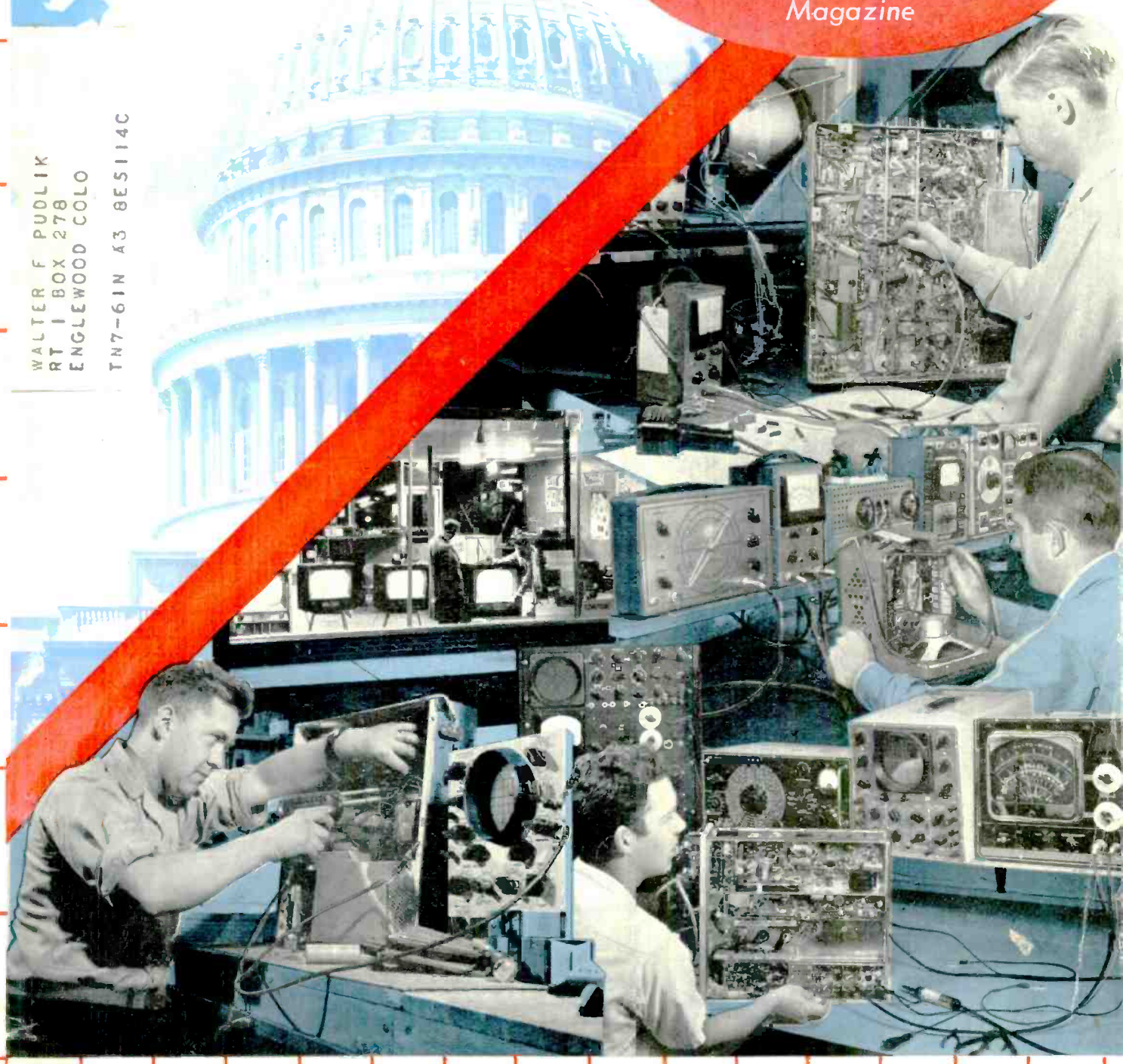
ELECTRONIC TECHNICIAN

Now Including
SERVICE
Magazine



Investment in Instruments & Facilities

1956 1957 1958

1959-YEAR for SERVICE BUSINESS EXPANSION ACROSS THE NATION

50¢

January • 1959

one of these Electro-Voice microphones will meet your needs best

CHOOSE FROM THE WORLD'S MOST COMPLETE LINE: ELECTRO-VOICE THE CHOICE OF PROFESSIONALS

Whatever your microphone problem, Electro-Voice has the solution. Because only Electro-Voice offers you such a wide selection to choose from, and only Electro-Voice has spent years of painstaking research to bring you microphones which rate BEST in every category.

Choose from carbon, crystal, ceramic or dynamic E-V microphones; choose any pick-up pattern: non-directional, cardiod, or differential Electro-Voice has them all. Look at this chart . . . and choose the BEST. And, for detailed information regarding special applications, write Dept. ET-1

Electro-Voice INC., BUCHANAN, MICHIGAN

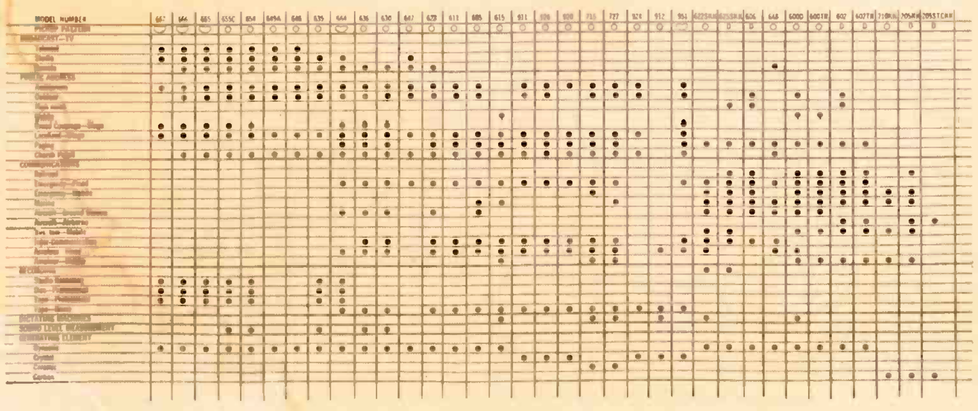
NONDIRECTIONAL MICROPHONES pick up sound equally well from all directions. In this diagram of a pick-up pattern, the omnidirectional microphone is in the center. Diagrams of pick-up patterns are often called polar patterns.

CARDIOID (UNIDIRECTIONAL) MICROPHONES, so named because their polar pattern is heart-shaped, pick up sound arriving at the front and reject sound arriving at the back. Proper placement of cardioid microphones reduces pick-up of ambient noise and echoes, minimizes risk of feedback.

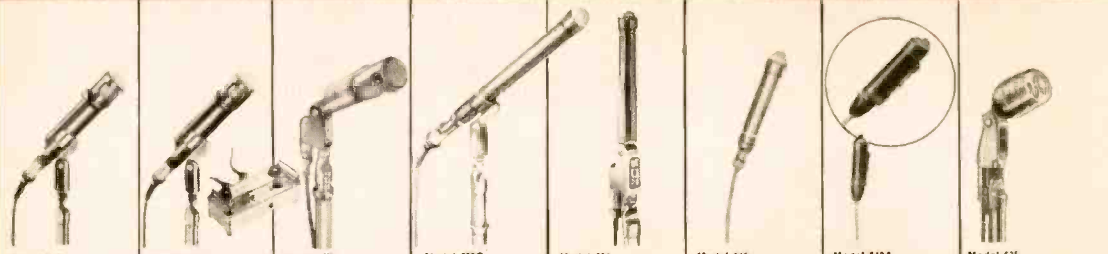
DIFFERENTIAL MICROPHONES have a noise-cancelling pick-up pattern. Sound waves originating from a point more than a few inches away from the microphone enter both sides of the case at the same time and cancel each other. When sound source is close to microphone, the sound waves do not cancel. Differential microphones are ideal for use in areas of high surrounding noise.

ACOUSTALLOY DIAPHRAGM IN ALL DYNAMIC MICROPHONES. Acoustalloy—the virtually indestructible diaphragm material—gives peak-free response, prevents popping as commonly experienced by explosive syllables "B" and "P" in ribbon-type microphones. Because Acoustalloy gives improved response, operators can work with confidence under rigorous program conditions.

ELECTRO-VOICE MICROPHONES FOR EVERY PURPOSE



BROADCAST AND TV MICROPHONES



Model 666
Dynamic, Cardioid
Rejects unwanted sound—doubles the working distance—wide range. Floor or desk stand and boom mount available.

Model 667
Dynamic, Cardioid
Variable response—low noise—transistorized—shockproof. Controls compensate for varied acoustic conditions found in TV, broadcast, recording.

Model 665
Dynamic Cardioid
Economical—high value—top performance. Similar to 666 but designed for less exacting conditions.

Model 655C
Dynamic, Nondirectional
Widest range—to 22KC for TV, broadcast and recording. Can be hand-held or mounted on floor or desk stand.

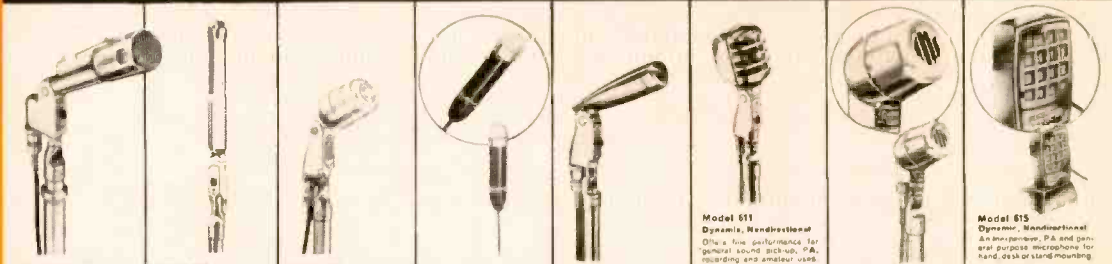
Model 654
Dynamic, Nondirectional
Similar to 655C except designed for all-around use; economical.

Model 646
Dynamic, Nondirectional
Compact lavalier for chest, desk or hand use. Designed for broadcast, TV or PA use.

Model 649A
Dynamic, Nondirectional
Exceptionally small highest quality lavalier that can be easily concealed anywhere for chest or hand use.

Model 635
Dynamic, Nondirectional
For TV, broadcast, recording, ideal for remote use—rugged. May be hand held or mounted on desk or floor stand.

PUBLIC ADDRESS, RECORDING AND GENERAL PURPOSE MICROPHONES



Model 664
Dynamic, Cardioid
Designed for rugged use in any PA, recording or communications situation. [illegible]

Model 636
Dynamic, Nondirectional
World's finest for wide range PA, recording and general purpose. Slim style does not [illegible]

Model 630
Dynamic, Nondirectional
Favorite for years in PA, with recording, amateurs and broadcast applications.

Model 647
Dynamic, Nondirectional
A versatile PA lavalier for chest, desk or hand use, [illegible]

Model 623
Dynamic, Nondirectional
Handsome modern styling. Designed for PA general use [illegible]

Model 611
Dynamic, Nondirectional
Offers fine performance for general sound pick-up, PA, recording and amateur uses.

Model 911
Crystal, Nondirectional
For economical PA, home recorders, amateur uses. Desk or floor stand mounting.

Model 896
Dynamic, Nondirectional
A small, convenient microphone for PA, general purpose, or paging. Desk or floor stand mount.

Model 615
Dynamic, Nondirectional
An inexpensive, PA and general purpose microphone for hand, desk or stand mounting.

Model 716
Ceramic, Nondirectional
An inexpensive microphone for general PA, home recording and amateur uses. Hand held, as required on desk or floor stand.

Model 951
Crystal, Cardioid
For widest variety of PA, general purpose and amateur uses. Increases working distance—retards feedback.

Model 926
Crystal, Nondirectional
Excellent for PA, general purpose, paging, home recording and amateur use.

Model 920
Crystal, Nondirectional
All direction pickup for conferences, discussions, home recording and PA.

