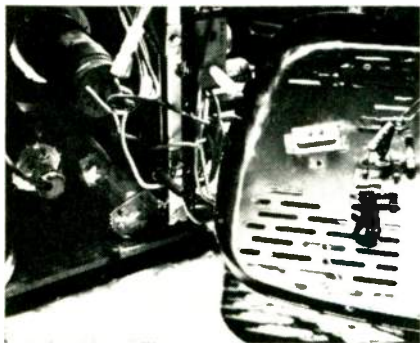
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# SHOP HINTS

## TIPS FOR HOME AND BENCH SERVICE

### Protect TV Antenna Coils

In many of the new a-c/d-c TV portables there are two capacitors that connect the input terminals of the tuner to the antenna terminal board. Sometimes these capacitors have a carbon resistor



Repositioning capacitors from set's back to the tuner prevents possible antenna coil burnouts.

bridged across them. Purpose of the capacitors is to isolate the outside antenna from the hot side of the chassis or wiring in case the a-c plug polarity is hot. If these two capacitors were not there the antenna coil will become blown apart and then must be replaced. It is discouraging to repair the original trouble in a small a-c/d-c portable and then through a careless mistake have to pull the chassis out and replace those antenna coils. Especially when the coils sometimes are inside the VHF tuner. When a set of this type comes into the shop and the back is removed, the first thing to do is to see if the capacitors are mounted on the set's back or to the tuner. If they are mounted to the back, simply unsolder them from their original position and solder them directly on the tuner itself. Then solder the small antenna wire connecting them to the antenna terminals. The antenna coils are now safe and will not be damaged when the antenna is connected. Nine out of 10 TV manufacturers place these capacitors on the removable back of the portable TV receiver.—Homer L. Davidson, Fort Dodge, Iowa.

### Soldering Iron Cleaner

A suede shoe brush does a nice job of cleaning soldering iron or gun tips. The brush doesn't leave slivers like steel wool and is much easier to handle. The same brush can be used to clean lint from felt covered phonograph turntables.—N. E. Cullinan, LaSalle, Ill.

### Schematic Reference

When a set comes into the shop, a schematic is almost always needed. I found that I was spending too much time looking up schematics so now I mark each set I repair with its schematic No. on the chassis. A grease pencil will make a permanent mark on the back of the chassis and can be easily found if the set needs repairs at a later date.—M. Halpern, New York, N. Y.

### Faster Tube Checks

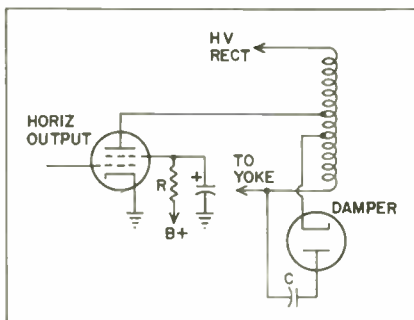
When a transformer type TV comes in requiring a complete tube check, I remove the rectifier and turn the set on. The tubes are then pre-heated and can be rapidly checked in numerical-alphabetical order.—J. G. Gaweau, Lindsay, Ontario.

### Chassis Drilling Aid

When drilling holes in instrument panels, or similar finished surfaces for component mounting, stick a piece of adhesive tape over the area and then center punch it. The tape makes it less probable that the drill will climb out, but if it should, the finish will not be damaged by the bit.—Harry J. Miller, Sarasota, Fla.

### Insufficient Width Remedy

Many TVs coming off assembly lines today do not have a width control. Low line voltage or similar causes for insufficient width cannot be readily compensated for in these sets. A simple circuit modification can be accomplished, however, to obtain satisfactory width in most cases. Modification involves increasing the horizontal output



Changing values of screen resistor and boost capacitor in the horizontal output circuit increases width in problem TV sets.

tube's screen resistor value by 50 to 60 percent. This will lower the high voltage, so it then becomes necessary to decrease the boost capacitor's value between 25 and 30 percent. A good capacitor with 6000 v breakdown should be used as a replacement.—E. L. Deschambault, St. Romauld, Quebec, Canada.

### Intermittent Volume Controls

In the manufacture of small transistor radios, for example, Sylvania's 4P19, 6P08 and comparable types, rosin may be forced into the control giving the effect of an open or intermittent control. The unit does not require replacement in most cases. It has been found that a control cleaner (GC Electronics #8666, or equivalent) does a fine job of cleaning out the rosin.—Sylvania Home Electronics Corp., Batavia, N. Y.

### Poor Focus In Color Sets

The most likely cause of poor focus in Zenith 27KC20 and 27KC20Q color TV chassis is a faulty focus voltage rectifier tube. Check the focus voltage. It should be approximately 4900 v. If this voltage is low, check the associated components in the circuit. Also check V20. If HV is slightly low, poor focus may exist. Also check horizontal sweep alignment.—Zenith Radio Corp., Chicago, Ill.

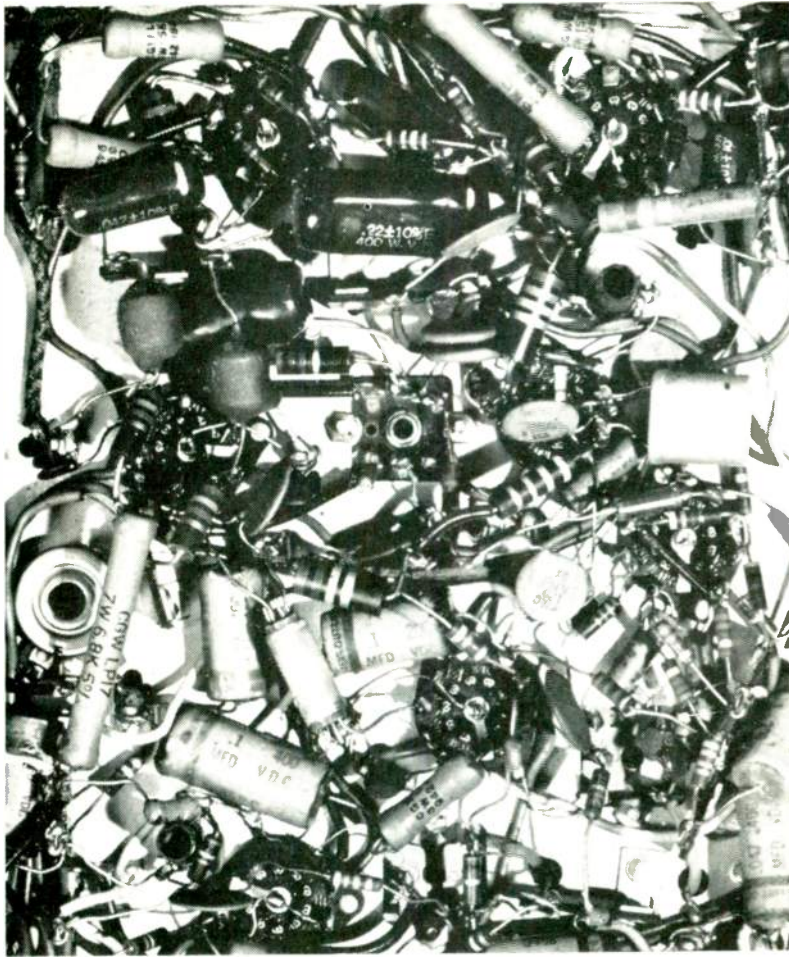
### Buzz In G-E Chassis

Residual audio buzz in the 17 in. M5 chassis may be caused by vertical hold control leads running too close to the volume control terminals. This vertical pick-up on the volume control terminals appears as a buzz in the speaker which may be changed in pitch by varying the vertical hold control. Dress the gray and yellow vertical hold control leads away from the volume control terminals to eliminate the buzz.—General Electric Co., Owensboro, Ky.

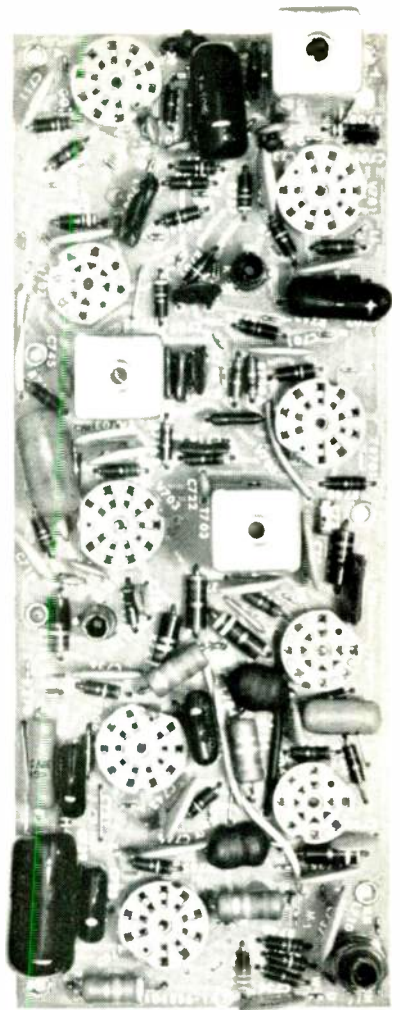
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\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.





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New

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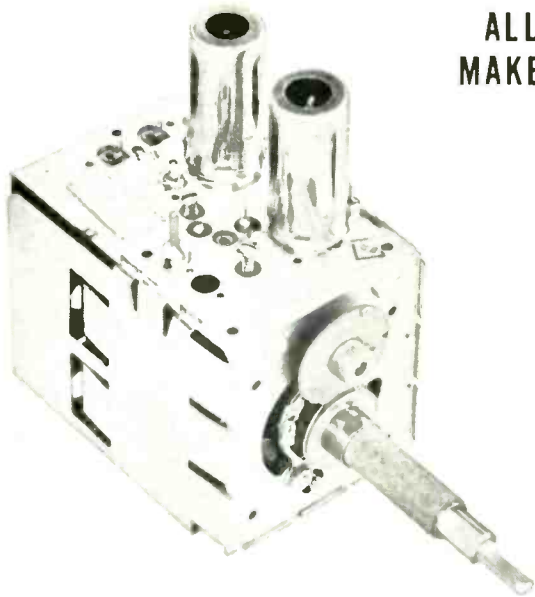


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Continued from page 27

its needle carefully to zero on its zero-center scale. Place the meter probes across TP-2, (Fig. 5). Adjust the discriminator secondary until the meter reads zero-center. This adjustment is made only at this time and only when a proper signal at the second i-f frequency is being injected into the second mixer grid.

In some receivers the discriminator transformer primary must be peaked to the second i-f frequency. In others, the primary is adjusted for equal voltage swing on both sides of zero. Details regarding adjustments for a particular receiver can be found in manufacturers' service manuals. The voltage swing adjustment is made as follows:

With the signal generator output set to the receiver's second i-f frequency, and the meter centered at zero across TP-2, adjust the generator to a "lower" frequency point as specified for the particular receiver. Note the amount of voltage swing on the meter. Now adjust the generator frequency the same amount to a "higher" point. Again note the amount of voltage swing in the opposite direction. If the primary has been properly adjusted the voltage swing will be the same each side of zero. Recheck the discriminator transformer secondary adjustment at this point with the meter across TP-2. The secondary adjustment may require slight re-touching to bring the meter reading back to zero.

Lower the signal generator output level to a point below "limiting" action and adjust the second i-f coils to peak on the meter while it is connected across TP-2. If the second i-f transformers are over-coupled types, consult the service manual for details. Overcoupled type transformers will be "double humped" and cannot be peaked properly on a meter without placing a specified amount of resistive loading across the coils. Once again, consult service data for proper amount of resistive loading.

When all second i-f transformers are properly peaked, recheck the discriminator secondary to determine if it still zeros. Also, check to determine if it zeros with the generator output signal removed

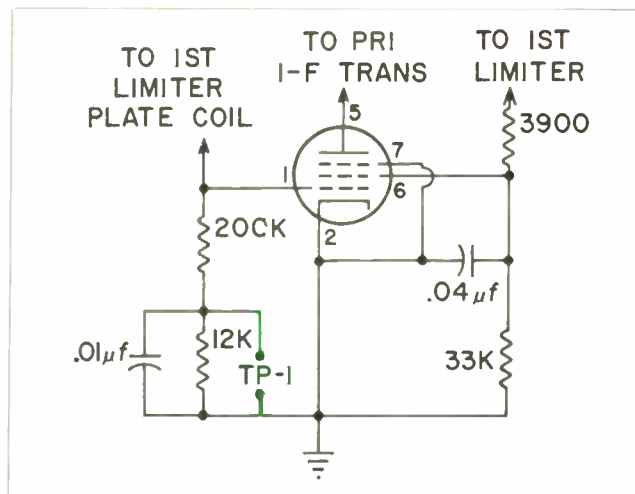


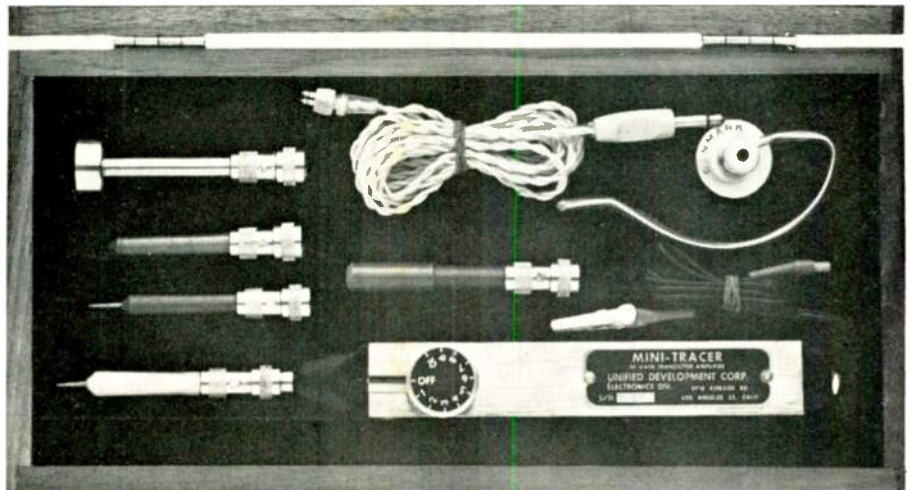
Fig. 4—Simplified second limiter circuit showing meter test point at TP-1.

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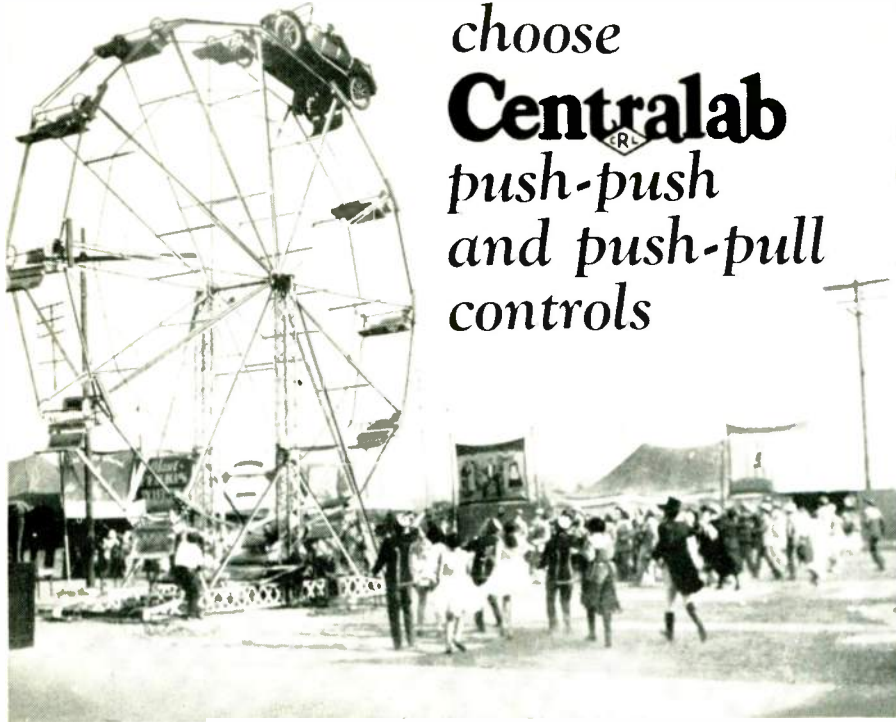
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from the second mixer grid. This is very important. The meter should read zero with or without a signal. If it does not, this indicates a circuit fault or misalignment. A receiver that "idles" off zero will show a loss of sensitivity and increased noise. Proper alignment of the second i-fs is extremely important for optimum receiver selectivity and sensitivity.

Move the signal generator output leads to the first mixer tube grid and set the generator dial to the first i-f frequency. Place the meter across TP-2 and bring the meter reading to zero by vernier adjustment of the signal generator frequency dial. The signal generator output level, as measured with the meter at TP-1 should be kept below the point of saturation.

Peak all first i-f coils. Two peaks will generally be noted. Select the peak that gives the greatest gain.

Radiate a signal from a nearby dummy-antenna-loaded (unshielded) transmitter, or other r-f source having sufficient power, and tune the signal in on the receiver. Adjust the first oscillator crystal trimmer to obtain zero on the meter across TP-2. *Never adjust the discriminator secondary to zero with an on-frequency r-f signal.* This will only upset the alignment. If the receiver has two crystals, the second oscillator crystal trimmer should be adjusted to "rubber" the oscillator on frequency.

### Tips and Precautions

It is possible to tune the first i-f coils to the wrong peak. The

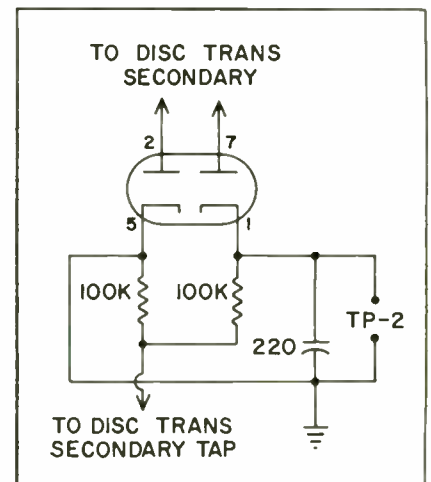


Fig. 5—Meter probes are placed across TP-2 in Foster-Seeley detector circuit when adjusting discriminator transformer secondary circuit for zero center.

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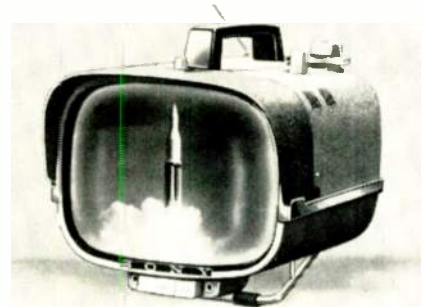


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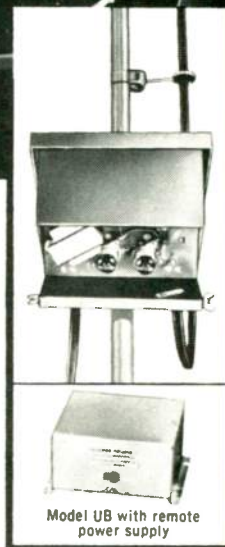
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peak that gives the highest meter reading at the limiter will be the correct one for those receivers that use one crystal controlled oscillator to generate both i-fs. The limiter peak will have to coincide with the discriminator's zero indication while the first i-f coils are tuned. Little additional difficulty should be encountered with the first i-f circuit except for an occasional defective tube.

If the second oscillator changes frequency it may lead you to the conclusion that the first oscillator is off. Without wasting time guessing, inject an accurate first i-f signal to the first mixer tube grid. This will quickly determine which crystal is off frequency.

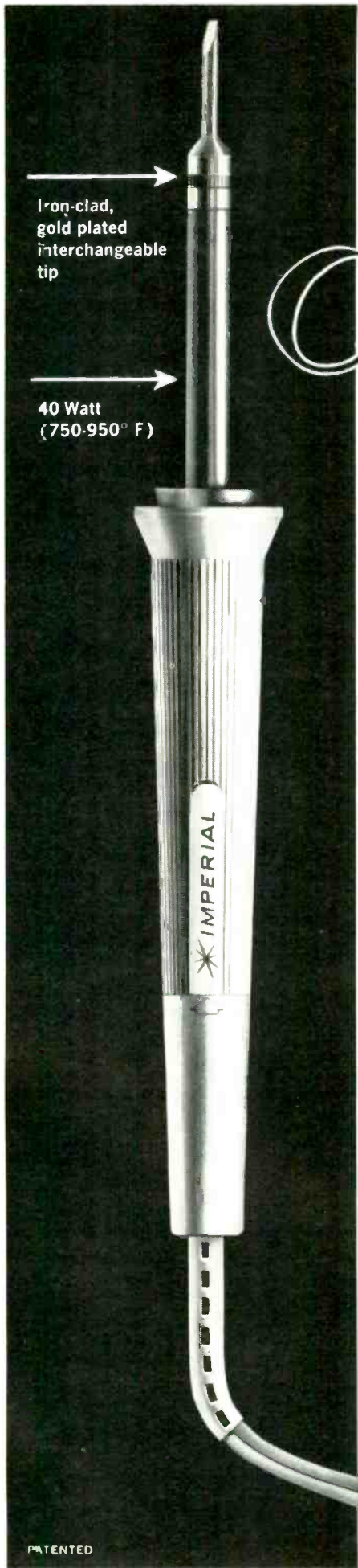
A shorted second i-f tube may show up as increased RFI from the vehicle's motor or as "idling" of the discriminator off zero. Do not depend upon tube testing. Substitute with known-to-be-good tubes. If new shelf-stock tubes are used and their condition is not known, substitute two or more before you jump to conclusions. Even when known-to-be-good tubes are used, it may be necessary to try more than one because of interelectrode capacitance variations.

A common fault of the squelch circuit is a high resistance short in the squelch tube. In some sets a squelch problem may be traced to an electrolytic capacitor connected to the first audio tube cathode. ■

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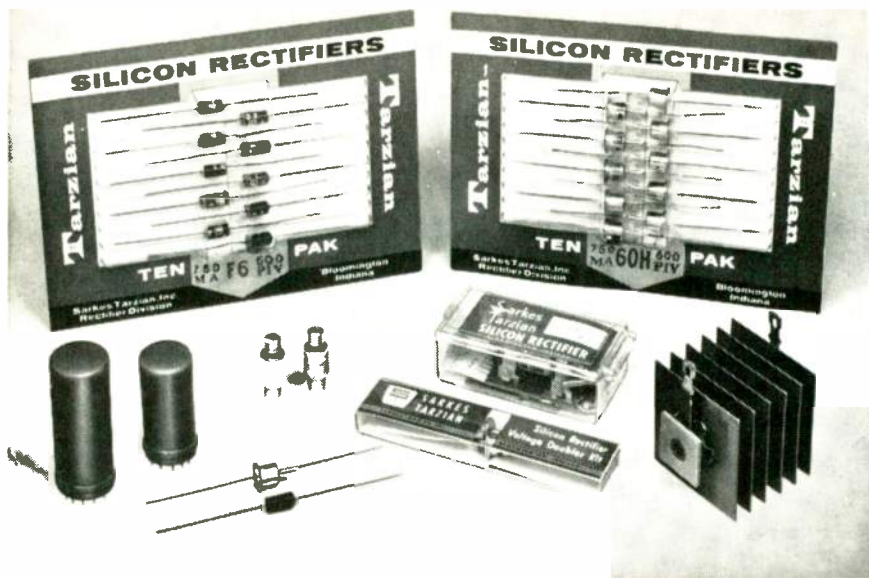


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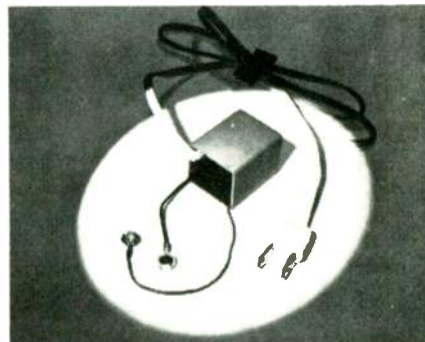
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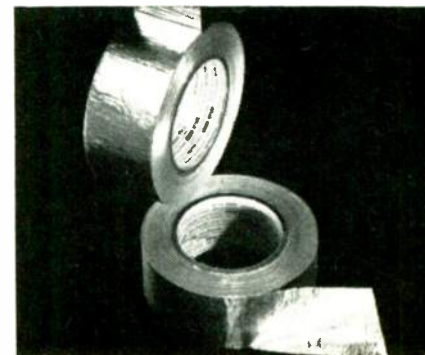
Model 1200 is a dynamic mutual conductance tube tester with fast push button settings. Tests the new tube types



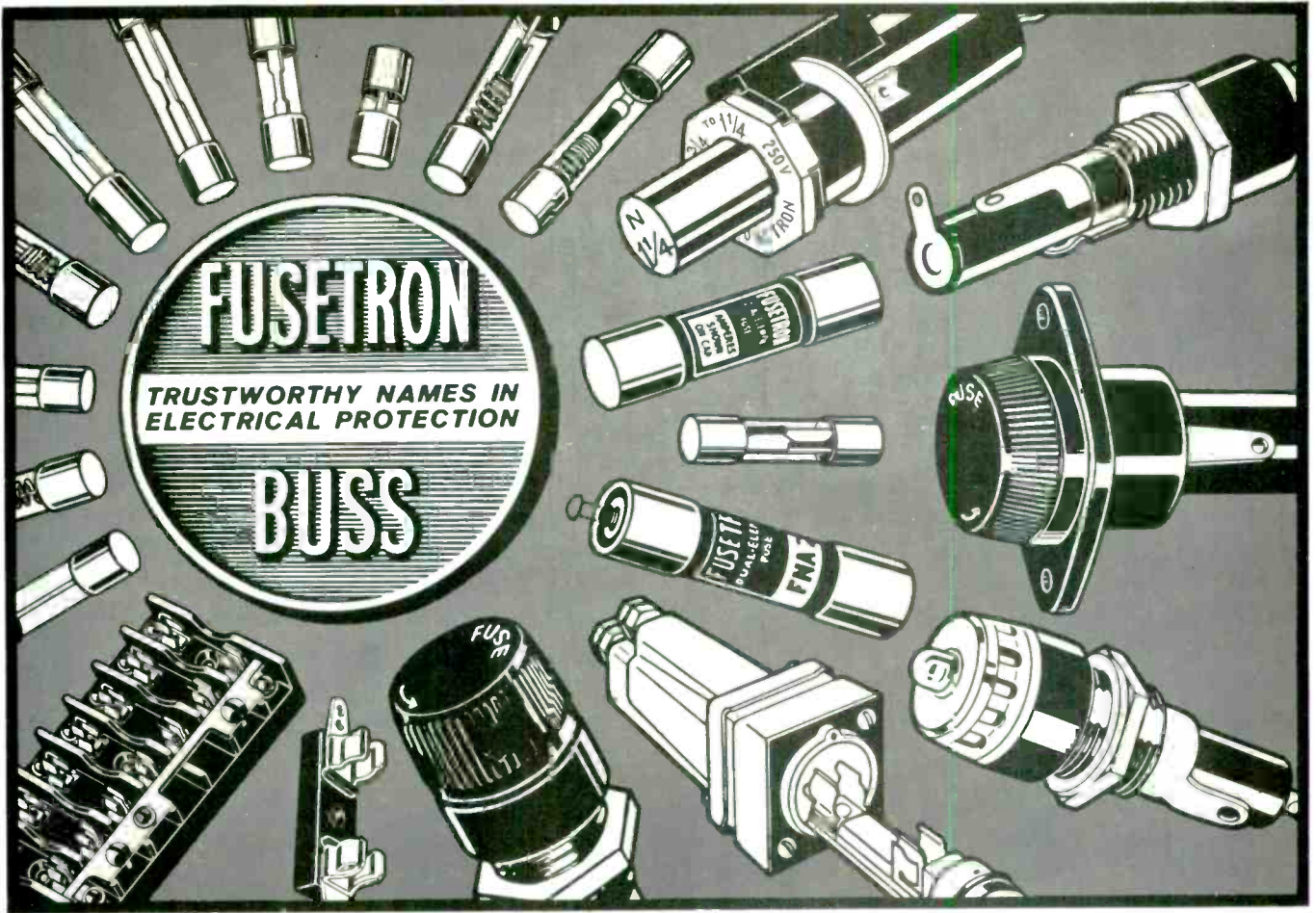
including nuvistors, novars, new 10-pin tubes and compactrons. Handles shorts and leakage, gas and grid emission, and has provisions for testing transistors and batteries. Line voltages is automatically regulated. \$119.95. Mercury Electronics Corp.

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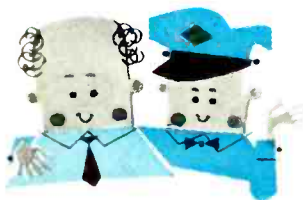
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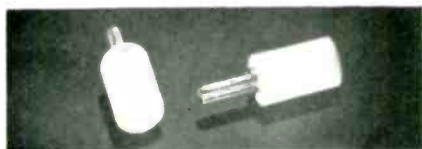
ELECTRONIC TECHNICIAN

## NEW PRODUCTS

find wide usage in applications requiring a seal against moisture or dust: sealing truck bodies, chambers, cabinets, containers, and packages, as a heat reflector in electronics, and as a protective covering on cable splices. Available in widths from ¼-in. up, in 60-yard lengths, in both bulk and box. Meets MIL-T-11291. Johns-Manville, Dutch Brand Div.

### TEST POINT PROBE 203

The PR-300 probe provides test or connection into a .080 x .270 in. deep jack on printed circuit boards without



soldering. The "Press-Fit" probe has a Teflon body .375 x .218 in. and is available for color coding. The terminal lug is brass over hard nickel, .0003 minimum thickness, and is designed for continuous duty with a current rating of 5.5 amp. Sealectro Corp.

### PA SYSTEM 204

Designed for emergency service, the Vanguard I mobile electronic siren and pa system is said to be the only 100%



transistorized and pushbutton-controlled electronic siren/pa system for panic and traffic control, as well as general communications. Functions include electronic siren, pa, civil defense alert, and radio relay. Power output is 50 w for siren and 30 w for pa and radio. Frequency response is 400-10,000 cps and power requirements are 12.4 to 14 v, 3.5 to 5.1 amp. University Loudspeakers, Inc.

### MULTI CHANNEL CB 205

This 10-channel citizens band two-



## Your PHILCO Distributor—One-Stop Center for Every Servicing Need

Part No. 326-5029  
Part No. 326-5029-1  
with volume control.



FREE—2 attractive card displays with every dozen.

Speakers of molded plastic in streamlined design. 8 ohm voice coil impedance with .68 oz. Alnico magnet, Coaxial connector socket, cable connection.

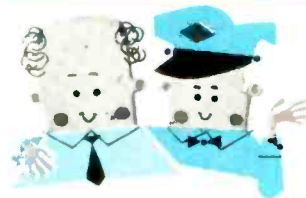


### PHILCO Deluxe PF 65 Stereo-Phone Swivel Speakers

A truly deluxe speaker set for the most particular stereo customer. Exclusive with Philco, these speakers use the famous Philco Fidelitron curved push-pull electrostatic reproducer. Unit on each Stereo-Phone swivels for tonal direction. Installs in minutes in any 8 ohm amplifier system. Glowing gold finish. 2" x 10" oval speaker.

Part No. 423-1003-1

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Direct-Pay Plans Totaled  
Over \$1 Million to  
"independents" Last Year



Thousands of independent service businessmen are registered members of Philco Factory-Supervised Service Association. You, too, can be factory-trained; enjoy special benefits plus extra income. Ask your Philco Distributor about joining PFSS today!



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A SUBSIDIARY OF *Ford Motor Company*

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Please send me FREE, the Philco Calculator. (Saves hours of time figuring out net costs and selling prices.)

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Retailer with Service Dept.  Service Only.

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# Now in breakproof plastic utility case!



Case can be used for carrying or storing tools, parts and equipment—or as a lunch box. Made of rugged polypropylene with self-hinge that won't rust.

Weller adds greater value to the Heavy Duty Soldering Kit with a new utility case of miracle plastic that won't break. Kit features the Weller 275-watt Soldering Gun used by electronic service technicians the world over. Instant heat. Twin spot-lights. Long life, long reach tip—made of copper for superior heat transfer and iron plated for long life. Also included in this kit are smoothing tip, cutting tip, tip interchange wrench and supply of solder. Model 8250AK.

**\$1495**  
list



## Weller Hi-Speed Sabre Saw

For smooth, super-fast cutting of all kinds on speaker and record player mounting boards, cabinets, walls, etc. Makes its own starting hole for inside cuts. Never splinters or tears wood. Heavy duty, 4.8 amps. Model 88. **\$2295** list

On sale at your  
Electronic Parts Distributor

**WELLER ELECTRIC CORP. • EASTON, PA.**

... for more details circle 83 on post card

## NEW PRODUCTS

way radio is said to be designed especially for command installations in offices and industrial applications. A full-band, tunable receiver permits the user to switch instantly and listen to traffic on all 23 CB channels. The electronic design of the new Band Spanner unit offers positive, crystal-tuned transmit and receive channels with the economy of only one crystal required for each channel used. Webster Mfg.

## INDUSTRIAL KNIFE

206

A line of industrial knives with replaceable razor type blades in various designs consists of six different models



of handles and more than 12 different selections of blades. The blades, called "Dura-Honed" reportedly are manufactured from select steel and surgically honed to meet the most exacting cutting jobs. They are said to be sharp yet durable enough to cut heavy plastics, shave or scrape solder and cut fine wires. The handles are covered with a soft plastic. The diameters of handles run from the smallest 1/4 in. to the largest 7/8 in. Length of the knives are 5 and 6 in. Hunter Tools.

## MICROPHONES

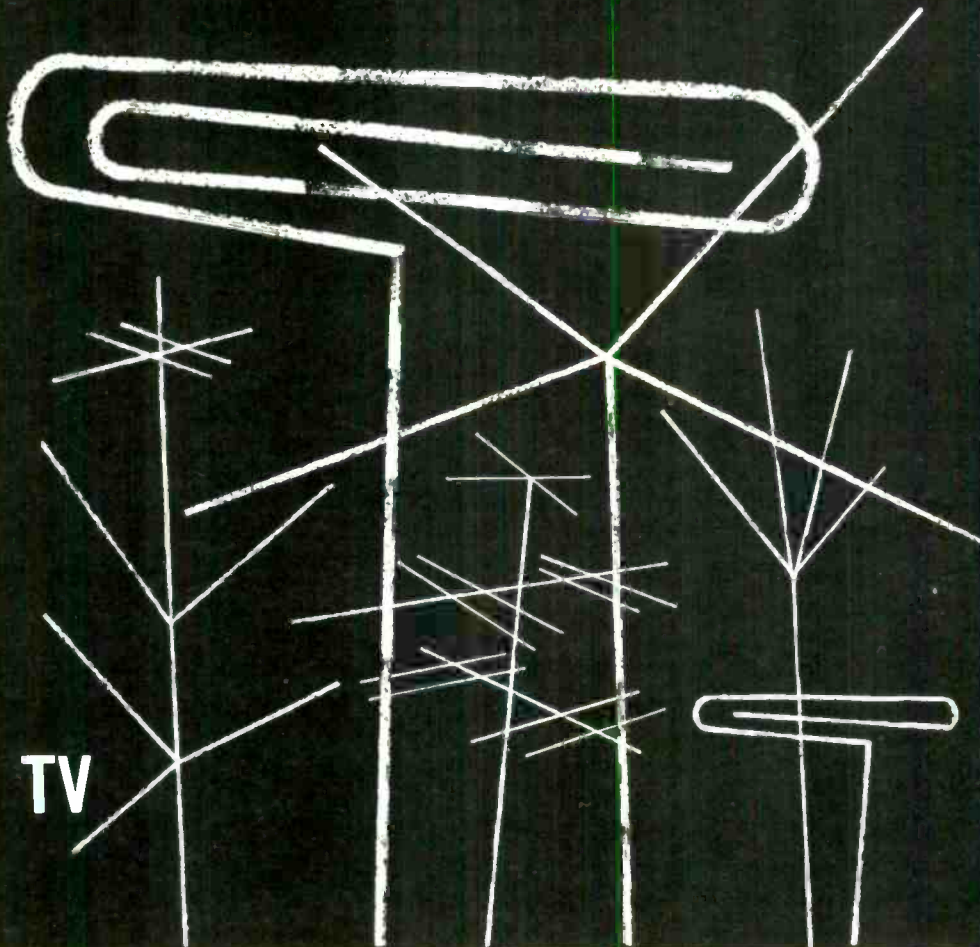
207

The model 61 dynamic, omnidirectional microphone has a frequency response of 95-9500 cps. an impedance of



ELECTRONIC TECHNICIAN

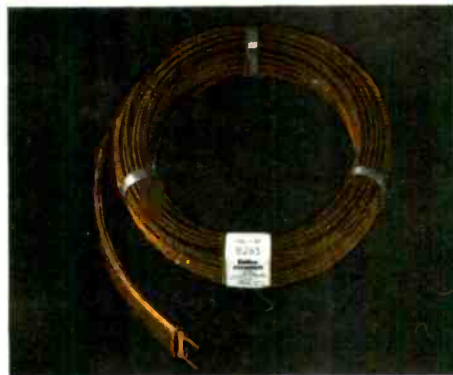
# 2 GREAT BELDEN CABLES FOR **COLOR** TV RECEPTION



## CELLULINE 8275

\* Maintains uniform electrical characteristics by eliminating all possible moisture between conductors. The thick outer wall of polyethylene protects the cable from abrasion and sun damage, and the round shape offers less resistance to wind. The result is a long lasting, efficient transmission line for clearer color and black and white TV reception.

AWG & (Stranding)	Color	Nom. O.D. (Inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft)	Nom. Attenuation per 100'		Standard Package Lengths in ft
					mc	db	
20 (7x28)	Brown	.300 x .400	80%	4.6	100	1.05	50' coils 75' coils 100' coils 500' spools 1000' spools
					200	1.64	
					300	2.12	
					400	2.5	
					500	2.98	
					700	3.62	
900	4.3						



## PERMOHM 8285

\* Conductors are encapsulated in cellular polyethylene. This exclusive design provides clearer TV pictures in all areas including areas where conditions of salt spray, industrial contamination, ice, rain, or snow exist. It further improves fringe area reception as well as strengthens UHF and color TV reception.

AWG & (Stranding)	Color	Nom. O.D. (Inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft)	Nom. Attenuation per 100'		Standard Package Lengths in ft
					mc	db	
22 (7x30)	Brown	.255 x .468	73.3%	5.3	100	1.4	50' coils 75' coils 100' coils 500' spools 1000' spools
					300	2.8	
					500	3.8	
					700	4.8	
					900	5.6	



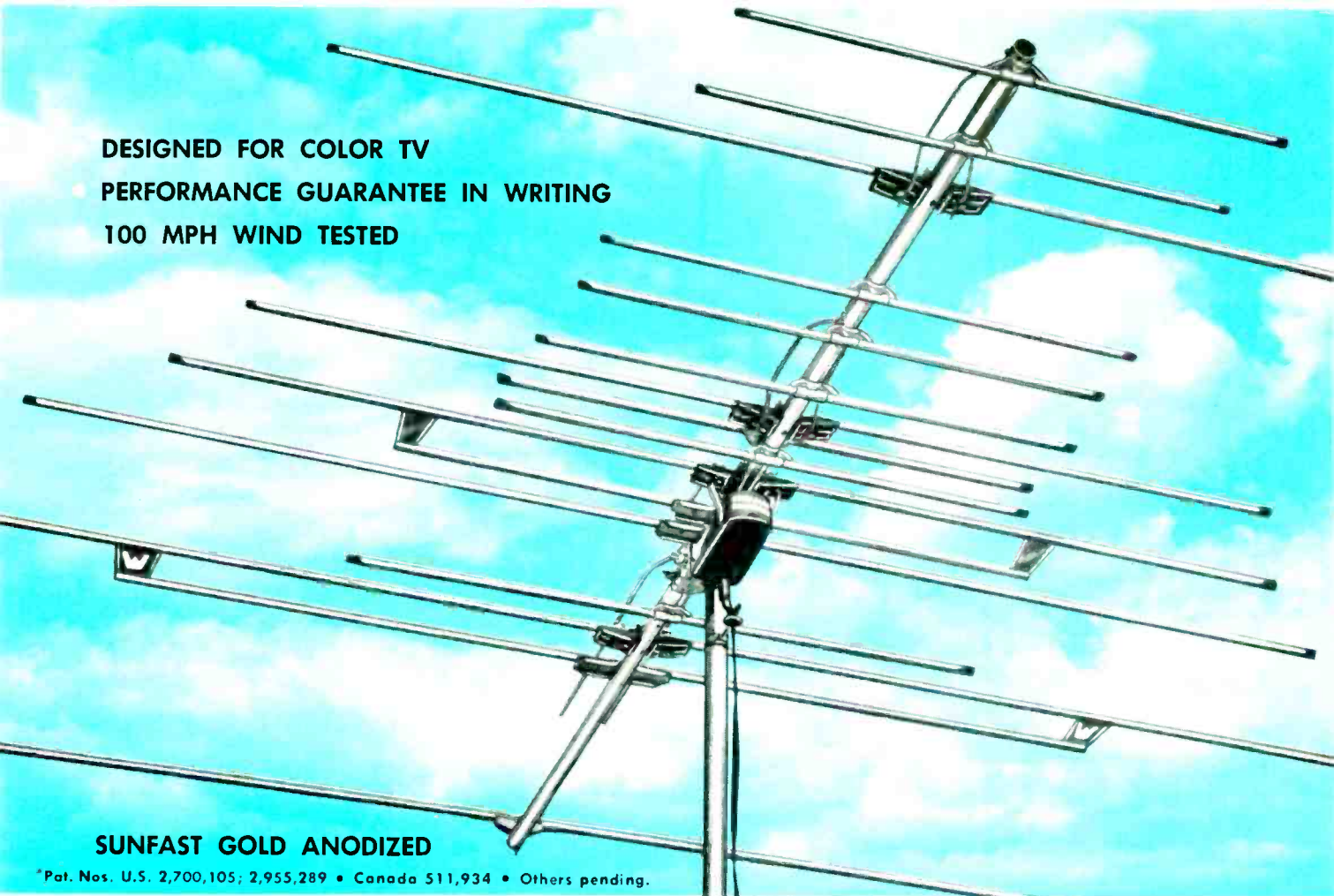
Belden Cable is Packaged in Standard Lengths for Display and Handling

Power Supply Cords • Cord Sets • Portable Cordage • Electrical Household Cords • Magnet Wire • Lead Wire • Automotive Wire and Cable • Welding Cable

\*Belden Trademark—Reg. U. S. Pat. Off.