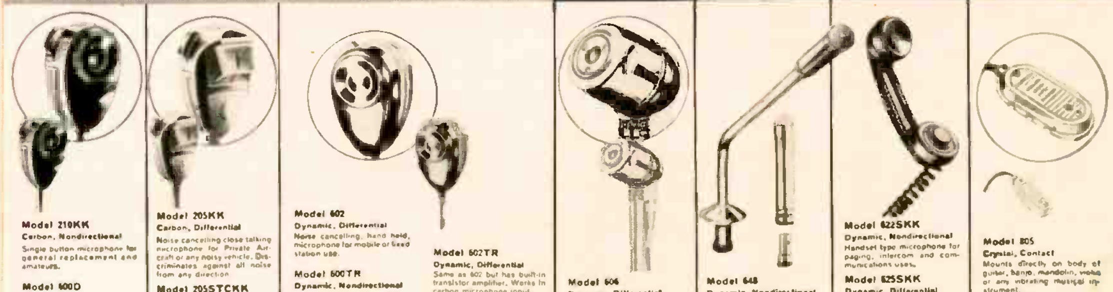
Model 727
Ceramic, Nondirectional
Designed for PA, paging, recording and amateur uses. Hand held, desk or stand mounted.

Model 924
Crystal, Nondirectional
Small lavalier for chest or hand use, home recording, PA and amateur applications.

Model 912
Crystal, Nondirectional
An inexpensive microphone for general PA, home recording and amateur uses. Hand held.

Model 718
Ceramic, Nondirectional
Suitable for paging, home recording and amateur use. Can be hand held or desk mounted.

COMMUNICATION MICROPHONES



Model 210KK
Carbon, Nondirectional
Single button microphone for general replacement and amateurs.

Model 600D
Dynamic, Nondirectional
A rugged mobile microphone. Offers flat response and light weight.

Model 205KK
Carbon, Differential
Noise cancelling close talking microphone for Private Aircraft or any noisy vehicle. Discriminates against all noise from any direction.

Model 205STCKK
Carbon, Differential
A noise cancelling microphone for commercial aircraft. Has CAA type certificate 1040

Model 602
Dynamic, Differential
Noise cancelling, hand held, microphone for mobile or fixed station use.

Model 600TR
Dynamic, Nondirectional
Same as 600D but has built-in transistor amplifier. Works in carbon microphone input to give high quality sound

Model 602TR
Dynamic, Differential
Same as 602 but has built-in transistor amplifier. Works in carbon microphone input.

SPECIAL PURPOSE MICROPHONES

Model 606
Dynamic, Differential
Noise cancelling microphone for stand use under high ambient noise.

Model 648
Dynamic, Nondirectional
For intercom, paging or PA. Mount on stand, boom, gooseneck or Model 448 boom

Model 622SKK
Dynamic, Nondirectional
Handset type microphone for paging, intercom and communications uses.

Model 625SKK
Dynamic, Differential
Noise cancelling handset for use under high noise conditions.

Model 805
Crystal, Contact
Mounts directly on body of guitar, banjo, mandolin, violin or any vibrating musical instrument.

ELECTRONIC TECHNICIAN

Now Including SERVICE Magazine

World's Largest Electronic Trade Circulation

ELECTRONIC TECHNICIAN & Circuit Digests, including Service, January, 1959. Vol. 69, No. 1. $.50 a copy. Published monthly by Electronic Technician, Inc. Publication office, Emmett St., Bristol, Conn. Editorial, advertising and executive offices, 480 Lexington Avenue, New York 17. Telephone YUkon 6-4242.

Entered as second class matter at the Post Office at Bristol, Conn., June 10, 1954. Subscription rates: United States and Canada, $4.00 for one year; $6.00 for two years; $8.00 for three years. Pan-American and foreign countries: $7.00 for one year; $10.00 for two years; $14.00 for three years. Printed in U.S.A. by Hildreth Press.

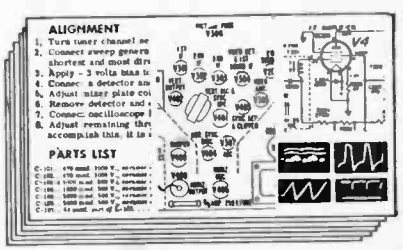
January, 1959

FRONT COVER After the past year of recession, 1959 happily promises to be a year of economic growth for the nation. This offers service dealers and technicians opportunities to improve their plant facilities, and expand maintenance operations to cover hi-fi, industrial electronics and communications, as well as radio-TV. For special story on how to obtain Government aid in financing your growth, see page 35.

FEATURES and ARTICLES

DEPARTMENTS

CIRCUIT DIGESTS 81



IN THIS ISSUE

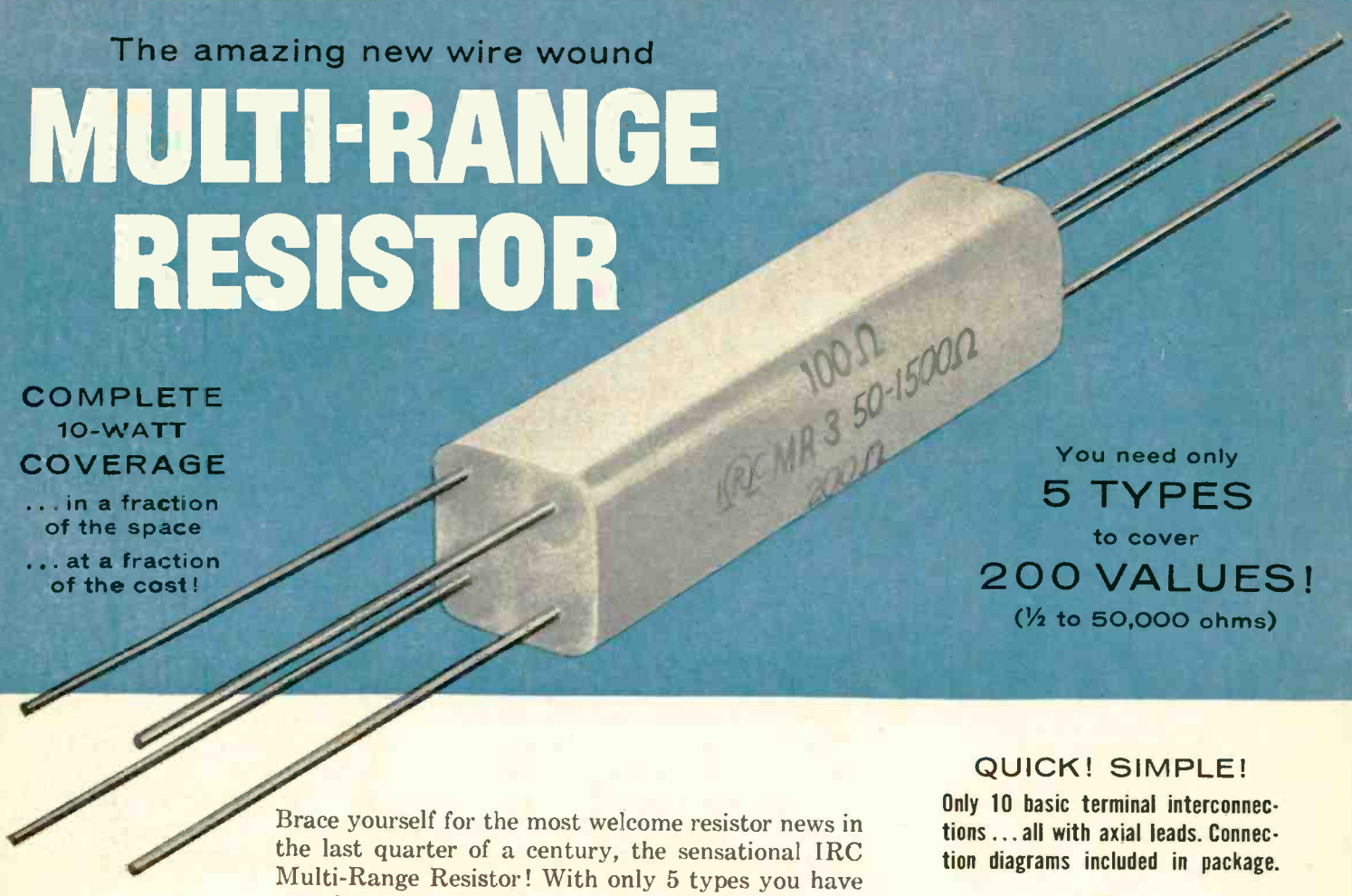
(16 pp. latest schematics—see last page)

ADMIRAL: TV Chassis 14YP3D
DOMINION ELECTROHOME Canada: TV Model Viscount, Viscount MK1, Viceroy, Viceroy MK1
MAGNAVOX: TV Chassis 28 Series
MOTOROLA: Stereo Phonograph Chassis HS704
PHILCO: TV Chassis 9L38, 9L38U
RCA: TV Chassis KCS121K, L, M, N
TRAV-LER: TV Chassis 1051-19

NOW from IRC . . . the first new

The amazing new wire wound

MULTI-RANGE RESISTOR



COMPLETE 10-WATT COVERAGE

. . . in a fraction of the space

. . . at a fraction of the cost!

You need only

5 TYPES

to cover

200 VALUES!

(½ to 50,000 ohms)

Brace yourself for the most welcome resistor news in the last quarter of a century, the sensational IRC Multi-Range Resistor! With only 5 types you have complete 10-watt coverage. Never again will you need to delay set servicing to order an odd resistance value. Neither will you have to tie up inventory dollars on slow-moving types. Just 5 Multi-Range resistors cover all your 10-watt needs.

In addition to their amazing convenience IRC Multi-Range resistors are setting new standards of performance and reliability for power resistors.

- Revolutionary design—4 separate 10 watt elements are sealed in a single steatite housing.
- All types are one size—for easier handling.
- Axial leads speed servicing.
- Special steatite housing provides superior insulation.
- Conservatively rated—10 watts or more.

QUICK! SIMPLE!

Only 10 basic terminal interconnections . . . all with axial leads. Connection diagrams included in package.

FOR REQUIRED RESISTANCE VALUE, SIMPLY SOLDER DESIRED INTERCONNECTION AND CUT OFF UNWANTED TERMINALS

HERE'S IRC's SOLUTION

Type	Watts	Resistance	# of Values	Dealer Net
MR-1	10	½ to 15 ohms	47	60c
MR-2	10	5 to 150 ohms	47	60c
MR-3	10	50 to 1,500 ohms	47	60c
MR-4	10	500 to 15,000	47	60c
MR-5	10	3,000 to 50,000	12	90c

all types 10% tolerance

Another Multi-Range Feature! Supplied in exclusive IRC

HANDY-PAKS

For greater convenience and ease of stocking and handling, MR Resistors are supplied in Handy-Paks only . . . 2 of a type to a Pak.

HANDY-PAK PRICES	
MR-1, 2, 3, and 4	MR-5
$1.20 dealer net	$1.80 dealer net
Handy-Pak of 2	Handy-Pak of 2

approach to Power Resistors in 25 years

LOOK!
A complete 10-watt resistor inventory in the palm of your hand.

Here's SUPER Convenience
New! Compact! Efficient!

MULTI-RANGE RESISTOR KIT!

Now you can have complete 10-watt power resistor coverage at your fingertips . . . in a stock so compact it occupies no more space than 2 packs of cigarettes. Your entire stock is always visible. Identification of type, value, etc. shows through the plastic case. You always know what you have, and have what you need with an IRC Multi-Range Resistor Kit.

- Kit gives complete 10-watt coverage of 200 values.
- Contains 5 Handy-Paks—2 of each Type MR resistor . . . 10 Multi-Range units.
- Rigid, clear-plastic box with hinged lid.
- Measures only 5¼ x 1¼ x 3½".

FULL 10-WATT POWER RESISTOR COVERAGE IN STURDY PLASTIC KIT!

Assortment #55
Contains 5 Handy-Paks
10 MR Resistors

dealer net **$6.60**

PLASTIC CASE FREE!

IRC®

Available now from your IRC distributor. Order yours today!

INTERNATIONAL RESISTANCE COMPANY
401 North Broad Street, Philadelphia 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee

Editor's Memo

New readers constantly join us, but this month is something special. The welcome mat is out to the thousands of former *Service* subscribers who will now receive *Electronic Technician*.

These newly acquired friends may be curious about what we do in these pages, and why. First note the multi-color cover. Each month a different art design is used.

The Letters to the Editor column represents a cross-section of interesting reader correspondence. Let's hear *your* views. Whether we agree or disagree with them, within space limitations there's a good chance we'll publish your letter.

This Editor's Memo column is personal and unpredictable. It has covered business tips, wry comment, jokes, accusations and pretty girls.

The editorial page generally reflects the official position of the magazine on important issues, and its observations and thoughts on topics of major interest. Sometimes we step on people's toes when they deserve it.

"Tuning In" section? We hope you can be informed and entertained here at the same time.

Acceptable "Shop Hints" earn $3 to $10 each for our readers. Surely you've developed a time-saver or bench aid of some sort at one time or another. Send us a description of it.

"Tough Dogs" are service jobs which do not respond in the usual way to proper troubleshooting procedures. Let's hear about some of the puzzlers you've solved. $10 each if we can use them.

To discuss the major technical and business articles would take too long. Just look at the annual article index in this issue. Note the broad range covered —TV, audio, circuits, test equipment, industrial electronics, components, etc.

You can receive copies of the free literature, and more information on the new products described simply by filling in the special coupon for this purpose.

The "Circuit Digests" section is a real servicing aid, bringing you the latest TV-radio-hi-fi schematics. It's the only service of its kind.

And every May you can look forward to a complete Buyers Directory of products and manufacturers, with addresses, plus a national roster of service associations.

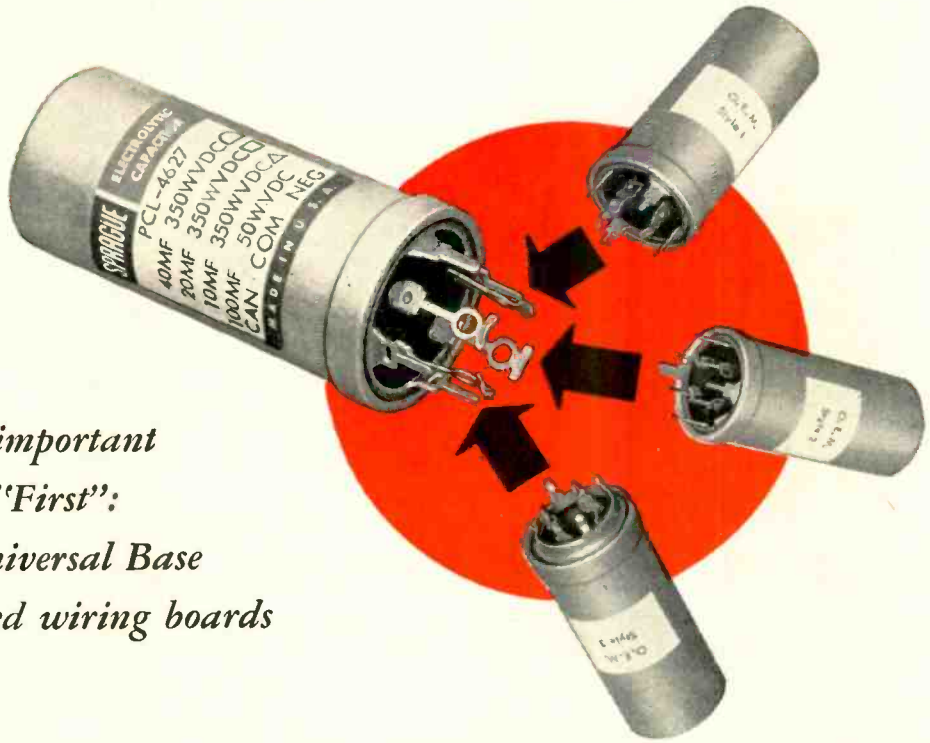
Yes, we try to cram as much worthwhile information into these pages as we can. It's all intended to serve the professional electronic technician and service dealer.

Al Forma

Sprague PRINT-LOK* 'lytics

with universal bases for printed wiring boards

simplify servicing reduce inventory



Another important
Sprague "First":
3-in-1 Universal Base
for printed wiring boards

Sprague's new PRINT-LOK Electrolytic Capacitors have a newly-developed universal base that's designed to fit all sets. A touch of your pliers is all that's needed to adapt PRINT-LOK capacitors to any one of three different types of printed circuit bases!

How's that for simplified servicing? And just as important, you need only stock a third as many 'lytics as were required previously. Still another feature—PRINT-LOK capacitors also replace standard twistbase electrolytic capacitors.

*Trademark

PRINT-LOK capacitors are hermetically sealed in aluminum cases to give extra long life and top performance under extremely high temperatures and high surge voltages, as well as in high ripple selenium rectifier circuits.

Sprague's new TV Electrolytic Capacitor Replacement Guide K-103 gives complete listings for PRINT-LOK 'lytics as well as standard TWIST-LOK capacitors. Get your free copy from your distributor, or send 10c to cover handling to Sprague Products Co., 65 Marshall Street, North Adams, Massachusetts.

don't be vague...insist on SPRAGUE®

world's largest capacitor manufacturer

AGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

New Mallory *Diffused*

Type T . . . for most economical replacement. Encapsulated in Mallo-Seal*, this lowest-priced model can stand 500 hours in boiling water. Available in handy packs of five each for mounting by leads, and in kits using plug-in rectifiers, with mounting hardware. 400 and 365 volt ratings, 0.5 ampere. Also available from 50 to 600 P.I.V. inclusive.

Trademark of P. R. Mallory & Co. Inc.

Type P . . . for plug-in replacement. Fuse model fits sets already converted to this type of silicon unit. Available in 5-packs, and as conversion kits for half-wave, full-wave or doubler application, with fuse clip and mounting hardware. 400 and 365 volt ratings, 0.5 ampere. Also available from 50 to 600 P.I.V. inclusive.

Type E . . . for higher reliability. Military grade "top hat" rectifier, hermetically sealed for jobs where you want the absolute peak in life and dependability. Two to a pack; rating is 400 volts, 0.75 ampere. Also available from 50 to 600 P.I.V. inclusive.

Junction Silicon Rectifiers

A completely new concept in silicon rectifier design gives these new Mallory models reliability never before possible. At the heart of each is a unique diffused junction silicon element, product of extensive Mallory research in semiconductors, which has these characteristics:

Low reverse leakage.....less than 250 microamperes

Low forward drop.....less than 0.5 volt

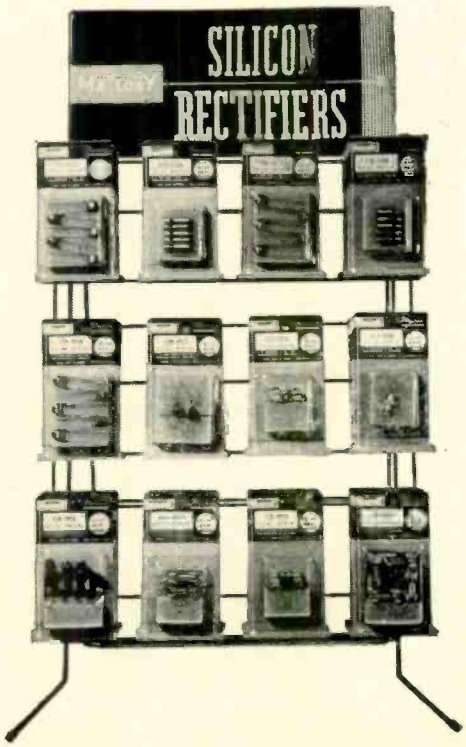
Exceptional life.....takes over 2000 hours at 85 C, with 1.5 million switching operations without failure

Moisture-proof.....exceeds humidity requirements by four times (MIL 202A)

High reliability.....100% testing eliminates premature failures, protects you against call-backs

Three different models, each designed for specific service applications, are now available to fit all television and radio circuits as replacements for metallic rectifiers.

See this display on your Mallory distributor's counter—a complete assortment—in handy see-through packs—of the full line of Mallory silicon rectifiers.



P.R. MALLORY & CO. Inc.
MALLORY

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Sylvania received Altoona's official welcome through front-page headlines and a special feature section filled with congratulations.

Why the whole town made such a fuss over

Sylvania's new tube plant

For one thing—Altoona folks know that progress by an important resident company means the whole town progresses. Sylvania's President, Don Mitchell, at the multi-million-dollar plant's formal opening called it "the largest in the receiving tube industry—containing many innovations."

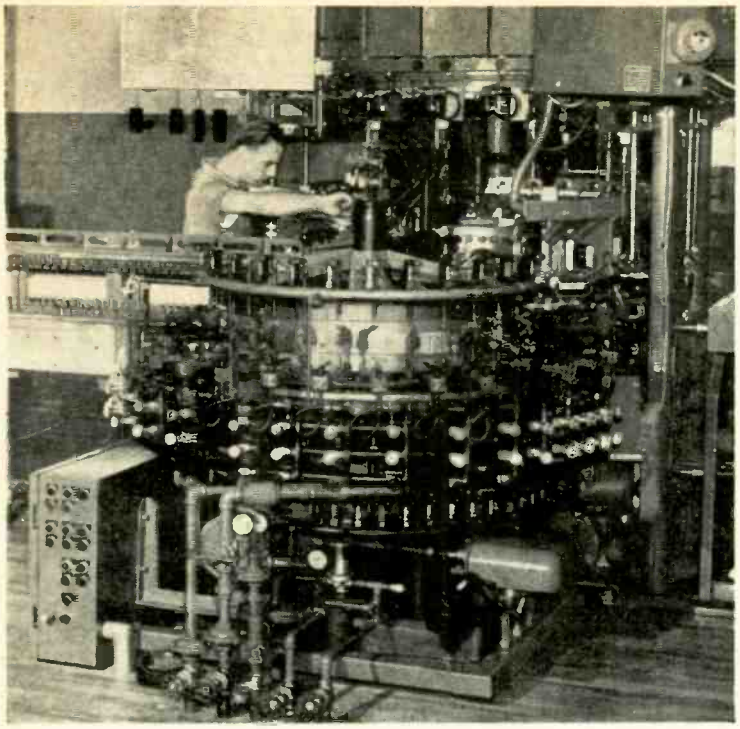
This is where you come in. Because most of these innovations affect your business profit. As the world's most modern tube plant, Altoona will be producing the world's most reliable tubes in both commercial and military types. Two of the industry's biggest bugaboos, intermittent shorts resulting from dust and lint and unstable emission caused by contamination and humidity variations during tube manufacture, promise to be vastly improved. You'll be hearing more about these developments in the future.

The Altoona plant is as much a dedication to the independent serviceman as it is to the entire tube industry. It's a modern example of why profit-minded dealers are relying on Sylvania tubes.

SYLVANIA

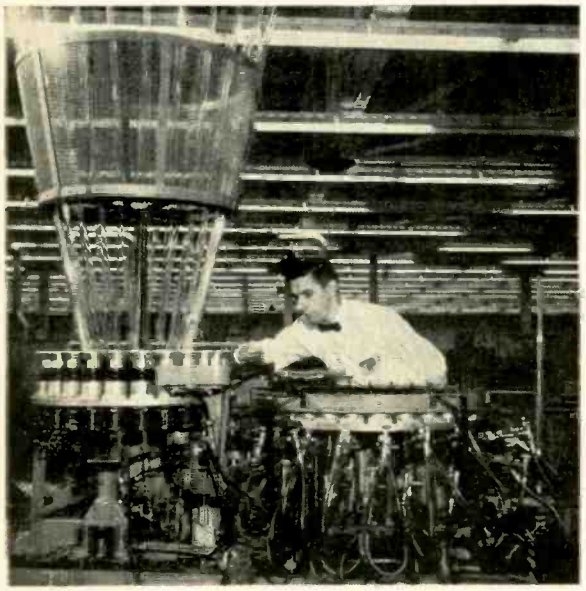
SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N.Y.
In Canada: P. O. Box 1190, Station "O," Montreal 9

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY



New concepts in tubemaking, which have been in development for the past decade, are put into high-speed production facilities at Altoona. The new concept bulb, in the making here, adds new tube reliability.

in Altoona



The new double-turret sealex is an important new development. Oil-diffusion pumps work in series with mechanical pumps to produce the most nearly perfect vacuum possible.

LETTERS

To the Editors

We Flunk Latin

Editor, ELECTRONIC TECHNICIAN:

What kind of Latin is "Trostice"? Don't blame it on the printer, since it occurs on pages 1 and 27 of the December issue. An electronic technician should have a well-rounded education because of the very important customer approach. So study your Latin, then "Respice, Prospice."