8-5-2

DESIGNED FOR COLOR TV  
 PERFORMANCE GUARANTEE IN WRITING  
 100 MPH WIND TESTED



SUNFAST GOLD ANODIZED

\*Pat. Nos. U.S. 2,700,105; 2,955,289 • Canada 511,934 • Others pending.

# NEW FOR COLOR Winegard COLORTRON

**EVOLUTIONARY** — The finest TV antenna design ever engineered is the time-proven Electro-Lens all channel Yagi. This patented basic design, with its cross-phased driven elements and intermixed director system, was introduced by Winegard to the industry in 1954 and has never been surpassed. Now, through continuous research and product development, a new, improved Electro-Lens Yagi has evolved—the New WINEGARD COLORTRON—bringing this acknowledged design to a new peak of perfection.

**4 COLORTRON MODELS \$24.95 to \$64.95**  
 There are 4 new COLORTRON yagis to cover every reception need, from suburbs to distant fringe areas . . . setting new industry standards for reception results and mechanical construction. They are

the only outside antennas that carry a *written factory guarantee of performance* with full factory back-up of consumer satisfaction.

**PERFECT COLOR ANTENNA** — COLORTRONS have an almost flat frequency response (plus or minus ½ DB across any 6 MC channel), no “suck-outs” or “roll-off” on end of bands . . . accurate 300 ohm impedance match, (VSWR 1.5 to 1 or better) . . . unilobe directivity for maximum ghost and interference rejection. They deliver today’s finest TV reception—COLOR or BLACK AND WHITE.

**RUGGED CONSTRUCTION** — SUNFAST GOLD ANODIZED—COLORTRONS are *built to last* . . . made of high tensile aluminum

tubing for rigidity and stability. New locking devices keep the elements aligned—straight as a die. This quality of construction will satisfy a perfectionist! Insulators have a triple moisture barrier to insure top performance, rain or shine. Every COLORTRON is GOLD ANODIZED the WINEGARD way for the best looking, most corrosion-proof and permanent Gold finish known for aluminum.

**POWERFUL ELECTRONIC ANTENNA** — Because the COLORTRON and the NUVISTOR amplifier were designed to match each other perfectly, electronically and mechanically, together they make the most efficient electronic TV antenna yet devised.

**MODEL C-44**  
 GOLD ANODIZED \$64.95

**MODEL C-43**  
 GOLD ANODIZED \$51.90

**MODEL C-42**  
 GOLD ANODIZED \$34.95

**MODEL C-41**  
 GOLD ANODIZED \$24.95



- USES 2 LONG LIFE NUVISTORS
- STRONG SIGNALS CAN'T OVERLOAD IT
- COMPLETELY WEATHER-SEALED

# ANTENNA and COLORTRON AMPLIFIER

**REVOLUTIONARY**—Now a revolutionary new circuit, using two NUVISTORS enables the WINEGARD COLORTRON amplifier to overcome the limitations of other antenna amplifiers. For instance, oscillations, strong signal overloading and cross modulation picture interference are not problems with a COLORTRON AMPLIFIER because it will take up to 400,000 microvolts of signal input, 20 times more signal than other antenna amplifiers. *You can use it to amplify weak signals from far-away stations even though you have strong local signals from TV and FM stations. The COLORTRON NUVISTOR Amplifier is the only antenna amplifier that can do this!*

**"LIFESAVER" CIRCUIT GIVES NUVISTORS 4 TIMES THE LIFE OF ORDINARY TUBES**—A special "LIFESAVER" circuit has been designed to give the rugged LONG LIFE NUVISTORS an operating life many times

that of tubes, and superior to transistors in similar use. The COLORTRON NUVISTORS will operate perfectly for years.

**PERFECT COLOR TV AMPLIFIER**—The COLORTRON amplifier *has what it takes* to give CLEAN, CLEAR COLOR PICTURES, sharp and bright without smear. On weak signals, it will effectively reduce snow and interference, often making the difference between a very good picture and a poor one. It has an ultra low noise circuit... high amplification... flat frequency response... accurate impedance match (VSWR 1.5 to 1 or better, input and output)... and no phase distortion. You can be confident it will improve color and black and white TV reception in any location. This amplifier is so powerful, it can easily drive 6 sets at once with gain to spare!

**WEATHER-SEALED POLYSTYRENE CASE ... CORROSION-PROOF**—The COLORTRON

NUVISTOR amplifier is completely weather-sealed! Nothing is exposed to corrode and cause trouble—even the terminals are protected. A rubber boot over the twin-lead keeps moisture out. A built-in heat sink controls temperature of NUVISTORS. Everything possible has been done to eliminate maintenance problems. It comes complete with an all AC power supply with built-in 2 set coupler. (Mod. No. AN-220, \$39.95). The COLORTRON amplifier will give trouble-free performance for years. Install it and forget it!

#### OTHER ANTENNA AMPLIFIERS

FOR TV—2 Transistor (Mod. No. AT-220, \$39.95) also available. Will take up to 80,000 microvolts of signal input without overload. This is 3 times the input of other transistor antenna amplifiers.

FOR FM—Super sensitive 2 Nuvistor, 200,000 Microvolts Input—\$39.95.

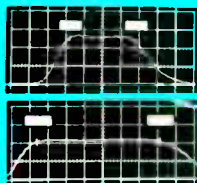
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AMPLIFIER WORKS ON ANY ANTENNA.



SPECIALLY DESIGNED AMPLIFIER CLAMP SNAPS ON COLORTRON ANTENNA IN SECONDS.



UNRETOUCHED PHOTO OF AMPLIFIER GAIN CURVE—FLAT RESPONSE ALL CHANNELS.



COLORTRON POWER UNIT WITH BUILT-IN 2 SET COUPLER.



Write for technical bulletins

## Winegard

ANTENNA SYSTEMS

3019-9 KIRKWOOD • BURLINGTON, IOWA

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**NEW PRODUCTS**

25,000 ohms, an output level (open circuit) of 18 mv/10 dynes/cm<sup>2</sup> and dimensions of 4 x 2 1/4 x 1 3/4 in. The companion model 61HF has similar specs except for a frequency response of 70-14,000 cps. University Loudspeakers, Inc.

**SWEEPING OSCILLATOR 208**

The "Rada-Sweep 386-AR," a new sweeping oscillator designed for the rapid alignment of a-m and f-m radios.

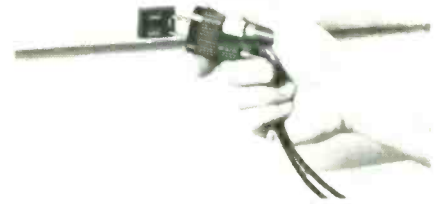


features 20 pulse-type, crystal controlled markers accurate to ± 0.05% and has an output of 0.2 v rms into 50 ohms, ± 0.5 db over the widest sweep width. Center frequencies of 455 kc, 1.1 Mc, 10.7 Mc, and 98 Mc are provided. Attenuation is by additive switchable steps of 20 db, 10 db, 6 db, and 3 db, with

a variable of 3 db. Sweep varies from 60 kc to 24 Mc. Kay Electric Co.

**LINE ADAPTER 209**

The dual adapter 5-way binding posts reportedly facilitate making line voltage connections directly from output re-



ceptacles to binding posts for use where quick, safe connections must be made to equipment lacking a parallel-blade plug and cord assembly. Connections can be made by (1) plug-in standard banana plug, (2) clip-lead to the shafts, (3) hook-up wire (up to No. 12) clamped through center holes, (4) wires looped around shafts and clamped and (5) clamped spade lug connections. Rated for 15 amp, 125 v, the units feature gold-plated brass parts for stable electrical contact and resistance to corrosion. The Superior Electric Co.

**TERMINALS 210**

A line of insulated solderless terminals and connectors in wire ranges #8 and #6 involves over 100 items, including



**CITIZENS VOICES are clearer stronger by STAR**

**THE ALL NEW GLOBE STAR Citizens Band TRANSCEIVER**

Vacationers, Sportsmen, Businessmen, Installation Engineers, Contractors, Farmers, Railroaders, Maintenance Men, Civil Defense Workers, Scientists, Doctors, Coaches, Housewives . . . on the job or just for fun . . . they all count on the Globe STAR for greatest range, for crystal clear reception, for maintenance free operation.

In your car, your boat, your home, down at the office . . . you bet . . . the STAR performs anywhere. Anyone can use it simply by applying to the FCC for a free licence. No examination is necessary and you'll find an application packed with every unit.

Nothing else to buy. The Globe Star is ready to go right from the carton.



See your local CB Distributor or write:

GLOBE STAR: Dept. 14  
400 So. Wyman Street  
Rockford, Illinois

**WRITE FOR LITERATURE**

Use this handy coupon to get the complete STAR Story with specifications. FREE.

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ADDRESS \_\_\_\_\_

CITY, STATE, \_\_\_\_\_  
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I'm considering using a STAR for:

THE GLOBE STAR IS A PRODUCT OF GC ELECTRONICS CO. DIVISION OF TEXTRON ELECTRONICS, INC. 400 SO. WYMAN ST., ROCKFORD, ILL., USA

**HIGH GAIN ANTENNAS CONTROLLED RADIATION**  
Pattern is beamed toward the horizon for optimum response. Mounting Structure Does Not Affect Radiation Pattern

**"TEAM-MATES"**  
TG-5-S (144-170 mc) TG-2-R

\$74.25 Not 3 ELEMENTS Fixed Station 3X Power of TG-2-R	\$18.00 Not Half Wave Element Maximum Possible Gain
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Although independent use of the TG-5-S and TG-2-R give amazing performance, their combined use as "Team-Mates" produce the ultimate in gain and efficiency. The engineered compatible characteristics of pure vertical polarization and matched feed points, with the elimination of horizontal polarization, make the "Team-Mates" leaders in the field of communication. Gain Figures, Radiation Patterns and Catalogs Listing All Models are Available

**EASY TO INSTALL**  
no need to remove upholstery!

Mounts from outside by insertion through 3/8" hole | Mounts flat: only uses 3/8" inside roof.

SEE YOUR DISTRIBUTOR OR WRITE GAM DIRECT

**GAM Electronics Inc.**  
138 Lincoln St., Manchester, N. H.

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# FOUR NEW WAYS TO HOUSE MICROFUSES

(SUB-MINIATURE)

282001



Front panel mount Microfuse holder (with the hexagon nut rear of panel). Rugged aluminum body and knurled cap; both can be anodized in color. Fungus and shock resistant. Sealing "O" rings in cap and on body. "Eye" type terminals specially designed for easy soldering.

282002



Rear panel mount Microfuse holder (with the round nut mounted from front of panel). Rugged aluminum body and knurled cap; both can be anodized in color. Fungus and shock resistant. Sealing "O" rings in cap and on body. "Eye" type terminals specially designed for easy soldering.

281002



Front panel mount Microfuse holder (with the hexagon nut rear of panel). Molded from high strength, high dielectric material. Knurled cap for easy grip, with skirt for positive "O" ring seal. Rugged "Eye" type plated brass terminals separated by molded barrier to provide complete insulation.

281000 Series



Indicating Microfuse holder — when the fuse blows indicating bulb glows. Knob molded from transparent material with serrations for easy gripping. Skirt of knob for positive "O" ring seal. Body from high strength, high dielectric material. Indicating holders available in wide voltage ranges from 2½ to 125 volts.

PRODUCTS  
SHOWN  
ACTUAL  
SIZE

Microfuses achieve low fuse resistance values with high reliability in ultra-fast blowing characteristics. Microfuses can be hermetically sealed, suitable for potting applications. Glass enclosed visible filament. Microfuses available in 1/500 through 5 amps at 125 V. Short circuit interrupting capacity 125 V—10,000 amps DC.

# LITTELFUSE

Des Plaines, Illinois

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# TELEPROMPTER

## AMPHICON 190 TV PROJECTOR



the first large screen TV projector designed, engineered, and priced to capture the custom installation market.

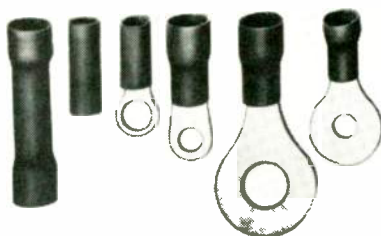
Sell, install and service the Amphicon 190 TV Projector. It operates as safely and simply as any home TV set and sells for less than half the cost of other TV projectors. This lightweight (under 70 lbs.), portable unit, may be ceiling mounted. It will project (front screen or rear) a brilliant picture 3' by 4' or up to 12 feet wide—and its miniaturized remote control panel permits operation up to 50 feet from unit.

Most of your commercial sound customers are good prospects for the Amphicon 190. In schools and colleges, classroom and lecture halls, in custom home building and modernization and in hotels, motor inns, restaurants, there's a need and demand for the 190. An exciting advertising and publicity campaign will be telling your customers about the advantages of Amphicon 190 televiewing. Local distribution is now being established. Why not get the full picture now? Write to: Dept. ET-9.

**TELEPROMPTER**  
CORPORATION

50 West 44th Street, New York 36, N. Y.

### NEW PRODUCTS



elongated ring terminals for tight clearance as well as regular ring tongue terminals, butt, and parallel connectors. The insulating sleeve, made of tough rigid plastic is permanently attached to the barrel of the terminal. The sleeve supports the wire insulation for increased resistance to vibration by preventing the wire from flexing at the point of crimp. Waldom Electronics, Inc.

#### CB TRANSCEIVER 211

The "Globe Star" employs one triple purpose tube, three dual purpose tubes, six single purpose tubes and four silicon



rectifiers. This special feature reportedly provides a "reserve power" capability that means longer life and greater reliability. Crystal tolerance is 0.005%. Full a-m modulation with adjustable squelch for quieter operation is provided. Adaptable to 5 channels, the "Star" is delivered complete, ready to operate with one set of crystals. Net price is \$159.95. GC Electronics Co.

#### SOLDERING TIP 212

An iron clad, tapered screwdriver, the "Mini-Tip" thread-on soldering tip #6481, is designed for pin, tube socket and connector soldering work. The tip is 24K gold-plated for easier tinning and better alloying. The tip may be threaded onto any one of three "Imperial" long-life heat cartridges with fingertip ease. Available wattages and tip temperatures are 25 w (690°), 30 w (750°) and 40 w (860°). Ungar Electric Tools.



Send for NEW  
FREE CATALOG #962  
with oscillator  
circuits

#### Citizen Band Class "D" Crystals

CITIZEN BAND CLASS "D" CRYSTALS  
3rd overtone — .005% tolerance — to meet all FCC requirements. Hermetically sealed HC6/U holders. 1/2" pin spacing. .050 pins. (Add 15c per crystal for .093 pins). **\$2.95 EACH**

All 23 channels in stock. 26.965, 26.975, 26.985, 27.005, 27.015, 27.025, 27.035, 27.055, 27.065, 27.075, 27.085, 27.105, 27.115, 27.125, 27.135, 27.155, 27.165, 27.175, 27.185, 27.205, 27.215, 27.225, 27.255

Matched crystal sets for ALL CB units (Specify equipment make and model numbers) ..... \$5.90 per set

#### CRYSTALS IN HC6 U HOLDERS

##### SEALED OVERTONE

.486 pin spacing — .050 diameter — .005% tolerance  
15 to 30 MC ..... \$3.85 ea.  
30 to 45 MC ..... \$4.10 ea.  
45 to 60 MC ..... \$4.50 ea.

##### FUNDAMENTAL FREQUENCY SEALED

From 1400 KC to 2000 KC  
.005% tolerance ..... \$5.00 ea.  
From 2000 KC to 10,000 KC,  
any frequency, .005% tolerance ..... \$3.50 ea.

##### RADIO CONTROL

Specify frequency. .05 pins spaced 1/2"  
(Add 15c for .093 pins) ..... \$2.95 ea.



#### QUARTZ CRYSTALS FOR EVERY SERVICE

All crystals made from Grade "A" imported quartz—ground and etched to exact frequencies. Unconditionally guaranteed!

Supplied in:

FT-243 holders Pin spacing 1/2" Pin diameter .093	MC-7 holders Pin spacing 1/2" Pin diameter .125
CRIA/AR holders Pin spacing 1/2" Pin diameter .125	FT-171 holders Pin spacing 1/2" Banana pins

#### MADE TO ORDER CRYSTALS . . . Specify holder wanted

1001 KC to 1600 KC: .005% tolerance	\$4.50 ea.
1601 KC to 2500 KC: .005% tolerance	\$2.75 ea.
2501 KC to 9000 KC: .005% tolerance	\$2.50 ea.
9001 KC to 11,000 KC: .005% tolerance	\$3.00 ea.

#### Amateur, Novice, Technician Band Crystals

.01% Tolerance . . . \$1.50 ea. — 80 meters (3701-3749 KC) 40 meters (7152-7198 KC), 15 meters (7034-7082 KC), 6 meters (8335-8650 KC) within 1 KC FT-241 Lattice Crystals in all frequencies from 370 KC to 540 KC (all except 455 KC and 500 KC) 50c ea. Pin spacing 1/2" Pin diameter .093

Matched pairs — 15 cycles ..... \$2.50 per pair  
200 KC Crystals ..... \$2.00 ea.  
455 KC Crystals ..... \$1.25 ea.  
500 KC Crystals ..... \$1.25 ea.  
100 KC Frequency Standard Crystals in HC6/U holders ..... \$4.50 ea.  
Socket for FT-243 Crystal ..... 15c ea.  
Dual Socket for FT-243 Crystals ..... 15c ea.  
Sockets for MC-7 and FT-171 Crystals ..... 25c ea.  
Ceramic Socket for HC6/U Crystals ..... 20c ea.

ENGINEERING SAMPLES and small quantities for prototypes now made at either Chicago or Fort Myers plants with 24 hour service. IN CHICAGO, PHONE Gladstone 3-3555

IF YOUR PARTS DEALER DOESN'T STOCK Texas Crystals, order direct and send us his name

TERMS: All items subject to prior sale and change of price without notice. All crystal orders must be accompanied by check, money order or cash with payment in full.

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**TEXAS CRYSTALS**

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FOR SHIPMENT VIA FIRST CLASS MAIL AT NO EXTRA COST ATTACH THIS ADVT. TO YOUR ORDER!

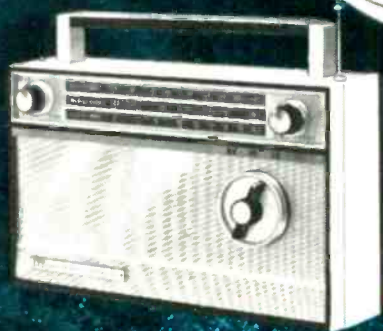
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ELECTRONIC TECHNICIAN

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FROM THE LEADING NAME IN WORLD-WIDE COMMUNICATIONS

*Electronic  
Elegance*



## NEW TRANSISTOR RADIO LINE

### PLEASURE-STYLING AT BETTER THAN COMPETITIVE PRICES

Here are some highlights which make the ITT Transistor Radio Package more than just another transistor radio line • Coast-to-coast service centers stocked with original parts • Recognized and accepted ITT prestige label on a quality product • Dealer-oriented sales program backed by national advertising and merchandising • Better than competitive pricing • 90-day warranty on all material • National network of warehouses • Sold through ITT franchised electronic distributors.

You can increase your radio department profits with ITT's complete line — ranging from the rugged AM/FM portable to the petite wrist strap model. See them at an ITT franchised electronic distributor or write direct.

**ITT**  
DISTRIBUTOR PRODUCTS DIVISION  
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION  
P. O. BOX 99, LODI, NEW JERSEY

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# ATR

## PRODUCTS FOR MODERN LIVING

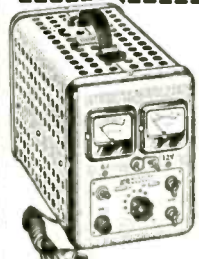


### ATR PLUG-IN TYPE PORTABLE INVERTERS\*

A.C. Household Electricity Anywhere . . . In your own car, boat or plane Operates Standard A.C.

- Record Players
- Dictating Machines
- Small Radios
- Electric Shavers
- Heating Pads, etc.

MODELS  
6-RMF (6 volts) 60 to 80 watts. Shipping weight 12 lbs. DEALER NET PRICE . . . \$33.00  
12T-RME (12 volts) 90 to 125 watts. Shipping weight 12 lbs. DEALER NET PRICE . . . \$33.00  
\*Additional Models Available



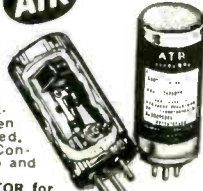
### ATR "A" Battery ELIMINATOR

For Demonstrating and Testing Auto Radios—TRANSISTOR or VIBRATOR

Designed for testing D.C. Electrical Apparatus on Regular A.C. Lines—Equipped with Full-Wave Dry Disc-Type Rectifier, assuring noiseless, interference-free operation at extreme long life and reliability.

MAY ALSO BE USED AS A BATTERY CHARGER  
MODEL 610C-ELIF . . . 6 volts at 10 amps. or 12 volts at 6 amps. Shipping weight 22 lbs.  
DEALER NET PRICE . . . \$49.95  
MODEL 620C-ELIT . . . 6 volts at 20 amps. or 12 volts at 10 amps. Shipping weight 33 lbs.  
DEALER NET PRICE . . . \$66.95

### AUTO-RADIO VIBRATORS



By every test ATR Auto-Radio Vibrators are best! and feature Ceramic Stack Spacers, Instant Starting, Large Oversized Tungsten Contacts, Perforated Reed, plus Highest Precision Construction and Workmanship and Quiet Operation!

There is an ATR VIBRATOR for every make of car!

Ask your distributor for ATR's Low Priced type 1400, 6 volt 4-prong Vibrator, and 1843, 12 volt 3-prong; or 1840, 12 volt 4-prong Vibrator. THE WORLD'S FINEST!

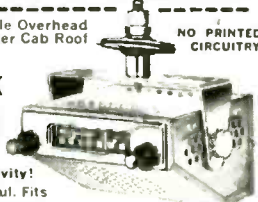


### ATR UNIVERSAL KARADIO MODEL 600 SERIES

Easily installed in-dash or under-dash. Amplifier power-supply chassis may be separated from tuner chassis for installation flexibility and easy servicing. Utilizes 6-tube super heterodyne circuit (2 dual-purpose tubes) with 8-tube performance . . . pulls in those distant stations with good tone and volume. Supplied with separate 5" x 7" speaker which is installed in original automobile speaker compartment for high fidelity performance. Neutral gray-tan baked enamel finish. Over-all size 4" deep x 6 1/2" wide x 2" high. Tuner Chassis; with Amplifier Chassis, 2 3/8" deep x 6 1/2" wide x 3 3/8" high. Shipping weight 7 lbs. WILL OUTPERFORM MOST SETS!

Model 612—12 volt Dealer Net Price . . . \$31.96  
Model 606—6 volt Dealer Net Price . . . \$31.96

### ATR TRUCK KARADIO



Excellent Tone, Volume, and Sensitivity!

Compact, yet powerful. Fits all trucks, station wagons, most cars and boats. Just drill a 3/8 inch hole in roof and suspend the one-piece unit (aerial, chassis and speaker) in minutes. Watertight mounting assembly holds antenna upright. Yoke-type bracket lets you tilt radio to any angle.

Extra-sensitive radio has 6 tubes (2 double-purpose), over-size Alnico 5 PM speaker for full, rich tone. Big, easy-to-read illuminated dial. Fingertip tuning control. Volume and tone controls, 33-in. stainless steel antenna. Neutral gray-tan enameled metal cabinet, 7 x 6 1/2 x 4 in. high over-all. Shipping weight 10 1/2 lbs.

Model TR-1279—12A for 12V Dealer Net Price . . . \$41.96  
Model TR-1279—6A for 6V Dealer Net Price . . . \$41.96

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## ATR ELECTRONICS, INC.

Formerly American Television & Radio Co.



Quality Products Since 1931  
ST. PAUL 1, MINNESOTA—U.S.A.

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# NEWS OF THE INDUSTRY



Wright

Sylvania Home Electronics Corp. announces the appointment of Wesley B. Wright as district sales manager, Washington, D. C. Mr. Wright succeeds Kenneth W. Connor who was recently named vice president—

National Sales for the marketing subsidiary. Mr. Wright will be responsible for the sale of television, radio, and stereophonic high fidelity sets in the District of Columbia and portions of Maryland, Delaware, and Pennsylvania.

Jerrold Electronics Corp. reports the highest sales and earnings in the company's 14-year history. The diversified electronics corporation showed a 137 percent increase in earnings on 51 percent higher sales for the fiscal year ended Feb. 28, 1962.

Laboratory For Electronics, Inc., dedicates its new Western Regional Headquarters. The modern one-story building will house the first West Coast manufacturing operation and a sales office for the Boston-based firm's Automatic Signal Div., in addition to sales offices for the company's Eastern Industries, LFE Electronics and Tracerlab divisions.

Aerovox, New Bedford Div., appoints Harold Lipschultz as manager of manufacturing engineering. Mr. Lipschultz brings to the division a considerable background in the field of capacitor manufacturing.

Amerdyne, Inc., National Sales Div., for cathode ray tubes and other electronic products, names Academy Marketing Corp. to conduct an extended advertising, merchandising and public relations program. The program will include establishment of Amerdyne TV Servicemen's Awards as an annual recognition of the fine work being done by America's TV service men and their organizations.

Littelfuse, Inc., manufacturer of fuses, circuit breakers and associated electronic components, acquires 14.1 acres of land for the building of a new 100,000 sq. ft. plant and future expansion. The initial planned expansion is expected to be the construction of a modern, one-story, brick 100,000 sq. ft. plant. It will house Littelfuse manufacturing, sales, office, engineering and research facilities. The firm's present facilities at 1865 Miner Street in Des Plaines will be moved upon the completion of the new building, it was reported.

Blonder-Tongue Laboratories, Inc., chooses Richard Helhoski as director of marketing. Mr. Helhoski's past experience includes Magnavox Co., where he directed the contract sales div. and RCA.



Helhoski



Brandt

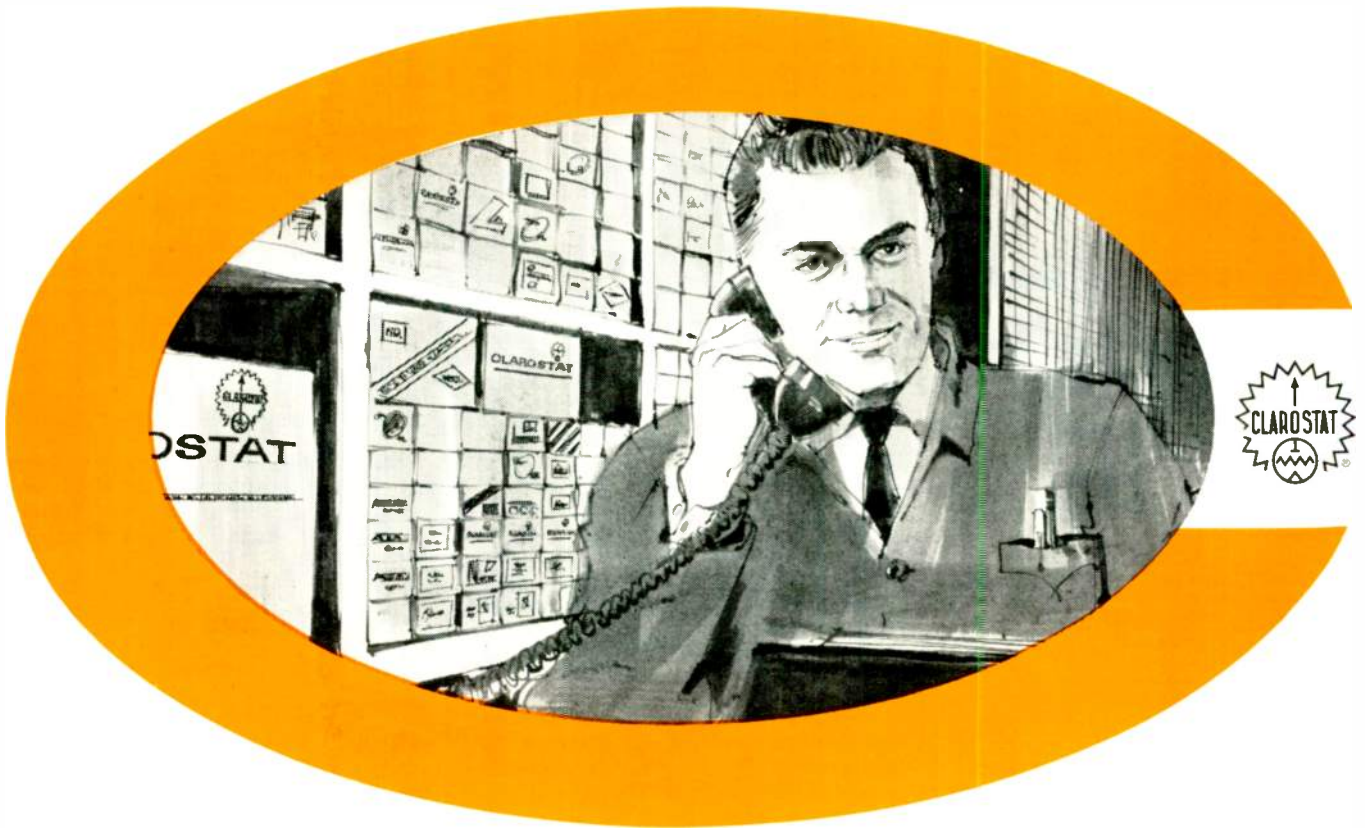
Eric Resistor Corp., names Alfred and Erika Kaspaul, well-known scientists in solid state physics and space technology, as senior research fellow, and scientific specialist, respectively. Mrs. Kaspaul will work closely with her famous husband in the firm's research and development program.

Jerrold Corp. is the new name approved by stockholders of Jerrold Electronics Corp. at the annual meeting. According to Sidney Harman, company president, the new plan of organization more fully reflects the diversified character of the company which, during the past year, has engaged in a major acquisition and diversification program.

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**Multicoire**  
5-CORE SOLDER  
WORLD'S FINEST

Multicoire Sales Corp. Port Washington, N.Y.

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The distributor counterman—fountainhead of information, aids to servicing, new products. At his fingertips is a wealth of information on the latest replacement parts, cross references to currently available components and older equipment. Ask your counterman—he'll steer you right every time.

**CLAROSTAT SERVICE COMPONENTS** Your counterman knows the completeness of the Clarostat line of potentiometers and resistors. Clarostat keeps him fully informed of all new Clarostat products, as well as where they go. With your counterman and Clarostat you're on the winning team of successful servicing...

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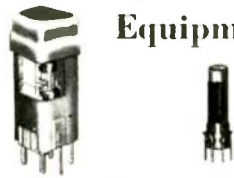
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CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

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## REPS AND DISTRIBUTORS

### Exact Replacements for Original T.V. Equipment



Cat. No.	Use	O.E.M. Part No.
<b>Admiral</b>		
1471-A	Sound Take-Off	72B185-2
1472-A	Sound Take-Off	72C132-19
6332	Horiz. Osc.	94C17-4
<b>Crosley</b>		
7101	2nd Sound I.F.	157856-1
<b>Dumont</b>		
7103-DE	Discriminator	20004441
7104-DE	Sound I.F.	20004511
<b>Emerson</b>		
6339-E	Width	708275
6340-E	Horiz. Osc.	716102
7112-E	4.5 Mc. Disc.	708276

### General Electric and Hotpoint

6206-PC	TV Ratio Det.	RTD-026 (WT56X38)
6207-PC	TV Ratio Det.	RTD-025 (WT56X37)
6208-PC	TV Ratio Det.	RTD-020
6209-G1	TV Ratio Det.	RTD-024 (WT 56X36)
6334-G	Horiz. Phase	RLI-365
6335-G	Horiz. Osc.	WT36X402

### Hallcrafters

1482 IFT	Sound I.F. and Trap	51B1996
7101	2nd Sound I.F.	51A1859

### Muntz

7111-M	4.5 Mc. Disc.	LO-0076
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### Philco

6209-P1	TV Disc.	32-4721
6209-P2	TV Disc.	32-4689-1, 2
6209-P3	TV Disc.	32-4735-1, 2
7102-P	4.5 Mc. I.F. and Trap	32-4688-10

### R.C.A.

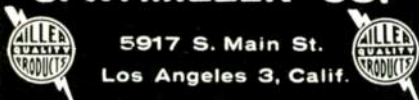
1483 IF	Sound I.F.	76437
1484 RD	Sound Ratio Detector	102692
1485 RD	Sound Ratio Detector	102644
1486 RD	Sound Ratio Detector	102253
1487 RD	Sound Ratio Detector	100364
1488 RD	Sound Ratio Detector	79141
1489 RD	Sound Ratio Detector	101219
6333	Horiz. Osc.	103103
6336-R	Horiz. Osc. and Sync.	107284

### Westinghouse

6204-W3	TV I.F.	V12128-1, 2, 3
---------	---------	----------------

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**Jerrold Electronics Corp.**, names **Delta Sales, Inc.**, of Indianapolis, as "Rep of the Year." In making the award, a company official cited Delta's "extremely substantial sales achievement." The award is presented annually to the representative with the most outstanding sales record for the year.

**Alpha Wire Corp.**, honors three sales representative organizations and two individual salesmen with bronze plaques. The award for top representative sales organization was presented to **Gerber Sales Co., Inc.**, Brookline, Mass. A company achievement award was presented to **L. H. Josefson and Associates**, St. Paul, Minn. **Neal Bear Corp.**, West Richfield, Ohio, received an award in recognition of the company's sales increase. Two alpha reps, **Tom Beil**, of **Beil and Whitaker**, Reading, Pa., and **Howard Bear**, of the Neal Bear Corp., received individual achievement awards.

**Olympic Radio & Television Div of Lear Siegler, Inc.** names **Radio & TV Distributing** South Bend, Ind. and **J. E. McMurray Distributing Co.**, Grand Rapids, Mich. as distributors. Radio & TV Distributing will cover Indiana and southern Michigan, while McMurray will handle western Michigan.

**Radio Corp. of America** announces the appointment of **Functional Communications Co.**, Chicago, Ill., as an authorized RCA Engineered Sound Distributor. Functional Communications has moved its general offices from 222 N. Michigan Ave., to 1945 N. Sheffield Ave., Chicago 14, Ill.

**Semitronics Corp.** announces six new sales representatives. **Keene Sales Co.**, Boston will cover the New England area; **B. Bernard Halpern & Associates**, N. Miami Beach will cover the state of Florida; and **Cox Sales Co.**, Salt Lake City has been appointed representative for the Rocky Mountain area. The Pacific Northwest area has been assigned to **W. K. Wood**, Seattle. **Haskell Associates**, Oak Park, Ill., will represent Semitron in the Chicago area and **L. R. Massey Co** Greenwood, Miss., has been assigned the southeastern area, with the exception of North and South Carolina and Florida.

**TelePromPter Corp.** names **Pacific Audio Sales, Inc.**, Los Angeles, as Southern California sales rep for its Weathers Industries div.

**Philco Corp., Consumer Products Div.** is revising its factory field sales force to better service its national distributor and dealer organization. Under the new program there will be six regional offices with district representatives covering laundry, home appliances and electronic consumer products. In some areas the product lines will be handled separately

while in others laundry and home appliances will be a combined assignment. According to a company spokesman, "the main function of the district representatives will be to greatly increase product sales training at both distributor and dealer levels."

**L. P. Henaman Co.**, is a new manufacturers' firm according to an announcement made by **L. Porter Henaman**. The Minneapolis rep will specialize in electrical and electronic products to be sold through electronic distributors in the states of Minnesota, North Dakota, South Dakota and Western Wisconsin.

**Bendix Corp.** announces the appointment of **James P. Buckley** as western corporate representative. Buckley who will be responsible for coordinating all sales activities of the various divisions of the corporation in the Western area, will headquarter at the West Coast offices at 117 E. Providencia, Burbank, Calif.

**British Industries Corp.** announces the appointment of **Harrison J. Blind and Associates**, 1705 DeSoto Lane, Indianapolis, as its representative in Kentucky and Indiana.

## TRANSFORMERS

*Continued from page 25*

er which provides the required current without overload from the secondary with the lowest current rating. One other point: The winding leads must be properly polarized. If either winding is reversed, net voltage will remain at 12.6. Reversing the primary will have no effect on the voltage except to reverse the polarity.

The same transformer can be used to supply higher current to a

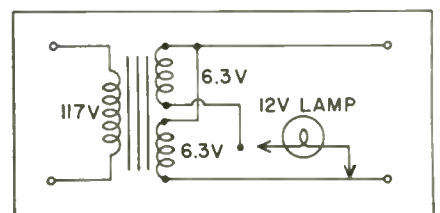


Fig. 4—A 12 v lamp is used to determine polarity of winding leads (see text).

load at the original 6.3 v rating by connecting the transformer secondaries in parallel, as shown in Fig. 3B. Here the polarity is extremely important and a wrong connection will result in a dead short on both windings. Use a scope to check for similar polarities or employ a simple shortcut with a 12 v lamp as illustrated in Fig. 4. If the lamp lights normally, reverse the leads of one winding. If it doesn't light at all, remove the lamp and tie the two leads together.



## Where you gonna get it?

From the distributor that stocks the "exact replacement" line? Too bad. Chances are 8 to 1 he can't fill your order. (This really shouldn't surprise you. There are more than 10,000 different values of electrolytics used in electronic equipment today. How can any line of 1600 exact ratings possibly include the exact replacement every time?)

Or maybe you hope to get it from the distributor who stocks the "service-designed 300." Pity. By the manufacturer's own admission, you'll be out of luck 3 times out of 10. You then have to "double up" (assuming you have the space, the time, the patience and the customer's consent) or you high-tail it to another distributor who has the right value (made by somebody else, probably us).

Smart technicians get their electrolytics from their Cornell-Dubilier distributor. Even though CDE

manufactures and stocks well over 1,000 different standard values, CDE distributors, by stocking only 425 Preferred units, have a replacement for you every time you call. Each and every CDE Preferred unit conforms to EIA Standard RS-154 (revised) for electrolytic capacitors, so you know they're right.

Next time you need an electrolytic, check your copy of the CDE Service Selector Catalog. Pick out the Preferred unit you need (they're starred in the listings). Call your CDE distributor. He'll have it for you! And ask him for a copy of "Truth of the Matter," Cornell-Dubilier's bulletin on electrolytic capacitors.

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the only Company that makes them all

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# NEWEST RCA SENIOR VOLTOHMYST®

NOW AVAILABLE AS A KIT FOR ONLY \$57.95\*

## NEW!

0.5-volt full-scale DC range for more accurate measurements of low voltages used in transistor circuits.

## EXTRA!

Pre-assembled, factory tested probe (V/G-299D) is included with every kit.

**SAVE MONEY** with this kit version of the RCA WV-98C, the newest improved model of the popular RCA SENIOR VOLTOHMYST. Even with its added features for extra versatility, this new kit still costs less than prior models.

This rugged precision instrument measures **AC voltages** (0.2 to 4200 volts peak-to-peak and 0.1 to 1500 volts rms); **DC voltages** (0.005 to 1500

volts DC); and **resistances** (0.2 ohms to 1000 megohms). Accurate to  $\pm 3\%$  full-scale on both AC and DC ( $\pm 5\%$  on the 1.5 and 5-volt AC ranges). Less than 1% tracking error.

Scales are separately color-coded to differentiate peak-to-peak and rms voltage readings. Its big meter, 6½ inches wide—electronically protected against burnout—is one of the most readable ever designed into a VTVM.

## RCA WV-98C

**\$57.95\***  
KIT

**\$79.50\***  
WIRED

For more information, ask your Authorized RCA Test Equipment Distributor.

\*User Price (Optional)

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.



THE MOST TRUSTED NAME IN ELECTRONICS

A transformer arrangement of this type may be needed to supply additional current whenever a changeover is made from a single-ended audio stage to a push-pull stage, or when converting from monophonic to stereo.

### Adjusting A-C Inputs

It sometimes becomes necessary to drop or boost ordinary a-c supply lines on TV, radio or Hi-Fi equipment. Of course, expensive auto or variable transformers can be used. And the power company can be induced to install a new line transformer at considerable expense. In most cases a much less expensive solution is possible.

As shown in Fig. 5A, an ordinary inexpensive filament transformer is placed across the a-c line with primary and secondary connected *series aiding* to boost the voltage. As shown in Fig. 5B, the same transformer can be connected *series bucking* to reduce the voltage. Note that one of the a-c line leads is also connected to one side of the low voltage winding. The connections shown in 5A will boost the input 6.3 v while reversing *either* winding (Fig. 5B) will reduce the supply 6.3 v.

If the transformer's secondary is center tapped, a choice of 5 different voltages is available: 6.3 v below line voltage, 3.15 v below, exact line voltage, 3.15 v above line voltage, and 6.3 v above. The only require-

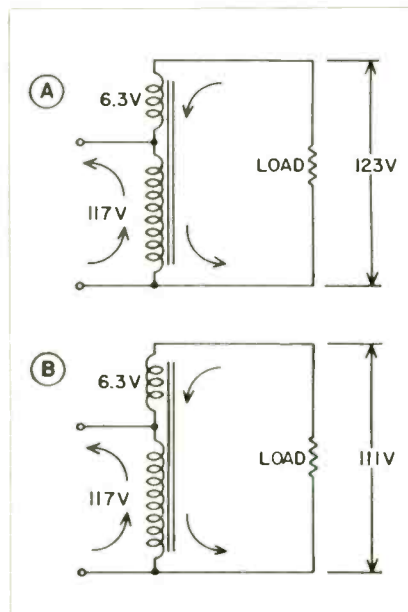


Fig. 5 (A)—The primary and secondary of an inexpensive filament transformer is connected series-aiding across power input to boost voltage. (B)—Series-opposing circuit reduces voltage.



# SO SAFE!



won't damage glass tubing  
let alone wire or cable!

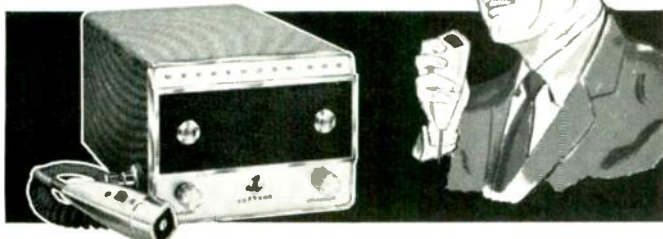
ARROW STAPLE GUNS can't damage wire or cable because driving blade automatically stops staple at right height! That's why Arrow Staple Guns are proved safer on jobs all over the country. And Arrow staples have tremendous holding power because they're rosin-coated, have diverging points that lock into wood.

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with 25 to 50 MC. Industrial  
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The "Messenger 202" sells for less than \$200.00—is priced within easy reach of any business! A complete 10-tube (including rectifier) crystal-controlled AM transceiver, the "202" is F.C.C. type accepted for use in the Industrial, Public Safety, and Land Transportation service. The "202" practically sells itself when you point out the savings that almost any business or municipal organization can make with this top performing, low cost industrial equipment! Highly selective and sensitive superheterodyne receiver, built-in "Squelch," and AVC, ANL circuits. Designed for easy operation—fast, smooth installation—and simplified maintenance. Available nationally from E. F. Johnson Company distributors. Powerful dealer aid program shows you how to make big money in sales and service in this highly profitable field—gives you everything you need to handle your own line of industrial 2-way radio equipment!

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Manufacturers of World's Most Widely Used Personal Communications Transmitters

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PRODUCT  
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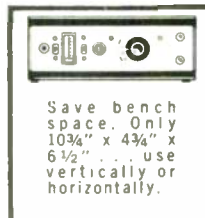
## ...nothing cheap but the price!

Compare performance, filtering, quality, output



EC-1  
\$29<sup>95</sup>

EC-2  
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Save bench space. Only 10 3/4" x 4 3/4" x 6 1/2" ... use vertically or horizontally.

### New DC Power Supplies

Guaranteed 1 Year

They'll sell you on sight. Never before has so much value and performance been packed into a completely assembled power supply.

**Auto radio...** Use EC-2 for all servicing needs. Use EC-1 for "warm-up" and "check-out" or as low cost power source for FM and AM demonstrations.

**Transistor portable servicing...** Ideal as a hum-free DC voltage source.

**Research and development work...** Reliable performance for wide application in industry and laboratory.

	EC-2	EC-1
DC VOLTAGE OUTPUT	0-15 VDC continuously adjustable	12 VDC (adjustable)
AMPERAGE OUTPUT	0-5 ADC	0-5 ADC
RIPPLE	0.5% at 5A	0.5% at 5A
REGULATION	1.8 V/A	1.4 V/A
METER	0-20 V/0 - 10A	.....
DC IMPEDANCE	1.8 ohms	1.4 ohms
PANEL FEATURES	On-off switch, pilot light, meter function switch, variable voltage control, insulated birding posts, fuse, 6' cord.	4-position voltage adjustment switch, pilot light, wing nut output terminals, 6' cord.

Write for Complete Line Catalog P5-562

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ment is that the low voltage winding's current capacity is capable of handling the total equipment load. A 6.3 v, 1.2 amp winding will work without overheating on a continuous load of 150 w. A 2.5 amp winding is sufficient for 300 w, which is

more than most radio-phono combinations, TV receivers or sound systems need.

Did you ever get a piece of equipment in the shop that requires 220-240 v for operation? If you do, connect a 1-1 power or isolation transformer as shown in Fig. 6, and you're in business. Just make sure that the heavier winding (if there is a difference) is connected at "X" and that it will carry the current necessary to operate the equipment. The heavier winding will show the lowest resistance reading when

### NEW REVISED "WORKING WITH TRANSISTORS"

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Author of the CBS  
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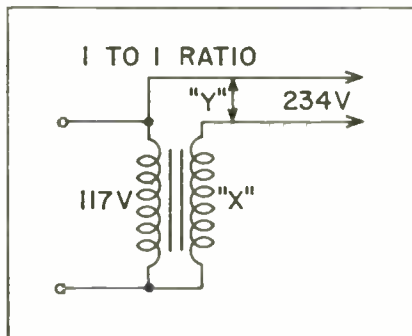


Fig. 6—A 1-to-1 ratio isolation transformer is used to boost 117 v line power to 234 v for operating 220-240 v powered equipment.

measured with an ohmmeter. If the output at "Y" is near zero, reverse one pair of leads.

With the aforementioned information as a starter, you will probably find all kinds of situations arising where a little experimenting will result in quickly solving many problems at lower cost. ■

### PRINTED CIRCUIT REPAIRS

done quickly with

DeSod SYSTEM



### DESOLDERING TOOLS

Designed especially for the TV-Radio serviceman.

### Put MORE PROFIT in

Your service business by using tools that do the removal and replacement of multi-contact parts all in one fast operation.

Tools available to fit most multicontact parts.

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Try one today.

DeSod Division  
Eversole Industries  
Fremont, Ohio

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## Now... Tomorrow and for years to come!

# Sonar CITIZENS BAND RADIO

- 8 Channels, crystal controlled transmitter and receiver
- Tunable receiver for 22 channels
- Transmitter 100% Class B modulated
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- FCC Type accepted\*

with 1 pair of crystals, microphone and power cables

**\$17950**



### Sonar RADIO CORPORATION

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Please send me complete information on Model "E" CB Radio.

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The quality, proved lubricant for effective silencing of noisy controls and switches on TV, radio and electronics instruments. And the FREE EXTENDER TUBE makes those once pesky places easy to reach. Put quality QUIETROLE in your repair kit and see how quickly and easily you satisfy more of your customers.



6 Oz. SPRAY PACK CAN  
(with FREE Extender Tube)



2, 4, 8 oz. Bottles  
(with Dropper)

Product of  
**QUIETROLE COMPANY**  
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in Canada: CROSS CANADA ELECTRONICS  
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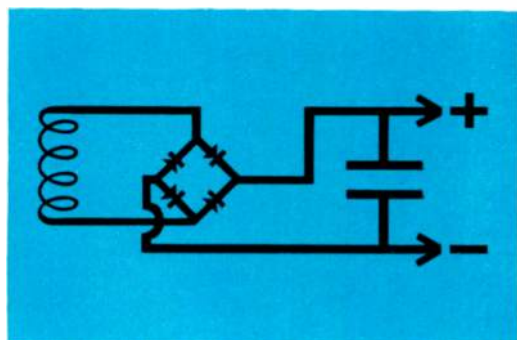
ELECTRONIC TECHNICIAN

# Hints on Reducing Hum . . .



In high fidelity sound systems . . . and in many kinds of commercial and industrial electronic equipment . . . reduction of 60-cycle hum is one of the toughest problems that a technician has to tackle. Most hum comes from 60-cycle voltage sneaking into the signal circuit. There are, of course, many well-known precautions that should be observed . . . using shielded or coax cable between major components, keeping cables short especially in the low-level portion of the system, making sure connectors are tight. Here are some other thoughts that may be useful.

Power supplies in sound systems . . . hi-fi or commercial . . . generally operate at higher temperatures than those encountered in radio or TV. So it pays to be particular about filter capacitors. It pays to use electrolytics rated at 85° C. Those rated at only 65° C start to run into trouble. Then too, because of the added heat, the vent construction is important. In other words, "How good is the seal?" Our tip is to always use Mallory FP-WP electrolytics . . . voltage ratings are conservative and dependable . . . they have excellent stability at high temperature . . . and they all have *etched cathode* construction. This latter is extremely important in avoiding hum. We covered the reasons in a previous TIP (remember?).



Here's another source of hum . . . filament circuits. Many of the highest quality sound systems use a DC filament supply in the preamplifier. It's easy to add this refinement to any system. All you'll need is a Mallory FW-50 "packaged" silicon rectifier circuit. It's encapsulated in a tiny plastic block and takes up very little space. Simply connect the FW-50 to the circuit, add a WP-042 electrolytic and filament hum disappears permanently. If you want more specific information, write and ask us.



Another tip: call on your Mallory Franchised Distributor for prompt service, at sensible prices, on Mallory capacitors, switches, silicon rectifiers, controls, and batteries . . . and for any other parts you may need.

## FREE LITERATURE

### ANTENNAS 300

A line of auto and communication antennas is outlined in catalog No. 607. Cables, mounting hardware and accessories also are shown. Ward Products Corp.

### CORE SOLDER 301

Bulletin 456 gives key information about Alpha "Centri-core" solder and includes a sample. The sample is suitable for making 50 reliable connections. Alpha Metals, Inc.

### ANTENNA TEST 302

The antenna test capabilities available at a 2870 ft. test range are graphically described in this brochure. The long range test site offers unusual topographical characteristics in addition to an absolute minimum of interference and man-made noise. Technical Appliance Corp., Defense and Industrial Div.

### TRANSISTOR TESTERS 303

This technical brochure describes Models 1890RD and 1890M Dynamic Beta In-Circuit Transistor Tester. Model 1890RD is designed for research and development applications; Model 1890M, electrically identical, is built to military specifications with military type components. RD Instruments Div., Hickok Electrical Instrument Co.

### ANTENNAS 304

This catalog illustrates and describes a complete line of automobile antennas and accessories. New-Tronics Corp.

### DEGAUSSERS 305

Complete information is available on each of the three models of tape and film degaussers which are capable of erasing a recorded signal to more than 50 db below saturation. The Type 9205 A is primarily designed to be a stationary unit for home and industrial use. The type 64221 is also designed for home and industrial use, however, it's lighter in weight (17 lb). Type 8905 is an erasing pencil. Hi-Q Div., Aerovox Corp.

### PHONO CARTRIDGES 306

A cross-reference booklet, SAC-17 lists the latest complete line of stereo-mono, ceramic and crystal replacement cartridges. Included are 1200 models made by 33 leading manufacturers. The guide is five-hole, universal-punched for easy use in binders. Sonotone Corp.

### ELECTRONIC COURSE 307

Eight electronics courses among the 30 correspondence courses on electronics, rad'io, television and telephony, are described in this catalog. The new courses cover fundamentals, instrumentation and servos, automation, calculus and applied electronics, industrial electronics, and telephony. International Correspondence Schools.

### CONNECTORS 308

This 32-page catalog of parts for industry features over 1,700 items of solderless terminals and connectors. In addition, it includes a complete selection of shakeproof products, electronic hardware, instrument and equipment knobs and dials, instrument cases, terminal strips, standard and printed circuit tube sockets, jack covers and planetary drives. Waldom Electronics, Inc.

### ANTENNA AMPLIFIERS 309

The "black box" system provides a power booster for base station antennas, according to the manufacturer. Specifically the unit is said to increase the effective transmitted gain by 10 db. The Antenna Specialists Co.

### AUTO RADIOS 310

The "Golden Classic" series all transistor, custom a-m/f-m auto radios are described in this bulletin. The unit is said to incorporate two complete radios, one for a-m and the other for f-m. Automatic Radio.

### MICROPHONES 311

Microphones for studio, general and special purposes are cataloged in this publication. Crystal, carbon magnetic, dynamic and ribbon types are listed along with accessories and replacement parts. Shure Bros., Inc.

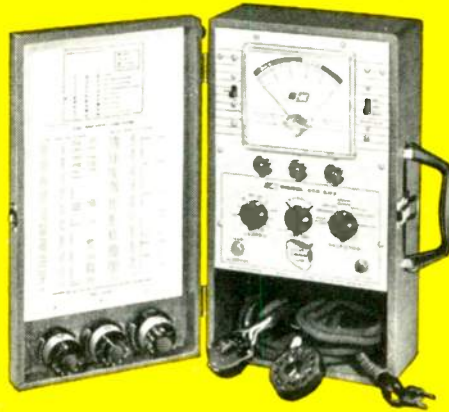
### ELECTRONIC CHEMICALS 312

A wide variety of chemicals designed for use in the electronic industry are listed in catalog #62. Many preparations are supplied in dispensers for quick, easy use. Chemtronics, Inc.

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 Public Address Catalog  Microphone Catalog

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# STEREO '63

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Newly developed Hi-Fi tubes provide higher power and less complicated circuitry in less chassis space

# AMPLIFIERS for Stereo

■ Stereo amplifiers now on the market take up less space than most of their equivalent-rated monophonic cousins. Engineering layout must be given a great deal of credit for this,

although the largest single element which has had its effect on the modern amplifier is new tubes. Special circuitry used with these new tubes offer the audiophile more for

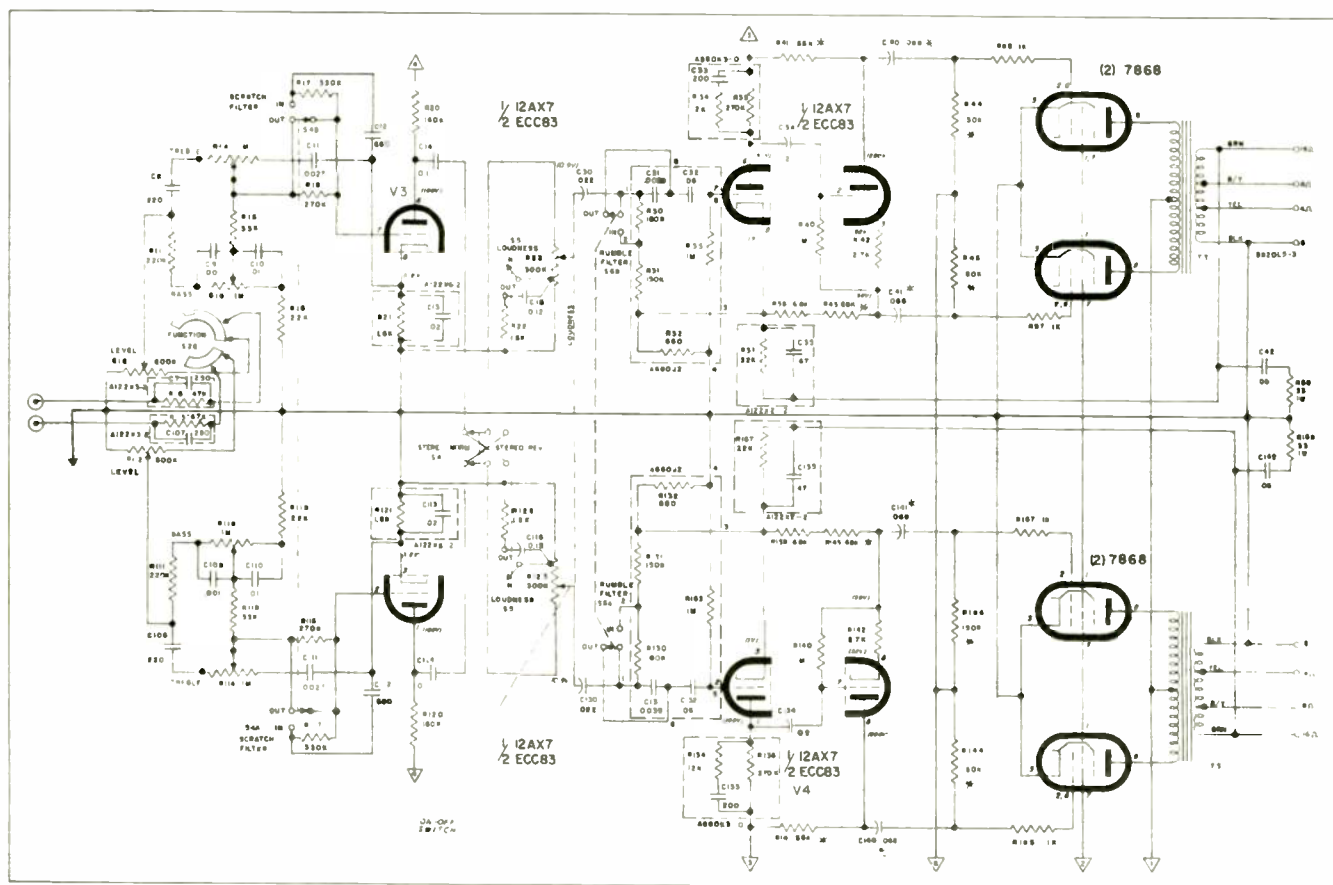


Fig. 1—Modified schematic of Sherwood's 80 w stereo amplifier shows simple approach avoids problems encountered with more "sophisticated" circuits.



his Hi-Fi dollar than ever before.

At the rate Hi-Fi manufacturers are now progressing, it seems reasonable to assume that one-unit, solid state, transformerless amplifiers will be offered in a few years.

### New Tubes

When Hi-Fi was still young in this country, a basic monophonic amplifier had no less than five tubes and some as many as seven or eight. Amplifiers with the same capability now use three tubes. The underlying reason is new high gain multi-section tubes and solid state rectifiers.

The most popular of these triode-pentodes is the 7199, similar to the 6AN8, which is being used by some Hi-Fi manufacturers. One section of this tube is used as a pentode voltage amplifier and the other section functions as a phase splitter.

More and more new miniature amplifier tubes are being packaged into one envelope. New output tubes have also been added to the list. Heading the list several years ago was the British KT66 and the American equivalent, the 6L6G. Both of these tubes did a very good job and still perform quite well in amplifiers up to 20 w. Arguments between engineer and audiophile raged about the relative merits of each tube. Although they are electrically almost identical, the 6V6GT was used then, as it is now, for low power amplifiers up to about 10 w in push-pull.

New output tubes have been built with the primary goal of increasing output power without increasing the total number of tubes. The first of the high power tubes were the 6650s and KT88s, which develop up to 100 w in push pull. The EL84/6BQ5 is used widely in low power amplifiers. Each develop a clean 15 w and fill the gap between the 10 and 20 w tubes.

The EL34 and KT77 handles up to 70 w per pair with ease. These tubes are very popular in high power stereo amplifiers.

The 7591 is also gaining wide acceptance and is capable of 30 w in push-pull. The trend in stereo amplifier power is leveling off, with most audiophiles settling for between 50 and 60 w total power from both channels.

The basic difference between high gain voltage amplifier tubes is special filament construction. Spiral heaters minimize hum and special construction permits operating the filaments at a lower voltage for hum reduction.

A few years ago audiophiles discovered the advantages of employing heater voltages on the 12AX7

and similar tubes. Slight reductions in the filament voltage supplied to the tubes greatly reduced the hum at no appreciable loss in tube gain.

### An Over-All View

A typical Hi-Fi stereo amplifier schematic is shown in Fig. 1. A standard output system is used as opposed to the ultra linear out-

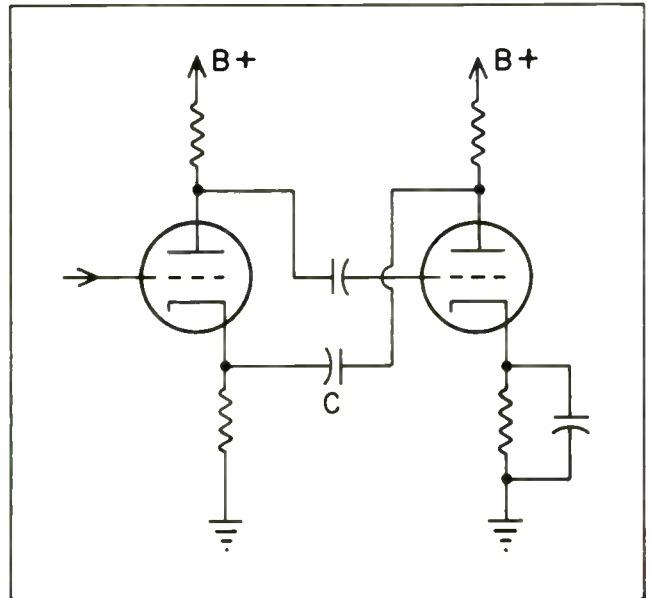


Fig. 2—Simplified diagram of tone circuit used in some amplifiers. Capacitor C is tuned with an in-circuit potentiometer (not shown).

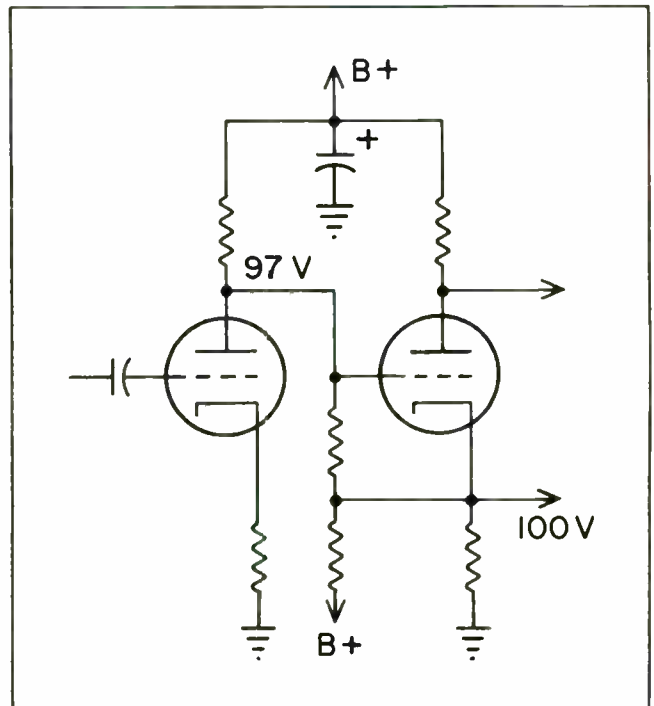


Fig. 3—Direct coupled amplifier stages extend bass response to d-c.

# AMPLIFIERS for Stereo

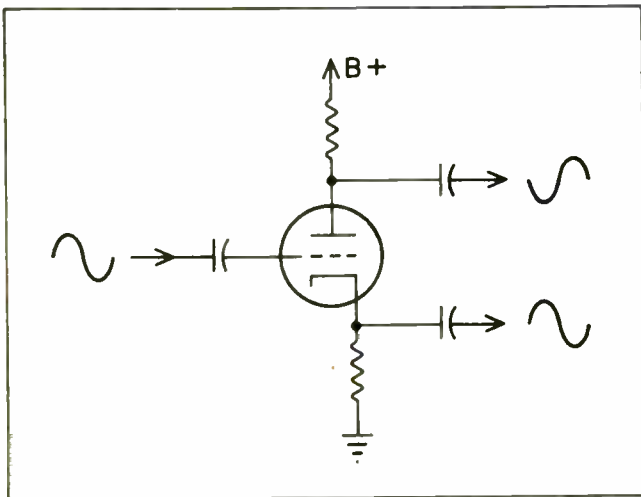


Fig. 4 — Simplified phase splitter (concertina) is very popular with Hi-Fi manufacturers.

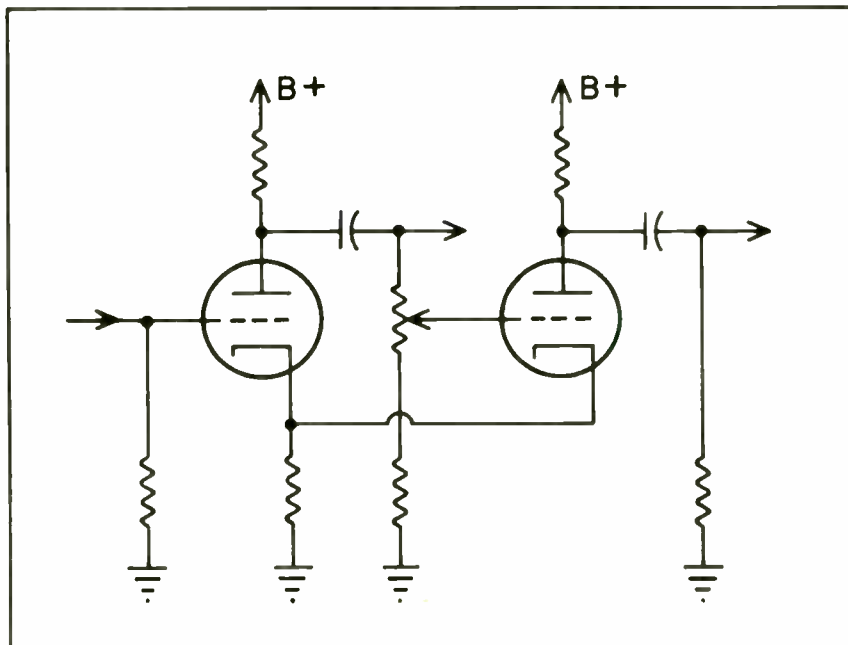


Fig. 5—Cathode coupled phase splitter increases amplifier expense but is very stable and distortion free.

put which was popular a few years ago. Excellent linearity is achieved through generous feedback from the secondary of the output transformer.

Using feedback in this manner also increases the damping factor which assures a good transient response. The damping factor of an amplifier depends greatly on the impedance which the amplifier is working into. This is not the rated impedance of the speaker, but the actual impedance of the system where damping plays an important part: in the bass region. At resonance, the loudspeaker's impedance may increase six times.

The damping factor may be calculated by dividing the actual output load into the plate impedance of the output tubes. Typical factors range from 2 to 20.

When triodes are used in the output stage, the damping factor takes on less importance because the triode tends to cancel any increase in output in the bass region. With sufficient feedback, however, the pentode's damping factor is excellent. Negative feedback also increases the amplifier's stability, although at the price of a decrease in the over-all gain.

Other methods used to cope with amplifier instability include decoupling between stages. Decoupling networks are used freely in Hi-Fi amplifiers and layout of components is often very critical.

Tone compensation methods employed in many amplifiers now on the market use feedback. A typical circuit is shown in Fig. 2. The capacitor (or other tuned components) in series with the feedback loop acts as a selective filter which attenuates high frequencies—effectively boosting bass frequencies.

Since the feedback in this type of tone compensation is tied to the voltage amplifier cathodes, a bypass capacitor cannot be used. This may be desirable since this also adds a certain amount of negative feedback, but decoupling the cathode then becomes impossible.

Bass frequency response in the audio amplifier is largely dependent on the coupling network used be-

tween stages. To minimize losses encountered when large coupling capacitors are used, direct coupling is often employed. A direct coupling system is shown in Fig. 3. When this coupling method is used, cathodes of the following tubes have to be elevated to a point which will allow the tube to develop sufficient bias.

### The Phase Splitter and Output Stage

A typical "concertina" type phase splitter or paraphase amplifier is shown in Fig. 4. You will note that the lower half of the stage resembles a cathode follower and the upper half resembles the standard common ground amplifier. Actually, the load for the phasesplitter is, "split" between the cathode and plate.

In this manner, the tube has two outputs: one in phase with the input (the cathode) and one 180 degrees out of phase with the input.

In practice, many Hi-Fi manufacturers use more complex methods to produce two outputs which are needed to drive the output tubes. A typical system is shown in Fig 5. Each system type has a distinct advantage, even if it is only economy. Systems employing two stages usually have a greater gain than single stage phase splitters and are often self balancing.

Hum is frequently encountered in simple phase splitter circuits. One method used to eliminate hum is shown in Fig. 6. A basic concertina phase splitter is used, but the tube heater is elevated to minimize hum-producing effects caused from heater-to-cathode induced voltage.

The trend in most modern stereo and Hi-Fi amplifiers is to employ the single stage splitter. The floating phase splitter is limited in its high frequency response and others become unbalanced quite easily. Manufacturers' choice is usually dependent on the driving power required by the output tubes. For low drive requirements, the standard concertina circuit is most often used. For high drive requirements, the cathode coupled circuit seems best suited.

In either case, particularly the concertina circuit, the amplitude to

the phase splitter input should not be increased beyond its design limitations. Gross harmonic distortion will result.

Push-pull amplification is invariably used in Hi-Fi equipment to minimize distortion and cancel self generated hum and noise. Distortion is

minimized, and all even harmonics are canceled in the push-pull output.

Certain modern transistor types have characteristics which are very well suited to Hi-Fi amplifiers, but cost seems to have them out of the running at present. ■

CHART I					
B739	12A7 6060 6201 6679	ECC82 ECC83 ECC85	12AU7 12AX7 6AQ8	HBC90 HL92 HY90	12AT6 50C5 35W4
B749	12AU7 5814 6067 6189 6680	ECC8015 ECC8025	6201 6060 6067 6189	GZ34 KT66	5AR4 5U4G 6CN5 6L6 6L6G 1614 1622 5932 5881 7027
B759	12AX7 5721 5751 6057 6681 7025 7247	ECF80 ECF82 EF41 EF85	6BL8 6U8 6CJ5 6BY7		
EAA-EB91	6AL5	EF94 EK90	6AU6 6BE6	KT77	6CA7 6L6GB 7581
EAA91	6AL5	EL34	6AC7		
E591	6AL5	EL37	6L6/6L6GB 5881	KT88	6L6GC 6550 7027A
EC90	6C4	EL84	6BQ5	M8136	6189 12AU7WA M8162 12AT7WA
ECC35	6FY5	EL90	6AQ5		
EC97	6SG7 6SL7GT	EZ81	6AC4		
ECC81	12AT7	G230	5Z4 5Y3	N709	6BQ5

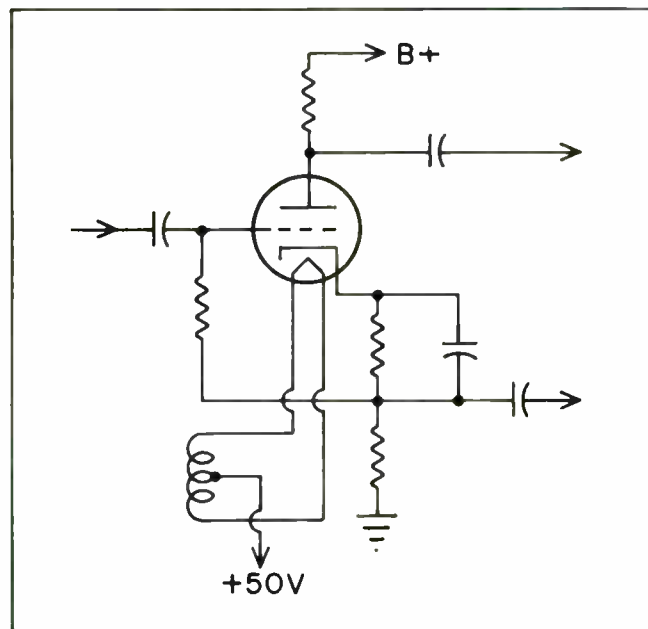
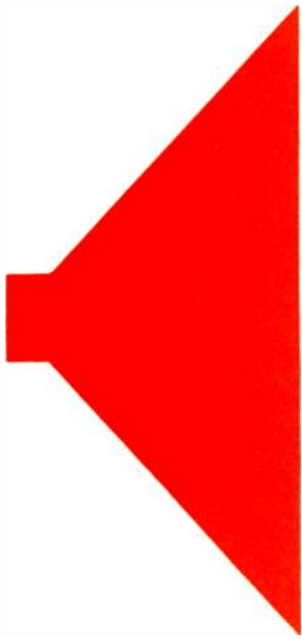


Fig. 6—Hum pickup in phase splitter circuits is a perpetual problem. Specially designed tube filaments and superimposed positive voltages on the filaments, reduce filament induced hum.



# Speakers for Stereo Listening

Help your customer select a satisfactory speaker system and pave the way for a successful stereo business

■ Loudspeakers, as with other Hi-Fi components, have gone back to the drawing boards for stereo revisions. The change in the quality of sound, however, has been slight. Emphasis in redesign has been placed on building smaller enclosures and with wide dispersion angles.

Speaker manufacturers have been fortunate in gaining public acceptance of the third stereo channel which supplies bass for both channels. Most service shops, however, seem slow to get on the stereo band wagon. The average stereo owner grows unhappy with his present system soon after each new addition, so it's up to you to modify and sell new components to these customers.

Speakers are not only profitable items to sell system owners, but even the non-critical listener will be able to appreciate the improvement with a better speaker or speaker system.

## Stereo Speaker System

Since monophonic systems preceded stereo by almost a decade, many stereo systems now in use were converted with add-on speakers. The second speaker in these systems usually leaves the true audiophile a little cold to stereo. The

add-on unit probably sounds a little "tinny" to his ear and the "hole in the middle" is bothersome when the speakers are widely separated. If the basic speaker system is properly chosen this can often be easily corrected with little expense to the owner.

To help the owner correct his system, the technician must first understand the principles of stereo distribution and popular speaker systems being used in the average audiophile home.

Speaker placement is the most important single factor to consider when installing or troubleshooting stereo. Similar situations will rarely be encountered because of room size, shape, furniture position and sound absorbent materials in the room. Some possible combinations which may be necessary in different rooms are shown in Fig. 1.

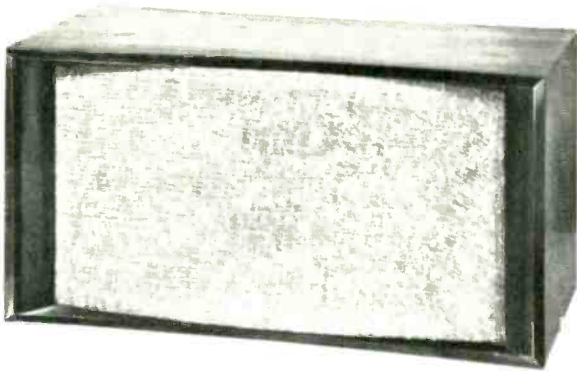
Stereo speaker systems have the same general requirements as speakers in a monophonic system. If a good basic monophonic speaker system is already installed, however, there is no need to duplicate it. Some hi-fi specialists take the opposite view. They hold that duplicate speaker systems tend to blend the two channels and decrease apparent separation. Furthermore, they add, including bass coverage on the sec-

ond speaker system is of no real value. Frequencies above 400 cps are relatively non-directional and add very little to the stereo effect.

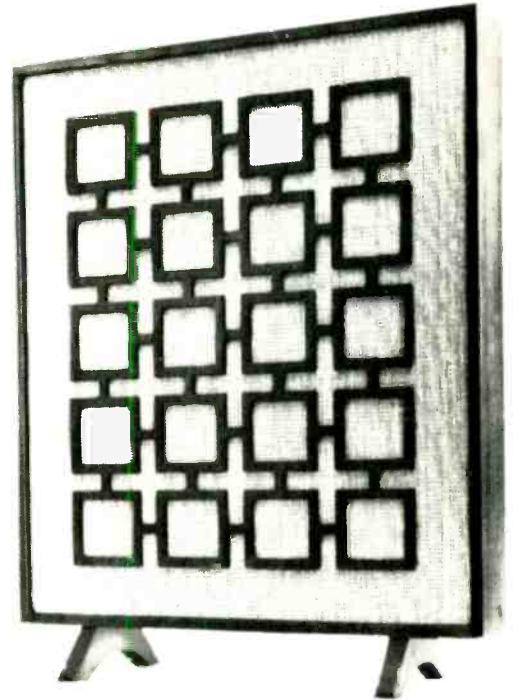
Some typical methods for converting monophonic speaker systems to stereo appear in Fig. 2. Systems which use more than one speaker location for monophonic sound are usually not too effective. A soloist will often sound like a duet or as if the singer's position changes as pitch changes. This is caused by different responses of the two systems.

If the system is a converted type, it is best to use only the original unit when playing monophonic material. This may be made even more advantageous if the room is small and the "center" speaker can be located adjacent to the monophonic speaker system since most existing monophonic systems need better bass reproduction.

In the final analysis, the customer almost invariably selects the individual speakers and the system type that fits a compromise between desires and his pocketbook. At least one speaker manufacturer offers to rent his speaker system for one week at one dollar. The dealer participating in this plan is paid an additional amount for his trouble by the manufacturer. The manu-



Wide range speaker system is typical of the shelf types available.



Sonoteer built by Rek-O-Kut/Audax shows trend toward smaller, thinner speaker systems. Front-to-back dimension is only 4 in.



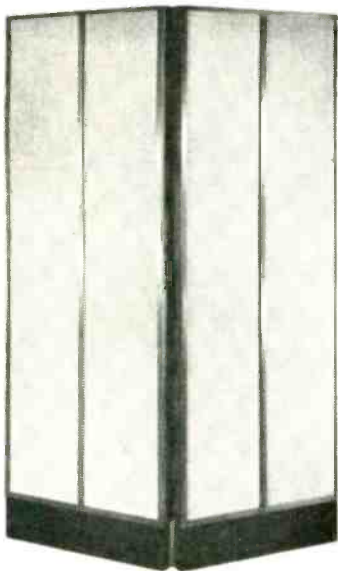
Styling trend in speakers is unlimited as shown by Sherwood's SR3W. Almost every decor can be matched with one of the available styles.



Stephens Trusonic speakers now carry a lifetime guarantee. The tweeter used in this speaker is available separately with gold mounting ring for either external or internal mounting.



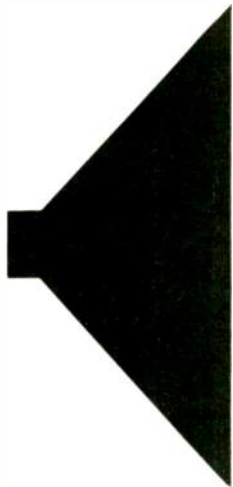
Free-cone tweeter by Altec is said to provide optimum distribution. A capacitor is built into the unit for proper crossover.



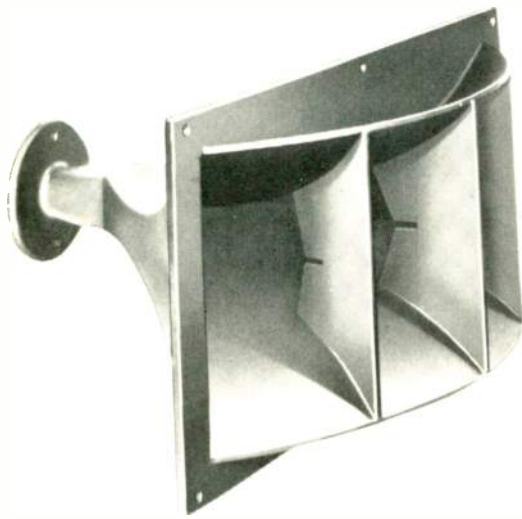
All electrostatic speaker systems by KLH has 28 ft of radiating area on each half of the stereo pair. The unit stands almost 6 ft high and comes complete with additional amplifiers used with electrostatic speakers.



Heathkit's Legato is another example of the wide range of styling available in speaker enclosures.



# Speakers for Stereo Listening



Sectorial horn design used in Altec's tweeter gives good wide angle dispersion.