PAUL STECHER
New York, N.Y.

• *Back in our school days we always did much better in math and science than Latin. It shows.—Ed.*

Attorney General

Editor, ELECTRONIC TECHNICIAN:

Let me commend you for your great assistance to the organized service industry in your letter to Mr. Louis J. Lefkowitz, Attorney General of the State of New York (Editor's Memo, December 1958 issue), concerning his "Guide for Consumers—10 Pointers for Careful Buying." We first called attention to his unjust release in June 1958. Since then we have received bundles of letters, and have met with him twice. Whether we have gained anything or not is to be questioned. At any rate, whatever progress we make with his office in the future will depend on letters such as yours. Your letter will be called to the attention of ESFETA members. Service will support those people who support us.

GEORGE CARLSON
Secretary
Empire State Federation of Electronic Technicians Associations
Jamestown, N. Y.

Poison Pen Pal

Editor, ELECTRONIC TECHNICIAN:

I think your rag stinks.

HENRY L. ROBERT
Manchester, Conn.

Captive Service

Editor, ELECTRONIC TECHNICIAN:

Congratulations on your editorial on captive service (November 1958). No doubt many small service dealers have been affected by the policies of these manufacturers. We for one make it a policy not to recommend any of these brands. I run a five-man organization doing strictly TV service, and I feel certain that our advice is very influential. I hope you have started a corrective trend in the TV service industry.

HARRY T. ELLIS
Delta Television Service
Cliffside Park, N. J.

(Continued on page 14)

Mr. Service Dealer...

YOUR PHILCO DISTRIBUTOR IS HEADQUARTERS FOR A COMPLETE SELECTION OF GENUINE PARTS

Bendix

Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

CROSLEY

Radio • Television • Refrigerators • Ranges • Freezers • Air Conditioners • Automatic Dishwashers.

PHILCO-Bendix

Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

PHILCO

Radio • High Fidelity • Stereophonic High Fidelity • Television • Refrigerators • Electric Ranges • Freezers • Air Conditioners • Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

Don't Settle for Less than Genuine Replacement Parts

COMPLETE PARTS CATALOGS—All models of all products listed above are completely covered in separate Philco catalogs on Electronics, Appliances and Home Laundry. See your Philco Distributor today for this valuable information.

PHILCO® *Accessory Division*

WORLD WIDE DISTRIBUTION

Service Parts • Power-Packed Batteries • Universal Components • Long-Life Tubes • Heavy Duty Rotors • Star Bright 20/20 Picture Tubes • Long Distance Antennas • Appliance Parts • Laundry Parts • Universal Parts and Accessories.

PHILCO . . . *Famous for Quality the World Over*

25,000,000 PEOPLE SAW THIS RECENT ADVERTISEMENT IN LIFE

A BRIGHTER, CLEANER CITY owes much to Bryce McNeely's work in connection with the Kelso, Wash., program for civic beautification. Bryce is on the mayor's committee for school and city improvement, is state JC vice president, and promotes young men's leadership training.

MAKES OTHERS' TROUBLES HIS OWN. One of the few TV technicians in an 85-mile area, T. E. "Buck" Adams of Channing, Tex., often aids in roadside emergencies, helps pen run-away cows, and has worked to improve local Baptist Church, parsonage.

COACHES MIDGET-LEAGUE TEAM. For the past two years, Theodore W. Fickert, TV technician of Hatfield, Pa., has shown his 25-boy club how to play baseball. Active in community causes, he helped organize the Hatfield Junior Chamber of Commerce, and served as its secretary and state director; participates in the Heart Fund and other worthy drives; and is on the planning committee of St. Peter's Lutheran Evangelical Church.

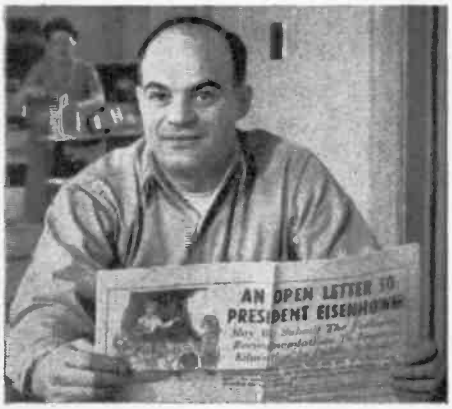
CRIPPLED CHILDREN LEARN TO WALK through fund-raising efforts of Vernon E. Brooks, Norristown, Pa., who helped obtain $100,000 to build a school for spastic paralytics. Mr. Brooks (center) is a director of the Chamber of Commerce, and a prime mover in Red Cross, Community Chest, United Fund, and Salvation Army work. As national president of the American Business Club, he helped obtain more than 100 scholarships for the training of physical and speech therapists. He is chairman of the Muscular Dystrophy unit for the Tall Cedars of Lebanon.

All-American TV Technicians

HELPED TORNADO VICTIMS. When disaster struck the area around Menomonie, Wis., on June 4, Vernon Townsend quickly organized emergency radio facilities to speed relief to the sufferers. A leading member of the Radio Amateur Civil Emergency service, he is active in Dunn County civil defense work, and also maintains a radio entertainment service for the local city-county hospital.

TEACHES SCOUTS RADIO. Boys in Brockton, Mass., learn Morse Code and the elements of electronics at an early age, from instruction by TV technician Albert P. Kazukonis. Much of the equipment he supplies without charge. A devoted youth and community worker, Mr. Kazukonis is treasurer and a past president of the Electronic Technicians Guild of Massachusetts, Brockton Chapter.

DONATED LOUDSPEAKER SYSTEM. The 1958 Centennial parade and pageant at Bloomington, Minn., owed much of its success to the fine amplifier system installed without charge by Edwin B. Haines. Ed is widely known for the time, effort, and equipment he has supplied for the 2,000 boys in Bloomington's sports program. He is a leader and counselor in Boy Scout work, and gives assistance to the Lions and the Bloomington Civic League.



SPENDS TO PROMOTE EDUCATION. Out of his own pocket, A. George Catavolo, TV technician of Somerville, Mass., financed two full-page newspaper ads which presented to the President recommendations on public school education. Last year George contributed over 30 radios, plus his time, to teach boys electronics.

WORLD OF TOMORROW! This novel space radio-man hat, invented by Stanley Everett of Alhambra, Cal., helped publicize many worthy drives. Stanley is president of the Los Angeles Electric League; a director of the Alhambra Chamber of Commerce; past president of Kiwanis and district chairman of the United Fund drive.

COMMUNITY SERVICE is a watchword with Wayne E. Lemons of Buffalo, Mo. An active Rotarian, he works with Boy Scouts, promotes Little League baseball, and has instructed TV technicians in surrounding cities. He is West Central vice-president of the National Alliance of Television Electronic Service Associations.

Win General Electric Awards

PEOPLE the nation over nominated candidates for the 1958 All-American Awards, honoring TV service technicians. This broad response showed how important a place the television technician holds in our community life, and how widely esteemed are his efforts in aid of others.

The Award winners, shown here, were chosen by a panel of judges including John Sparkman, U. S. Senator and Chairman, Select Committee on Small Business; Bennett Cerf, television panelist and head of Random House publishing firm; and Charles Shearer, 1957-58 president of the National Junior Chamber of Commerce.

With these Awards, General Electric pays tribute to the part played by the independent television technician in making this a better country for all. *General Electric Company, Receiving Tube Department, Owensboro, Kentucky.*

Winners received this trophy, $500 for community benefit, and a trip to Wash., D.C., for luncheon with Senator John Sparkman.

Progress Is Our Most Important Product

GENERAL ELECTRIC

2-111-231

(Letters. Continued from page 10)

Dissenter

Editor, ELECTRONIC TECHNICIAN:

Your magazine is the best available electrically. Sorry I can't say the same for your editorial poppycock in the November 1958 issue. Every bird named in the Editor's Memo comes to mind when reading "Fighting Mad Over Captive Service." Mad? The mad is caused by fear of not being capable of competing with the big organizations. I keep my prices higher than anyone. Mister, I am a service technician. I am better than good. Anyone who has the privilege to watch me repair their electronic equipment will know I am good, and if the person has had previous experience with any huge service company fixing their equipment, then the person will know me to be the genius I am. Captive service? You are crazy as the birds. To capture you have to be huge. To hold you have to be the genius I am. These are two different things. I'm the screwball who grossed just under $20,000 last year. My business and private phones are unlisted, and I do not advertise. New customers are always trying to get me.

C. B. WARD

Los Angeles, Calif.

Missing Friend

Editor, ELECTRONIC TECHNICIAN:

I hope you can run a brief mention about a missing friend of mine. His name is Bernie Bedrock. He operated his own TV sales and service shop and was in the habit of reading the various trade publications. His wife is dying of cancer, and his two daughters are pleading, "Please come home."

J. GREENBLATT

North Hollywood, Calif.

Last of the Mohicans

Editor, ELECTRONIC TECHNICIAN:

Now that *Service* and *Electronic Servicing* have passed on, ELECTRONIC TECHNICIAN is the last magazine being published for the working electronic technician. I haven't read your magazine for some time, but if your editorial and articles are anything like they used to be, I shall look forward to each issue.

JOHN A. DOYLE

Doyle's TV Radio Service
Bath, Maine

Kudo for Stereo

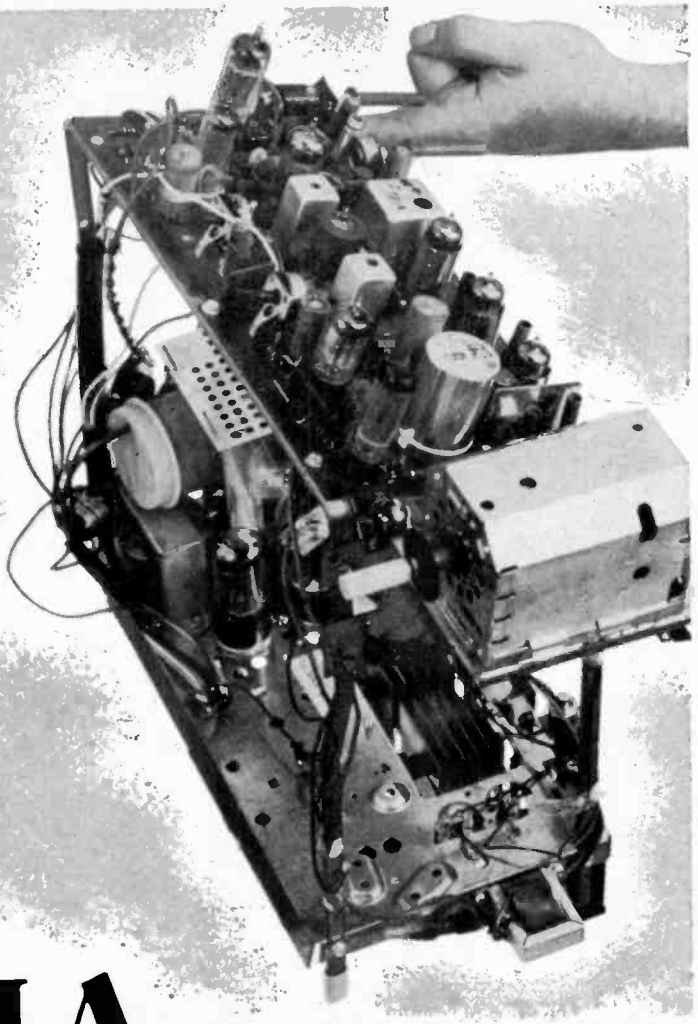
Editor, ELECTRONIC TECHNICIAN:

The article, "The Meaning of Stereo," in September's Stereo 1959 section is one of the best statements I've seen on this subject. I would like your permission to reproduce this for our customers.

J. W. RUBIN

Manager, Adv.-Sales Promotion
Allied Radio Corp.
Chicago, Ill.

Its two year record speaks for itself!



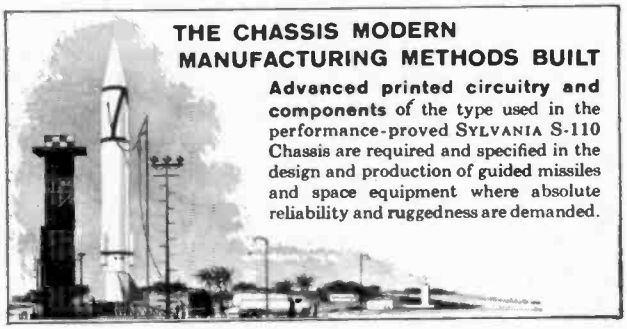
SYLVANIA S-110 CHASSIS

Only 10½ lbs. without yoke

performance proved

- **Better performance under the extremes of line voltage variation.** The advanced high voltage design of the SYLVANIA S-110 Chassis adjusts automatically for maximum performance at both high- and low-voltage extremes.
- **Better performance under heat, humidity and freezing conditions.** The rigid specifications of reliability of components in the SYLVANIA S-110 Chassis assures better performance and longer trouble-free life under extremes of humidity and temperature conditions.

  Alkyd Resin used in the high voltage socket of the S-110 Chassis withstands moisture, dirt and even frost accumulations without any permanent damage, even if these conditions are severe enough to cause arcing. Top performance is assured regardless of warehouse locations.
- **Cuts repair time by 60%.** The orderly arrangement of components in the SYLVANIA S-110 Chassis means that most defects can be located in seconds. Circuit can be traced easily from either side by shadow graph method over your bench light.
- **Designed for maximum strength and minimum weight.** The SYLVANIA S-110 Chassis has all-around girder frame construction which gives it the most favorable strength to weight ratio in the industry. This means easier handling and faster servicing because of its light weight. Yet the S-110 is sturdy and rigid when mounted in the cabinet.



THE CHASSIS MODERN MANUFACTURING METHODS BUILT

Advanced printed circuitry and components of the type used in the performance-proved SYLVANIA S-110 Chassis are required and specified in the design and production of guided missiles and space equipment where absolute reliability and ruggedness are demanded.

SYLVANIA

Pioneer in modern manufacturing methods

Now—Kit or Wired

A new VoltOhmyst® Kit—WV-77E(K) for only $29.95*

RCA WV-77E VOLTOHMYST (completely wired and calibrated for only $49.95*)

*User Price (Optional)

Look what you get in this Easy-to-assemble VTVM Kit!

- Meter electronically protected against burnout—PLUS—ohms-divider network fuse-protected. *Unit is burnout proof!*
- Ultra-slim probes and flexible leads—easy-to-use in those tight spots!
- Cables can be stored in sleeve attached to handle for increased portability! (Plenty of room for power cord, too!)
- Separate scales for 1½ volts rms and 4 volts peak-to-peak assure rated accuracy on low ac readings!
- Famous RCA VoltOhmyst circuit means excellent stability under conditions of line voltage fluctuation—PLUS—special circuit minimizes effects of residual gas in bridge tube!
- Easier, faster-to-read scales—meter scale color-coded to match range switch!
- Extra-rugged 400-microampere meter movement!
- Metal case shields sensitive electronic bridge from rf fields!
- Front panel is brushed aluminum—all lettering is acid-etched to last the life of the unit!

Both kit and wired unit available locally from your RCA Distributor!

TV service technicians, hams, hobbyists—now you can buy this easy-to-assemble RCA VTVM kit! Step up and meet the new RCA VoltOhmyst which incorporates famous VoltOhmyst quality, accuracy, and performance—an instrument you'll be proud to display "on the job!"

You get simplified step-by-step instructions, laminated circuit board construction, oversized drawings—all the help needed to accomplish mechanical and electrical assembly faster than you've ever believed possible!

You can buy this instrument, kit or wired "off the shelf" at your local RCA Distributor. Either way, you are assured of an instrument which can give you long, dependable performance. See the RCA WV-77E VoltOhmyst—Kit or Wired—today!

SPECIFICATIONS

Ranges:

DC—0.02 volt to 1500 volts in 7 overlapping ranges

RMS—0.1 volt to 1500 volts in 7 overlapping ranges

Peak-to-peak—0.2 volt to 4000 volts in 7 overlapping ranges

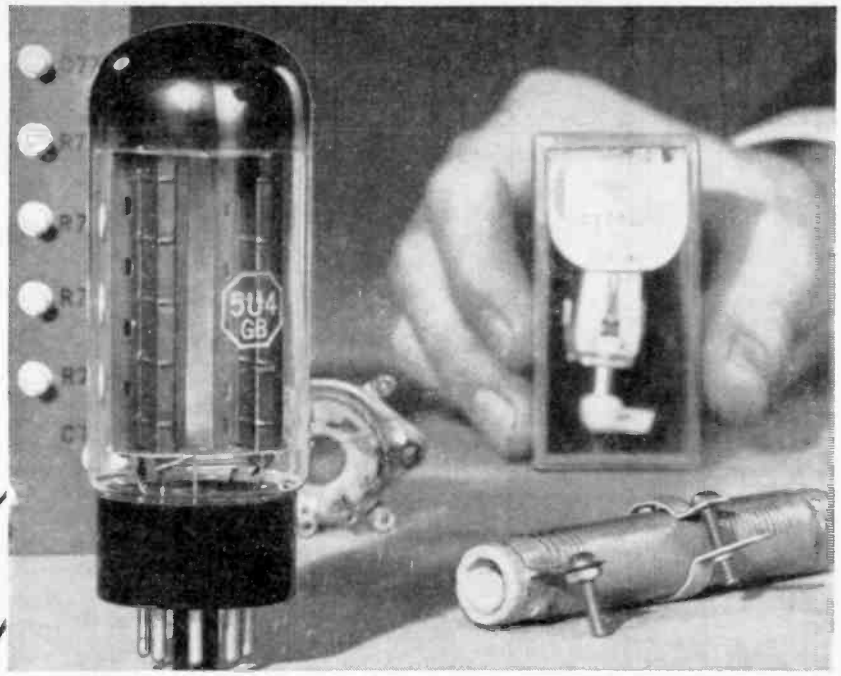
Resistance—from 0.2 ohm to 1000 megohms in 7 overlapping ranges. Zero-center indicaton for discriminator alignment

Accuracy—±3% of full scale on dc ranges ±5% of full scale on ac ranges

Frequency Response—flat within ±5%, from 40 cycles to 5 Mc on the 1.5, 5, and 15-volt rms ranges and the 4, 14 and 40-volt peak-to-peak ranges

DC Input Resistance—standard 11 megohms (1 megohm resistor in probe)

RADIO CORPORATION OF AMERICA
Electron Tube Division **Harrison, N. J.**



Now you can be sure he'll get his tuner sooner...

SHIP BY
GREYHOUND®
PACKAGE EXPRESS

IT'S THERE IN HOURS... AND COSTS YOU LESS!

Your packages go anywhere Greyhound goes... and Greyhound goes over a million miles a day! That means faster, more direct service to more areas, including many, many places not reached by other public transportation.

What's more, Greyhound Package Express offers this service seven days a week... twenty-four hours a day... even on week-ends and holidays! Packages get the same care and consideration as Greyhound passengers...riding on dependable Greyhound buses on their regular runs. And you can send C.O.D., Collect, Prepaid—or open a Charge Account.

So remember — anything from tubes to transformers can be sent Greyhound Package Express. **Call your nearest Greyhound bus station or write to Greyhound, Dept. H-1, 5600 Jarvis Ave., Chicago, Ill.**

News of the Industry

ALLEN B. DU MONT LABS., INC. has appointed JOSEPH P. GORDON as general manager of Tube Operations.

GENERAL INSTRUMENT CORP. has named PHILIP M. PRITCHARD as marketing manager for entertainment electronic components.

AMERICAN TELEVISION & RADIO CO. reports the purchase of ECKSTEIN RADIO & TELEVISION CO., of Minneapolis. The products will be marketed under the ATR label.

INT'L CORRESPONDENCE SCHOOLS has named JOSEPH A. RISSE as Director of the School of Electrical Communications.

PHILCO CORP. reports the appointment of JOHN R. HOWLAND to sales manager, Closed-Circuit Television and Product Control Equipment, Government and Industrial Div.

JOHNS-MANVILLE Dutch Brand Div. reports the opening of a new plant in south Chicago; and the promotion of C. GREGG GEIGER to general sales manager.

JOHN F. RIDER PUBLISHER, INC. reports that contracts have been signed for the translation of a number of titles in their line, into several foreign languages and publication in the respective countries.

INSTITUTE OF RADIO ENGINEERS has elected: Pres., ERNST WEBER; Vice Pres., DONALD B. SINCLAIR; and Directors, FERDINAND HAMBURGER, JR., and BERNARD M. OLIVER.

RADIO CORP. OF AMERICA reports the following appointments: L. HARRISS ROBINSON, manager of marketing, Surface Communications Dept., Defense Electronic Products; GORDON R. VANCE, manager, Sales Coordination, Distributor Sales, Electron Tube Div.

REK-O-KUT CO., INC. has announced the winners of their Combined Consumer and Dealer Contest. Of over 50 dealer window displays submitted, the top award of a round-trip flight to the Brussels World's Fair and Paris went to M. A. GRIBBLE, of the SIXTH AVE RECORD SHOP, Portland, Ore. Round-trip flights to Bermuda, second and third place awards, went to JIM CONOSCENTI, CONCERTO ROOM INC., Pittsburgh, Pa.; and to DENNIS E. WONN, BOYD-WONN HI-FI SHOP, Vallejo, Calif. The Consumer Sweepstakes were won by RICHARD MINDEL, who won a trip to the Brussels World's Fair and Paris. One hundred other winners were named.

(Continued on page 22)

DESTROYED—NOT FIRST QUALITY!

...why General Electric ships only top-grade tubes!

One small area in every General Electric receiving tube plant is given over to destruction. Here steel jaws chew to fragments any tubes that happen to fall short of first-quality standards. These tubes cannot be "recovered," re-branded, or used or shipped in any manner.

A single high level of quality holds for General Electric tubes. In every case, they're the top product of facilities that lead the industry. See your friendly G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*

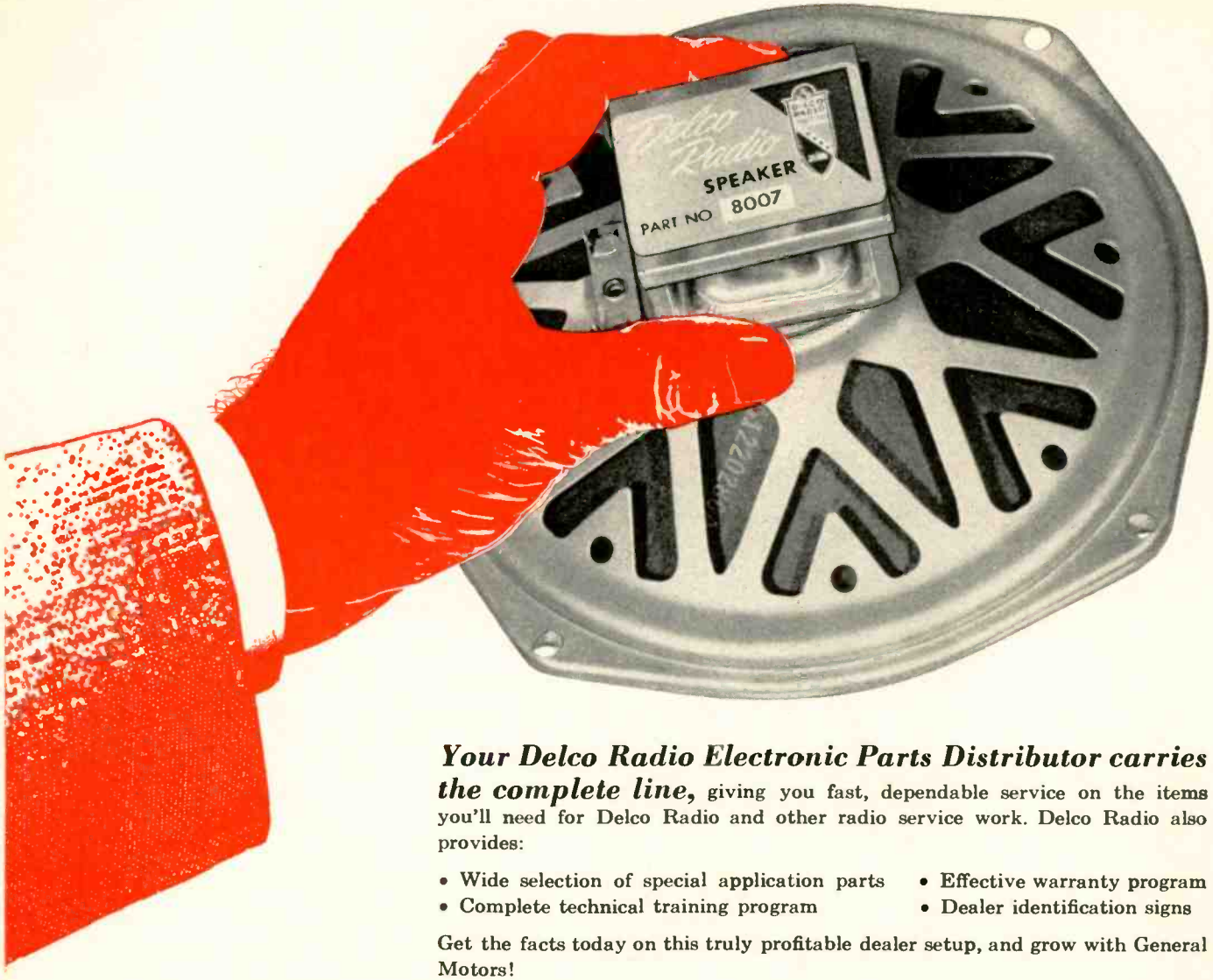
Progress Is Our Most Important Product

GENERAL ELECTRIC

2-111-201

Use Delco Radio Service Parts!