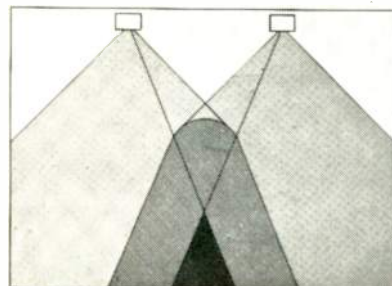
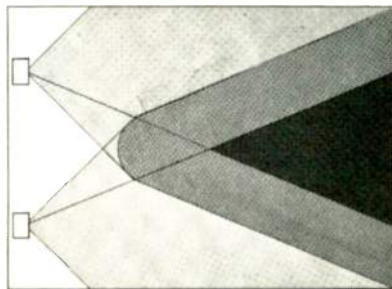
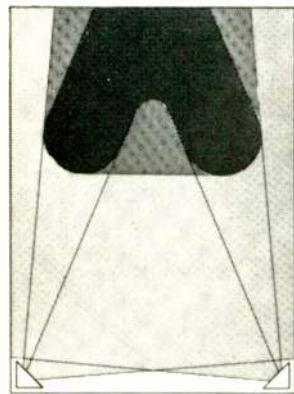


Fig. 1—Some speaker combinations for stereo listening in rooms with different sitting arrangements. Dark area is best stereo and medium shade is "fringe" stereo.

facturer says customers feel no qualms about returning the system if they decide not to buy since they feel rent has been paid.

## Selecting a Speaker

A showroom is an invaluable tool for selling Hi-Fi equipment of all kinds. A relatively small area is needed, so you may consider using less space for TV sales and using the difference for Hi-Fi sales. Unlike TV, however, the showroom or show area must be properly laid out and must have certain acoustic properties.

If possible, the show area should be as nearly like the average living or listening room as possible. That is, about the same size and with the same ratio of hard and soft materials to absorb and reflect the sound. Plaster and similar walls can be deadened with draperies. Some manufacturers provide the dealer with draperies — bearing manufacturers' insignia or other advertisement—at little or no cost. Stuffed chairs will serve two purposes: Sound absorption and a seat for the potential buyer.

The room should have a relaxed atmosphere. Rushing the customer into a sale will probably end up in a loss of future sales. The customer has the right to listen until he is sure of his purchase. If necessary loan him a system for a short time so he may judge in his own home with his own type of material.

### CHART 1

#### Frequency Response

White	300 - 3000 cps
Red	180 - 5000 cps
Orange	120 - 7000 cps
Gray	90 - 10,000 cps
Blue	65 - 12,000 cps
Violet	45 - 14,000 cps
Brown	35 - 16,000 cps
Gold	20 - 20,000 cps
Dot	0.5 mw
Circle	2 mw
Bar	10 mw
Triangle	50 mw
Diamond	200 mw
Star	1 w
Jewel	5 w

Courtesy of Walsh Engineering Company

The potential customer should be encouraged to listen to several speaker systems — as many as practical. He should be discouraged from thinking in terms of price only, since, some very good units are very reasonably priced. Various systems will sound different and few people will agree on which is best. The best, of course, is the system which sounds best to the purchaser. Ask the customer to select two or three speakers for a later choice.

No effort should be made to speed up closing of a sale. Request the prospect to return to the showroom as early as possible on a subsequent day. The ears are more sensitive to high frequencies than. Demonstrate speakers previously chosen and suggest the most desirable one be selected. The customer should be critical of the one selected. Boominess in bass, "hangover" of sharp or short duration sounds (transients) should be pointed out as undesirable characteristics. A natural quality in voices should be pointed out as desirable speaker characteristics. Many persons complain that voices "hiss"—this is a natural tendency and to the surprise of many, is really present in ordinary speech.

If the customer is unsure about his choice, tell him to forget about the speaker and attend a "live" presentation. If he plans to listen primarily to concert music, then he should go to a concert. If he likes Hillbilly music then any "honky-tonk" should do. If a PA system is used, he should discount the listening test. Much coloration is added in this type of re-broadcast.

Tell your prospect to place the live presentation firmly in his mind; if necessary have him return to the live performance and listen again. On his third visit to the Hi-Fi showroom he will be ready to buy or try. If the reproduction does not approach his ideas of the real thing, start over again.

Remind the customer how the orchestra, vocalist, band, etc. sounded. Stereo should be natural—not widely separated.

And finally, be reasonable with your customers. Help them select a speaker system they will be happy

with. It's your assurance that you will have a customer for new and better equipment at a later date.

### Enclosures

Infinite baffle, bass reflex, acoustic suspension, folded horn and labyrinth type enclosures used in monophonic reproduction are still found in stereo systems. In the interest of size, however, the infinite baffle has given way to the bass reflex. Folded horns and labyrinth enclosures are being used in the basic monophonic system, where add-ons were used, but the helmoltz resonator, acoustic suspension, and similar small enclosures are being used on new component stereo systems and for quality add-on units. Some enclosure designs are illustrated here.

The general layout of the room may have some bearing on the type of speaker system chosen. For example, if the room in question lends itself well to corner speakers, then the corner horn or other similar corner enclosures should be considered.

Speaker manufacturers will recommend the type of enclosure which best matches the speaker. Don't haphazardly interchange speakers. The resulting sound may be little better than a \$15 table radio. A speaker in an infinite baffle enclosure, however, will probably sound better in a larger "infinite" baffle enclosure. Bass reflex enclosures must be matched to the speaker by port opening adjustments. Acoustic suspension speaker enclosures use special speakers and cannot be interchanged without serious drawbacks. Horns and labyrinth enclosures usually extend and smooth the low end of a speaker's response but must be designed

for specific speaker ranges and resonances.

A simplified rating system which can be understood by the layman was introduced recently at the Electronic Industries Association's Loudspeaker Industry Meeting. The system involves the use of a colored symbol and a number. The color of the symbol would indicate the speaker's frequency range; the symbol's shape, power handling capacity and designates its power handling capacity and number of symbols, its General Performance Number (GPN), which would be a sum of several other factors.

The meaning of each of these is given in Chart I. Institution of this system should go a long way in helping the layman and technician alike in rating a speaker. ■



Hartley Products' loudspeaker uses a patented system called Magnetic Suspension. In place of "spider" cone centering mechanisms, the magnet's force is employed to center the cone. Response is 20 to 20,000 cps.

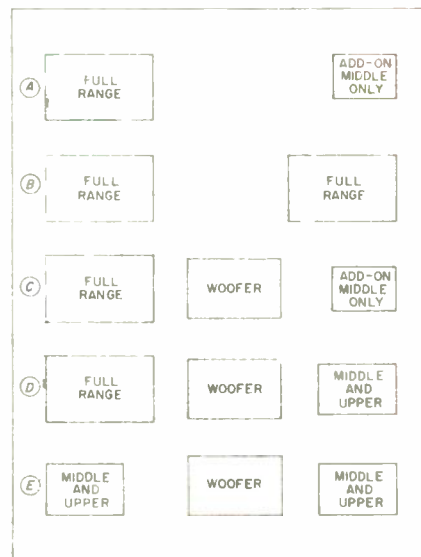


Fig. 2 (A)—Addition of middle range speaker is simplest method of converting a monophonic system to stereo. (B)—Two full range speakers are not recommended for stereo. Expense and "hole in the middle" are major objections. (C)—Effective method for eliminating "hole in the middle" effect is inexpensive since only a mid-range unit is used for one channel. (D)—Most popular conversion method offers optimal results at minimum expense. (E)—Method used by most new equipment stereo manufacturers is very effective. If Channel speakers are located near each other, woofer may be situated near monophonic channel to reinforce bass.

# SOLVING —

## Stereo and Hi-Fi

### Installation Problems

An orderly Hi-Fi installation gives the customer confidence in you and his equipment

■ Installing a Hi-Fi or stereo can be as simple as installing a refrigerator (and equally as cumbersome) or as complex as a studio set up. A package type system usually simplifies an installation, but it is impossible to predict necessary adjustments, or other troubles which almost invariably crop up.

The secret in preventing and eliminating these headaches, however, assuming that the proper selection of equipment was made—is to be thoroughly familiar with what can happen and how to correct it.

#### Installation

The layout of the living room and the “little lady’s” personal prefer-

ences as to where the system will *look* best will affect your job. Unless it’s impossible to achieve good sound in a selected position, you have to make it fit. The chances are better than even that the area for the stereo or Hi-Fi was picked out before the system was purchased. If you’re given a choice or asked your recommendations, you must be able to pick the spot with considered authority.

Monophonic systems rarely present the problems that stereo systems do. And generally, stereo principles can be applied to monophonic systems. The exception, of course, is speaker and seating arrangements conducive to good stereo. For the most part, stereo can be considered

to be two monophonic channels, and the monophonic system equivalent to one-half of the stereo set up. Keep this in mind when troubleshooting stereo; think one channel at a time.

You should be able to judge the size of the room where the Hi-Fi is to be installed for a check on the power which will be necessary to produce good music. Several factors must be taken into consideration: Size of room, acoustic materials in the room and speaker efficiency. The larger the room, the more power will be needed. If the room is plush with a thick carpet, draperies along windows and walls and overstuffed chairs, even more power will be necessary. Speakers may have an



Coffee table in this 18th century study houses the main controls and record player. Stereo speakers are located at the extreme left.

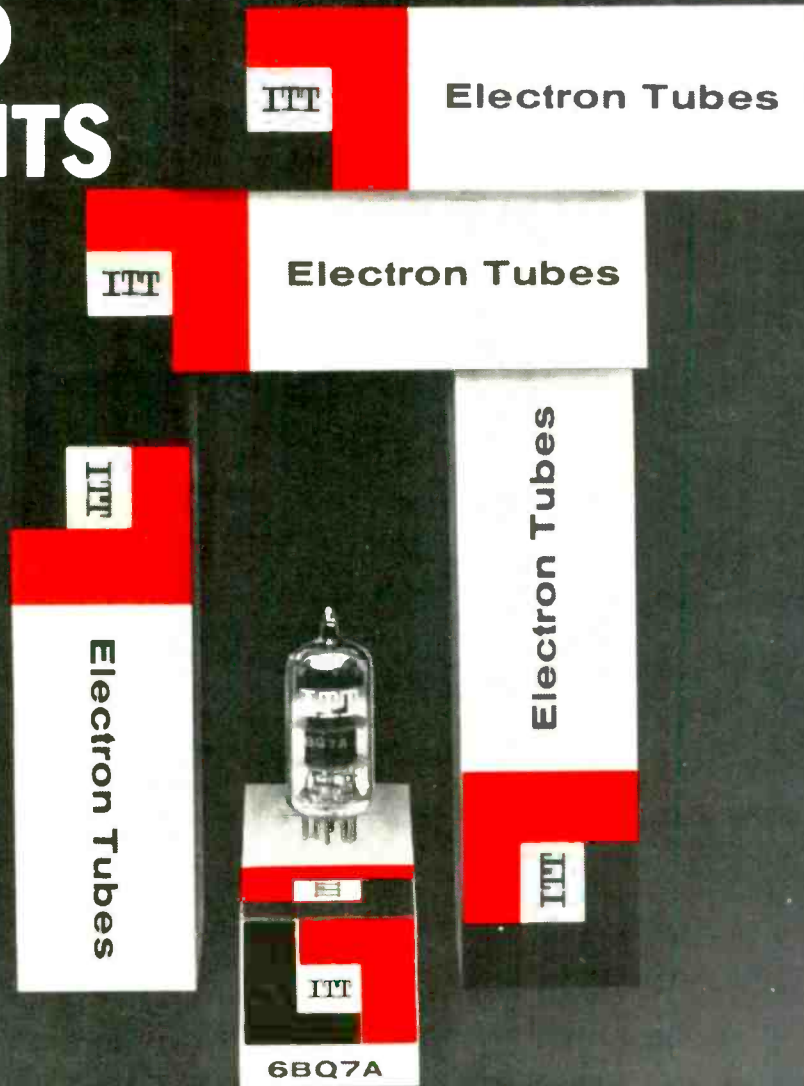


Contemporary living room emphasizes the Hi-Fi system by “showing” it in a glass case.



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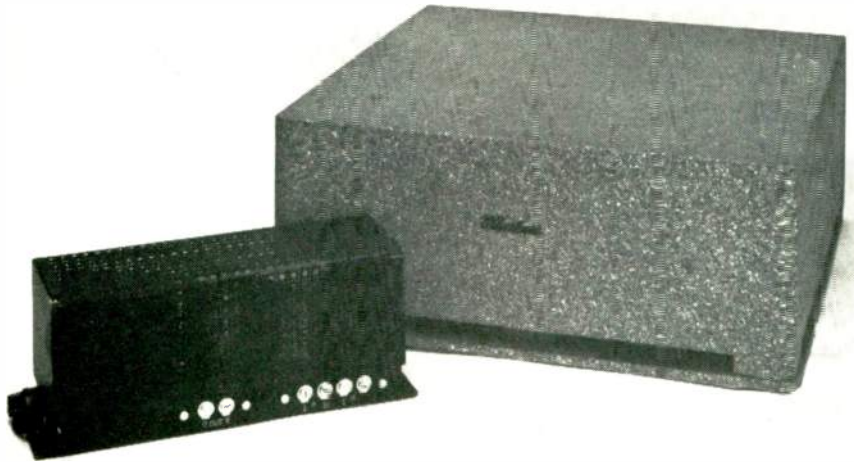
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# Stereo and Hi-Fi Installation Problems



Weather's bass center-channel speaker can be conveniently tucked under a chair, table or couch. The amplifier-crossover shown is completely transistorized.



Provincial styling uses oiled walnut finished cabinets which can be moved and are concealed when the system is not in use.

efficiency of 20 percent or may be as low as 2 or 3 percent. Good quality speaker systems may be found throughout this efficiency range; efficiency is not related to speaker performance except that it is necessary to supply the low efficiency units with more power to achieve the same db equivalent of higher efficiency units.

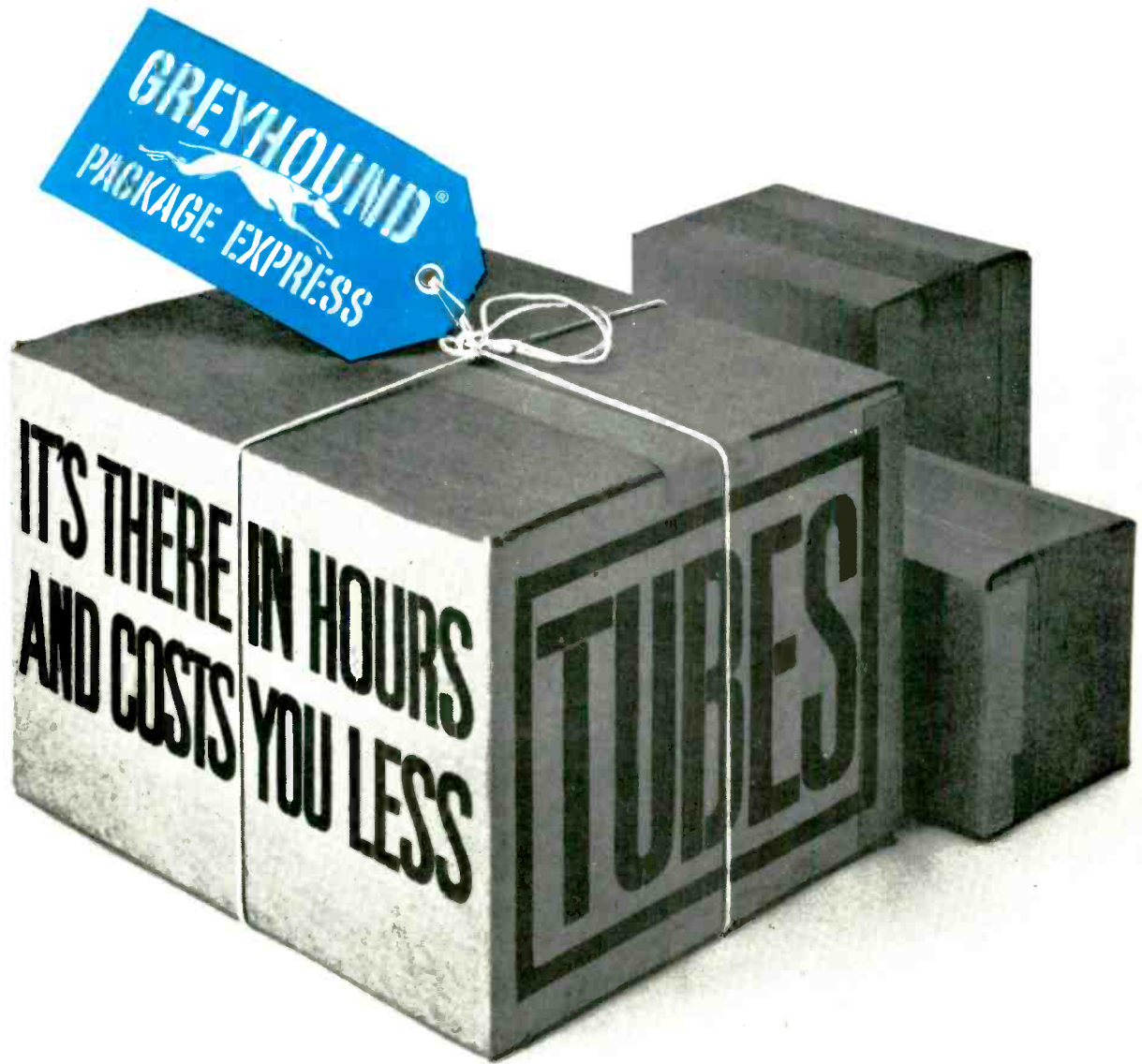
Chart 1 gives required range of power for a monophonic system or for both channels of a stereo system. If only one speaker system is to be used for monophonic reproduction in a stereo set-up, however, the power of that channel should be as great as the necessary total. If this is not practical, a switching arrangement to connect both amplifier channels to the single system should be arranged.

Another thought to keep in mind is acoustic isolation of low level stages from the speaker output. The amplifier or turntable, for example, should never be placed on the speaker enclosure. The same equipment rack for housing speakers and components should also be avoided where possible.

## Intercabling

When sloppy wiring techniques are used in a Hi-Fi installation the satisfaction gained from using the system is decreased. Although the sound may be as good as another system which is neatly cabled and harnessed, the layman has doubts. Don't let these doubts develop. It's just as simple to install the wiring in a neat fashion and a lot easier to troubleshoot should the occasion arise.

After the components are arranged in a manner dictated by the shelves, cabinets or tables, the shield hookup wire should be cut to length and fitted with phono



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# Installation Problems

plugs. Leave a little extra wire to allow movement of the components for cleaning and minor repairs.

When all the wires have been connected to the power units, use one of the many methods available to harness the wires. On a simple turntable-amplifier-speaker arrangement this will not be necessary. On more complex stereo systems that have more than one program source, however, it is almost imperative.

Wires to the speaker should be about 18 gage—standard lamp cord wire. If the wire can be run under a carpet, twin lead used for TV and f-m antenna feed lines can be employed.

Interconnecting power to the system can cause hum if certain precautions are not observed. The amplifier and one program source should be plugged into an a-c re-

ceptacle while the hum content is noted either by ear, or better still, by an a-c meter across the speaker terminals while using no program material. If an f-m tuner is used for an input, tune it to a vacant spot on the dial. Boost the bass so the hum can be more easily measured.

Now change both of the power input plugs to each of the remaining three possible positions. Leave the plugs in the position where minimum hum is noticed and mark them with tape (or similar means) for future reference. As each new component is connected to the system reverse its plug and leave it at the position which gives the least hum.

Unusually large amounts of hum can frequently be traced to an open shield connection in the signal wiring.

After these preliminaries are over, hum-pots should be adjusted

for minimum hum. Again, a meter is the best method to detect hum level at the speakers.

## Customer Instructions

To gain the most satisfaction from Hi-Fi equipment, the owner should be briefed on proper adjustment of operator controls and should not be afraid to use them. In stereo equipment, the most used adjustment will be the balance control. When the balance control is not properly set, stereo is lost.

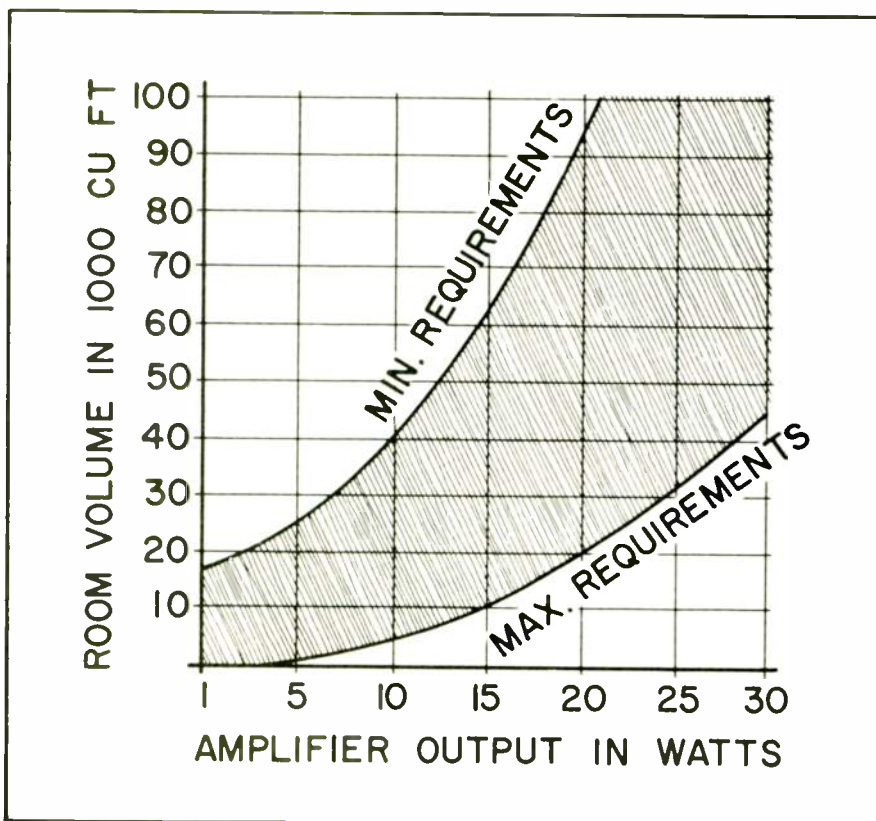
Adjusting the balance control varies the amount of signal applied to the left or right channel. The final adjustment will depend on the seating arrangement and will require trial and error balancing and listening.

The customer should be instructed to use the tone controls freely if he wishes to get maximum enjoyment from his equipment. Room acoustics, equipment variations and recording techniques all play a large part in sound quality. If the microphone was placed too far from the bass in a particular composition, for example, the bass will have to be boosted to hear it in its proper perspective. The owner is the listener; he should not fear that the response is being destroyed by turning the tone controls. That's why they were installed on the equipment.

For the customer to achieve long-time appreciation of his equipment he should be warned about improper care of his record collection. Records should be stored vertically and should be wiped clean with a soft cloth made for the purpose *before every use*. A diamond stylus should be inspected regularly — about once a month for average use — to insure that no damage has taken place. A poor stylus ruins records and distorts the sound. Under average listening conditions, the stylus should be replaced yearly, or after approximately 1000 plays.

Indiscriminate component buying is probably the worst offender of Hi-Fi quality. It is also a waste of money. A cheap changer connected to high quality components, for instance, usually leads to unbearable rumble and distortions which can only be partially corrected with rumble filters. The end result is never as good as when less expensive components are used throughout. ■

CHART I





## are you replacing top quality tubes with identical top quality tubes?

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Next time you visit your distributor, look for the green and yellow box and ask about Ampliframe tubes for TV and other entertainment replacement applications. Amperex Electronic Corporation, 230 Duffy Avenue, Hicksville, L. I., N. Y.

In Canada: Philips Electron Devices Ltd., 116 Vanderhoof Ave., Toronto 17.

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The flyweight class is represented by the Weathers 66 record player. Flutter is less than 0.04 percent and wow is 0.02 percent. Rumble is said to be below 60 db. The platter is driven by a soft idler wheel.

# 'Inactive' Hi-Fi Components

A review of tone arms, lightweight and heavyweight platters



"Battleship" design of the Rek-O-Kut player is obvious. This unit has three speed lever control. A special belt is used to drive the platter.



Gray 208-5 tone arm is viscous-damped to prevent rapid movement of the arm but the damping system offers little resistance to slow movements. The tracking error on this particular arm is less than two degrees.



Objections to automatic tone arms were virtually eliminated by the new Rek-O-Kut system. Two motors are used to drive the system: one for the turntable and the other for the arm.

■ A few years ago, when Hi-Fi was getting under way, the big argument between manufacturers of changers and turntables was whether changers were as good as turntables. This was not exactly a good argument; especially at that time, when a good changer might not be as good as the poorest turntable.

Changer vs. transcription type tone arm debates took the same form. The tone arm battle has subsided leaving most manufacturers agreeing that dynamically balanced transcription arms are superior.

Now that most changer manufacturers have beefed-up their product and an argument could be justified, turn-table manufacturers have diverted attention from the original debate by cooking up an argument among themselves: Flyweight turntables versus heavyweights. And though it doesn't sound fair, each side has a valid argument.

## The Flyweight Case

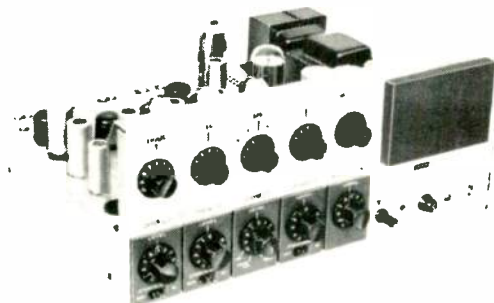
When it is necessary to move a small mass, only a small driving force is needed. Very light turntables now on the market utilize precision designed hysteresis synchronous motors in most cases to deliver smooth power to the turntable. Since small motors are used, a limited amount of mass is set into motion; the motor and other mechanisms being very light. Rubber wheels or drive belts are used to drive these and heavier turntables. The light weight of the entire assembly allows good platter isolation from floor vibration.

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# Sy says:



## Microphones — Part 1

There are four types of microphones commonly used in commercial/industrial applications — ceramic, crystal, dynamic and carbon. The technician should understand each of these, since they are not readily interchangeable.

The carbon microphone is the least understood, although it's actually the forerunner of all microphones. It consists of tightly packed carbon granules and a diaphragm which alternately compresses and loosens the carbon granules, varying the resistance of the carbon "button" in accordance with the sound pressure variations.

A carbon microphone requires a voltage source and a low-impedance input circuit. In high-impedance tube circuits, an input transformer must be provided to match the low microphone impedance to the grid-circuit.

Carbon microphones are characterized by their ruggedness, high output, and usually limited frequency range. All these characteristics have made it a favorite in the past on communication equipment, however, there are undesirable traits in all carbon type microphones such as carbon noise (hiss), granule coherence, non-linear response (distortion) and possible affects on carbon granules by excessive temperature or humidity. Because of these common faults and the fact that a carbon type microphone cannot be directly replaced by standard dynamic, crystal or ceramic units, Astatic is developing a transistor amplifier for use in our new mobile microphones which then will directly replace the carbon unit. In the meantime, we will still offer our 10M5A carbon microphone as we have for over 10 years.



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## The Heavyweight Case

Irregularities caused by vibration and line variations can be smoothed by large masses. Flywheel action is achieved in the heavyweights by weighted and balanced platters. Some "heavies" use hysteresis synchronous motors which are dependent on line frequency for stable speed, though it is more common to find a shaded four pole motor. Irregularities caused by the four pole motor speed are said, by the proponents of this system, to be eliminated by the inertia of the heavy platter.

The most popular drive system is still the idler wheel, but belt drives are gaining ground. It is felt by some manufacturers that the

belt drive further isolates the turntable from the motor.

## The Tone Arm

The dynamically balanced tone arm has gained wide acceptance by the audiophile for more reasons than its ability to play upside down. Vibrations and other forces acting on the tone arm which cause record skip and skating are greatly reduced. The arm also allows the stylus pressure to be significantly reduced. Tone arms now on the market allow tracking pressures as low as a fraction of a gram.

All of this means reduced distortion as well as less record and stylus wear.

*Continued on page 100*



The Dynaco B&O tone arm is designed to be used only with the Stereodyne pickup. The arm is completely dynamically balanced to minimize vibration effects and eliminate the need for turntable leveling.



Empire's tone arm is dynamically balanced in all directions. Tracking error on this arm is said to be 0.65 degrees. Pivots used are on ball bearings. Fundamental resonance is 8 cps.

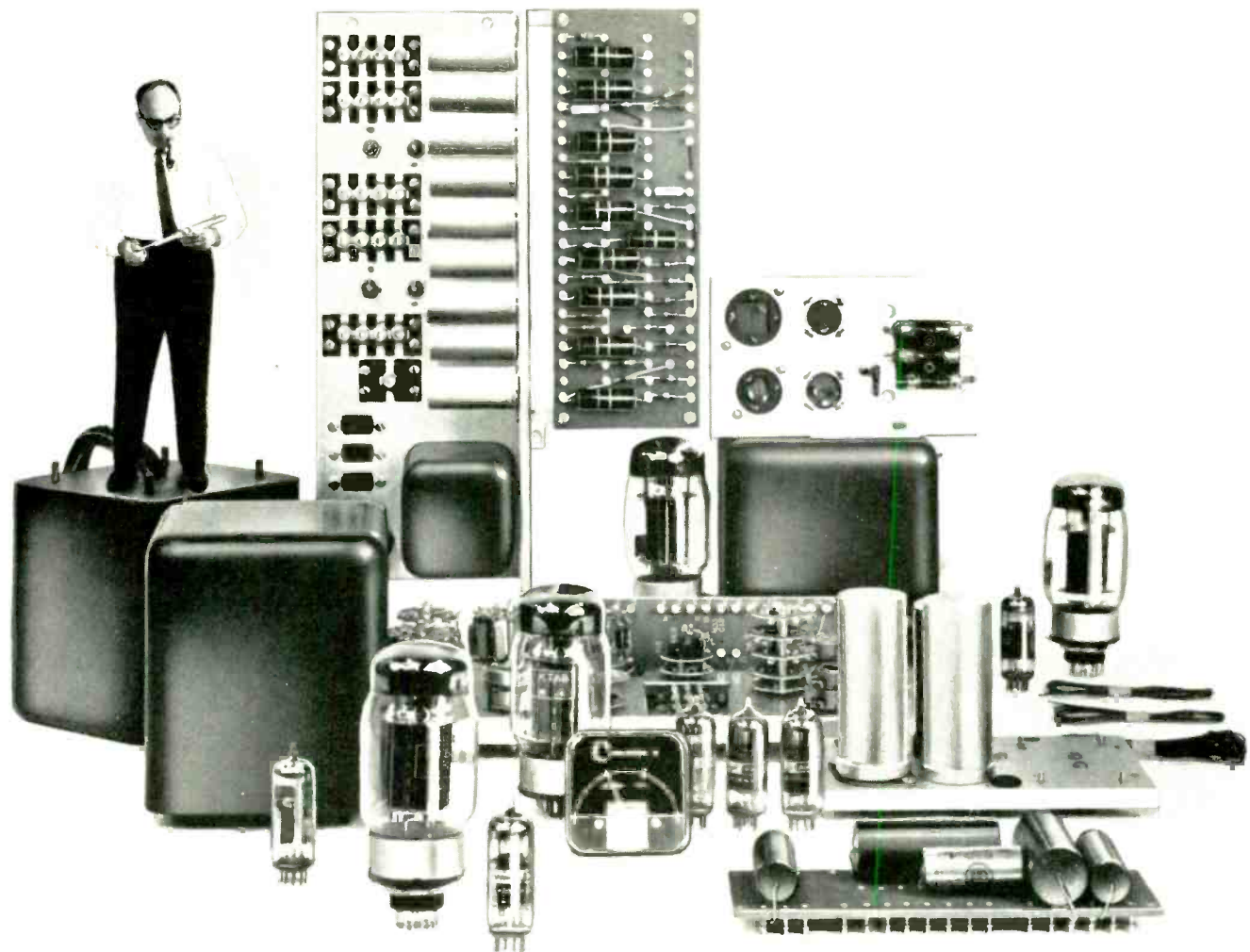


Model 200 Stanton Unipoise arm is said to track at as little as 1/4 gram. The entire moving assembly weighs only 6 oz. A calibrated stylus force adjustment is built-in for 0 to 3 grams pressure.



Newest Garrard changer uses a dynamically balanced tone arm. The changer intermixes all common record sizes and speeds.





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It is far more difficult to design a kit than to produce a completely manufactured product. In the plant the engineer can control his design from the moment of inception until the final packaging. The kit builder has only his tools, his ingenuity and little, if any, test equipment.

Therefore, the complex process of in-plant production and control which guarantees the fine finished product must somehow be *embedded* in the kit design. The Citation engineering group at Harman-Kardon, headed by Stewart Hege-man, has succeeded in doing just this in the design of all Citation instruments.

Heavy duty components, operating at tight tolerances, have been selected for the Citation Kits. As a result, even if every component is operated at its limit—remote as this possibility is—the instruments will perform well within their specifications.

Only Citation provides rigid terminal boards for mounting resistors and condensers. Once mounted, these components are

suspended tightly between turret lugs. Lead length is sharply defined. The uniform spacing of components and uniform lead length insure the overall stability of the unit.

Improper routing of leads, particularly long leads, can result in unstable performance. To prevent this, the Citation II is equipped with a template to construct a Cable Harness. The result: each wire is just the right length and in just the right place to achieve perfect performance.

To meet the special requirements of the Citation III X, FM Stereo tuner, a new tuner cartridge was developed. This embodies most of the critical tuner elements in one compact unit. The cartridge is completely assembled at the factory, totally shielded and perfectly aligned—eliminating the difficult problems of IF alignment, oscillator adjustment and lead definition.

All resistors and condensers have been uniformly mounted and labeled on special component cards to eliminate hunting through paper bags. All of the small parts have been packaged in cellophane bags which are mounted on cardboard for ease of identification and handling. The unique

Citation packaging techniques save much unnecessary time searching and sorting out parts.

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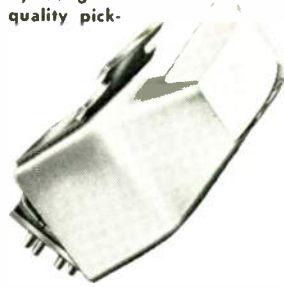
Citation III

HK-64

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The Stanton model 481 pickup tracks at only 1/4 gram in professional quality pickups.



Pickup made by Dynaco fits only their dynamically balanced tone arm.



Jensen Industries is one of many phonograph needle displays used by dealers to increase sales.

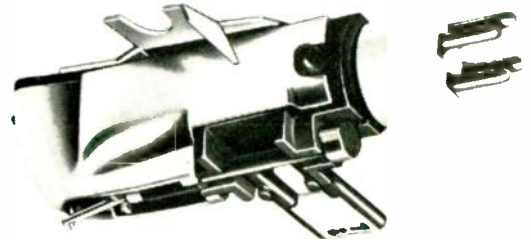
# Phono Cartridges and Styli

Stereo advances have upgraded pickup quality and extended life of styli



Benjamin's ELAC stereo cartridge is designed for conversion sales. The cartridge comes complete with mounted needle and one extra diamond for replacement purposes.

Sonotone's newest ceramic stereo cartridge has increased compliance and is said to have 30 db separation.



■ The impact improvement of stereo on Hi-Fi quality is more obvious in the phono cartridges than any other single system part. Increased frequency response, compliance, and tracking ability can be seen best in specifications listed in almost any Hi-Fi component catalog.

A pronounced decrease in stylus wear can be directly attributed to extremely light tracking pressures which new tone arms and cartridges have made practical.

## Specifications

Extremely light tracking abilities found in today's pickups can be primarily attributed to increased

cartridge compliance and to new tone arm design. Compliance is a measure of stylus ability to move freely. It can also be called the "yielding" quality of moving parts which suspend the stylus.

A cartridge with high compliance allows the stylus to move freely in the record groove and prevents skip and inter-groove vibration at light tracking pressures. The measure of compliance is given in dynes and directly equals the resistance which the stylus offers to movement. One pound of force is equal to  $4.448 \times 10^7$  dynes; more technically, a dyne is the force required to produce an acceleration of one cm/sec/sec on a one gram mass.

A typical compliance figure is  $8 \times 10^{-6}$  cm/sec/dyne. One cartridge now on the market claims a compliance of  $30 \times 10^{-6}$  cm/sec/dyne. The dynamic mass of that cartridge is only  $0.5 \times 10^{-3}$  grams.

Figures are given for vertical compliance in stereo cartridges, and lateral compliance in monophonic units.

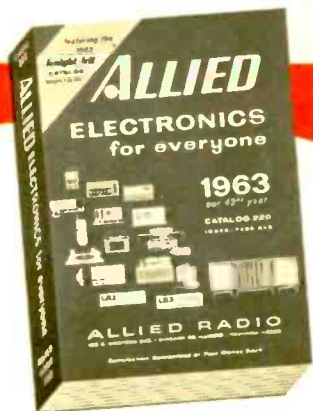
Channel separation, of course does not apply to monophonic pickups. As in stereo amplifiers, separation of stereo cartridges is given in db. This data is obtained by feeding a pure one-channel signal (a record modulated for one side only) and measuring the output from the other channel. Specifici-

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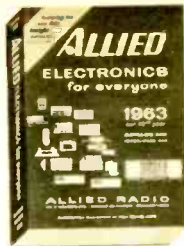
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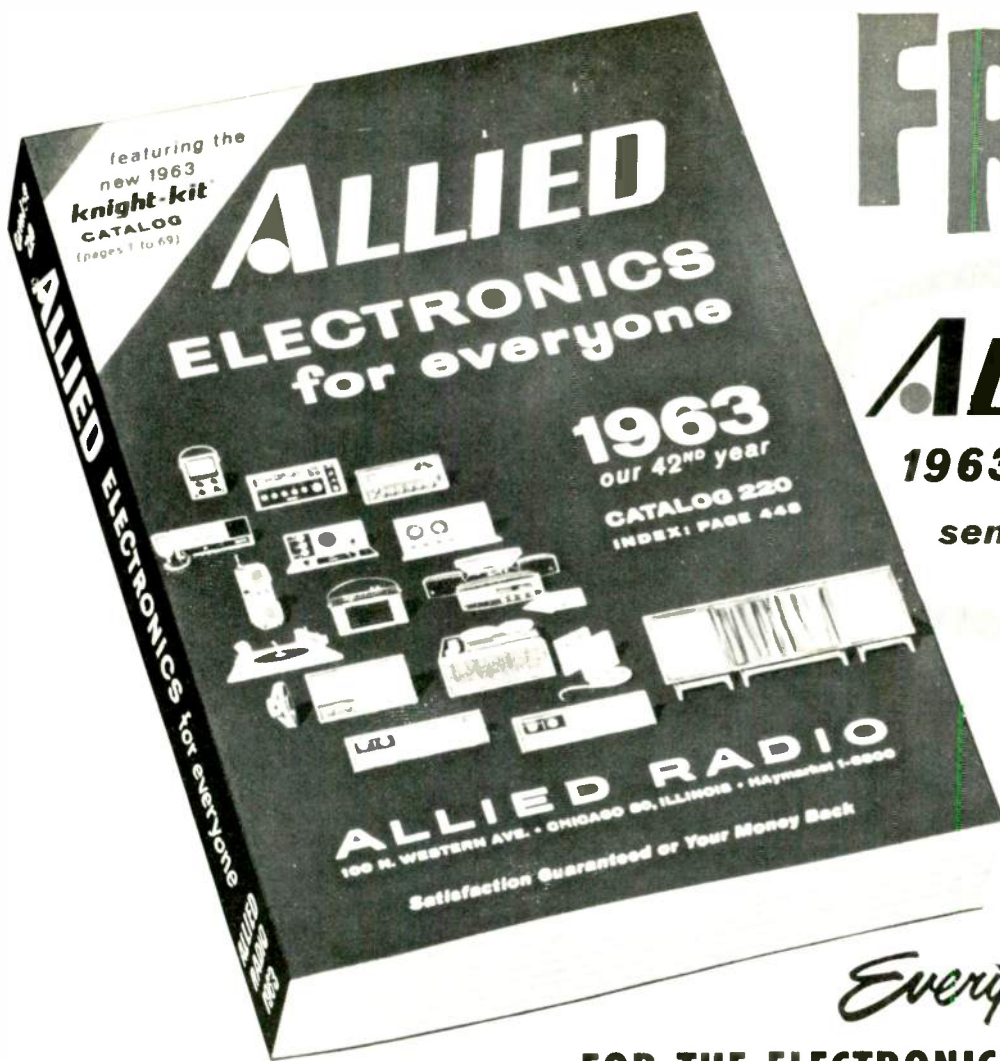
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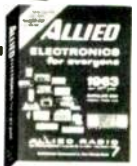
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ications state what frequency is used for this check (generally 1000 cps) and the separation usually decreases as the frequency increases. Typical separation of recent cartridges is between 10 and 30 db at 1000 cps.