8-inch "Hi-Fi" speaker, No. 8007 offers the most highs, the most lows, the most watts in a medium-price speaker. Designed for replacement use and high fidelity audio systems.



Your Delco Radio Electronic Parts Distributor carries the complete line, giving you fast, dependable service on the items you'll need for Delco Radio and other radio service work. Delco Radio also provides:

- Wide selection of special application parts
- Complete technical training program
- Effective warranty program
- Dealer identification signs

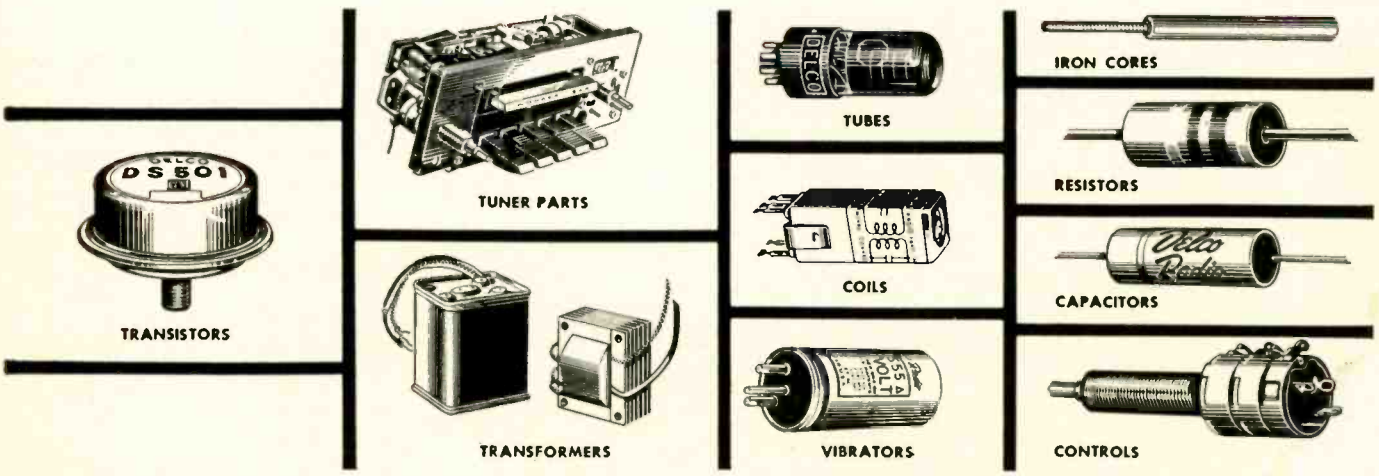
Get the facts today on this truly profitable dealer setup, and grow with General Motors!

Available everywhere through Electronic Distributors associated with . . .

GM U·M·S PARTS SALES
UNITED MOTORS SYSTEM

DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA



Silicon Rectifier... ...1N2078

NEW Tung-Sol 1N2078 designed and made for simple, speedy TV replacement!

Tung-Sol's new 1N2078 diffused junction silicon rectifier possesses distinct advantages the service industry will welcome. Optimum physical and electrical characteristics combine to make 1N2078 convenient to handle and install, and assure your TV and radio service customers the high-grade performance they want and appreciate.

Small size, easy to install. Tung-Sol's 1N2078 is smaller than most semiconductor devices, at no sacrifice in efficiency. Long flexible leads can be quickly soldered to existing connections with no additional hardware. This is especially suited to printed circuitry.

1N2078 Maximum ratings (100°C) capacitive load:
(Similar types available with Peak Inverse Voltages ranging from 50 up to 600)

Peak Inverse Voltage	400 Volts
Continuous D. C. Reverse Working Voltage	400 Volts
Average D. C. Output Current	500 mAdc
Peak Recurrent Forward Current	5 Amps.
½ Cycle Surge Current	30 Amps.
Full Load Voltage Drop @ 25°C	1.1 Volts
RMS Input Voltage	130 Volts
Minimum Series Resistance (for capacitive filter)	5 ohms, 10 watt

Long life. Negligible voltage drop that remains stable over lengthy operation promotes long life. 1N2078 virtually unaffected by high current surges . . . maintains high B+ over full-length operation.

Special insulated case. Special case insulates against chassis shorts to further ease replacement. Also, 1N2078 dissipates its own heat . . . needs no heat sink . . . yet never requires derating. Only leads get hot.

You can replace any other device and, in some cases, rectifier tubes, with the new, high-quality Tung-Sol 1N2078. For complete information . . . to stock up, contact your distributor or: Tung-Sol Electric Inc., Newark 4, New Jersey.

TUNG-SOL®

(News of the Industry Continued from page 18)

SWITCHCRAFT, INC. has named THOMAS L. DOWELL as distributor sales manager.

UNIVERSAL TRANSISTOR PRODUCTS CORP. has appointed GEORGE L. ZIFF as sales engineer.

MORAN PRODUCTS CO. is the new name of ROTOR SERVICE CO., Cleveland, antenna rotator manufacturer.

ZENITH RADIO CORP. announces the purchase of the entire capital stock of CENTRAL ELECTRONICS INC., Chicago. CENTRAL will operate as a wholly owned ZENITH subsidiary.

P. R. MALLORY & CO., INC. has named MOGENS E. CHRISTIANSEN as general sales manager of the MALLORY BATTERY CO., Cleveland. Mr. Christiansen was formerly assistant general sales manager.

HOFFMAN ELECTRONICS CORP. reports the following promotions: HENRY F. SCHOEMEHL to general sales manager; and ROY J. HERTER to assistant director of marketing, Semiconductor Div.

QUAM NICHOLS states that their special ninety-day promotion on hi-fi speakers is winning warm acceptance by distributors and dealers. The promotion points out that list prices provide profit for distributor and serviceman. Audiophile net to the public is not offered.

CHANNEL MASTER CORP. has filed an action in the Federal Court, Northern District of Ohio, Eastern Div., against WHILE-AWAY PRODUCTS CO., of Toledo, Ohio, for an infringement of Patent No. 2,817,085, covering the CHANNEL MASTER "T-W" (Traveling Wave) Antenna.

ALTEC COMPANIES, INC. has announced the appointment of LEWIS E. GILLINGHAM as marketing director and advertising manager. Also the resignation of ROBERT J. CARRINGTON, advertising manager. The firm includes ALTEC SERVICE CO., ALTEC LANSING CORP., PEERLESS ELECTRICAL PRODUCTS, and NEWPATHS, INC.

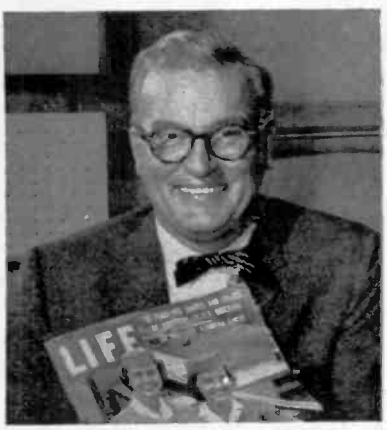
SERVICE INSTRUMENTS CORP. announces the following: Registration of their trade mark, SENCORE, has been officially granted; SENCORE reports test equipment will be featured in ELECTRONIC TECHNICIAN magazine, in at least six different advertisements appearing in each monthly issue during 1959; and ED FLAXMAN has been appointed Vice Pres.

For more information on new products described in this issue, fill in coupon on page 45.

Dave Garroway, NBC-TV star, tells his viewers to replace their old antennas with T-W's.

Let Garroway show you

...how CHANNEL MASTER promotes antenna replacements on network TV, in national ads



There are millions upon millions of over-aged, obsolete antennas in use today — providing weak TV reception for their owners. **These antennas must be replaced immediately** — and that's just what Channel Master has been telling the public in a no-punches-pulled ad campaign. We're also telling them that the best way to get good, clear reception and more years of peak performance is to replace their old antennas with Channel Master T-W's — the word's most powerful and largest-selling fringe area antennas.

We've wheeled advertising's Big Berthas onto the firing line for this campaign. Leading the barrage is Dave Garroway on his "Today" show, with 134 NBC-TV stations from coast-to-coast. This is the first time that network TV has ever been used to advertise antennas. A battery of 6 top consumer magazines — LIFE, SATURDAY EVENING POST, LOOK, TV GUIDE, FARM JOURNAL and PROGRESSIVE FARMER — also takes aim on the antenna replacement target.

CHANNEL MASTER CORP.

ELLENVILLE, NEW YORK

Catalogs & Bulletins

VOLTMETER: The new digital voltmeter model 402 is covered on data sheet 19-24. Specifications, applications, dimensions and price are included. Kin Tel, 5725 Kearny Villa Rd., San Diego 12, Calif. (ELECTRONIC TECHNICIAN B1-4)

TUBES: A 40-page supplement to the Engineer's Handbook contains new and revised data for fourteen types and eight curve sheets. The table of contents lists more than 500 types now included in the Handbook. CBS-Hytron, Danvers, Mass. (ELECTRONIC TECHNICIAN B1-1)

ULTRASONIC CLEANER: Series 5000 SonBlaster is described in a new data sheet. The series consists of 23 systems for applications to mass-production cleaning or degreasing. Narda Ultrasonics Corp., 625 Main St., Westbury, N. Y. (ELECTRONIC TECHNICIAN B1-5)

RADIO: A new 4-page brochure covers the Trans-Solar radio which operates on free power from the sun, on light from an incandescent bulb, or by battery. Specifications and operating instructions are given. Hoffman Electronics Corp., 3761 S. Hill St., Los Angeles 7, Calif. (ELECTRONIC TECHNICIAN B1-3)

CONVERSION CHART: How to convert tape recorders to stereo by replacing the existing head, and adding another amplifier, is shown in this chart. Over 200 tape recorder models are listed and information shows which one of the four basic mounting heads should be used. Nortronics Co. Inc., 1015 S. 6th St., Minneapolis 4, Minn. (ELECTRONIC TECHNICIAN B1-6)

TUBES: Catalog 2220 is a 6-page, two-color, illustrated brochure giving specifications, applications and performance data. Includes data on model 3050 vacuum gauge, designed to measure pressures of 1/1000 to 1/10,000 mm. of mercury. Central Electronic Manufacturers, Denville, N. J. (ELECTRONIC TECHNICIAN B1-2)

"He won't get very far. . . . I wrote it"

Audio NEWS LETTER

GLASER-STEERS moves into larger plant at 155 Oraton St., Newark, N. J.

ASTATIC releases General Catalog 33-3, Cartridge Guide CRC-58.

SHURE ad manager Howard T. Harwood named ad chairman of EP&EM.

ALTEC names Lewis E. Gillingham marketing director and ad manager.

RECOTON appoints Stang Sales rep in N. Y.-N. J. The firm reports the resignation of VP Jack Karns. Alfred Wish is the new VP, Hank Miller sales manager.

ERCONA has been named sole U. S. distributor of British Reslo microphones. Models range from $59.50 to $84.95.

CBS is expanding phono operations. The Columbia Phonograph Dept. is being shifted from Columbia Records to CBS-Hytron.

SERVICE TECHNICIAN association in Philadelphia is planning to set up a test standard and buying guide on rated hi-fi units.

JENSEN MFG. is furnishing retailers with "Stereo Center" speaker merchandising display. DS-100 dual or pair of SS-100 systems are used.

BOGEN-PRESTO acquires exclusive distribution rights to phono mechanisms made by Lenco A. G., Burgdorf, Switzerland. Four models to be marketed in the U. S. under the Bogen name are B-21, B-59, B-60 and B-61.

PHILCO has petitioned the FCC to establish an experimental field test program to test the company's new AM radio stereo broadcasting system. This system is reported to be compatible in that it does not degrade AM service to existing monophonic receivers.

RCA announces that production of its magazine loading stereo tape recorder started on Dec. 1. First unit is a 3-speaker portable, the SCP2. Auxiliary speaker for stereo is the SHS13 @ $9.95 or SHS12 @ $19.95.

FISHER introduces the MPX-10 multiplex adaptor, designed for stereo use with FM tuners. It is produced under Crosby license, @ $79.50, less cabinet. KARG is another company making such a unit, the MX-1 @ $99.50.

UNITED CATALOG announces the United Cost System, a useful jobber business aid. It contains latest jobber cost prices, manufacturer policies and new item announcements. Many jobbers have subscribed to service @ $25/mo.

BELL SOUND becomes a full division of Thompson Ramo Wooldridge, effective Jan. 1, 1959. The firm was acquired by Thompson Products in 1953.

CONSUMERS UNION Dec. 1958 Buying Guide issue devotes 9 pages to rating hi-fi speakers (as well as 11 pages rating whiskey and wine). To say that CU is way off base would be understatement. Of the many speakers on the market, only 3 makes are considered very good—2 smaller companies making full range units, and one Japanese tweeter import handled by a mail jobber. Again, this distorted reflection on the hi-fi industry points up the need for self-monitoring by manufacturers, perhaps along lines parallel to the publishing industry's circulation audits, as we suggested earlier. Nasty or clever editorials are not the answer. Neither are piecemeal rebuttal tests by independent labs. We strongly urge the Institute of High Fidelity Manufacturers to outline a general approach to the problem in a special meeting called for this purpose.

Independent TV-Radio Service Dealers:

THIS AD IS FOR YOU! *

1 DOES HE HAVE AN ESTABLISHED BUSINESS FACILITY?

It takes a big investment to set up a properly equipped TV-Radio service operation. When the Service Dealer has a place of business—particularly in your community — you can be certain he's planning to stay. Your business is important to him. As an independent small businessman in your community he's going to do everything he can to satisfy you. It's the only way he can assure his own future.

2 DOES HE GUARANTEE HIS WORK AND PARTS?

It's standard practice to guarantee work and parts and most qualified dealers do so. Be sure to find out the duration of the guarantee so that you will know just how long you are protected. Remember, however, the guarantee *covers only the parts replaced by the dealer, not everything in the set.* If some other tube or component fails during the guarantee period the dealer cannot be held responsible.

3 DOES HE CHARGE A FAIR PRICE FOR A HOME SERVICE CALL?

Be sure the Service Dealer you choose makes a charge sufficient to cover his time and transportation expenses. Like any other businessman, your Service Dealer has basic costs . . . overhead, rent, taxes, insurance, salaries, etc. . . . expenses that must be considered when he establishes his service call charges.

4 DOES HE PROVIDE AN ITEMIZED BILL?

He should, for his own protection as well as yours. Then you know exactly what work was done, which parts replaced and exactly how much each cost. You both know what replacements are covered by the guarantee in case of an early failure.

If the answer is *yes* to all four of these questions, the chances are you'll receive fast, competent, expert TV-Radio service at prices that are reasonable.

What's more, the chances are he'll be a *Raytheon Bonded Electronic Technician* and that's an added bonus for you. These expert technicians offer a 90 day work and parts guarantee that *is backed by a Bond* issued through one of America's largest insurance companies. They observe a strict 8-Point Code of Business Ethics designed to protect you. For the quick, safe, sure solution to all TV-Radio servicing problems, call a Raytheon *Bonded* Electronic Technician.

For Your Convenience
Raytheon TV-Radio Service Dealers Are Listed In The Yellow Pages of Your Telephone Directory

Raytheon Quality TV and Radio Tubes Mean Better Set Performance for You . . . When a Service Dealer replaces old tubes with Raytheon Tubes you're sure of long life and lasting operation. Produced by Raytheon, pioneers in electronics, these fine tubes are made to the same rigid standards of quality and precision that are designed into the superb Raytheon Tubes. Transistors and Diodes used in 14 of America's major missiles. A lifetime of experience in the development and production of Raytheon Tubes for military, industrial and commercial applications is behind them. That's why you are certain of satisfaction from Raytheon TV and Radio Tubes.

RAYTHEON
Excellence in Electronics

Raytheon Manufacturing Company, Distributor Products Division, 55 Chapel Street, Newton 58, Massachusetts

* Raytheon is running this advertisement in the January 19, 1959 editions of NEWSWEEK and TIME magazines to help you. Read it carefully. It makes four simple suggestions to set owners that should result in substantial increases in service business for qualified Independent TV-Radio Service Dealers. It clarifies the set owners' misunderstandings about the standard work and parts guarantee. Giant blow-ups of this advertisement are available from your Raytheon Tube Distributor at no cost to you. Be sure to feature one in your shop window.

ELECTRONIC TECHNICIAN

Welcome SERVICE Subscribers

Something new has been added. Starting this month, ELECTRONIC TECHNICIAN goes to thousands of SERVICE subscribers to fill the unexpired portion of their subscriptions after October 1958—when we purchased and merged Service into ELECTRONIC TECHNICIAN.

To the SERVICE readers who are receiving ELECTRONIC TECHNICIAN for the first time—welcome to the fold. We are delighted to have you join our fraternity of professional technician readers. And we hope you will be as outspoken as our old-time readers in telling us what you like, what you don't, and how we can best serve you.

Our Aims and Policies

To help us get acquainted more quickly with former SERVICE subscribers—and further to clarify some points for our long-time friends—let's state some of the important things ELECTRONIC TECHNICIAN believes in and does.

First, we are dedicated completely to serving the electronic maintenance industry, disseminating useful information, and fighting for the rights of independent service businesses.

We cater to the professional technician. We are not interested in the hobbyist, so we do not sell on newsstands.

We are the only magazine in the electronic service trade to publish a complete Buyers Directory (every May), and to provide, at no extra cost, 16 pages of the latest schematics every month (Circuit Digests, inside back cover).

We believe technicians should join and be active in their local service associations.

We are firmly opposed to captive service—that is, service business grabbed by the set manufacturer or his distributor by combining service cost with the set's purchase price. (Copies of our editorial, "Fighting Mad Over Captive Service," available on request.)

Though we are affected by the same rising production costs which are forcing other electronic publishers to increase their subscription price, we plan to retain the same rate in effect since ELECTRONIC TECHNICIAN was founded.

We believe that a well-informed technician, be he employer or employee, has a most promising future in the constantly expanding electronic industry. Not only do the growing number of radio and TV sets require maintenance, but high fidelity, communications and industrial electronics are opening new avenues toward greater installation, sales and repair opportunities.

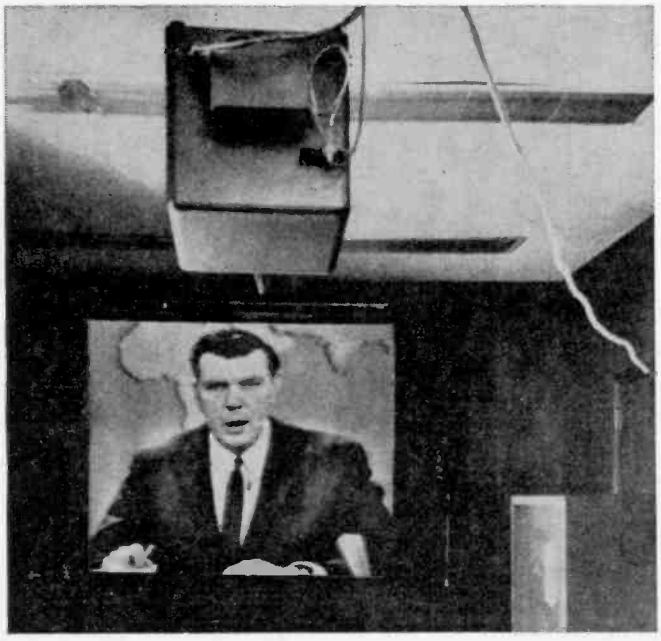
And we believe that the electronic technician is a vital force in shaping the fabulous electronic future.

Tuning In the

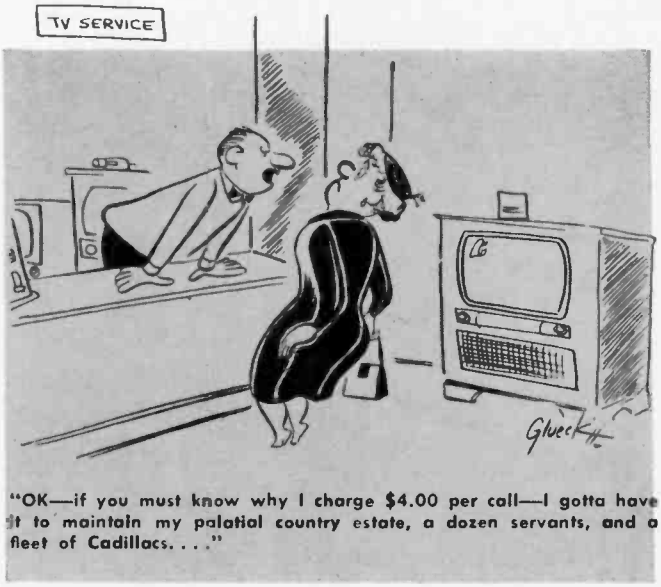
HIGH FIDELITY has become important business for service dealers and technicians—and vice versa. Manufacturers are catering to the servicing arm of the industry more than ever. Blonder-Tongue has come out with a hi-fi tuner and amplifier line designed to be sold from the jobber through the service technician to the consumer. Units carry a list price instead of audiophile net. Walco (Electrovox) has developed a Super Bonus Club program based on stamps removed from phono needle boxes. Based on the number of stamps, small dealers can obtain paid-up life insurance, hospitalization and other big company type benefits. And as many technicians have found out, most hi-fi units sold by jobbers can be purchased by technicians at below "audiophile net" for profitable resale and custom installation.

REGULATED HIGH-VOLTAGE DC: is magnetically regulated and capable of providing 2,300 volts at 15-50 milliamperes, with ¼% regulation. Isolation of the control and output sensing circuits from the high-voltage output is accomplished by placing the control element—a self-saturating magnetic amplifier—on the low-voltage input side of the regulated supply and by adding an auxiliary winding for output sensing. Silicon rectifiers in the high-voltage output circuit and in the voltage reference circuit are used. A conventional voltage doubler serves as the high-voltage rectifier.

COMPACT TV PROJECTOR



Remote control TV projector throws picture up to 12 by 15 ft. on movie screen. Unit by Giant View div. of Meilink may be suspended from ceiling or placed on table without obstructing view, thereby making possible use in smaller rooms than were previously possible.



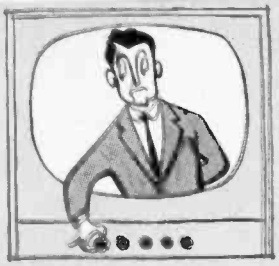
"OK—if you must know why I charge $4.00 per call—I gotta have it to maintain my palatial country estate, a dozen servants, and a fleet of Cadillacs. . . ."

FTC WAR ON FICTITIOUS PRICES. Solid support for the Federal Trade Commission's drive to curb price trickery in advertising has been volunteered by representatives of the nation's most influential business organizations, including those for newspapers, radio and television, advertising, and the Better Business Bureaus. The object of this effort is to combat the practice of many merchants and manufacturers to exaggerate the original price of consumer products in order to make the selling price appear to be a bargain. A month ago the FTC issued a nine-point guide to clarify where and how this kind of deception violates the law.