Frequency response claims for recent cartridges range up to 10 to 50,000 cps. Most cartridge response specifications fall somewhere between 20 and 15,000 cps, however. The important consideration is output deviation for a constant input throughout this range. Figures are given in  $\pm$  db for a specific frequency range. Frequency response specifications vary widely from "flat, 20 to 20,000 cps" to " $\pm$  5 db 30 to 15,000 cps." As with most Hi-Fi components, however, the crucial test is listening to the pickup.

Sensitivity is usually not considered vital to the audiophile, since high gain, low noise preamps are almost universally adaptable for all but a few special pickups. The cartridge output impedance should be rigidly adhered to since the output may be increased in the most audible region and suffer greatly at the extreme ends of the audible spectrum.

At least one cartridge on the market utilizes a transformer to match its low impedance to the preamp. Still another uses a capacitive pickup which must be demodulated and amplified before it is fed to a standard preamp.

## The Stylus

Probably no component in Hi-Fi has received as much attention as the stylus. But a cloud of mystery surrounds it. Styli with tip radii of 3, 2, 1, 0.75, 0.7, and 0.5 mil, can be purchased at almost any record shop. Some tips are compromises for various record types. The proper stylus should be used only with the record for which it was designed, however — a compromise should not be used.

The three mil tip should be used with 78 rpm records only. Seven inch 45s should use 2 mil needles; later "extended play 45s" and 33 1/3 rpm records both use 1 mil styli. Talking book records (16 2/3 rpm) were designed to employ 0.5 mil styli.

Stereo developments have created considerable confusion regarding stylus selection. Manufacturers of both styli and records, have varying

opinions. If the majority is correct, however, the 0.5 mil stylus should be used for "stereo only." This stylus should not be used with monophonic records. The 0.7 and 0.75 mil tips can be used to play both monophonic and stereo records, but it is not highly recommended.

If styli with too large a tip is used to play a record, poor tracking, distortion, and increased record wear will result. An oversize tip causes the point to ride too high in the record groove. On the other hand, an undersized point causes distortion, poor tracking, increased noise, and exceptionally high record wear.

## Replacement

Changing diamond styli every year isn't logical. If a record player is used once a day for one record, then a total number of plays for the year would be 365. If the records are short, the total time may be as little as 80 or 100 hours — far short of a diamond needle's life when normal tracking pressures are used.

When the system is used every day to play two long selections, plus Saturday and Sunday, the total time may exceed 1200 hours — far beyond the normal life of a diamond stylus. The best "rule-of-thumb" seems to be a combination of checking the stylus regularly and keeping track of the approximate hours the unit played. Elapsed-time meters are available to measure the exact playing time.

The quality of styli available to the dealer is often cause for concern. What is the basic difference between a two dollar diamond tipped needle and one costing \$20?

Top quality diamond tipped styli have larger diamonds which are sometimes embedded in the shank of the assembly. Less expensive styli are only tip polished and are not usually secured as well to the shank as more expensive units. Under magnification, cement can often be seen on the sides of the less expensive types.

This should be thoroughly explained to the customer if you are going to handle both types of styli. If the customer has records which cannot be replaced, the more expensive stylus replacement is a must. ■

# This is where an investment in a Garrard Automatic Turntable pays off

Chances are that sooner or later more is spent on records than on any record player. More, it may be, than the cost of the entire music system. Listening enjoyment is dependent upon records and the unit that reproduces them. This is exactly why more GARRARD Type A's, for example, have been sold—and are being sold—than any other high fidelity record playing equipment, without regard to cost. Just consider this...

Most people today want to use one of the ultra-sensitive cartridges developed originally for separately-sold tone arms because of high compliance. Garrard has integrated precisely such an arm in the Type A Automatic Turntable—dynamically-balanced, counterweight adjusted, designed and built with the same precision, the same balance, the same freedom from friction, the same playback characteristics and low resonance. This arm, operating in conjunction with the Type A's heavy, full-size, non-magnetic turntable—a laboratory-balanced, double-shielded motor; and (when wanted) the gentlest automatic record-handling mechanism ever designed; rewards the listener with the full measure of the magnificent reproduction expected from the best recordings.

Garrard's Type A Automatic Turntable is proudly owned by a growing legion of highly critical people who, originally amazed at the \$79.50 price, have come to realize this completely integrated precision instrument could have been developed only by the Garrard Laboratories.

*For illustrated literature, write Dept. GM-552, Garrard Sales Corp., Port Washington, N. Y.*



Canadian inquiries to Chas. W. Pointon, Ltd., 66 Racine Road, Rexdale, Ontario — Territories other than U.S.A. and Canada to Garrard Engineering and Mfg. Co., Swindon, Wilts., England

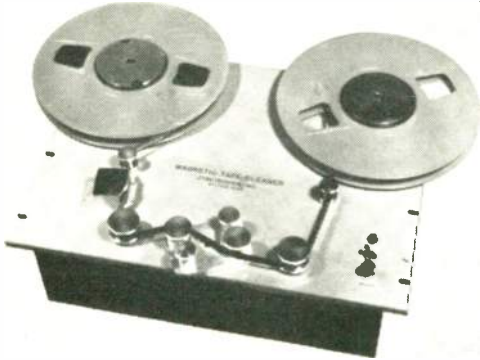
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Preamplifier-control unit for tape desk employs VU meter to assure optimum recording level for all material.



Viking playback tape deck is designed for use in custom installations or as an integral part of packaged recorders.



Cybertronics, Inc. markets a magnetic tape cleaner which can also double as a tape rewinder.

# STEREO RECORDS AND TAPES



"Packaged" stereo recorders are appearing in increasing numbers. Concertone's model 510 is an example of a complete high quality unit.

New tapes offer several advantages over discs, but it is the dealers responsibility to show 'both sides of the coin' to prospective purchasers of 'tape only' systems

■ Tape recording has come a long way in the last year or so. The tape cartridge is gaining wider acceptance almost daily and new developments in tape recording are offering genuine competition to the disc.

To the person who simply works on these machines, keeping up with all the new developments can be quite a task. It's a necessary task, however, if the service-dealer and technician are to sell or intelligently troubleshoot tape recorders now on the market.

## Multitrack Systems

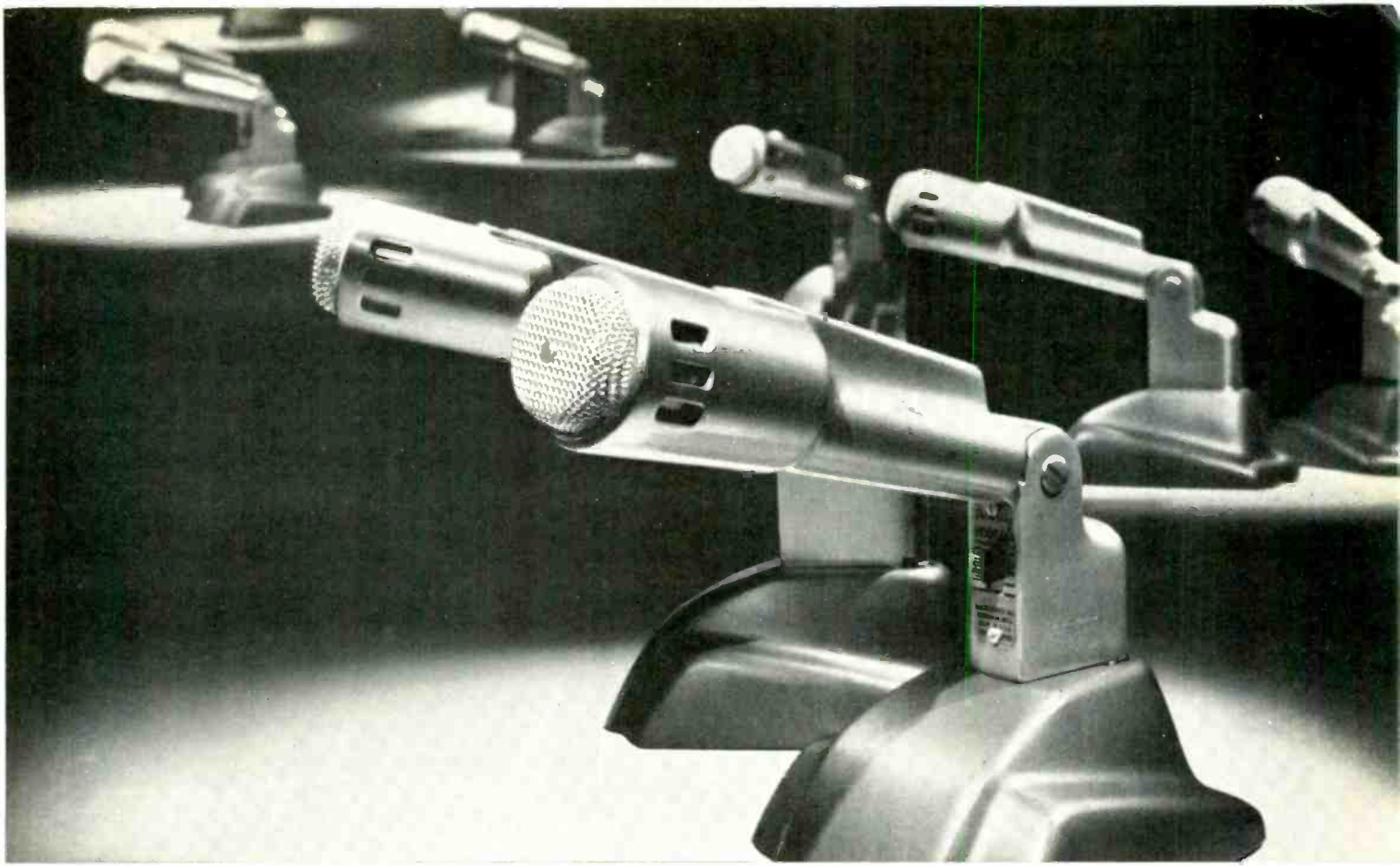
When tape recorders were first developed, the entire width of the tape was utilized to record and playback and the tape traveled only in one direction. This system is still used with very high quality tape systems in monophonic recording. Before the advent of popular stereo, however, smaller heads were built for the recorders and half of the 1/4 in.-wide tape was recorded in each direction. Tapes recorded in this

fashion could be played twice as long.

Older tape recorders were obsoleted or required extensive changes when the two track system became a "standard." Achieving the ability to print two completely separate channels of information side by side on 1/4 in. tape naturally opened the door for home stereo tapes. The system was short-lived because the four track system was yet to come.

The four track system simply doubled up the information.





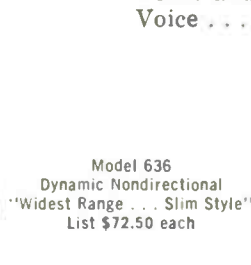
# **E-V** matched dynamic microphones take guesswork out of stereo recording

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**STEREO RECORDS  
AND TAPES**

With stereo, half of the reel is played in one direction and the other half in the opposite direction by reversing the tape.

The problem seems to be coming to a head since no manufacturer has yet suggested six or eight tracks on a standard tape. If one does, it could mean the end of an up-and-coming consumer product. Only two years ago the confusing variety of tape types on the market kept even those with tape machines away from the pre-recorded tape counters: Mono, stereo, two track, four track, reels and cartridges. As if this weren't enough to completely confuse the customer, he also had to consider speeds: 1 $\frac{7}{8}$ , 3 $\frac{3}{4}$ , 7 $\frac{1}{2}$  and in some cases 15 in./sec.

Standard pre-recorded stereo tapes now available are almost entirely four track recorded at 7 $\frac{1}{2}$  in./sec. The cartridge tapes developed by Columbia and Minnesota Mining and Manufacturing Co., however, may still find their position with the separate reel tapes. The new cartridge uses three tracks for stereo. Two are active tracks and the third is an optional channel. The cartridge

measures about 3 $\frac{1}{2}$  x 3 $\frac{1}{2}$  x 5/16 in. and will play for 64 minutes at 1 $\frac{7}{8}$  in./sec. The system is fighting for a place in the audiophile's home and deserves consideration by those thinking of buying a new recorder. The new speeds used on these cartridge tapes is said to produce sound on a par with the best 7 $\frac{1}{2}$  in./sec. tapes.

**Tapes vs. Discs**

There is little doubt in the minds of either record companies or tape manufacturers that both records and tapes will remain on the market with neither greatly affecting the sales of the other — at least for some time to come.

But the serious audiophile's decision may be a difficult one to make. If one or the other must be decided upon, the advantages and disadvantages of both recording mediums should . . . be pointed out.

Tape has an inherently greater frequency range since the recording process is entirely electrical. The disc is severely limited at higher frequencies because the cutting stylus, as well as the pick up stylus,

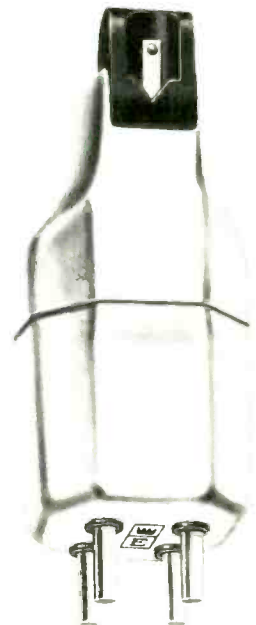
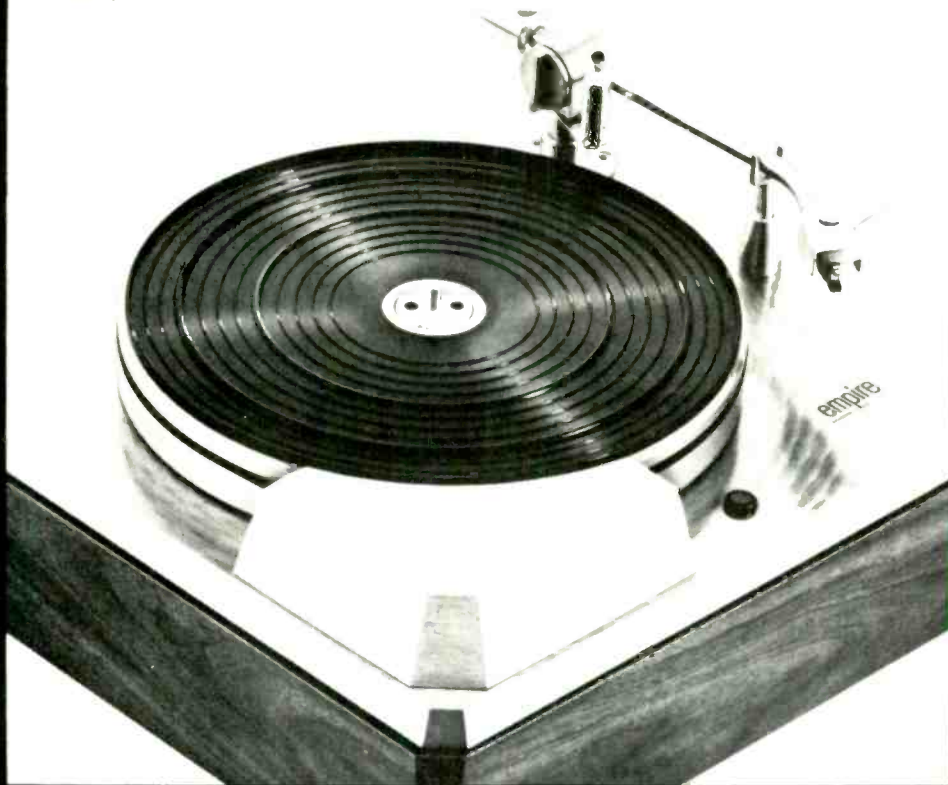
*Continued on page 100*



Portable stereo tape recorder, model 6-44, by Tandberg can be incorporated into existing Hi-Fi or stereo system.

# this is the **EMPIRE TROUBADOR**

## **EMPIRE 208 TURNTABLE**



## **EMPIRE 880<sup>P</sup> CARTRIDGE**



## **EMPIRE 980 PLAYBACK ARM**

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### **TROUBADOR TABLE OF CONTENTS**

Empire 208 3-speed "silent" turntable... Empire 980 dynamically balanced playback arm with the sensational Dyna-Lift\*... and the new Empire 880p mono-stereo cartridge featuring the virtually indestructible Dyna-Life\* stylus... Complete with handsome walnut base: \$222.

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\*Patent Pending

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Understand f-m multiplex operating principles  
and simplify your sales and service problems

# Servicing F-M Stereo Receivers and Adapters

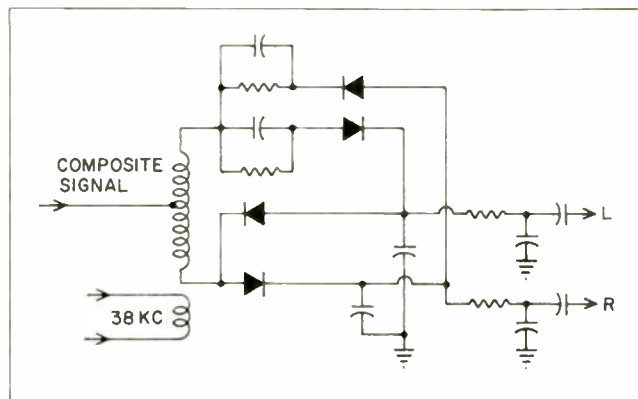


Fig. 1—Simplified demodulator used in Pilot's multiplexer. Switching is accomplished by feeding a 38 kc signal to the composite by transformer coupling.

■ Stereo multiplexing may yet provide the long awaited shot-in-the-arm needed to stimulate a significant increase in f-m broadcasting throughout the country. More than 100 stations are now broadcasting stereo and another 100 are expected to be on the air before the end of this year. Technicians and service dealers can certainly look forward to modest increases in f-m equipment sales and service in those areas having stereo broadcast stations. Sales of good high-gain f-m antennas will also increase.

## Special Service Equipment

Although few additional service instruments will be required by the well equipped TV service shop, a good stereo generator will more than pay for its keep by speeding up service work and providing accurate alignment necessary for satisfying audiophile ears that grow more discriminating with the passage of time.

Stereo generators presently offered by a few manufacturers will have one thing in common: a relatively high price. There's little information available at this moment to indicate that the instrument cost will change in the very near future. Those who have the potential business may do well to climb aboard the stereo band wagon without un-

due delay. As with many other new products, technicians who are set up to give immediate satisfactory service usually end up with the "lion's share" of the business.

The stereo generator can be considered a miniature f-m broadcasting station. It can also provide a number of synchronized signals for testing multiplex units. Actual stereo broadcasts can be made with some stereo test sets by simply feeding a stereo signal to the generator from a stereo disc or tape through a standard preamplifier.

If a stereo generator is used, the only other piece of equipment necessary will be an oscilloscope. Proper alignment can then be accomplished by using signals supplied by the test set to generate Lissajous patterns on the scope which are clearly defined in the generator operating instruction manual.

## How F-M Stereo Works

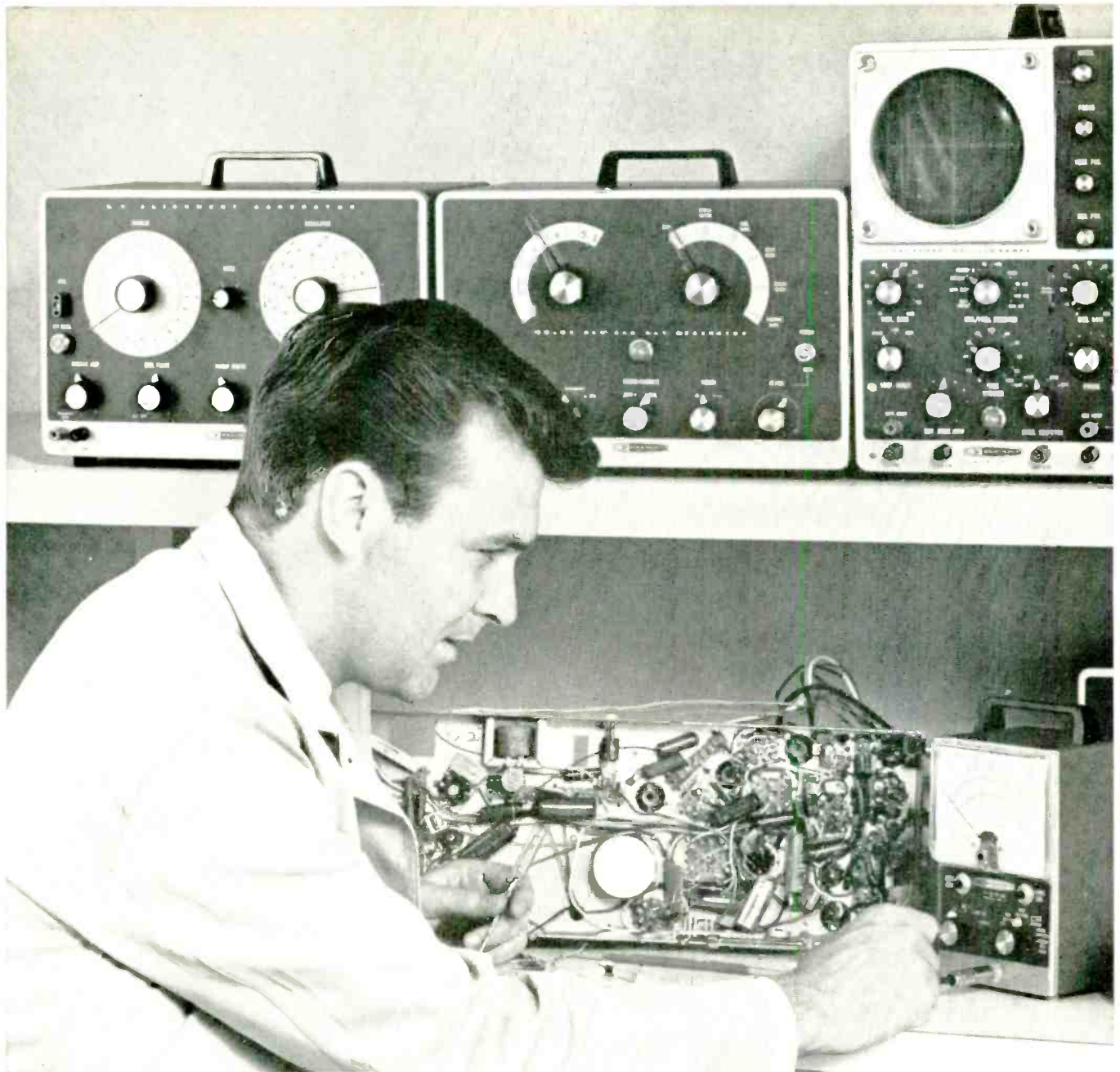
The confusion caused by "professional" explanations of f-m stereo adapter operating principles has caused many technicians to shy away from f-m multiplex equipment servicing. If all the explanations are denuded of the "double talk," basic principles are far less complicated than those involved in color circuitry—which many of these

stereo-discouraged technicians negotiate successfully in everyday stride. Risking the danger of being collared and accused of oversimplifying by a few "bright-eyed" stereo visionaries, a simple explanation of stereo broadcasting is presented herewith.

Two microphones pick up broadcast studio sound from the left (L) and right (R) side of the presentation. These two signals are "combined" to form two channels of information. The primary channel is identical to the monophonic signal which is the simple algebraic sum of both microphone signals ( $L+R$ ). This channel contains all the audible portion of the spectrum.

The second channel is the *difference* between the left and right channels ( $L-R$ ). The difference signal is used to modulate a 38 kc subcarrier. The carrier is then suppressed and sidebands of the carrier from 23 to 53 kc are retained. A 19 kc pilot frequency is also added to the signal for synchronization. The same signal is used at the transmitter to generate the 38 kc subcarrier.

All of these signals are combined on the f-m carrier and transmitted. In addition, the transmitting station is authorized to transmit storecasting (SCA) signals for broadcast to restaurants and other business es-



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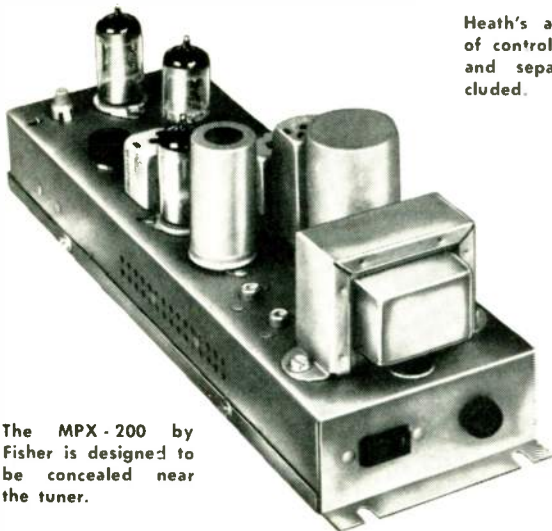
Bogen's multiplex adapter includes volume control.



Heath's adapter uses a minimum of controls. Only an on-off switch and separation controls are included.



Multiplex adapter by Sherwood connects to any high fidelity f-m tuner.



The MPX-200 by Fisher is designed to be concealed near the tuner.

establishments for entertainment or background music on a rental basis. The SCA signal occupies no more than 10 percent of the band between 60 and 74 kc.

In the receiver, the 19 kc signal is amplified and used to sync an oscillator for signal demodulation. The signal used for demodulation, of course, must be 38 kc. Each

of the signals are then amplified and fed to their respective channels. A typical demodulator circuit is shown in Fig. 1. Finding your way around these circuits is not too difficult and can be aided by studying the block diagram shown in Fig. 2.

### Antennas

Well installed high-gain antennas will be absolutely necessary for good f-m stereo reception. Areas which presently receive good single channel f-m will discover very unsatisfactory stereo reception unless these antennas are installed. The average decrease in received stereo with present antennas, will be about 20 percent. TV antennas can be "thrown up" on the roof with only a reduced signal or a ghost. Multipath effects in f-m, however, not only distorts fidelity (which is our prime concern) but certainly multipath effects can completely obliterate normal separations.

Several new high-gain antenna types, especially designed for stereo reception, are already on the market. Among these are remote controlled (wireless) systems, stacked yagis and parabolic dishes. The type of antenna best suited for a given installation can be easily determined by the experienced TV technician.

Too much signal can be a problem as well as too little signal—although too much is easier to handle. If only one f-m station is located in your area, it would certainly be a serious error to recommend a rotor-equipped antenna installation to a prospective customer. ■

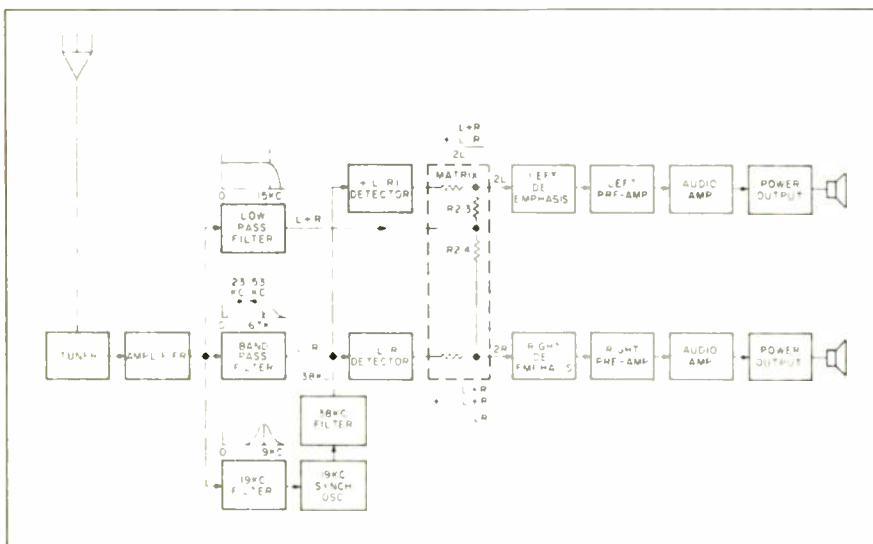


Fig. 2—Block diagram of G-E f-m stereo radio.

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*The Tancy Lounge proudly presents...*

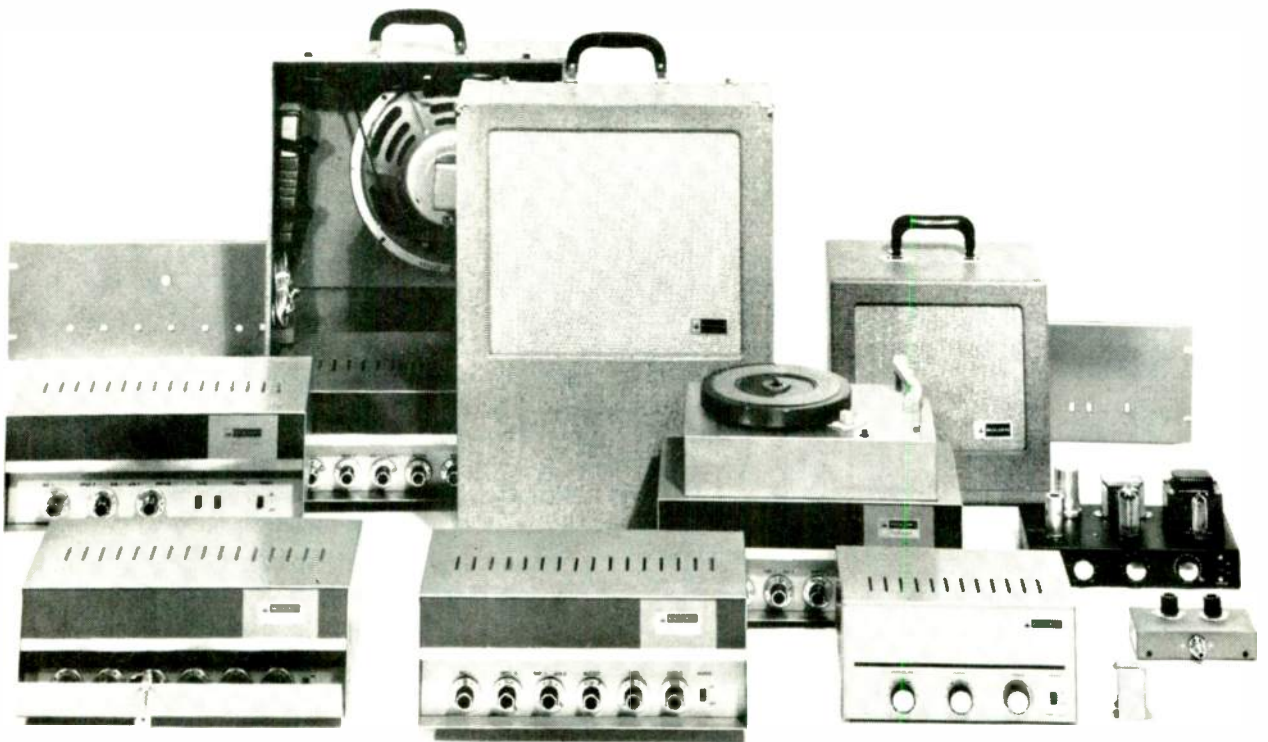


"My sermon for this morning deals with..."

**"WILL THE OWNER OF CAR 7Z-463 PLEASE..."**

*"FLIGHT 702 NOW LOADING AT GATE..."*

**"10...9...8...7...6..."**



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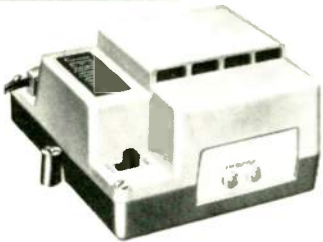
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# Hear! Hear!

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# Selling and Installing Background Music Systems

Automatic repeating tape systems offer additional source of income for TV-radio technicians and service-dealers

■ The better restaurants, bigger manufacturing plants, and most productive offices today are being served by background music. This is not a coincidence. It is generally well known that music played softly in the background increases employee production and gives a feeling of well-being to customers of businesses supplied with background music. Ironical as it may seem, however, the people who benefit from the music are often not consciously aware of it. The music is heard but not listened to.

Many places of business are ready to commit themselves to installing background music, but won't put out the effort to locate dealers or manufacturers of background music equipment. Technicians presently engaged in TV-radio, Hi-Fi and industrial electronic equipment repair, are in an excellent position to sell and service background music equipment.

#### Getting Your Foot in the Door

The hardest part of selling to business people is getting an appointment with the buyer. A well-written letter and a follow-up phone call are usually effective methods.

Manufacturers of background systems will supply you with sales information and price listings. Of course, all of this should be taken care of before contacting the potential buyer.

Technicians have been frequently preached to regarding their personal appearance. When dealing with industrial business customers, personal appearance becomes doubly important.

#### System Types and Installation

The same installation principles used for PA are employed in background music systems. You should brush up on sound distribution theory so you can make an intelligent

CHART I

Consideration	Reason
1. Number of square feet to be served	To determine total number of speakers required
2. Ceiling height	Spacing required between speakers
3. Noise levels in db	Determine power requirements for each speaker or group of speakers
4. Number of people in each area & amount of movement	Factors affecting sound coverage and volume level
5. Building design and construction, particularly ceiling and wall material	Determine best speaker mounting locations and wiring routes; wire above ceiling, through walls or between floors
6. Number of volume controls needed and best locations	Influences control type selection and wiring requirements
7. Environmental conditions—dust, corrosive fumes and temperature extremes	Selection of speaker types, location and wiring
8. Local building and electrical codes	All installations must conform to local codes



CHART 2

Noise characteristic	Area to be covered	Weighted background noise levels db
very noisy conversation difficult or impossible	factory (very noisy)	90
	machine shop	90
	printing plant (average)	80
noisy voice must be raised to be understood	assembly line (average)	75
	factory (average)	75
	machine accounting	75
	auditorium (average)	70
	supermarket	75
	shipping department	60
	office (busy)	70-75
normal conversation easily understood	transportation waiting room	75
	restaurant (noisy)	75
	department store	65
	bank (public area)	65
	restaurant (average)	60
	office (quiet)	55
	hotel lobby	55
	hospital areas	55
	office waiting room	55

cost estimate. (A word on this estimate: Don't forget to add an overhead percentage to your cost and profit figure).

The amount of power and the number of speakers necessary will depend on several factors. Most of these are included in Chart 1. Padders will be necessary at many speaker locations where speaker placement alone will not provide even sound.

Several systems which provide background music are presently available. The newest and most popular are the automatic tape cartridge units. Many types of music are available on these precorded cartridges which are simply plugged into the playback system. Most of the units operate about 2½ hours and then repeat the tape.

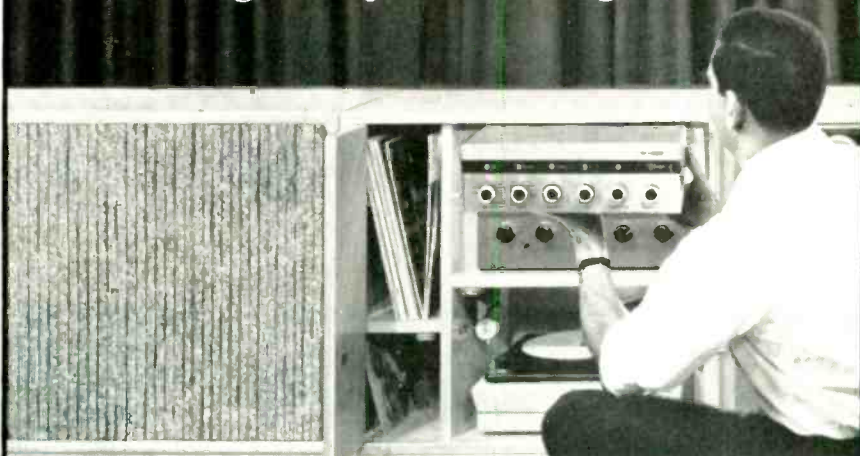
Restaurants and other places of business where music is primarily played for customers, the system can operate on a limited number of cartridges since customers rarely stay through an entire tape sequence. On the other hand, when the music is played for the benefit of full time employees, a larger selection of tapes would be necessary to prevent monotony—which the music should help prevent.

It's up to you. If your business needs a shove, investigate background music. The possibilities are limited only by the number of businesses in your area. ■

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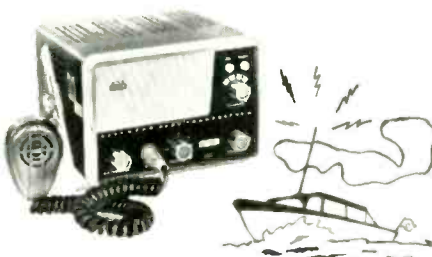


*...Use These:*

Whether it's hi-fi in the home, or CB in car, boat, truck, or taxi, custom installation jobs jump into the big-profit category when you deliver high quality at low cost.

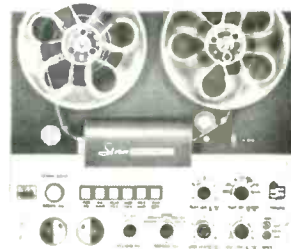
And especially with EICO kits, which average 40% less than our own, low, wired prices. Wire 'em up yourself and pocket the difference—with your customer's blessing, because if you build the components yourself, it's custom-made all the way through!

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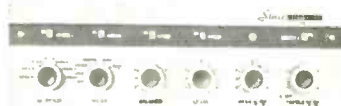
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Amplifiers, 1-channel .....	amp-1	Preamplifiers, 2-channel .....	pre-2
Amplifiers, 2-channel .....	amp-2	Records, stereo .....	rec
Amplifier-preamplifiers integrated, stereo .....	amp-pre	Speakers & Speaker Systems .....	spk
Antennas, FM .....	ant	Tape, blank .....	tap
Arms .....	arm	Tape, prerecorded stereo .....	tap-pr
Cartridges, stereo phono .....	car	Tape Recorder Accessories .....	tap-acc
Changers .....	cha	Tape Recorder Heads, stereo .....	tap-hed
Control Units, stereo .....	cont	Tape Recorders or Decks, stereo .....	tap-rec
Conversion Kits, stereo phono .....	conv-p	Tuners & Receivers, AM or FM "single play" .....	tun-1
Conversion Kits, stereo tape recorder .....	conv-t	Tuners & Receivers, AM & FM "simultaneous .....	tun-2
Enclosures & Cabinets .....	enc	play" .....	tun-mult
Headphones .....	hed	Tuner multiplex adapters .....	tun-ad
Microphones .....	mik	Turntables .....	tur
Needles .....	need	Kit form .....	K
Phono Systems, accessories .....	phon-acc	Wired .....	W
Phono Systems, stereo, complete .....	phon-sys		
Preamplifiers, 1-channel .....	pre-1		

**Acoustic Research, Inc.**, 24 Thorndike St., Cambridge 41, Mass.—spk; tur

**Aldshir Mfg. Co., Inc.**, 111 Lake Ave., Tuckahoe, N.Y.—car; need

**Allied Radio Corp.**, 100 N. Western Ave., Chicago 80, Ill.—amp-1; amp-2; amp-pre; hed; phon-acc; phon-sys; pre-1; pre-2; spk; tun-1; tun-2; tun-mult; tun-ad; K; W

**Altec Lansing Corp.**, 1515 S. Manchester Ave., Anaheim, Calif.—amp-1; amp-2; amp-pre; enc; mik; pre-1; pre-2; spk; tun-1; tun-2; tun-mult; tun-ad

**Amelux Electronics Corp.**, 60 E. 42nd St., New York 17, N. Y.—tap-acc; tap-hed; tap-rec; W

**American Concertone, Inc.**, Div. of Astro Science Corp., 9449 W. Jefferson Blvd., Culver City, Calif.—tap-acc; tap-rec

**American Elite Inc.**, 48-50-34 St., Long Island City 1, N. Y.—amp-1; car; cha; hed; mik; spk; tap; tap-acc; tap-hed; tap-rec; tun-1; tun-mult; W

**American Microphone Mfg. Co.**, 412 S. Wyman St., Rockford, Ill.—car; mik  
**Ampex Corp.**, 934 Charter St., Redwood City, Calif.—conv-p; spk; tap; tap-pr; tap-acc; tap-hed; tap-rec

**Amplifier Corp. of America**, 396 Broadway, New York 13, N. Y.—amp-1; amp-2; amp-pre; pre-1; pre-2; tap-acc; tap-rec; tun-mult; W

**Argos Products Co., Inc.**, 600 S. Sycamore St., Genoa, Ill.—enc; spk

**Astatic Corp.**, Conneaut, Ohio—car; arm; milk; need; tap

**Atlas Sound Corp.**, 1449 39th St., Brooklyn 18, N. Y.—spk

**ATR Electronics Inc.**, 300 E. 4th St., St. Paul 1, Minn.—D-C A-C inverters

**Audio Devices, Inc.**, 444 Madison Ave., New York 22, N. Y.—need; tap; tap-acc

**Audio Dynamics Corp.**, Pickett District

Rd., New Milford, Conn.—arm; car; spk  
**Audio Fidelity Records**, 770 11th Ave., New York 19, N.Y.—rec; tap-pr

**Audio-Master Corp.**, 17 E. 45th St., New York 17, N. Y.—phon-sys; rec; tap-pr

**Audio Originals**, 474 S. Meridian, Indianapolis 25, Ind.—enc

**Autocrat Electronics Co.**, 5024 Elm St., Skokie, Ill.—amp-1; amp-2; phon-sys; tur; W

**Becker Electronics Mfg. Corp.**, 1091 Rockaway Ave., Valley Stream, N. Y.—spk

**Bel Canto Stereophonic Recordings Div.**, Thompson Ramo Wooldridge, 6325 Huntley Rd., Columbus 24, Ohio—rec; tap-pr

**Bell Sound Div.**, Thompson Ramo Wooldridge, 555 Marion Rd., Columbus, 7, Ohio—

**Benjamin Electronic Sound Corp.**, 97-03 43rd Ave., Corona, New York, 68, N. Y.—car; cha; need; tur

**Blonder-Tongue**, 9 Alling St., Newalk 2, N. J.—ant; and r-f preamplifiers

**Bozak Mfg. Co. R. T.**, 587 Connecticut Ave., S. Norwalk, Conn.—spk

**British Industries Corp.**, 80 Shore Rd., Port Washington, N. Y.—cha; conv-p; spk; tur

**Burgess Battery Co.**, Magnetic Tape Div., Freeport, Ill.—tap

**Cabinart Acoustical Dev. Corp.**, 35 Geyer St., Haledon, N. J.—spk

**Calbest Electronics**, 4801 Exposition Blvd., Los Angeles 16, Calif.—amp-1; amp-2; amp-pre; tun-1; tun-2; tun-mult; tun-ad; W

**CBC Electronics Co., Inc.**, 2601 N. Howard St., Philadelphia 33, Pa.—ant; phon-acc; W

**CBS Laboratories**, Audio Products Dept., 227 High-Ridge Rd., Stamford, Conn.—stereo test equipment

**Channel Master Corp.**, Ellenville, N. Y.—amp-pre; ant; car; cha; spk; tur; W

**Cleveland Electronics, Inc.**, 1974 E. 61st St., Cleveland 3, Ohio—spk

**Clevite Electronic Components**, 232 Forbes Rd., Bedford, Ohio—hed

**Crosby Electronics**, 135 Eileen Way, Syosset, L. I., N. Y.—tun-mult; tun-ad; W

**"Crown" International**, a sub. of International Radio & Electronics Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.—amp-1; amp-2; amp-pre; pre-1; pre-2; tap-acc; tap-rec

**Dart Electronic Devices**, 6409 New Utrecht Ave., Brooklyn 19, N. Y.—mik; W

**Daystrom Products Corp.**, Box 167, St. Joseph, Mich.—amp-1; amp-2; amp-pre; cha; spk; tun-1; tun-2; tun-mult; tun-ad; K; W

**Dubbings Electronics Inc.**, 226 Franklin Ave., Hewlett, N. Y.—tap-acc

**Dukane Corp.**, 103 N. 11th Ave., St. Charles, Ill.—spk; W

**Duotone Co. Inc.**, Locust St., Keyport, N. J.—car; need; phon-acc; tap

**Dynaco Inc.**, 3912 Powelton Ave., Philadelphia 4, Pa.—amp-1; amp-2; amp-pre; arm; car; cont; mik; pre-1; pre-2; tun-1; tun-mult; tun-ad; K; W

**Eastman Kodak Co.**, 343 State St., Rochester 4, N. Y.—tap

**Eico Electronic Instrument Co., Inc.**—3300 Northern Blvd., Long Island City 1, N. Y.—amp-1; amp-2; amp-pre; cont; pre-1; pre-2; spk; tap-rec; tun-1; tun-2;

tun-mult; tun-ad; K; W

**Electron Enterprises Inc.**, 6917 Stanley Ave., Berwyn, Ill.—amp-1; amp-2; enc; phon-acc; phon-sys; spk; tun-1; W

**Electronic Applications Inc.**, 80 Danbury Rd., Wilton, Conn.—hed; mik; pre-1; pre-2; tap-rec; tur

**Electro-Voice, Inc.**, Cecil and Carroll Sts., Buchanan, Mich.—car; enc; mik; need; spk

**Alpha Marketing Ind. Inc.**, Thorens & Ortofon Divs., New Hyde Park, N. Y. arm; car; tur

**Emerson Radio Inc.**, 680 5 Ave., New York, N. Y.—tap-rec; W

**Empire Scientific Corp.**, 1075 Stewart Ave., Garden City, N. Y.—arm; car; tur

**Ercona Corp.**, 16 W. 46th St., New York 36, N. Y.—amp-1; amp-2; cont; mik; pre-1; pre-2; spk; tap-acc; tap-hed; tap-rec tun-1; tun-mult; W

**Eric Electronics Corp.**, 1823 Colorado Ave., Santa Monica, Calif.—amp-1; amp-2; amp-pre; tun-1; tun-2; tun-mult; tun-ad; W

**Euphonics Corp.**, Box 2746, Rio Piedras, Puerto Rico—car; mik; need

**Fairchild Recording Equipment Co.**, 10-40 45th Ave., Long Island City 1, N. Y.

**Fanon Electronics Industries**, 439 Frel-inghuysen Ave., Newark 4, N. J.—amp-1; amp-2; conv-p; phon-sys; W

**Fen-tone Corp.**, 106 Fifth Ave., New York 11, N. Y.—car; cha; hed; mik; need; phon-acc; phon-sys; pre-1; pre-2 tap-rec

**Ferrodynamics Corp.**, Gregg St. & Rt. 17, Lodi, N. J.—tap; tap-acc

**Fidelitone Microwave, Inc.**, 6415 N. Ravenswood Ave., Chicago 26, Ill.—need; tap; tap-hed; record accessories

**Finney Co.**, 34 W. Interstate, Bedford, Ohio—ant

**Fisher Berkeley Corp.**, 1475 Powell St., Emeryville 8, Calif.—amp-1; spk; tun-1; tun-ad; W

**Frazier Inc.**, 2649 Brenner Dr., Dallas 20, Tex.—spk

**GC Electronics Co.**, Div. of Textron Electronics Inc., 400 S. Wyman St. Rockford Ill.—ant; mik

**General Electric Co.**, Audio Products Dept., 2200 N. 22nd St., Decatur, Ill.—amp-pre; car; need; spk; tun-ad

**Glaser-Steers**, A Div. of Ametek, Inc., 155 Oraton St., Newark, N. J.—cha

**Gotham Audio Corp.**, 2 W. 46 St., New York 36, N. Y.—arm; car; hed; mik; tur

**Grado Laboratories Inc.**, 4614 Seventh Ave., Brooklyn 20, N. Y.—arm; car; phon-acc

**Gray Research and Development Co., Inc.**, P. O. Box 12, Elmwood 10, Conn.—arm; tur; K; W

**Harman-Kardon Inc.**, Ames Court, Plainview, L. I., N. Y.—amp-1; amp-2; amp-pre; cont; pre-2; tun-1; tun-mult; tun-ad; K; W

**Hartley Products Co.**, 519 E. 162nd St., New York 51, N. Y.—enc; spk

**Heath Co.**, Hilltop Rd., Benton Harbor, Mich.—amp-1; amp-2; amp-pre; arm; cha; enc; hed; mik; pre-1; pre-2; spk; tap-acc; tap-rec; tun-2; tun-mult; tun-ad; tur

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16¼" x 4½" x 14" deep. Combines Sherwood's brilliant FM stereo tuner design, two 32-watt amplifiers, two phono/tape pre-amplifiers, and all circuitry necessary to receive FM stereocasts.



S-8000 FM/MX 64-watt Stereo Receiver

**RAVINTA Model SR3 3-way speaker system** \$139.50. Walnut Cabinet 26¼" x 15" x 13¼" deep. 12" high-compliance woofer, 8" midrange, and 2½" ring-radiator tweeter. Features low intermodulation distortion, flat frequency response (± 2½dB) to 17 KC.

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S3000 IV FM/MX Stereo Tuner

FM Stereo Multiplex Adapters may be used to convert Sherwood and other FM tuners for stereo-cast reception. \$49.50 to \$69.50.

**S-5500 II 64-watt Stereo Preamp/Amplifier** \$164.50. 14" x 4½" x 12¼" deep. Identical to amplifier used in S-8000. Other amplifiers: S-5000 II 80-watt Stereo Amplifier-Preamp \$199.50.



S-5500 II 64-watt Stereo Preamp/Amplifier

This typical room setting includes Sherwood's "Superb Stereo Starters,"—one S-8000 Receiver and two SR3 Loudspeakers. Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Illinois.

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Write Dept. Y11

— for more details, circle 70 on post card

**Isotone Associates**, 3402 Third Ave., New York 56, N. Y.—spk

**Jay Electronics Inc.**, 65-37 Fresh Meadow Lane, Flushing N. Y.—tap-rec

**Jensen Industries**, 7333 W. Harrison St., Forest Park, Ill.—car; need  
**Jensen Mfg. Co.**, 6601 S. Laramie Ave., Chicago 30, Ill.—hed; spk  
**Jerrold Electronics Corp.**, 15th & LeHigh Ave., Philadelphia 32, Pa.—pre-1; pre-2; tun-2; tun-mult tun-ad; CATV Head-End equipment; W

**Karg Laboratories, Inc.**, 162 Ely Ave., South Norwalk, Conn.—amp-2; amp-pre; pre-2; tun-1; tun-mult; tun-ad; K; W

**Karlson Associates Inc.**, 433 Hempstead

Ave., West Hempstead, L. I., N. Y.—enc; phon-sys; spk; K; W

**KLIH Research and Development Corp.**, 30 Cross St., Cambridge 39, Mass.—phon-sys; spk; tun-1; tun-mult  
**Klipsch & Assoc. Inc.**, Box 96, Hope Ark.—enc; spk; W

**Lafayette Radio Electronics Corp.**, 111 Jericho Turnpike, Syosset, L. I., N. Y.—amp-1 amp-2; amp-pre; cont; enc; hed; mik; phon-acc; phon-sys; pre-2; spk; tap; tap-acc; tap-hed; tap-rec; tun-1; tun-2; tun-mult; tun-ad; tur

**Langevin**, A Div. of Sonotek Inc., 503 S. Grand Ave., P. O. Box 687, Santa Ana, Calif.—amp-1; amp-2; amp-pre; car; pre-1; pre-2; W

**Lansing Sound Inc.**, James B., 3249 Casitas Ave., Los Angeles 39, Calif.—amp-2; pre-2; spk

**Leear Siegler, Inc.** Bogen Communications Div., P. O. Box 500, Paramus N. J.—amp-1; amp-2; amp-pre; arm; enc; pre-1; pre-2; tap-acc; tap-hed; tap-rec; tun-1; tun-2 tun-mult; tun-ad; tur; W

**McIntosh Laboratories, Inc.**, 2 Chambers St., Binghamton, N. Y.—amp-1

**McMartin Industries, Inc.**, 1612 California St., Omaha, Nebr.—amp-1; amp-2; amp-pre; ant; tun-1; tun-2; tun-mult; tun-ad

**Maier CO.**, P. O. Box 126, Wellington, Ohio—Register-Music systems

**Marantz Co.**, 25-14 Broadway, Astoria, L. I., N. Y.—amp-1; amp-2; pre-1; pre-2; W

**Mercury Record Corp.**, 35 E. Wacker Drive, Chicago 1, Ill.—rec

**Minnesota Mining & Mfg. Co.**, Magnetic Products Div., 2501 Hudson Rd., St. Paul 19, Minn.—tap; tap-acc

**Monarch Electronics International, Inc.**, 7035 Laurel Canyon Blvd., North Hollywood, Calif.—amp-1; amp-2; arm; car; cont; hed; mik; pre-1; spk; tap; tap-acc; tun-1; tun-2; tun-mult; tun-ad; tur; W

**Motorola, Inc.**, Consumer Products Div., 9401 W. Grand Ave., Franklin Park, Ill.—phon-sys

**MP Engineering Co.**, Fairfield 1, Conn.—amp-1; amp-2; amp-pre; enc; phon-sys; W

**National Tape Service**, 1259 Route 46, Parsippany, N. J.—tap-pr

**Neshaminy Electronic Corp.**, 382 Easton Rd., Neshaminy, Pa.—rec

**Newcomb Electronics Corp.**, 6824 Lexington Ave., Hollywood 28, Calif.—amp-1; amp-2; tap-rec

**North American Philips Co.**, Hi-Fi Products Div., 230 Duffy Ave., Hicksville, L. I., N. Y.—car; cha; mik; spk; tap-rec; tur; W

**Nortronics Co., Inc.**, 8101 W. Tenth Ave. N., Minneapolis, Minn.—conv-t; pre-1; tap-acc; tap-hed

**Olson Electronics Inc.**, 260 S. Forge St., Akron, Ohio—amp-1; amp-2; amp-pre; ant; arm; enc; hed; mik; phon-sys; pre-1 pre-2; spk; tap-acc; tun-1; tun-mult; tun-ad

**Omega Electronics Corp.**, 10017 N. 19 Ave., Phoenix 21, Ariz.—amp-pre; tun-mult; W

**Oxford Components Div. of Oxford Electric Corp.**, 3911-29 S. Michigan Ave., Chicago 53, Ill.—spk

**Paco Electronics Co.**, 70-31 84th St., Glendale 27, N. Y.—amp-pre; spk; tun-1; tun-2; tun-mult; tun-ad; K; W

**Pentron Corp.**, 777 S. Tripp Ave., Chicago 24, Ill.—tap-rec

**Pernoflux Corp.**, 4111 San Fernando Rd., P. O. Box 1449, Glendale, Calif.—hed; mik

**Pfänstiel Chemical Corp.**, 104 Lake View Ave., Waukegan, Ill.—need

**Philco Corp.**, C & Tioga Sts., Philadelphia 34, Pa.—phon-sys

**Philmore Mfg. Co., Inc.**, 130-01 Jamaica Ave., Richmond Hill 18, N. Y.—amp-2; arm; car; hed; tun-ad; K; W

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Once again Musi-Pak sets the pace with the world's first round-the-clock cartridge (patent pending) that plays approximately 8 unduplicated hours of *quality* music at 3 $\frac{3}{4}$  ips . . . and 4-way Select-A-Mood control that permits your customer to pick his choice of 4 basic music moods at the touch of a dial. All this, plus the famous Musi-Pak metal cartridge, the world's largest and finest tape cartridge library and complete factory backed dealer promotion program make the Musi-Pak 800 the finest, most profitable background music system ever.

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**Pickering and Co. Inc.**, Sunnyside Blvd., Plainview, L. I., N. Y.—arm: car: need: tur: K

**Pro-Tex Reel Band Co.**, 2108 Payne Ave., Cleveland 14, Ohio—tap-acc

**Qualitone Industries Inc.**, 102 Columbus Ave., Tuckahoe, N. Y.—amp-1: amp-2: amp-pre: car: mik:need: pre-1: pre-2: W

**Quam-Nichols Co.**, 234 E. Marquette Rd., Chicago 37, Ill.—spk

**Radio Corp. of America**, Electron Tube Div., 415 S. Fifth, Harrison, N. J.—amp-1: mik: spk: tap: tap-pr: tap-acc: tun-mult: tur: W: stereo test equipment

**Recoton Corp.**, 52-35 Barnett Ave., Long Island City 4, N. Y.—need

**Reeves Soundcraft Corp.**, Great Pasture Rd., Danbury, Conn.—tap: tap-pr: tap-acc

**Reiter Co.**, E. 3340 Bonnie Hill Dr., Hollywood 28, Calif.—tap-acc

**Rek-O-Kut Co.**, 38-19 108th St., Corona, L. I., N. Y.—tur

**Revere Camera Co.**, 320 E. 21st St., Chicago 16, Ill.—tap-acc: tap-rec

**Riemer Co., Inc.**, David, 473 Broadway, New York 13, N. Y.—arm: car: mik: need: phon-sys: tap-acc: tur

**Roberts Electronics, Inc.**, 5920 Bowercroft St., Los Angeles 16, Calif.—spk: tap: tap-acc: tap-rec

**Robins Industries Corp.**, 15 58 127 St., Flushing 56, N. Y.—conv-p: phon-acc: tap-acc: tap-hed

**Rockbar Corp.**, 650 Halstead Ave., Mamaroneck, N. Y.—enc: spk: K: W

**Rye Sound Corp.**, 145 Flm St., Mamaroneck, N. Y.—hed: W

**Sargent-Raymont Co.**, 4926 E. 12th St., Oakland, Calif.—amp-1: amp-2

**Sarkes Tarzian Inc.**, E. Hillside Dr., Bloomington, Ind.—tap

**Scott, Inc., H. H.**, 111 Powdermill Rd., Maynard, Mass.—amp-2: amp-pre: arm: car: cont: pre-2: spk: tun-1: tun-2: tun-mult: tun-ad: K: W

**Sherwood Electronic Labs Inc.**, 4300 N. California Ave., Chicago 18, Ill.—amp-1: amp-pre: spk: tun-1: tun-2: tun-mult: tun-ad: W

**Shure Brothers, Inc.**, 222 Hartrey, Evanston, Ill.—arm: car: mik: need: phon-acc: pre-1: pre-2

**Smith Labs, A. Bernard**, 2969 Ludlow Rd., Cleveland 20, Ohio—car: mik: tun-mult: W

**Sonotone Corp.**, Elmsford, N. Y.—arm: car: mik: need: tap-hed

**Stanford International**, 569 Laurel St., San Carlos, Calif.—tap-rec

**Stephens Trusonic, Inc.**, 8538 Warner Dr., Culver City, Calif.—enc: mik: spk

**Stromberg-Carlson Corp.**, 1400 N. Goodman St., Rochester, N. Y.—amp-2: spk: tun-2

**Superex Electronics Corp.**, 4 Radford Pl., Yonkers, N. Y.—hed and remote listening control: W

**Superscope Inc.**, 8150 Vineland Ave., Sun Valley, Calif.—amp-pre: mik: spk: tap-rec: W

**Switchcraft, Inc.**, 5555 N. Elston Ave., Chicago 30, Ill.—phon-acc: tap-acc

**Tandberg of America, Inc.**, 8 Third Ave., Pelham, N. Y.—hed: spk: mik: tap-acc: tap-rec

*Continued on page 101*



## NEW VELOCITONE MARK II why it's the finest stereo cartridge you can use with your record changer

It isn't as if the new Mark II won't work wonders with your transcription turntable and arm. That it would. But, matching a cartridge to a record changer is the far more challenging problem. It's a tougher nut to crack.

Here are some of the problems. You can select one of those ultra-high-compliance magnetic cartridges that track at a gram or two. Now what?

Says Joe Marshall, noted authority in the January, 1962, issue of *High Fidelity*: "An attempt to reduce needle pressure with an arm not designed for low needle pressure will usually result in high distortion due to loading the needle with the mass and friction of the arm."

And in the April 7, 1962, issue of *Opera News*, Conrad Osborne observes: "The thing to be sure of when seeking a new cartridge is that the compliance... suits the characteristics of your tonearm. A cartridge with extremely high compliance will not necessarily turn in better performance with arms on changers, or with manual turntable arms requiring fairly heavy stylus pressure..."

Now let's take a look at the Velocitone Mark II. Compliance:  $5.5 \times 10^{-6}$  cm/dyne, designed to track at from 2 to 4 grams. Perfect! Also because it is a ceramic transducer, you can play it with an unshielded motor—in an intense magnetic field—without a trace of magnetically induced hum. Fire! But, how about frequency response, output, channel separation? How does it perform?

The usable response of the Mark II extends from 20 to 20,000 cycles —  $\pm 1$ db to 17,000. And it has better than 30db channel separation. What's more, it is supplied with plug-in, matched equalizers so that it functions as a constant velocity transducer, and can be fed directly into the 'magnetic' phono inputs of any stereo preamp. Universal terminal plug eliminates soldering to arm leads.

Its output is in the order of 11mv per channel. You can operate your amplifier with lower gain settings and with less power, resulting in improved signal-to-noise ratio, lower distortion. What more could you ask?

The Velocitone Mark II is priced at \$22.25 with two 0.7-mil diamond styli; \$19.25, diamond/sapphire; \$14.75, dual sapphire. Ask your hi-fi dealer to show you and demonstrate the new Velocitone Mark II.



## SONOTONE CARTRIDGES

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Cartridges • Speakers • Tape Heads • Microphones • Electron Tubes • Batteries • Hearing Aids

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## HI-FI COMPONENTS

*Continued from page 80*

The dynamically balanced tone arm differs from its predecessors in that it is balanced and loaded against the record by a spring. Neglecting this spring pressure, the arm will remain balanced in any position. Turntable leveling is not considered when using a dynamically balanced tone arm.

Tracking error still presents a minor problem and no significant improvements have recently been made.

The only remaining force which some manufacturers feel is detrimental to reproduction is the skating force on the stylus caused by record groove spiral. Some manufacturers have rigged eccentric balances or springs which compensate for this force to a large degree. Others refuse to admit that this force is sufficient to worry about.

### Stereo: Rumble and Resonance

The entry of stereo into the recording industry at first presented many serious rumble problems.

Vertical movement of the platter (caused by bearings and other mechanical design problems) was not a problem since most monophonic pickups were deliberately designed to minimize this effect.

Stereo, on the other hand, must reproduce both vertical and horizontal movement with about the same degree of ability. Even the best monophonic turntables were in a trying position when they were required to reproduce stereo discs. The resultant engineering has produced relatively rumble-free turntables and changers that have upgraded monophonic standards.

Stereo has taken its toll on tone arm resonance too. Rumble from turntables in stereo is often reinforced by the tone arm resonance. Since this rumble was not objectionable in monophonic equipment, the tone arm resonance stood alone. But the cumulative effects in stereo equipment has brought new designs to tone arms.

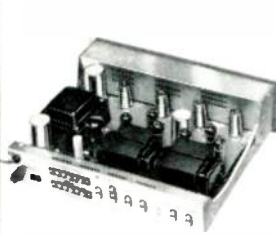
Manufacturers have designed tone arms with extremely low resonances which keep harmonic distortion to a minimum. Materials used in these arms run the gamut from wood to a variety of cast, extruded and formed metals and plastics.

## Confused About Brands?

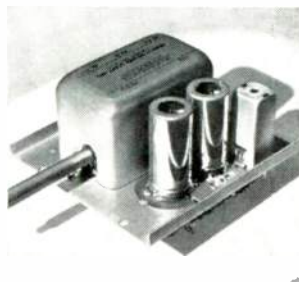
# Here's Why the Experts Recommend Scott® Tuners • Amplifiers • Speakers



**Advanced Engineering.** Scott begins in the laboratory where the Advanced Development Team pioneered Wide-Band Design and "Time-Switching" multiplex circuitry. Chief Engineer Daniel Von Recklinghausen is shown here with the original model of the world's first commercial FM Stereo signal generator, which is used by manufacturers throughout the world.



**Design Leadership.** All Scott amplifiers use massive output transformers to assure full bass response to below 20 cps. Important engineering extras such as solid aluminum chassis and DC heated preamplifier tubes assure performance that is totally free from hum and noise.



**Uncompromising Quality Standards.** The heavily silver-plated RF section and the Wide-Band circuitry common to all Scott tuners is shown here. These exclusive design features result in high sensitivity without distortion, complete freedom from drift, and outstanding reception even from weak multiplex stations.



**Conservative Claims.** Every Scott component is guaranteed to meet or exceed claimed specifications. Each component undergoes more than fifty separate tests. Scott uses IHFM test procedures to guarantee that you receive meaningful specifications. Shown here is the elaborate "screen room" used for precision alignment of tuners.



**Technical Recognition.** WCRB, Boston's leading good music station, uses Scott multiplex equipment for monitoring and for long-distance relay of their FM stereo broadcasts. The reliability, high sensitivity, and rugged construction of Scott tuners and amplifiers make them the choice of more than 100 leading FM stations.



**Musical Recognition.** Professional musicians, like these members of Boston's leading symphony orchestra, choose Scott components for their own music systems. The expert editors of America's most respected high fidelity magazines consistently give Scott components top ratings, and highly recommend them to their readers.



Scott components, like the 80-Watt 290C shown here, are designed with useful, years-ahead features including separate bass and treble controls, derived center channel output with front panel control, complete tape monitoring facilities and Scott's exclusive stereo balancing circuitry. Your franchised Scott dealer will be proud to demonstrate Scott tuners, amplifiers and speakers for you without obligation.



### FREE! New Stereo Record "The Sounds of FM Stereo"

Scott has just produced a new 7" stereo record demonstrating FM Stereo and explaining the meaning of the technical specifications used to describe this wonderful new kind of broadcasting. For a free copy, and Scott's new 20 page "Guide to Custom Stereo" mail this coupon today.



H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

Please send me, without obligation, your free demonstration record of FM multiplex stereo and your 20 page Guide to Custom Stereo

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If you would like Scott literature sent to any of your friends, include their names and addresses.

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Dept. 140-09

- - - for more details circle 67 on postcard

## RECORDS AND TAPE

*Continued from page 88*

involves mechanical movements. The disc on the other hand, seems to surpass the tape system in low frequency response, because wow and flutter are more easily controlled in disc recording.

Master recording, used in recent years for cutting discs, avoids this problem by using tape speeds of up to 30 in./sec. Such speeds for ordinary home playback, of course, are out of the question.

The dynamic range of the tape system betters the disc capability by about 10 db. What this means to the audiophile may be largely academic. The very quiet passages to the loud extreme passages produce a dynamic range of about 70 db in a large orchestra. Good home tape systems are capable of reproducing a range of about 60 db and discs range between 50 and 55 db. In small groups where the dynamic range is limited, either tape or discs

could reproduce the range equally well.

Both tapes and discs require compression of both ends of the audio spectrum. Tapes, however, require a greater compression for bass frequencies and therefore, must have greater amplification than discs for playback. This is simple enough in itself, but hum becomes a problem since the hum content in signals is amplified with the signal. This should be borne in mind when servicing these units so that careless rewiring or lead dressing does not introduce unnecessary hum.

The greatest single drawback for tape seems to be the difficulty of locating a particular selection without trial and error now involved. ■

## STEREO DIRECTORY

*Continued from page 99*

**Tannoy (America) Ltd.**, P. O. Box 177, East Norwich, L. I., N. Y.—enc: spk  
**Telecraft Electronics Corp.**, 55 Milbar Blvd., Farmingdale, L. I., N. Y.—amp-1; amp-2; amp-pre; conv-p; pre-1; tun-2; tun-mult; tun-ad; K; W  
**Telex Inc.**, 3054 Excelsior Blvd., Minneapolis 16, Minn.—hed and accessories  
**Turner Co.**, 909 17th St., N. E., Cedar Rapids, Iowa—mik; W

**United Artists Records** 729-7th Ave., N. Y. 19, N. Y.—Rec  
**University Loudspeakers**, 80 S. Kensico Ave., White Plains, N. Y.—enc: mik; spk  
**Utah Electronics Corp.**, 1124 E. Franklin St., Huntington, Ind.—enc: spk

**Vidaire Electronics Mfg. Corp.**, 365 Babylon Turnpike, Roosevelt, L. I., N. Y.—arm; car; cha; cont; tur  
**Viking of Minneapolis, Inc.**, 9600 Aldrich Ave. S., Minneapolis 20, Minn.—pre-1; pre-2; tap-acc; tap-hed; tap-rec  
**V-M Corp.**, 305 Territorial Rd., Benton Harbor, Mich.—amp-pre; cha; phon-sys; spk; tap-rec; tun-mult; tun-ad; tur; W

**Waber Electronics, Inc.**, Hancock & Somerset Sts., Philadelphia 33, Pa.—amp-2; conv-p; enc; K; W

**Waters Conley Co., Inc.**, 645 N. Michigan Ave., Chicago 11, Ill.—phon-sys; tun-2

**Webcor, Inc.**, 5626 W. Bloomingdale Ave., Chicago 39, Ill.—cha; phon-sys; tap-rec

**Webster Electric Co.**, 1900 Clark St., Racine, Wis.—

**Weathers Industries, Div. of Telepromter Corp.**, 66 E. Gloucester Pike, Barrington, N. L.—arm; car; spk

**Westinghouse Electric Corp.**, High Fidelity Products, Metuchen, N. J.—phon-sys

**Westminster Recording Co., Inc.**, 1501 Broadway, New York 36, N. Y.—rec

**Zenith Radio Corp.**, 6001 Dickens Ave., Chicago 39, Ill.—phon-sys

## NEW PRODUCTS

### F-M MULTIPLEX

213

Called the Model 4310, this tuner reportedly performs many unique automatic functions. When the user tunes across the dial, the 4310 senses a multiplex broadcast and turns itself to multiplex operation automatically. When multiplex reception is desired from extreme fringe stations the user sets a unique Threshold Control to accept only a predetermined degree of interference. When signal deteriorates below this point the tuner automatically and instantaneously

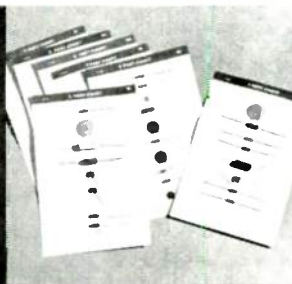


switches itself to monophonic f-m reception which is less susceptible to background noise. When the f-m signal has cleared itself of interference the 4310 instantly switches itself back to f-m stereo reception. The change back and forth from stereo to monophonic is swift and silent. H. H. Scott, Inc.

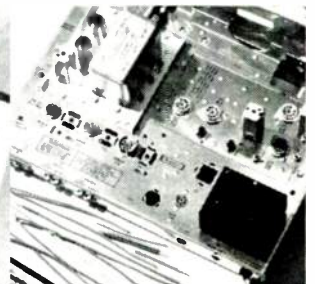
*Here's why Audio Magazine says Scott® Kits are*  
**“Simplest to build...” and have**  
**“Engineering of the highest calibre”\***



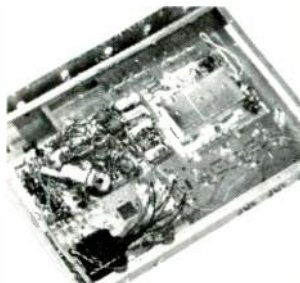
There are certain areas in every professional kit where you can't afford to cut corners. In the case of the Scott Full Color Kit, the instructions are so clear and easy to follow that even a novice can assemble the kit with confidence. There are no confusing steps to follow.



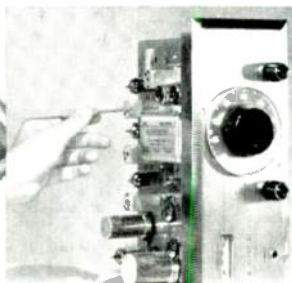
Each full color illustration is accompanied by a Part List—another Scott exclusive. The actual parts described in the illustration are packed in the exact sequence in which they are used. You can't possibly take a mistake.



Much of the uninteresting mechanical assembly is completed when you open your Scott Kit Pak. All the terminal strips and tube sockets are already permanently riveted to the chassis. To insure accuracy all wires are pre-cut and pre-stripped to proper length.



There are certain areas in every professional kit where you can't afford to cut corners. In the case of the Scott Full Color Kit, the instructions are so clear and easy to follow that even a novice can assemble the kit with confidence. There are no confusing steps to follow.



There are also included with the unique Scott Full Color Kit, a tuning meter on the tuner itself. This assures perfect alignment without expensive special instruments. Amplifier kit requires no laboratory instruments for perfect balancing.



The new Scott Warranty Performance Plan guarantees that your kit will work perfectly when completed. If you have followed all recommended procedures, and your kit fails to work, Scott guarantees to put your kit in working order at the factory at minimum cost.

\* Audio — February 1961, Pages 54-56

**SCOTT®**  
 H. H. SCOTT INC., DEPT. 140-09  
 111 Powdermill Rd., Weymouth, Mass.

Please rush me without charge your full color brochure on the complete line of Scott FM stereo tuner, stereo amplifier and speaker kits. A sample 36 page full-color Scott Kit instruction book will be included if you enclose 50¢ in coin or stamps.

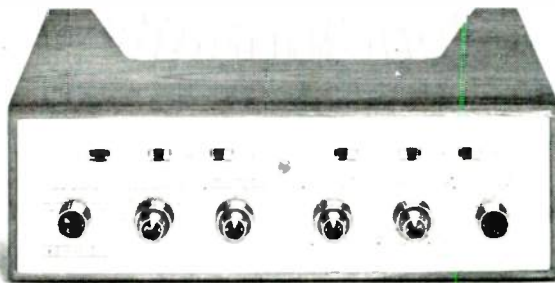
Name

Address

City  State

If any of your friends would like a copy of the new Scott Kit brochure send us their names and addresses.

Export: Morhan Exporting Corp., 458 Broadway, N.Y.C.  
 Canada: Atlas Radio Corp., 50 Wingham Ave., Toronto



When you finish your kit you'll be delighted by the handsome good looks. And when you turn your kit on, you'll know for yourself that the expert efforts of leading high fidelity manufacturers have resulted in only the most sophisticated engineering that could design a kit as simple and profitable as this.

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## 7 Ounce Headsets of Superior Quality

for: MUSIC ENJOYMENT - LANGUAGE LABS - AUDIO ANALGESIA - RADIO & TV STUDIOS - COMMUNICATIONS

Manufactured with dynamic (moving coil) drivers in impedances from 8 to 20,000 ohms with frequency characteristics from 30 to 15,000 cps. Constructed of un-breakable Royalite with removable ear cushions.

Of special interest to users such as schools are the porous ear cushions which allow air circulation eliminating perspiration in the ear canal and possible ear infection.

List prices range from \$15.95 to \$19.95. Mic booms optional. Write for detailed literature.

**R-COLUMBIA PROD. CO., INC.**

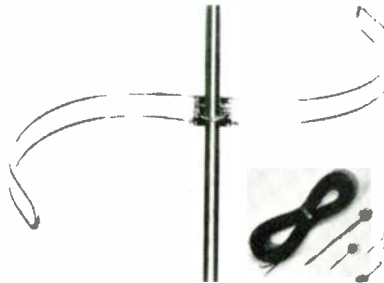
2008 St. Johns Ave. Highland Pk., Ill.

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## NEW PRODUCTS

### F-M ANTENNA 214

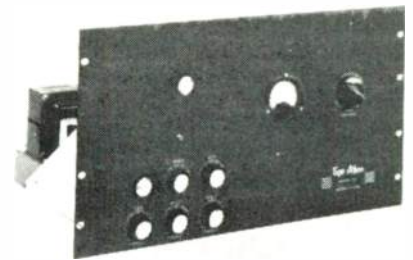
The "Lark Ad-A-Kit", designed for mounting on an existing TV antenna mast, adds properties of a separate f-m



antenna. The kit provides Taco's "Lark" S-type f-m antenna, with 50 ft lead-in, wood-screw and mast-type standoffs. Easily assembled, it can be installed in minutes. The antenna is omnidirectional, providing reception, without rotation from all directions, up to 25 miles from the transmitter. The Lark antenna is golden anodized and reportedly cannot rust or deteriorate. The kit lists for \$8.95. Jerrold Electronics Corp.

### DISTRIBUTION SYSTEM 215

A master distribution system is designed for transmitting audio signals over a large number of 600 ohm output lines.



This system is a totally integrated unit containing a professional-quality line amplifier, a signal distribution network with five isolated output tapes, a VU meter, and separate line volume control. In addition, the system has a built-in automatic gain control that regulates the over-all output by bringing extremely loud or soft signals to an even, pre-set level. Output impedance may be selected at 4, 8, 16, 500 and 600 ohms, and 70 v. The unit is priced at \$291.75 with delivery in 2 to 4 weeks. Tape-Athon Corp.

### THIN SPEAKER 216

A speaker system, the "Syl-O Fite," is claimed to be only 4 in. in depth, but with the response characteristics of full size speaker systems. As a result, the unit is said to be the only ultra-thin system that is totally free from the distortion problems inherent in other ultra-thin enclosures. The components used are a ultra-linear-response 8 in. woofer, a special 6 1/2 in. mid-range tweeter-radiator. Frequency response is rated at 40-20,000 cps and power handling capacity at 30 w maximum (integrated program material). Amplifier power requirements are as little as 10 w. Dimensions are 23 x 29 x 4 in. University Loudspeakers, a Div. of Ling-Temco-Vought, Inc.

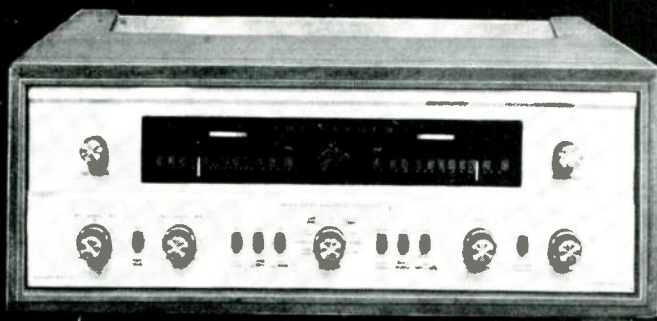
### STEREO AMPLIFIER 217

The AY-21 solid state stereo amplifier has a rated frequency response of 13 to 25,000 cps  $\pm 1$  db at 35 w per channel.



A total of 28 transistors and 10 diodes are employed to provide freedom from microphonics. All controls are front-panel mounted for operating convenience. These include a five position dual concentric input selector, a five position mode selector, and dual concentric volume, bass and treble controls. A hinged lower front panel conceals the tape-monitor input switch, speaker phase reversal switch, loudness switch and all input level controls. The lower right-hand section of the front panel is a on-off switch — touch to turn on — touch to turn off. All input and output connections are located on the rear chassis panel. Circuit safety is assured through the use of five fast-acting, bi-metal

## For your custom stereo installations



### THE FISHER 800-B

### Three of the world's finest components on one chassis

**1 AM-FM-Stereo Multiplex Tuner:** separate tuning indicators for FM and AM; exclusive Fisher STEREO BEAM automatically shows whether an FM station is broadcasting in stereo.

**2 High-Power Stereo Amplifier:** 65 watts music power; special center-channel output connection for third speaker.

**3 Master Audio Control-Preamplifier:** complete, easy-to-use control system assures total flexibility; provisions for every type of input. Price \$429.50\*

\*Walnut or Mahogany cabinet \$24.95; prices slightly higher in the Far West

#### USE THIS COUPON FOR DETAILED INFORMATION

Fisher Radio Corporation  
21-24 44th Drive, Long Island City 1, N. Y.

Please rush the following FREE literature:

- Complete specifications on the Fisher 800-B Receiver.
- The 1962 Fisher Handbook, a 40-page illustrated reference guide and component catalogue for custom stereo installations.

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E19

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# BACKGROUND MUSIC SYSTEMS

The Only World-Proven On-Premise Continuous Tape Cartridge Equipment

## 12 VOLT DC MOBILE UNIT

Model TP-IV

12 volt DC Endless Tape Cartridge Player for  
PUBLIC ADDRESS  
&  
CONTINUOUS BACKGROUND MUSIC

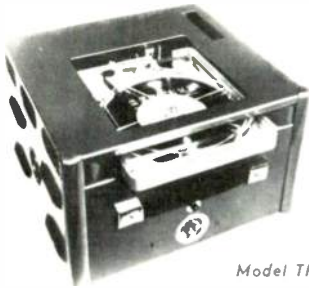
For use in all local, inter-city, inter-state trans-  
continental transportation such as:

- Buses: Sightseeing, public, etc.
- Trains
- Marine transportation of all types
- Air Travel
- All other mobile applications



**Specifications:**

- All transistor amplifier
- Audic Output: 6 watts at 8 ohms
- Power Source: 12 volts DC
- Weight: Approx. 22 lbs.
- Size: 8 1/2" H x 11 1/2" W x 10 1/2" D



Model TP-1

### PROGRAMMER 1

#### AN ENDLESS TAPE CARTRIDGE PLAYER

- In use throughout the world
- Complete with Amplifier (approx. 15 watts peak)
- Sufficient to drive in excess of 50 speakers
- Can be used as a public address system
- With pre-amp output
- Available with 3-hour continuous tape cartridge

#### OTHER MODELS AVAILABLE

- TP-1D — Deck only, with playback head and motor
- TP-1DP — Deck only, with playback head, motor and pre-amplifier
- TP-1R — Recorder-Playback unit complete for recording into pre-loaded cartridge
- TP-1V — 12-volt DC Mobile endless tape cartridge player (see description below)

**Specifications:**

- Power output: approx. 15 watts peak
- Pre-Amp output: 5 volts, unbalanced, 600 ohms
- Power Source: 95-125 volts, AC only, 60 cycles, approx. 100 watts
- Size: 8 1/2" H x 11 1/2" W x 10 1/2" D
- Weight: approx. 30 lbs.

### POINT OF SALE BROADCAST SYSTEM

PROGRAMMER II

- in use throughout the world
- for interspersing of commercial announcements at pre-determined intervals in supermarkets, variety stores, drug stores, specialty shops, etc.

**Specifications:** 115V

amplifier, or in conjunction with existing amplifier equipment

### MUSIC LIBRARY

The only truly balanced background music programming service complete with more than 10,000 selections in varied tempos, moods, specialties, from one of the world's most valuable music libraries. Recordings have been made by such leading conductors as Montavani, Melachrino, Edmundo Ross and others.

Distributor and Dealer Prices Available on Request

# JAY ELECTRONICS

65-37 FRESH MEADOW LANE, FLUSHING 65, N. Y.

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**ALL TYPES**

# 30¢

**BRAND NEW • FACTORY SECONDS • USED TUBES**

NATION WIDE TUBE CO.

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**\$27 per 100**

**1-YEAR GUARANTEE ON ALL TUBES!**

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A SPECIAL MESSAGE FROM NATION WIDE TO OUR SOUTH-OF-THE-BORDER FRIENDS

Over the years, we have served thousands of customers in Mexico, Central and South America. Right now we are looking for Centralized Distributors in each country! If you qualify, we can turn over 10,000 to 100,000 tubes annually. WRITE NATION-WIDE IMMEDIATELY!

OUR OVERSEAS AGENT WILL CALL ON YOU. OR WE WILL PAY YOUR EXPENSE TO NEW YORK TO GIVE YOU OUR SPECIAL DISTRIBUTOR DISCOUNTS!

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1H5GT 4B26 6A18 A	6CM7 6U8/A	10E7 12S8GT
1L6 4CB6 6AU4GT A	6CO8 6V3A	10E7 12S8GT
1LA6 4DT6 6AJS7A	6CU6 6W6GT	12ABGT 12S7
1LB4 5AM8 6AJ6/A	6C8 6W4GT/A	12AB5 12S7
1LH4 5AN8 6AJB	6DE4 6W6GT	12AD6 12S7
1LN5 5AQ5 6AV5GA	6DD6/A/B 6X4	12A66 12S7GT
1NSGT 5A38 6A46	6DT6 6XS7	12AF3 12S7
1RS 5AT8 6AW5 A	6E7 6X8/A	12AQ5 12W6GT
155 5BR7A 6AX4GT/B	6E8 6Y6/A	12A16 12X4
1T4 5BR8 6AX5GT	6EBB 7A4/XXL	12A17 12X4
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1U5 5CL8A 6BC5	6ER5 7A7	12AV5 13DR7
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2A74 5J6 6BE6	6FG7 7AG7	12AX7 14AF7
2B4 5TB 6BF5	6F55 7AU7	12A7 14E6
2CY5 5U4G 6BG6 A	6GH8 7B4	12B4 14F8
3AU6 5U4GA B 6BH6	6H6 7B5	12BA6 14H7
3BC5 5UB 6BH8	6J5 7B7	12BF6 14Q7
3BN6 5V4G 6EJ6/A	6JA6 7C5	12BH7 A 17AV5GA
3BU8 5X8 6BK5	6KG7 7C6	12BL6 17AX4GT
3BZ6 5Y3GT 6EK7 A	6K7 7F8	12B06 17C5
3C86 6ARGT 6EL7GT/A	6L6G B/C 7H7	12BY7 A 18A5
3C50 6AB4 6EN6	6OF7 7K7	12CA5 19AU4GT
3DK6 6AC7 6EO5	654 7X7 XF8	12CB6 19BG6G/A
3DT6 6AF4 A 6EO6GT/B	65A7 7Y4	12CU5 12C5 19T5
3E4 6AG5 6EQ7 A	65C7 7Z4	12CU6 25AX4GT
3J4 6AH4GT 6ER8	65H7 8AW8/A	12D4/A 25R06
3J5GT 6AH6 6HYSGA	65F7 8B05	12DB5 25C5
354 6AK5 6IY6	65K7 8C07	12DQ6 A B 25CD6GA/B
3V4 6AL5 6N27	65L7GT 8C57	12DT8 25CU6
4AU6 6AMB A 614	65N7GT/B 8C97	12EN6 25DN6
4BC5 6AN8 A 616	65O7 8C88	12FM6 25D06

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At 1/3 The Original Cost!

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Ideal for supermarkets and drug stores. Completely reconditioned; these machines have up-to-date charts, lighted back and locked compartment that stores up to 300 tubes.

**TV CONSOLES**

- Complete From Anodes To Back Cover!
- No Burned Out Picture Tubes or Transformers

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Shipped Relay Express FOB

16" 12" - 14" 16" 17" - 19" - 20" - 21" \$2.95 (see us) \$15.95 (see us)

**ONE YEAR GUARANTEED TV PICTURE TUBES**

Prices As Low As 49¢ Per Inch!

HERE ARE JUST A FEW SPECTACULAR SAMPLE PRICES!

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12BP4—\$7.19	17BP4—\$11.95	21AMP4—\$22.95
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NOTE: No Dud Required on any of the above tube types

**ATTENTION!**

All picture tubes sold by NATION-WIDE contain only new parts! The glass envelope which is tested has been closely inspected prior to manufacture to insure clear and perfect pictures!

ALL PICTURE TUBES SHIPPED FOB

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# NATION-WIDE TUBE CO.

**NATION-WIDE BLD. HARRISON, N. J. Humboldt 4-9848**

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## NEW PRODUCTS

circuit breakers. Kit AA-21 \$134.95. Assembled AAW-21 \$219.95. Heath Co.

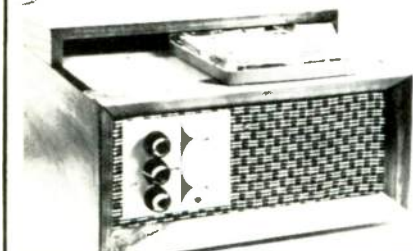
### TAPE PLAYER 218

A line of continuous tape cartridge background music systems feature the "Channel Matic" selector which provides playback of 4 hr of music at 3 $\frac{3}{4}$  ips or 8 hr at 1 $\frac{7}{8}$  ips without repeating. The selector control has five positions, channels 1, 2, 3, 4 and automatic. The



automatic position plays through 4 hr before repeating, or the user selects any of 4 1-hr music categories by rotating the selector to the desired channel. The categories are shown on each 4 hr cartridge. All units are guaranteed for one

## PROFITS IN BACKGROUND MUSIC



**CINE-SONIC SOUND, INC.**  
485 EIGHTH AVENUE, NEW YORK 1, N. Y.

Used in HOTELS, MOTELS, BANKS, OFFICES, RESTAURANTS AND ANY OTHER BUSINESS ESTABLISHMENTS.

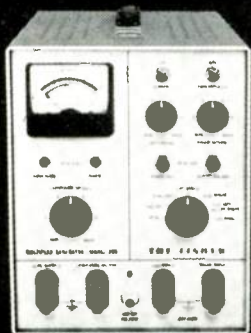
Become a distributor in your locality for the newest field of background music on tape in cartridges.

Build up an INCOME selling the instrument and leasing continuous play music

Send for circular and catalog of the largest and finest library of Programmed Music.

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**Who says Multiplex servicing is complex?  
All you need besides your 'scope  
is this!**



The Fisher Model 300 all-in-one Multiplex Generator with built-in FM Signal Generator.

Only Fisher could have designed this unique instrument—because only Fisher has the engineering depth in FM Stereo Multiplex tuners and receivers to create the ideal test equipment for servicing them. The future of high-fidelity radio unquestionably belongs to FM Stereo and the Model 300 is the instrument for the service technician in search of new business. It is compact, fully portable and completely self-contained. It has its own built-in FM signal generator. In addition to a composite MPX signal, it also generates low-distortion, stable audio signals. Thus it requires no companion instrument other than an oscilloscope for professional alignment of Multiplex equipment. Best of all, **THE FISHER** it costs only \$495.

USE THIS COUPON FOR DETAILED INFORMATION

FISHER RADIO CORPORATION ET-9  
21-24 44th Drive, Long Island City 1, N. Y.

Please send me complete data and technical specifications on the Fisher Model 300.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

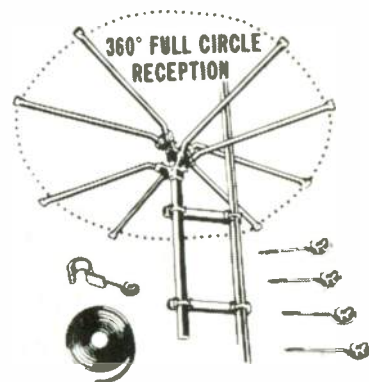
09917

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year and priced from \$118.65 to \$237.90. Sound Corp. of America.

### STEREO ANTENNAS 219

The "AAA Gold Bond Anodized, All-Directional Stereo-Cone" kit, with roof mount for new installations, contains a one 5 ft. gold anodized aluminum mast, one universal base mount for wall or roof installation, galvanized steel guy wire, guy ring, standoffs and mounting



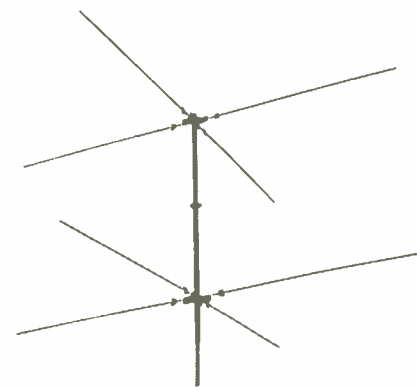
hardware. Fifty feet of 80 mil 300 ohm lead and the gold anodized antenna. JFD Electronics.

### STEREO TUNER 220

The Model 1451 high-fidelity f-m and a-m tuner is designed to "drop-in" to most of the firm's consoles. Features include: separate tuning and function controls, power transformer operation supplied from power amplifier in the console, 54 in. power cable, an f-m section that utilizes a limiter and Foster-Seeley discriminator and automatic frequency control. High impedance output jacks are provided for connection of dual channel amplifier. Retail Guide: \$99.95. V-M Corp.

### TV/FM ANTENNA 221

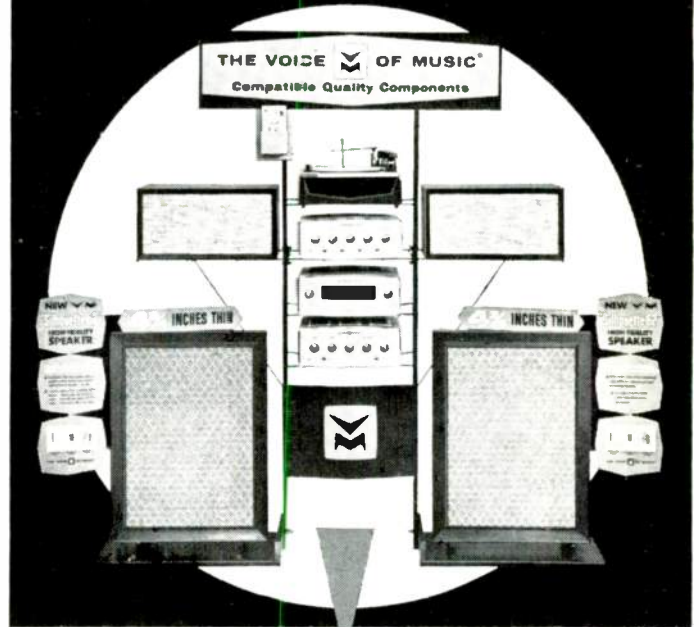
A stacked crossed-dipole antenna system, known as "Omni-Ray," model 3622, is said to give a perfect "figure-8" reception pattern with deep nulls at each side. The system is an adaptation of the classic bat-wing broad band dipole, with "cat's whisker" stubs on each dipole. The reception pattern is electrically "rotated" in 22 $\frac{1}{2}$ ° increments with an indoor switch. A 4-conductor non-mutual-coupling transmission line is employed. Channel Master Corp.




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—	1AX2	.62	—	6AU7	.73	—	6J6	.71	—	12CU5	.58
—	1B3	.79	—	6AU8	.87	—	6K6	.63	—	12CU6	1.06
—	1DN5	.55	—	6AV6	.41	—	6L6	1.06	—	12CX6	.54
—	1G3	.79	—	6AW8	.90	—	6N7	.98	—	12D4	.69
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—	1K3	.79	—	6AX5	.74	—	6SA7GT	.99	—	12DE8	.83
—	1R5	.77	—	6AX7	.64	—	6SG7GT	.41	—	12DL8	.88
—	1S4	.59	—	6BA6	.50	—	65H7GT	1.02	—	12DQ6	1.04
—	1S5	.75	—	6BA8	.92	—	6SJ7	.88	—	12DS7	.84
—	1T4	.72	—	6BC5	.61	—	6SK7GT	.95	—	12DT5	.76
—	1U4	.72	—	6BC7	.95	—	6SL7GT	.84	—	12DT7	.79
—	1U5	.65	—	6BC8	1.04	—	65N7GT	.65	—	12DT8	.78
—	1X2B	.82	—	6BD5	1.25	—	65Q7	.94	—	12DW8	.89
—	2AF4	.96	—	6BE6	.55	—	6T4	.99	—	12DZ6	.62
—	2BN4	.64	—	6BF5	.90	—	6T8	.85	—	12ED5	.62
—	3AL5	.46	—	6BF6	.44	—	6U8	.83	—	12EG6	.62
—	3AU6	.54	—	6BG6	1.70	—	6V6GT	.54	—	12EK6	.62
—	3AV6	.42	—	6BH6	.68	—	6W4	.61	—	12EL6	.50
—	3BA6	.51	—	6BH8	.98	—	6W6	.71	—	12EZ6	.57
—	3BC5	.63	—	6BJ6	.65	—	6X4	.41	—	12F8	.66
—	3BE6	.56	—	6BJ7	.79	—	6X5GT	.53	—	12FA6	.79
—	3BN6	.75	—	6BK7	.85	—	6X8	.80	—	12FM6	.50
—	3BU8	.78	—	6BL7	1.09	—	7A8	.68	—	12FR8	.97
—	3BY6	.58	—	6BN4	.62	—	7AU7	.65	—	12FX8	.90
—	3BZ6	.56	—	6BN6	.74	—	7B6	.69	—	12GC6	1.06
—	3CB6	.56	—	6BQ6	1.12	—	7EY6	.75	—	12J8	.84
—	3CS6	.58	—	6BQ7	1.00	—	7F8	.90	—	12K5	.75
—	3DG4	.85	—	6BS8	.95	—	7N7	.90	—	12L6	.73
—	3DK6	.60	—	6BU8	.70	—	7S7	1.00	—	12SA7	.99
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—	3Q5	.80	—	6BZ7	1.03	—	8BQ5	.60	—	12SK7	.95
—	3S4	.75	—	6BZ8	1.09	—	8CG7	.63	—	12SL7	.80
—	3V4	.63	—	6C4	.45	—	8CM7	.70	—	12SN7	.67
—	4BQ7	1.01	—	6CB6	.55	—	8CN7	.97	—	12SQ7	.91
—	4BZ7	1.04	—	6CD6	1.51	—	8CS7	.74	—	12U7	.62
—	4CS6	.61	—	6CE5	.57	—	8EB8	.94	—	12V6	.63
—	4DT6	.55	—	6CF6	.64	—	8FQ7	.56	—	12W6	.71
—	4GM6	.60	—	6CG7	.61	—	9CL8	.79	—	12X4	.47
—	5AM8	.79	—	6CG8	.80	—	11CY7	.75	—	17AX4	.67
—	5AN8	.90	—	6CK4	.70	—	12A4	.60	—	17BQ6	1.16
—	5AQ5	.54	—	6CL8	.79	—	12AB5	.60	—	17DQ6	1.06
—	5AT8	.83	—	6CM7	.69	—	12AC6	.55	—	17W6	.70
—	5BC8	.79	—	6CN7	.70	—	12AD6	.57	—	18FW6	.49
—	5BE8	.83	—	6CQ8	.92	—	12AE6	.50	—	18FX6	.53
—	5BK7	.86	—	6CR6	.60	—	12AE7	.94	—	18FY6	.50
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—	5BR8	.83	—	6CS7	.69	—	12AF6	.67	—	19BG6	1.39
—	5CG8	.81	—	6CU5	.58	—	12AJ6	.62	—	19C8	1.14
—	5CL8	.76	—	6CU6	1.08	—	12AL5	.47	—	19EA8	.79
—	5CQ8	.84	—	6CY5	.70	—	12AL8	.95	—	19T8	.85
—	5CZ5	.72	—	6CY7	.71	—	12AQ5	.60	—	21EX6	1.49
—	5EA8	.80	—	6DA4	.68	—	12AT6	.50	—	25AX4	.70
—	5EU8	.80	—	6DB5	.69	—	12AT7	.76	—	25BQ6	1.17
—	5J6	.72	—	6DE6	.61	—	12AU6	.51	—	25C5	.53
—	5T8	.86	—	6DG6	.62	—	12AU7	.61	—	25CA5	.59
—	5U4	.60	—	6DJ8	1.21	—	12AV6	.41	—	25CQ6	1.52
—	5U8	.84	—	6DK6	.59	—	12AV7	.82	—	25CU6	1.11
—	5V3	.90	—	6DN6	1.55	—	12AX4	.67	—	25DQ6	1.42
—	5V6	.56	—	6DQ6	1.10	—	12AX7	.63	—	25EH5	.55
—	5X8	.82	—	6DT5	.81	—	12AY7	1.44	—	25L6	.57
—	5Y3	.46	—	6DT6	.53	—	12AZ7	.86	—	25W4	.68
—	6A8G	1.20	—	6DT8	.94	—	12B4	.68	—	32ET5	.55
—	6AB4	.46	—	6EA8	.79	—	12BA7	.84	—	32L7	.90
—	6AC7	.96	—	6EB5	.73	—	12BD6	.50	—	35C5	.51
—	6AF3	.73	—	6EB8	.94	—	12BE6	.53	—	35L6	.60
—	6AF4	1.01	—	6EM5	.77	—	12BF6	.60	—	35W4	.42
—	6AG5	.70	—	6EM7	.82	—	12BH7	.77	—	35Z5	.60
—	6AH4	.81	—	6EU8	.79	—	12BK5	1.00	—	36AM3	.36
—	6AH6	1.10	—	6EV5	.75	—	12BL6	.56	—	50B5	.69
—	6AK5	.95	—	6EW6	.57	—	12BQ6	1.16	—	50C5	.53
—	6AL5	.47	—	6EY6	.75	—	12BR7	.74	—	50EH5	.55
—	6AM8	.78	—	6F5GT	.39	—	12BV7	.76	—	50L6	.61
—	6AQ5	.53	—	6FG7	.69	—	12BY7	.77	—	70L7	.97
—	6AR5	.55	—	6FV8	.79	—	12BZ7	.86	—	11Z3	.85
—	6AS5	.60	—	6GH8	.80	—	12C5	.58	—	807	.75
—	6AS6	.80	—	6GK5	.61	—	12CN5	.56	—	70Z5	.69
—	6AT6	.49	—	6GK6	.79	—					
—	6AT8	.86	—	6GN8	.94	—					
—	6AU4	.85	—	6H6	.58	—					

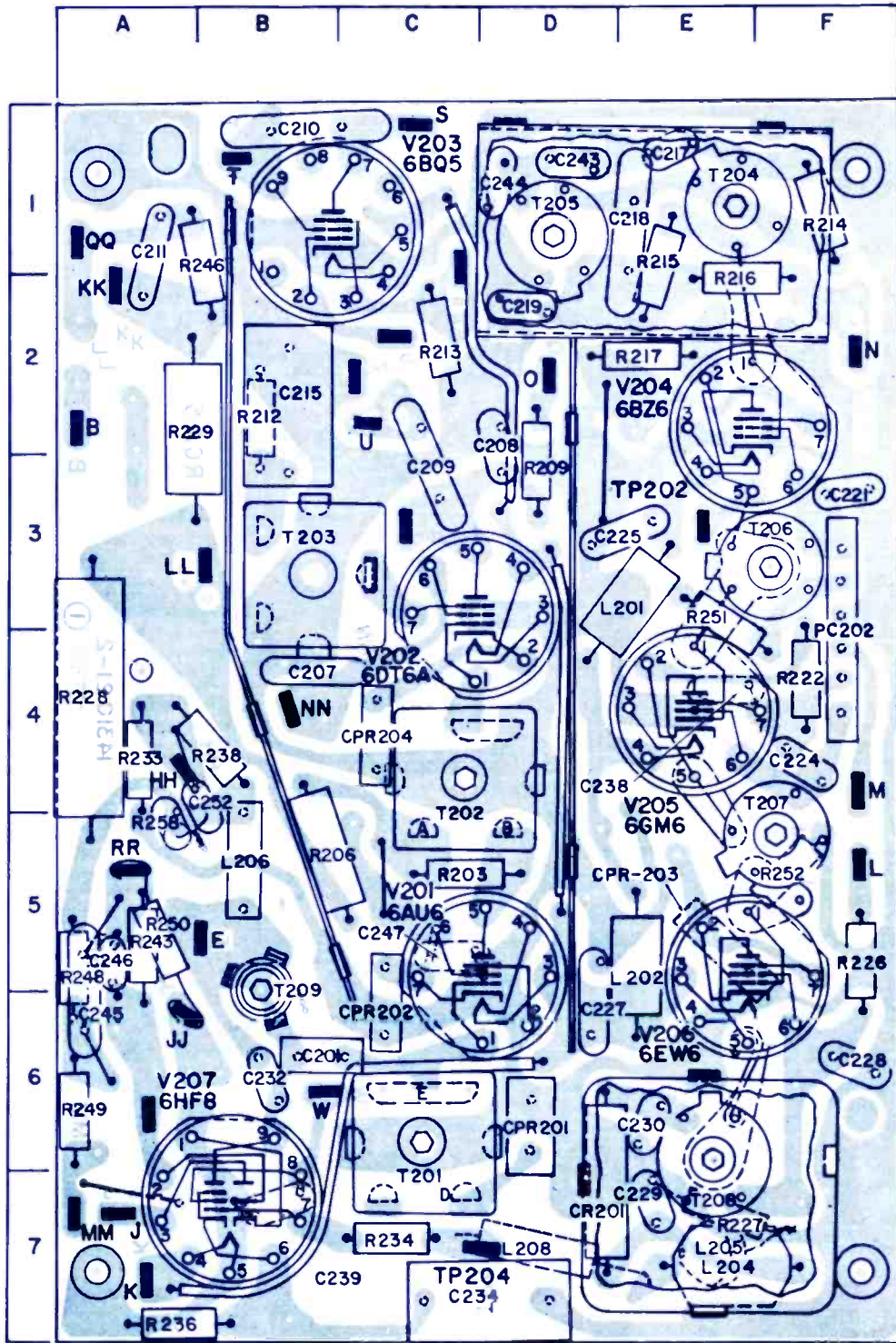
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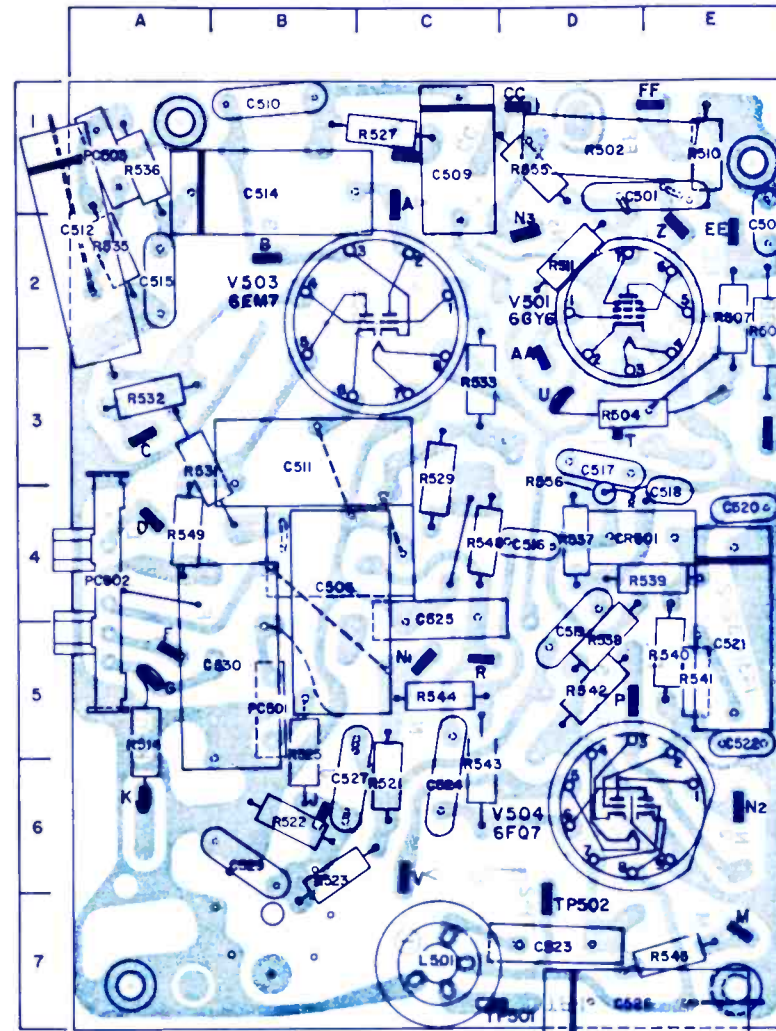
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C239	.....	B6
C243	.....	C1
C244	.....	C1
C245	.....	A5
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PC202	.....	D3
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R206	.....	B4
R209	.....	C2
R212	.....	A2
R213	.....	B2
R214	.....	D1
R215	.....	C1
R216	.....	D1
R217	.....	C2
R222	.....	D3
R225	.....	D5
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R228	.....	A3
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R233	.....	A4
R234	.....	B6
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R238	.....	A4
R243	.....	A2
R246	.....	A1
R247	.....	C6
R248	.....	A5
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R250	.....	A5
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T202	.....	B4
T203	.....	B3
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T205	.....	C1
T206	.....	D3
T207	.....	D4
T208	.....	D6
T209	.....	A5



*PW200 Sealed  
Circuit I.F. and Video Assembly  
Composite Diagram*

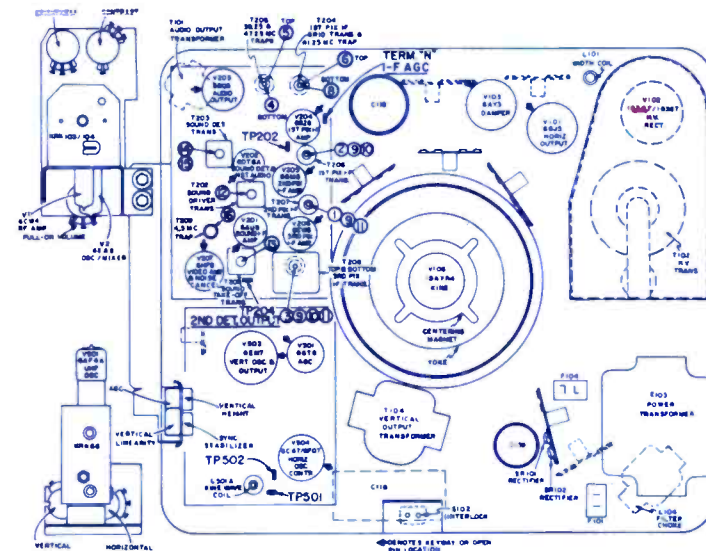
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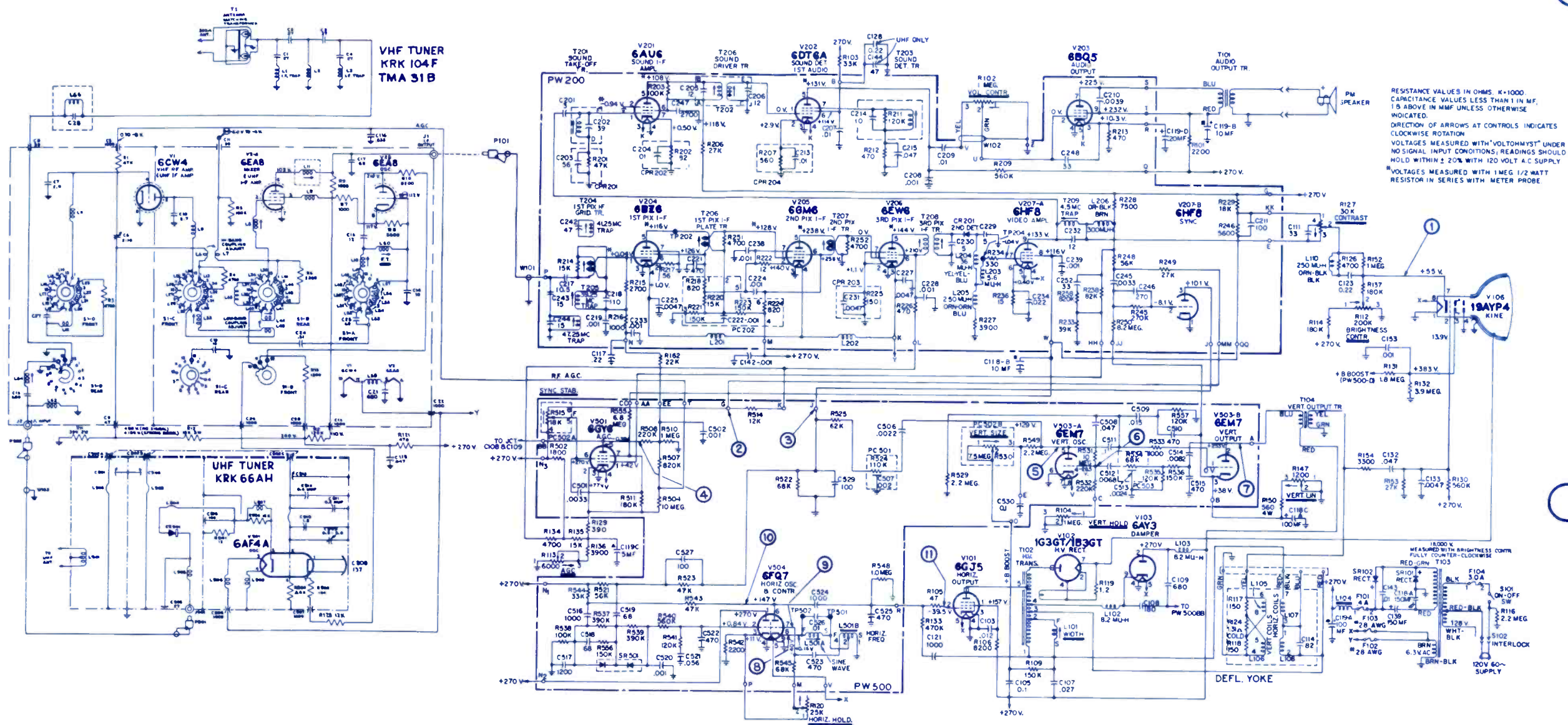


*PW500 Sealed Circuit Deflection Assembly  
Composite Diagram*

**PW500 COMPONENT LOCATION GUIDE**

C501	.....	C1
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C510	.....	B1
C511	.....	B3
C512	.....	A1
C514	.....	B1
C515	.....	A2
C516	.....	C3
C517	.....	D3
C518	.....	D3
C519	.....	C3
C520	.....	D3
C521	.....	D3
C522	.....	C5
C523	.....	C5
C524	.....	C4
C525	.....	C4
C526	.....	D5
C527	.....	B6
C530	.....	A3
CR501	.....	D3
L501	.....	C5
PC501	.....	B4
PC502	.....	A3
PC503	.....	A1
R502	.....	C1
R504	.....	D2
R507	.....	D2
R508	.....	D2
R510	.....	D1
R511	.....	C1
R514	.....	A4
R521	.....	B4
R522	.....	B4
R523	.....	B6
R525	.....	A4
R527	.....	B1
R529	.....	C3
R531	.....	A3
R532	.....	A2
R533	.....	C2
R535	.....	A1
R536	.....	C1
R537	.....	D3
R538	.....	D3
R539	.....	D3
R540	.....	D3
R541	.....	D4
R542	.....	C4
R543	.....	C4
R544	.....	C4
R545	.....	D5
R548	.....	C3
R549	.....	A3
R555	.....	C1
R556	.....	D3





RESISTANCE VALUES IN OHMS, K=1000  
CAPACITANCE VALUES LESS THAN 1 IN MF,  
1.0 ABOVE IN MMF UNLESS OTHERWISE  
INDICATED.  
DIRECTION OF ARROWS AT CONTROLS INDICATES  
CLOCKWISE ROTATION  
VOLTAGES MEASURED WITH "VOLTOHMYST" UNDER  
NO SIGNAL INPUT CONDITIONS; READINGS SHOULD  
HOLD WITHIN ± 20% WITH 120 VOLT A.C. SUPPLY  
\*VOLTAGES MEASURED WITH 1MEG 1/2 WATT  
RESISTOR IN SERIES WITH METER PROBE

REFER TO PAGE TWO FOR  
CHASSIS/TUNER/MODEL  
CROSS-REFERENCE  
INFORMATION

All resistance values in ohms, K = 1000.

All capacitance values less than 1 in F and  
above 1 in MF unless otherwise noted.

Directions of arrows at controls indicates  
clockwise rotation.

All voltages measured with "VoltOhmyst"  
and with no signal input. Voltages should  
hold within ±20% with 120 volts a.c. supply.

\*Measured with 1 megohm, 1/2 watt  
resistor in series with meter probe.

Balloons ①, ②, etc., shown on schematics  
indicate points of observation of the wave-  
forms shown below the schematic.

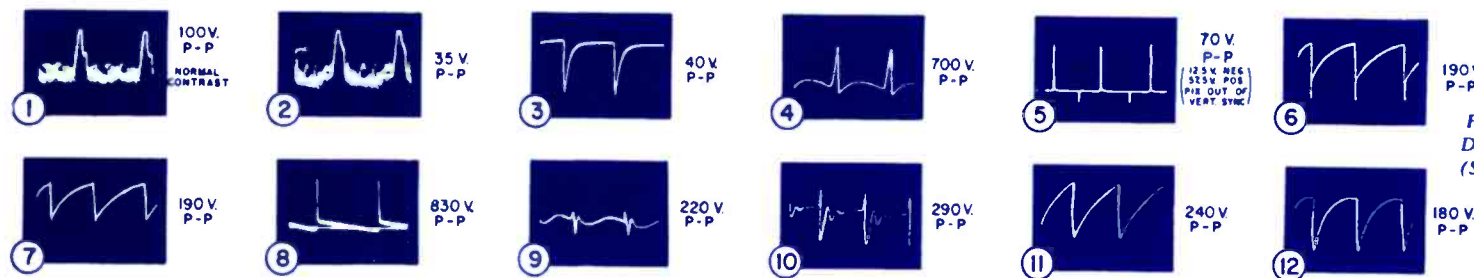


Figure 17—Circuit Schematic  
Diagram for Chassis 140A & B  
(Shown with KRK104F/66AH  
Tuners)

More Data on Reverse Side

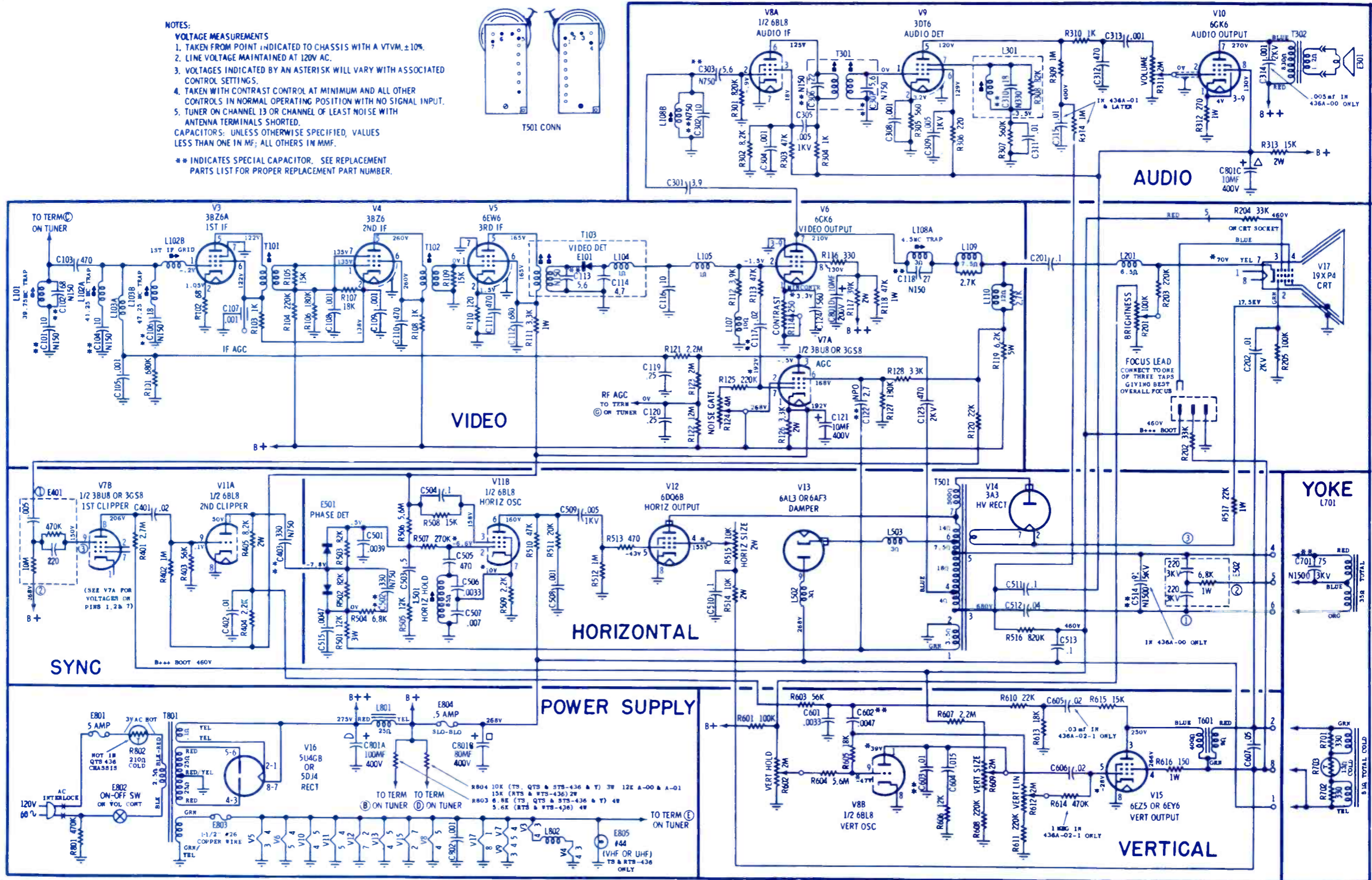
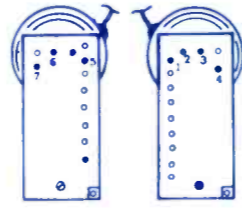
**NOTES:**

**VOLTAGE MEASUREMENTS**

1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM, ±10%.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS.
4. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.
5. TUNER ON CHANNEL 13 OR CHANNEL OF LEAST NOISE WITH ANTENNA TERMINALS SHORTED.

CAPACITORS: UNLESS OTHERWISE SPECIFIED, VALUES LESS THAN ONE IN MF; ALL OTHERS IN MMF.

\*\* INDICATES SPECIAL CAPACITOR. SEE REPLACEMENT PARTS LIST FOR PROPER REPLACEMENT PART NUMBER.



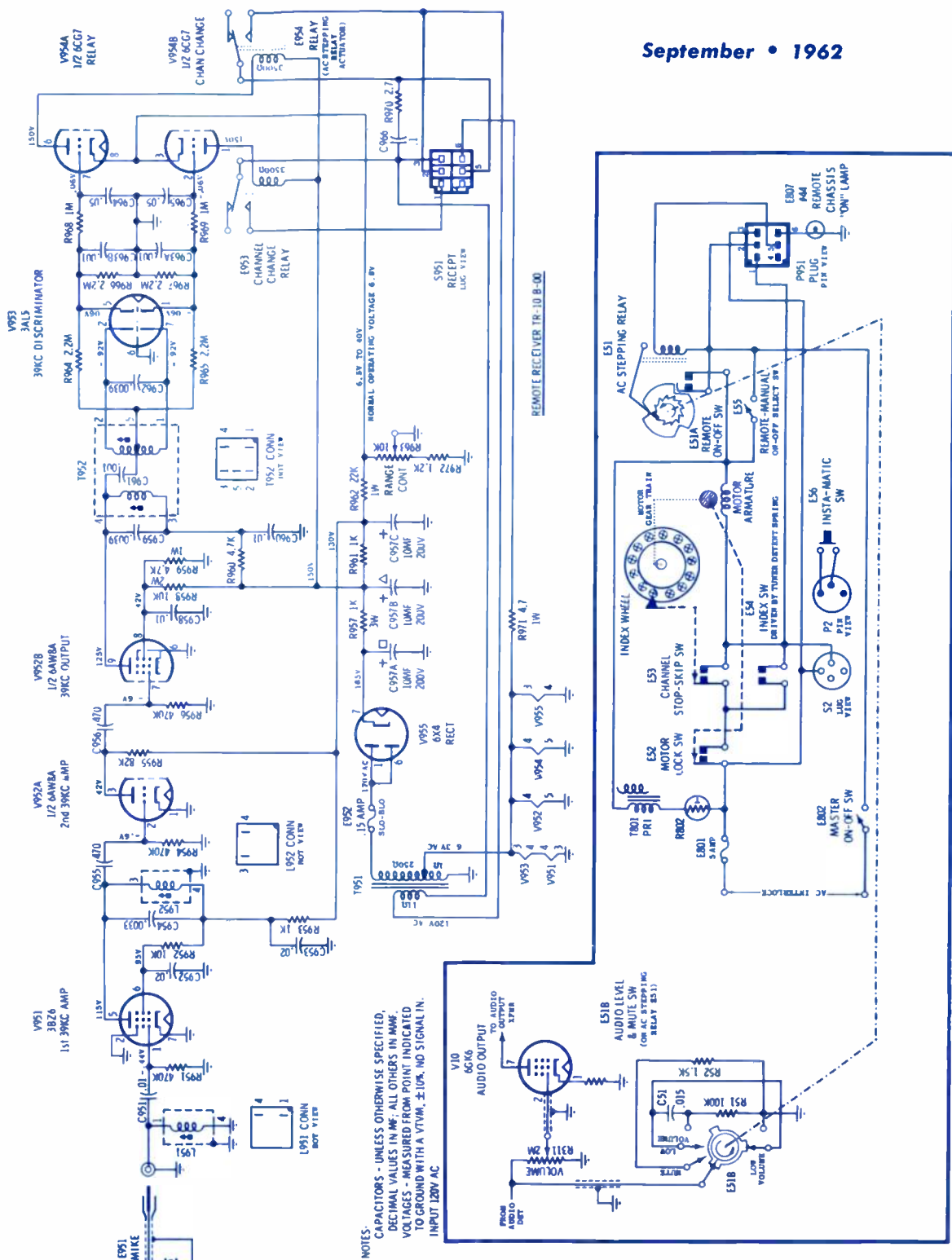
More Data on Reverse Side

# ELECTRONIC TECHNICIAN 731

## CIRCUIT DIGEST

**MOTOROLA**  
TV Chassis TS, QTS,  
RTS, STS, & WTS-436  
Models 19T5, 7, 11,  
12, 13, 14, & A19T8

September • 1962



More Data on Reverse Side

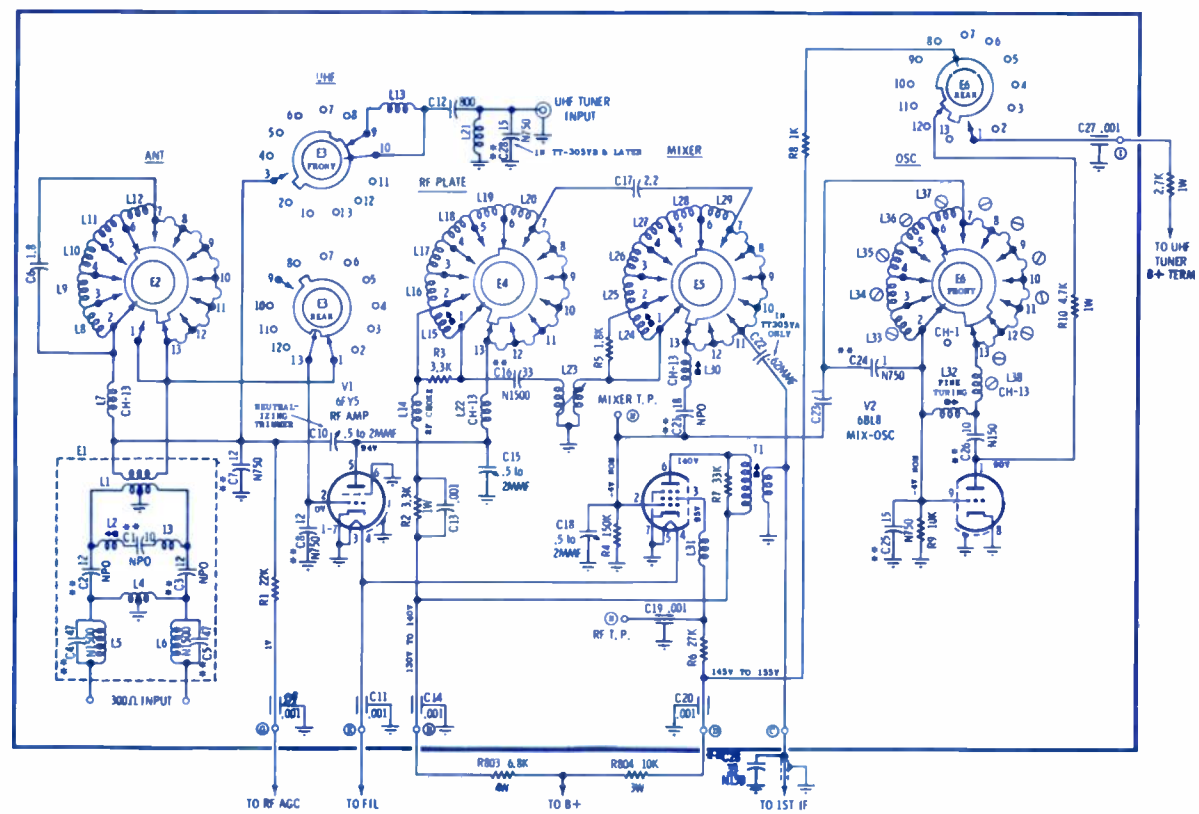
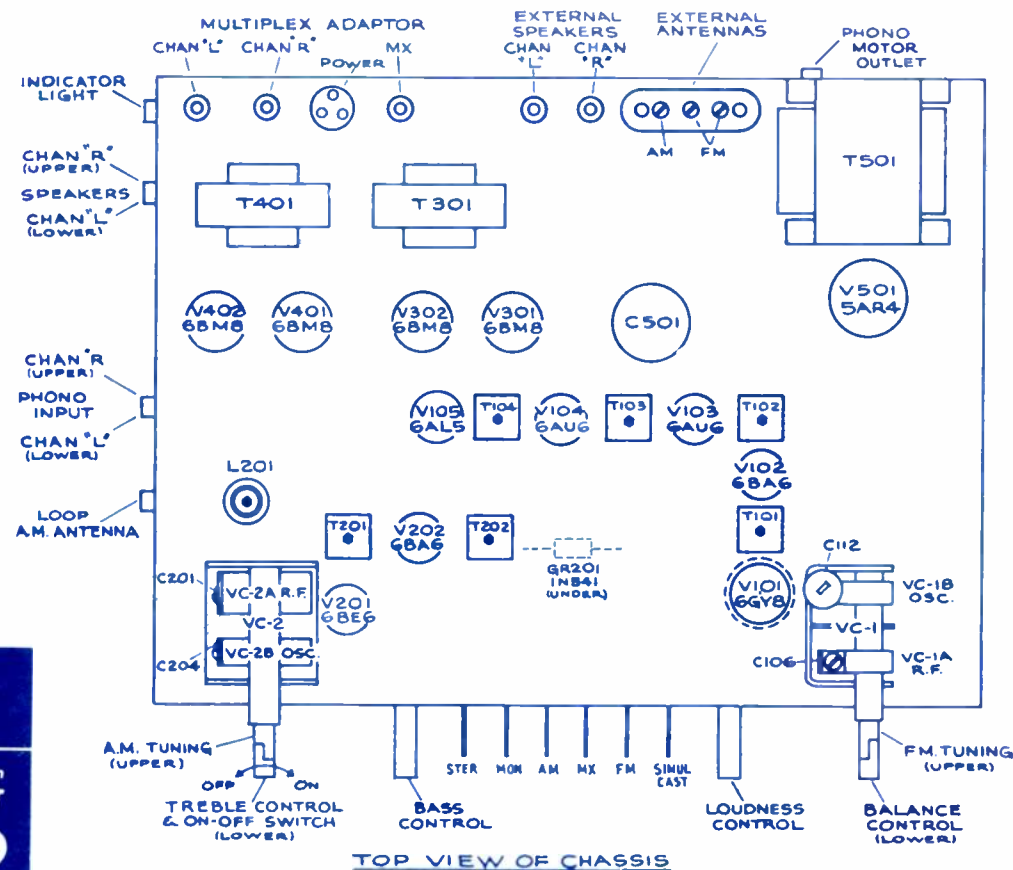
# SPARTON

Stereo Phonograph  
Model 12M5-P

## Electronic Technician

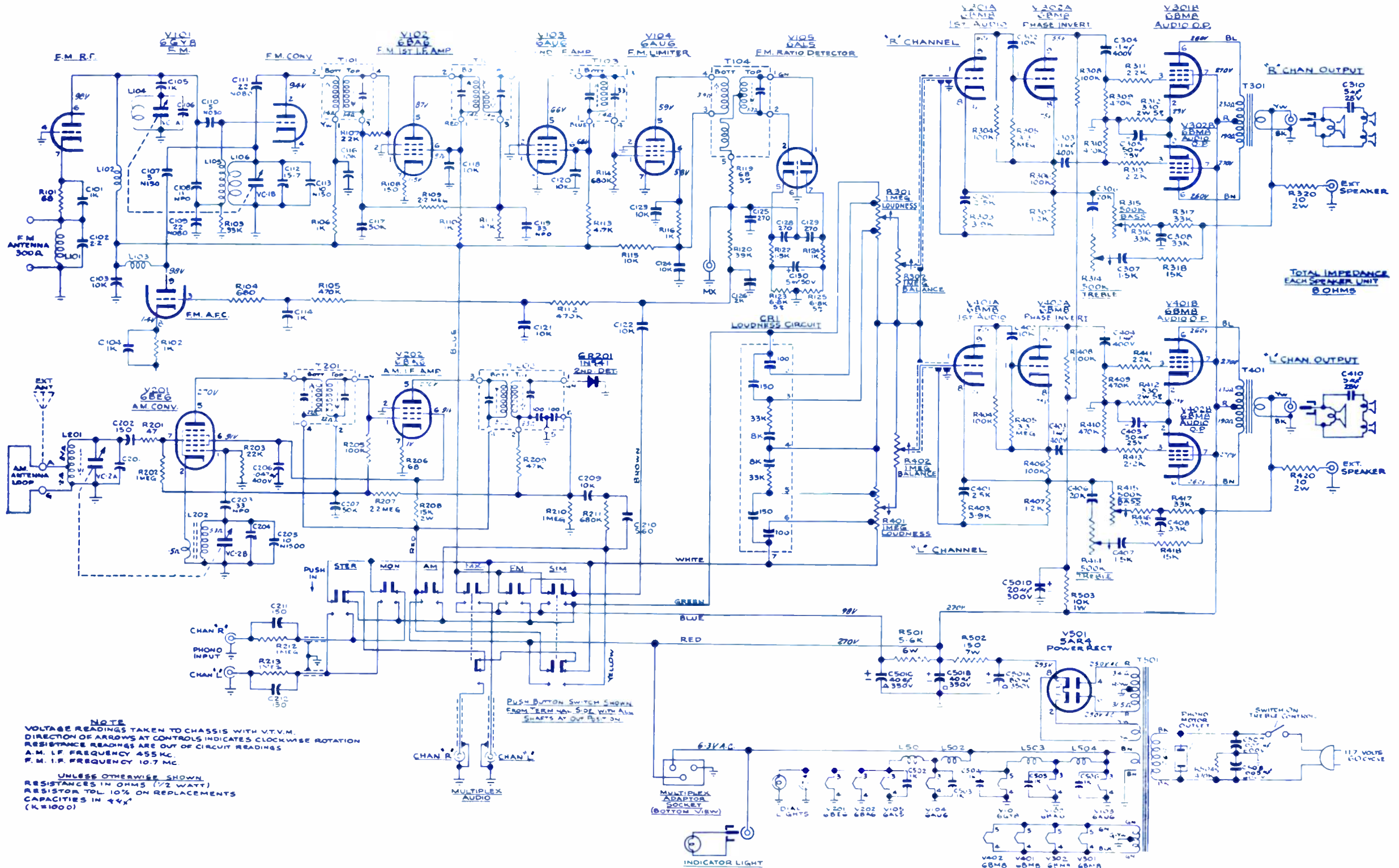
# CIRCUIT DIGEST

# 732





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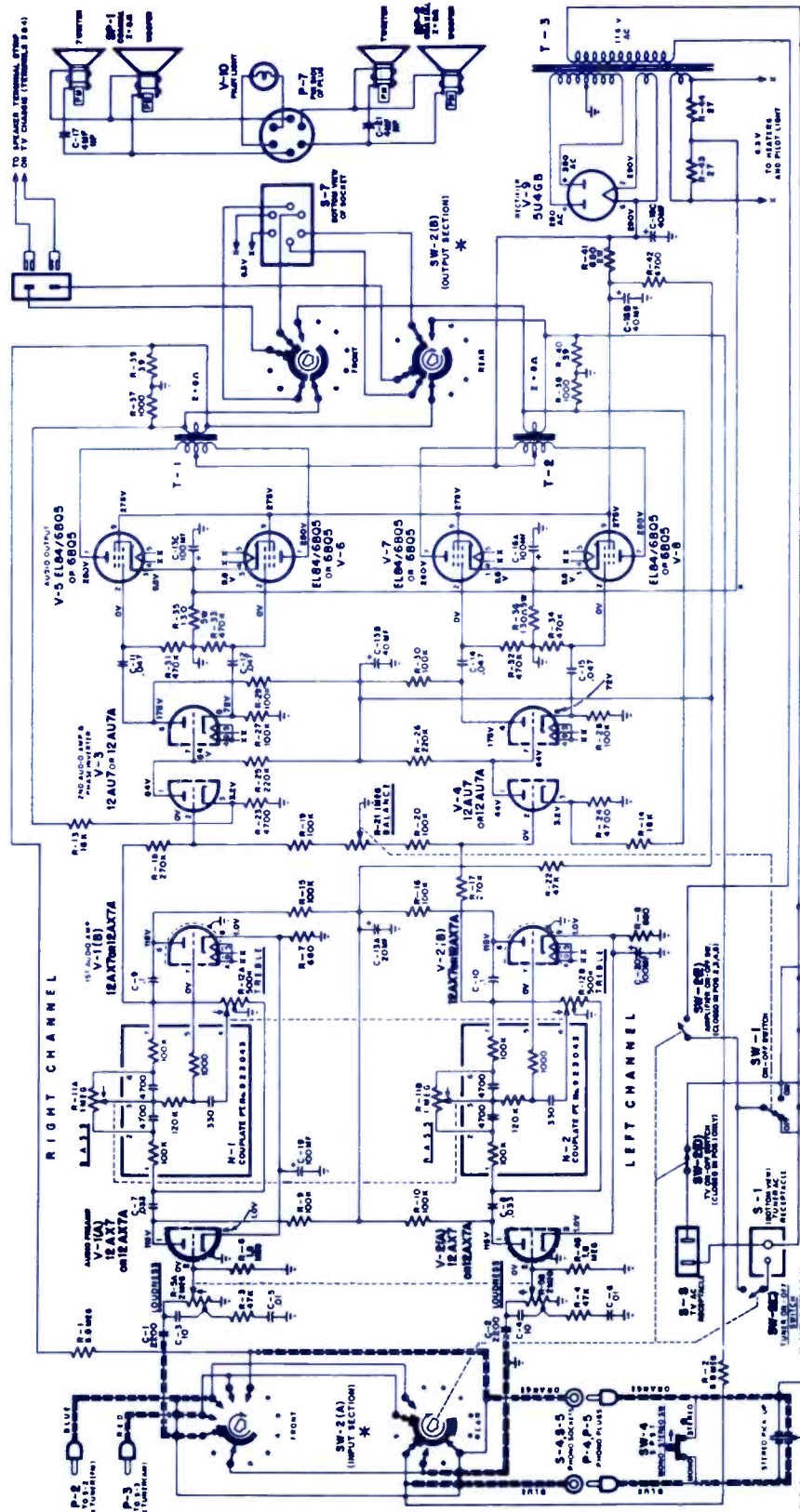


**NOTE**  
VOLTAGE READINGS TAKEN TO CHASSIS WITH V.T.V.M.  
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION  
RESISTANCE READINGS ARE OUT OF CIRCUIT READINGS  
A.M. I.F. FREQUENCY 455 KC.  
F.M. I.F. FREQUENCY 10.7 MC.

UNLESS OTHERWISE SHOWN,  
RESISTANCES IN OHMS (1/2 WATT)  
RESISTOR TOL. 10% ON REPLACEMENTS  
CAPACITIES IN 44%  
(K=1000)

PUSH-BUTTON SWITCH SHOWN  
FROM TERMINAL SIDE WITH ALL  
SHAFTS AT OUT POSITION

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NOTES:  
 = CERAMIC CAPACITORS, CAPACITY IN MICRO-  
 FARADS  
 \* TUBULAR CAPACITORS, CAPACITY IN MICROFARADS  
 † RESISTORS IN OHMS (K=1,000 OHMS) AND 1/2 WATT UNLESS OTHERWISE NOTED  
 ‡ AT CONTROLS INDICATE CLOCKWISE ROTATION

\* SW-2 (A, B) 5-PIN (VIEWED FROM XHO8 END) SHOWN IN EXTREME COUNTER-POSITIONS (CLOCKWISE) 1-TV, 2-AM, 3-FM, 4-AM/FM, 5-PHONO.

### CONDITIONS FOR VOLTAGE AND RESISTANCE READINGS, CHASSIS 120509-B (AUDIO), CHASSIS 120482-B, C (TUNER)

1. Voltages are positive DC, resistances in ohms, unless otherwise indicated.
2. All measurements taken with VoltOhmyst or equivalent.
3. All measurements taken between tube pin and chassis unless otherwise noted.
4. Voltage measurements made with:
  - a) Line voltage maintained at 115 volts AC.
  - b) Loudness control set for minimum volume (max CCW), all others set at mid-range.
  - c) No signal input (AM or FM) to tuner chassis.
  - d) No signal input to audio chassis.
  - e) SW-2 (on audio chassis) may be in any position.
5. Resistance measurements taken with:
  - a) Power line cord disconnected from outlet.
  - b) SW-2 (on audio chassis) may be in any position.
6. AFC switch in "OFF" pos. at all times.
7. Nominal tolerances of component values makes possible a variation of ±15% in voltage and resistance readings.
8. N.C. denotes no connection, K is kilohms, Meg is megohms.

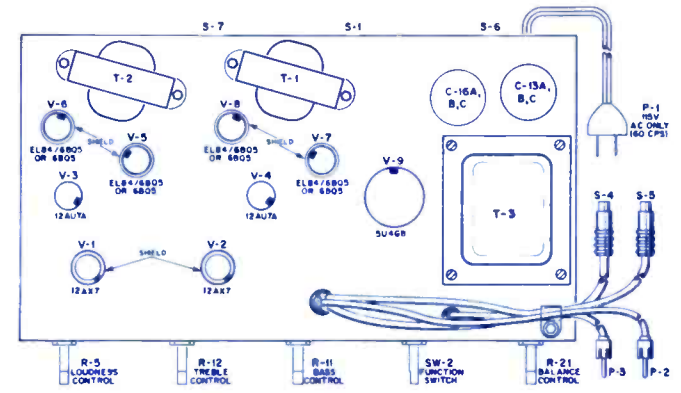


FIG. 11 - TUBE LOCATION AND ALIGNMENT POINTS CHASSIS 120509-B (AUDIO)

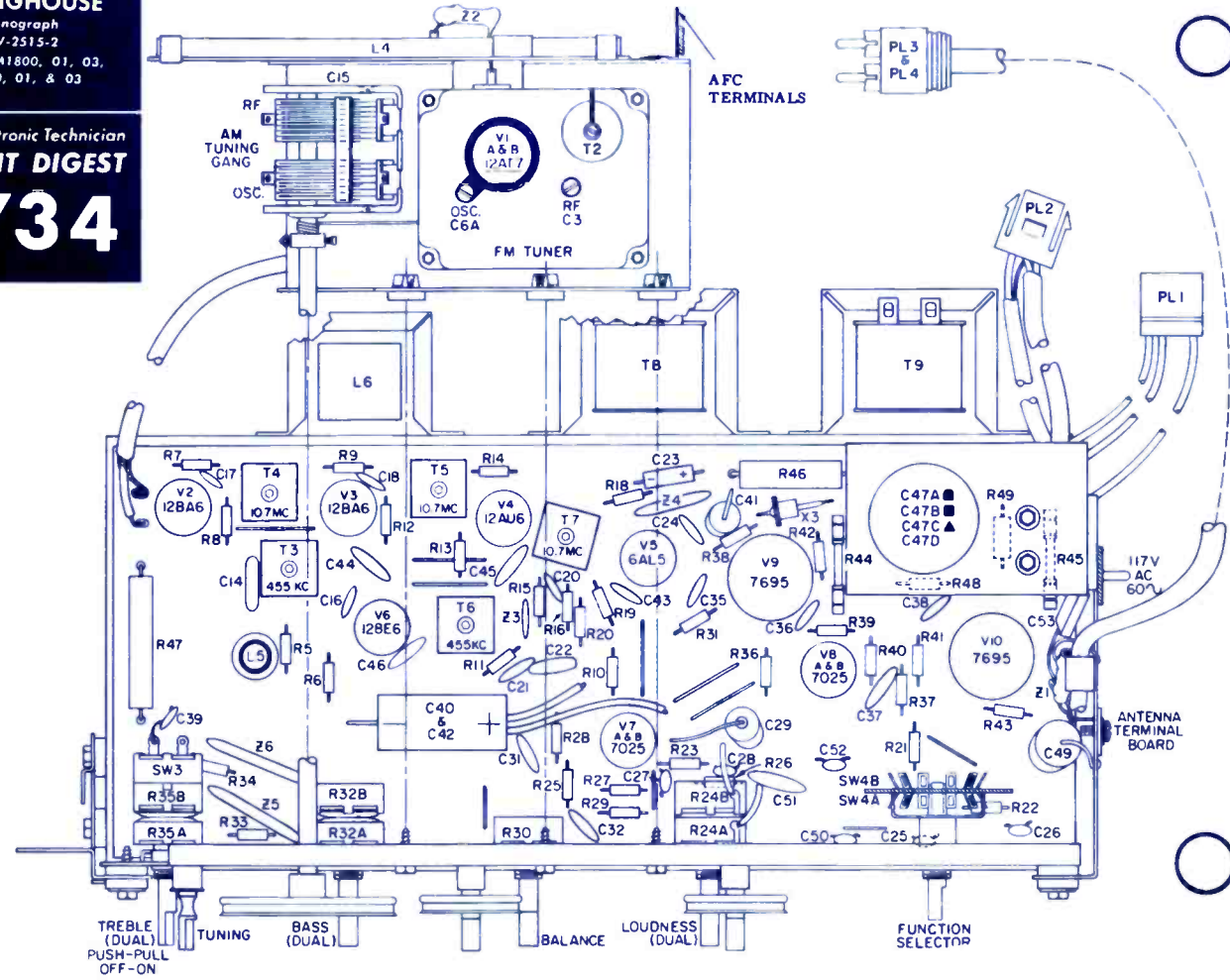
### RESISTANCE READINGS, CHASSIS 120509-B (AUDIO) NOTE: SCHEMATIC ON PG. 16

SYM.	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-1, V-2	12AX7	*150K	25Ω to 1 Meg. †	1K	130	130	*150K	400K to 550K	1K	130
V-3, V-4	12AU7	*225K	75K to 300K †	3.8K	130	130	*105K	*225K	100K	130
V-5, V-6, V-7, V-8	EL84/6BQ5	N.C.	470K	130	130	130	N.C.	*290	N.C.	680
V-9	SU4-GB	N.C.	1 Meg. or Higher	N.C.	430	N.C.	430	N.C.	1 Meg. or Higher	-

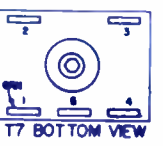
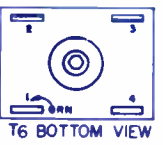
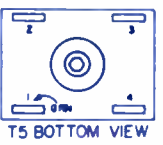
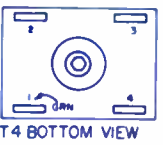
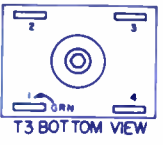
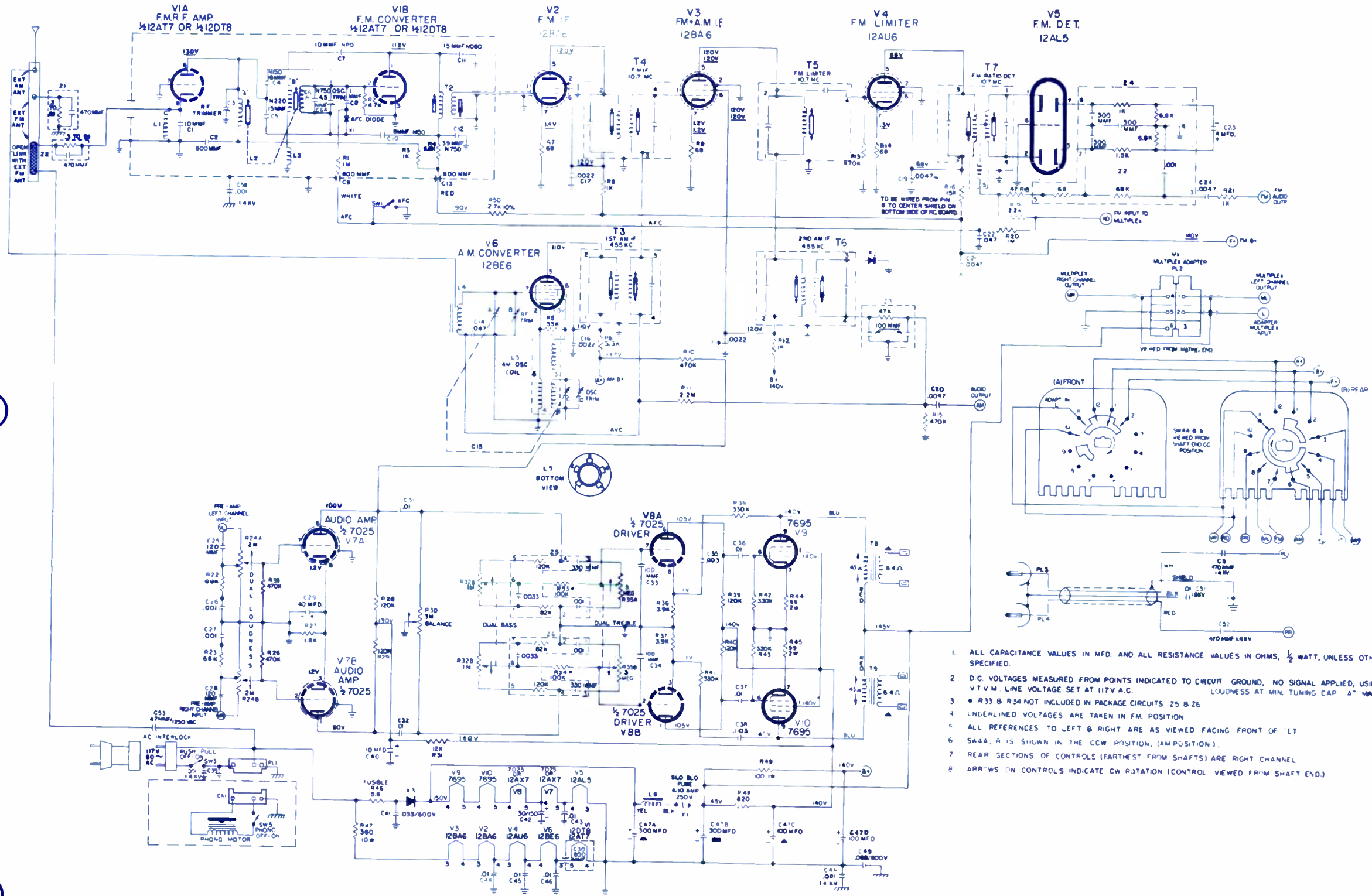
\* Indicates reading taken with negative lead of meter connected to Pin 8 of V-9.  
 † Indicates reading varies with control settings.

**WESTINGHOUSE**  
 Stereo Phonograph  
 Chassis V-2515-2  
 Models H-M1800, 01, 03,  
 H-M1900, 01, & 03

Electronic Technician  
**CIRCUIT DIGEST**  
**734**



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1. ALL CAPACITANCE VALUES IN MFD. AND ALL RESISTANCE VALUES IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. D.C. VOLTAGES MEASURED FROM POINTS INDICATED TO CIRCUIT GROUND, NO SIGNAL APPLIED, USING A V.T.V.M. LINE VOLTAGE SET AT 117V A.C. LOUDNESS AT MIN. TUNING CAP. AT MAX.
3. R33 & R34 NOT INCLUDED IN PACKAGE CIRCUITS 25 B 26
4. UNDERLINED VOLTAGES ARE TAKEN IN FM POSITION
5. ALL REFERENCES TO LEFT & RIGHT ARE AS VIEWED FACING FRONT OF TET
6. SW4A, R15 SHOWN IN THE CCW POSITION. (AMPOSITION).
7. REAR SECTIONS OF CONTROLS (FARTHEST FROM SHAFTS) ARE RIGHT CHANNEL
8. ARROWS ON CONTROLS INDICATE CW ROTATION (CONTROL VIEWED FROM SHAFT END)

# ELECTRONIC TECHNICIAN

## CIRCUIT DIGESTS

In This Issue (No. 121)

Circuit Digest Schematic No.

**DUMONT** ..... 733  
Stereo Amplifier  
Chassis 120509-B

**MOTOROLA** ..... 731  
TV Chassis TS, QTS, RTS, STS, & WTS-436  
Models 19T5, 7, 11, 12, 13, 14, and A19T8  
series

**RCA** ..... 730  
TV Chassis KCS 140A, B  
Models 193-A-542-MV, -MU, -546-VM,  
MU-549-MV, -MU

**SPARTON** ..... 732  
Stereo Phonograph  
Model 12M5-P

**WEBCOR** ..... 735  
Stereo Phonograph  
Models 1376 & 1377

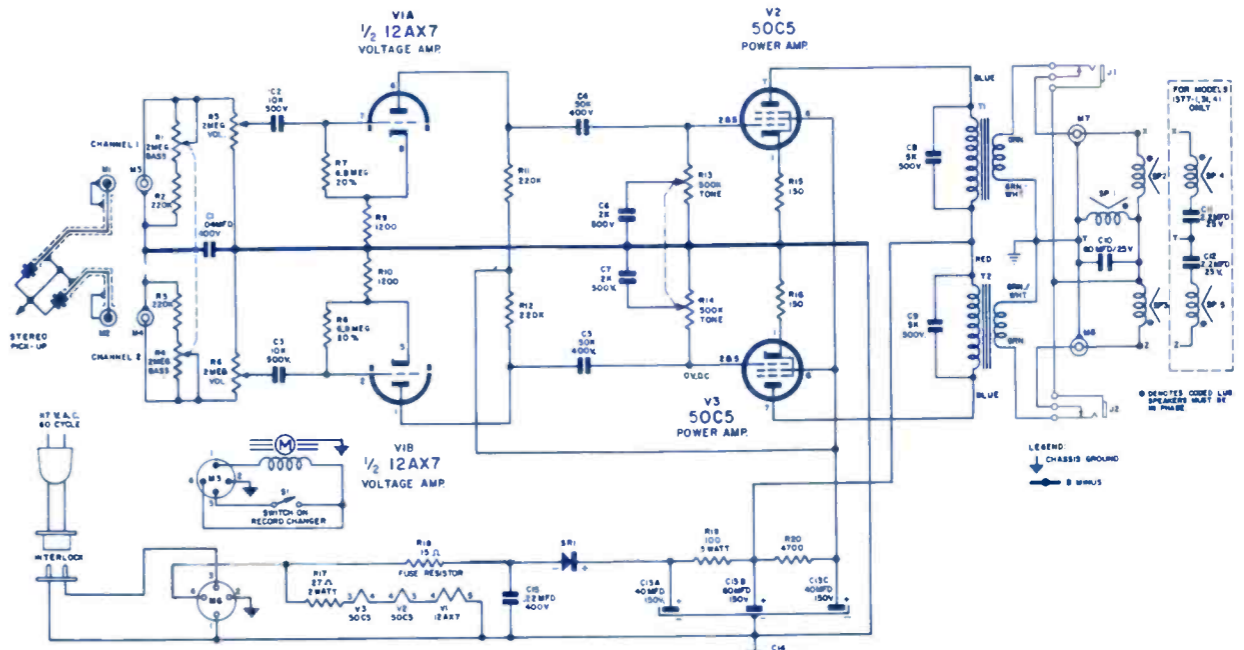
**WESTINGHOUSE** ..... 734  
Phonograph Chassis V-2515-2  
Models H-M1800, 01, 03, H-M1900, 01, &  
03



# ELECTRONIC TECHNICIAN 735

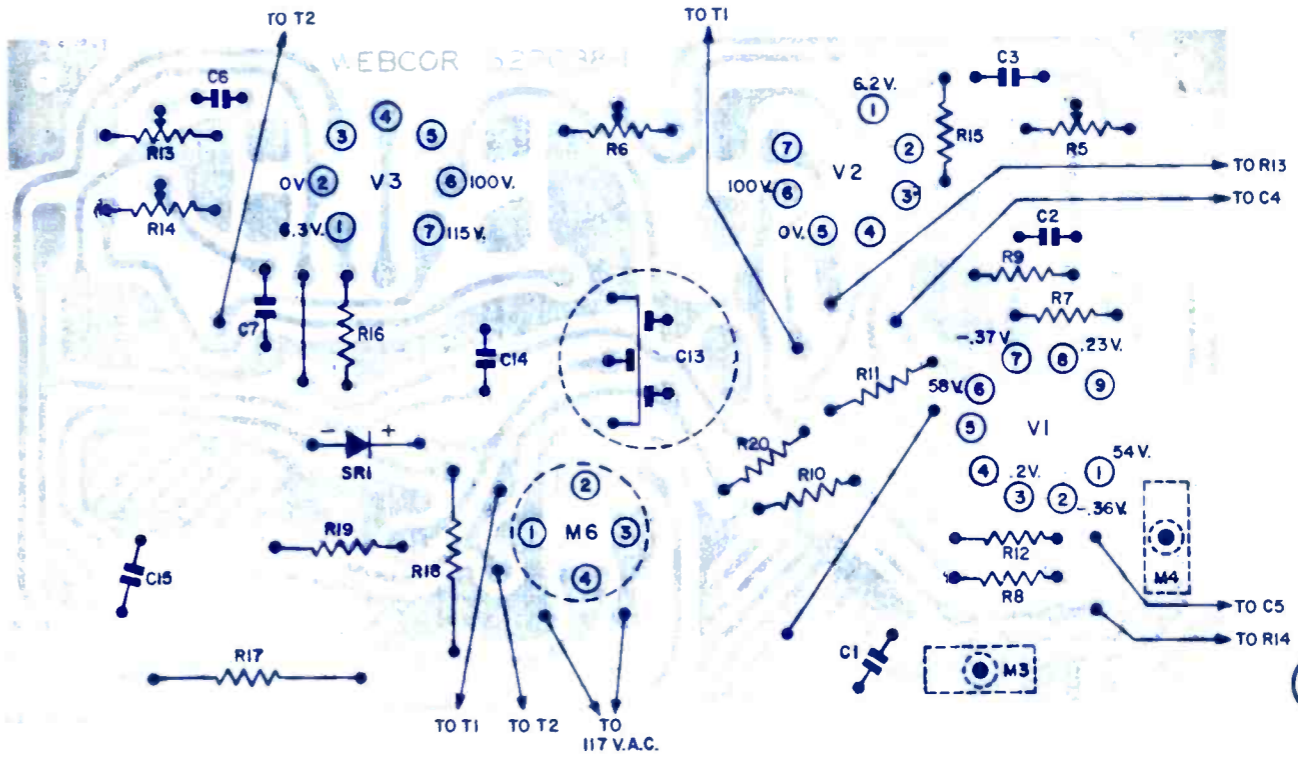
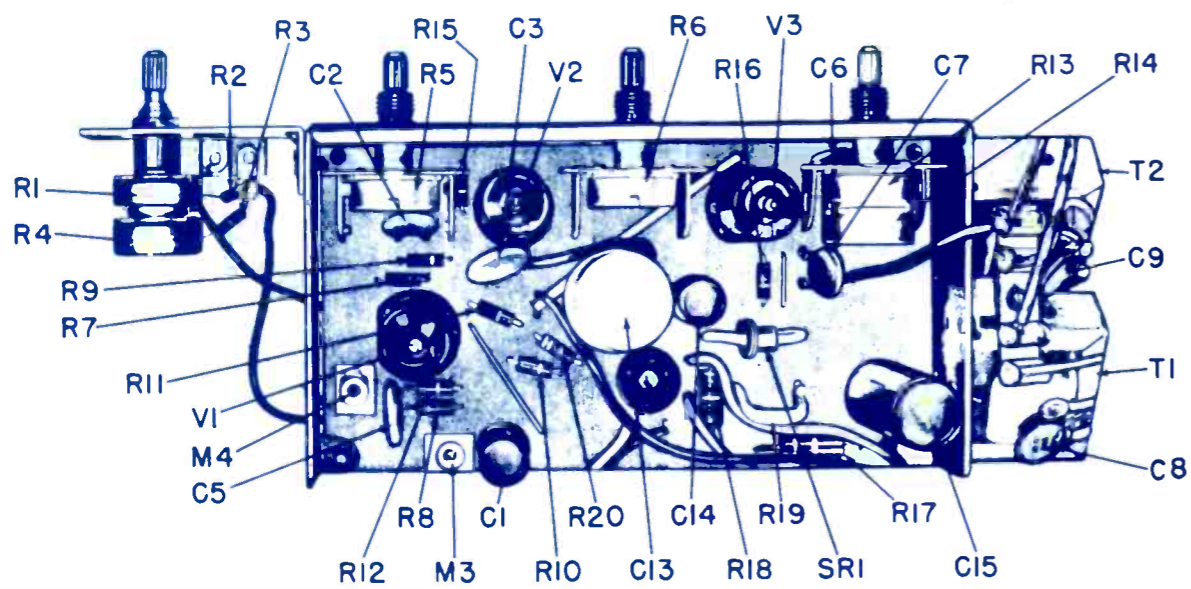
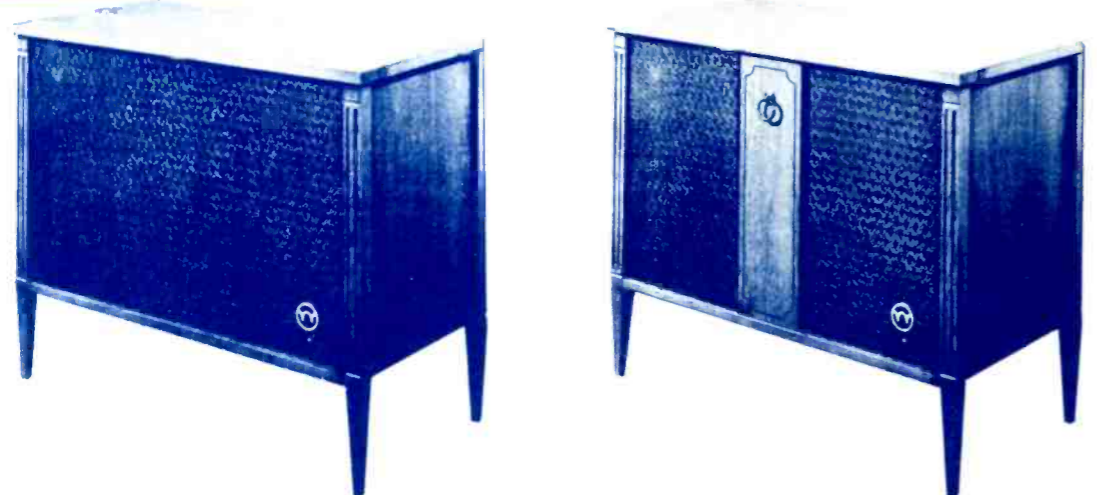
## CIRCUIT DIGEST

**WEBCOR**  
Stereo Phonograph  
Models 1376 & 1377



**LEGEND:**  
CHASSIS GROUND  
B MINUS

**NOTES:**  
1 - ALL RESISTORS RATED AT 1/2 WATT 10% TOLERANCE UNLESS OTHERWISE SPECIFIED.  
2 - ALL CAPACITOR VALUES EXCEPT ELECTROLYTICS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.  
3 - ALL CAPACITORS WITH WHOLE NUMBER VALUES ARE IN MFD AND ARE CERAMIC CAPACITORS.  
4 - ALL D.C. VOLTAGES TO BE MEASURED WITH A V.T.M. OF 10 MEGOHM INPUT RESISTANCE OR BETTER AND A LINE VOLTAGE OF 117 VOLTS A.C. 60 CYCLES.  
5 - A.C. SIGNAL VOLTAGES TAKEN WITH 10 VOLTS AT 1000 CYCLES INPUT. ALL CONTROLS AT MAXIMUM COUNTERCLOCKWISE POSITION UNLESS NOTED AS BEING CLAMPED LOAD FOR SPEAKER. D.C. VOLTAGES TAKEN WITH NO SIGNAL INPUT.  
6 - ALL VOLTAGE READINGS TAKEN FROM POINT INDICATED TO B MINUS.



# TOP

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Metal Wall Sign—big 40" x 28" size. (1A1276)



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Metal Flange Sign—18" x 12"—for outdoor-indoor display. (1A1277)



Decal—12½" x 8½"—for wall, window, door, or truck. (1A1279)

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