THINK YOU'RE FAST with that tube tester? Well, RCA has come up with a machine (for tube manufacturers) which tests up to 2,500 electron tubes in an hour. Fifteen individual electrical tests are performed on each tube. Here's how it works. The operator inserts the tubes into sockets on a conveyor, or into a chute if the tubes are to be automatically loaded. As the tubes travel along the conveyor, they are preheated and tested at various stations. Those not meeting specification are ejected at the respective station. Good tubes continue to the final station —all automatically.

INTERESTING SALES TREND noted by Ken Tibbetts, vice president of the National Credit Office, is that jobber sales volume is increasing at the fastest rate in certain low-population areas. This underscores the importance of dealer outlets in non-metropolitan markets, many of which have been sorely neglected by a number of manufacturers. It must be recognized that some 70% of the nation's population is in towns of under 100,000.

Picture .....



AMERICANS may have more than half of the world's 117,800,000 telephones (63,621,000 to be more exact), but people in other countries are out-talking us. We averaged 460 conversations per person last year, but Canadians hit a 497 average. Alaska averaged 581 conversations, the most talkative area of all.

AN ADVERTISING TRADE magazine has a section called, "Advertising We Can Do Without." We nominate the Lewyt Corp. for this dubious honor for its ad on an "electronic" vacuum cleaner. The beater sweeper and headlight are claimed to be electronic, though the former is a rotating nylon brush. When we asked the company exactly what was electronic about the vacuum cleaner, what components were used, etc., we were told that the president was in Europe, and the policy ruling was that nothing was to be released on the unit.

LOUD FIDELITY. Residents of Paramus, N.J., were warned not to panic while Bogen tests its 9 kw (that's right, KILOwatts) public address system. This 76-speaker giant is an airborne system to enable the Air Force to direct ground activity from a considerable altitude. To avoid sound damage, the speakers are pointed skyward during the tests, instead of groundward as they would in actual use.

FABULOUS GROWTH for transistor volume is anticipated by James Sweeney, GE semiconductor marketing manager. 1958 sales of 44,000,000 units is about 3½ times as many as 1956. For 1959, sales of 66,000,000 transistors are predicted, a 40% gain.

CALENDAR OF COMING EVENTS

Jan. 12-14: 5th Natl. Symposium on Reliability & Quality Control, Bellevue-Stratford Hotel, Philadelphia, Pa.

Jan. 21-23: Southwest Electronic Exhibit, Ariz. State Fairgrounds, Phoenix, Ariz.

Jan. 26-29: Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, Ohio

Mar. 3-5: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif.

Mar. 23-26: IRE National Convention, Coliseum & Waldorf-Astoria Hotel, New York, N. Y.

May 6-8: Electronic Components Conference, Ben Franklin Hotel, Philadelphia, Pa.

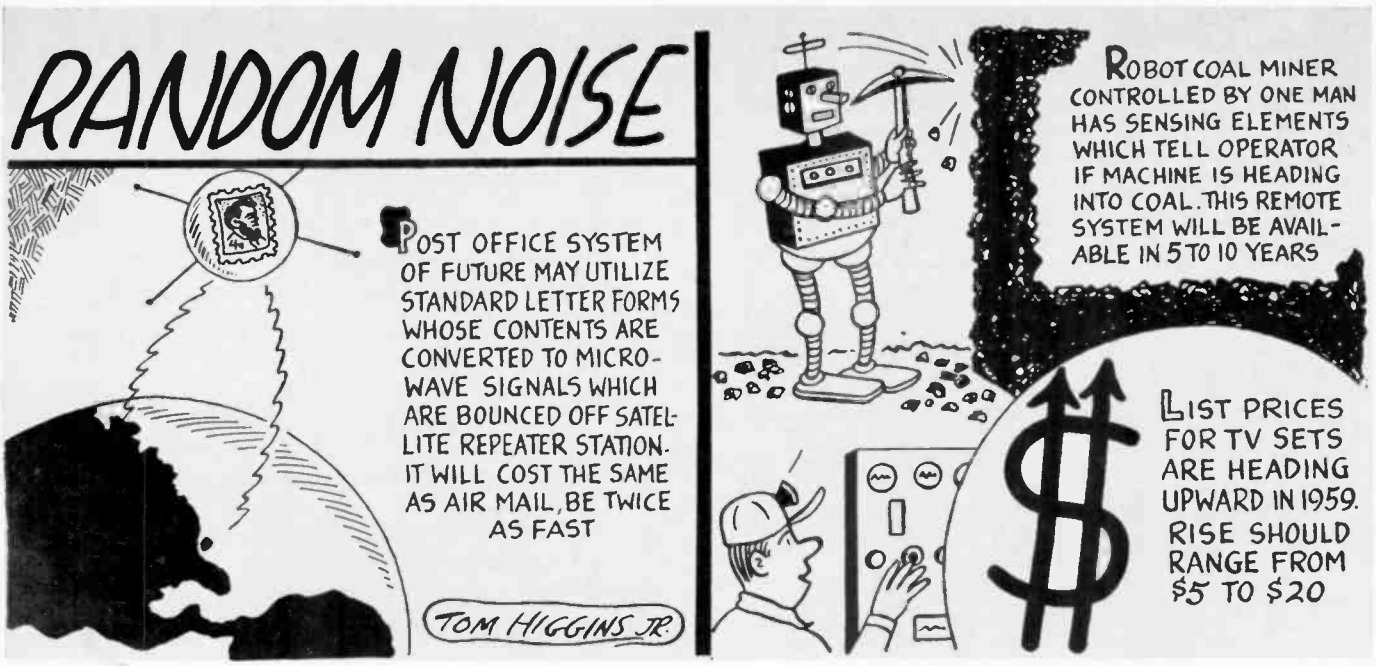
May 11-13: Joint Conference on Automatic Techniques, Pick-Congress Hotel, Chicago, Ill.

May 18-20: 1959 Electronic Parts Distributors Show, Conrad Hilton Hotel, Chicago, Ill.

HI-FI SHOWS

Feb 7-10: Cow Palace, San Francisco, Calif.
Feb 16-23: Biltmore Hotel, Los Angeles, Calif.

ONE YEAR SERVICE guarantee on its "StenOtape" tape recorder-transcriber, has been announced by American Geloso Electronics, 312 Seventh Ave., New York City. The guarantee will be carried out by independent service technicians, whom the firm invites to seek franchises.



Hi-Fi Servicing With A

Standard Shop Procedure Plus Proper Test Equipment Extracts

HARMONIC DISTORTION

Significance

Ease Of Use In The Field

Equipment

- **Audio Signal Generator**
- **Harmonic Distortion Meter**
- **Oscilloscope**

Measurements

- **Output Level**
- **Distortion**
- **Hum**

NORMAN H. CROWHURST
&
ROBERT CORNELL

• Servicing hi-fi equipment is a specialized endeavor which combines regular servicing procedure with certain laboratory techniques. The hi-fi owner is discerning of quality, and particularly critical of distortion. Distortion measurements and analyses are a must. What discourages many technicians in the beginning is the apparent complexity of the many different forms of distortion. This situation is not helped much by the lack of agreement as to what distortion is undesirable, and to what degree it must exist before it becomes objectionable. Some engineers may feel that a certain amount of harmonics may actually enhance the listening quality of certain types of musical programs. Others will argue that if the sound isn't in the program source, it shouldn't be in the output of the speaker. Almost all authorities believe that reproduced notes not harmonically related to the original signal is better left out. This is usually a product of intermodulation distortion (IM) where two signals get together and a third one develops because of sum or difference beat notes. Research on what distortion is of importance is still in progress, and more information is becoming available.

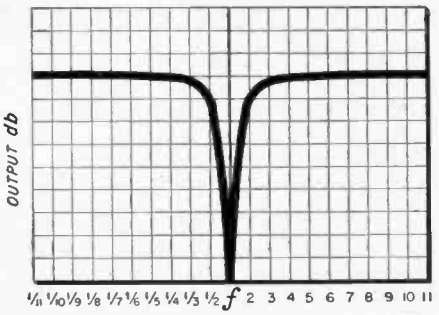


Fig. 2—Sharply tuned notch filter removes the fundamental and leaves only the harmonics.

To point up the problem of evaluating the significance of distortion readings, consider the amplifier that sounds nice and clean and yet according to the harmonic distortion analyzer has a very high distortion figure. On the other hand, where does the distortion come from when the readings are low, and the amplifier sounds terrible? IM techniques do not fare any better. An amplifier may come through admirably for one set of test conditions and make out poorly for another. Too many variables as to the selection of different frequencies, and relative amplitudes enables a large number of unrelated measurements to be made, which may or may not reflect what the amplifier will do under actual operating conditions. Some efforts have been made to standardize this procedure, but several methods prevail, and there is considerable disagreement as to the merits of each.

An important consideration in developing any system of measurements, is ease of accomplishment in the field as well as in the laboratory. Total harmonic distortion measurements are easier to accomplish, contain fewer variables, and are more widely used. It is therefore of advantage to know what is involved in the use of an harmonic distortion analyzer. One basic concept of a well designed audio amplifier is that it is a linear device.

Fig. 1—Harmonic distortion meter measures total amplifier output after the fundamental has been removed. The scope aids in interpreting the measured voltages.

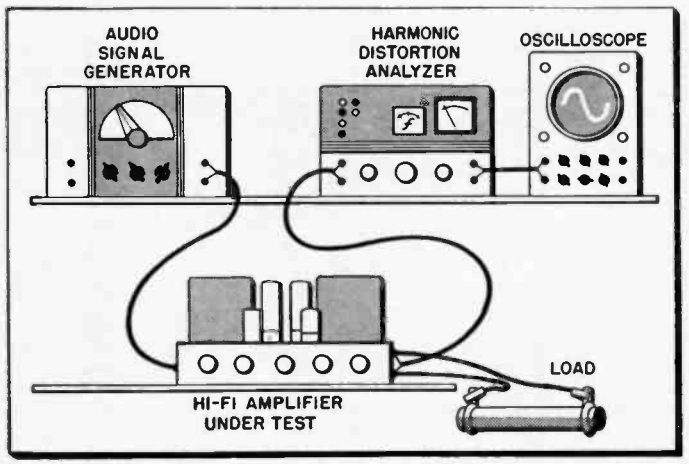
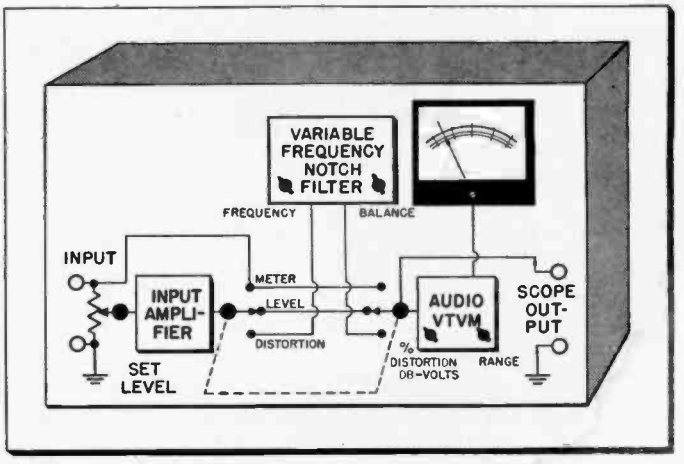


Fig. 3—In addition to showing total harmonic distortion as a percentage of the entire output signal, the analyzer can be used as an audio VTVM to measure hum, noise, rated output, and other levels.



Harmonic Distortion Meter

Laboratory Intelligence From Harmonic Distortion Measurements

If a pure sine wave signal is fed into the amplifier, theoretically, the output should be the same clean signal only amplified. Should any non-linearity exist, the output will be distorted. It can be shown that a distorted waveform contains many sine waves which are harmonically related to the fundamental. IM distortion is also a function of non-linear amplification, and somewhere along the line, under certain conditions, relationships do exist between IM and harmonic distortion.

To determine harmonic distortion, it is necessary to inject a harmonic-free sine wave signal into the amplifier, and measure the signal at the output before and after the fundamental has been removed. If there are no harmonics present, the output signal would be zero, assuming of course that hum and noise are not present, after the fundamental has been removed. The presence of harmonic components are measured, and expressed as a percentage of the total output signal.

$$\% \text{ Distortion} = \frac{\text{Output Signal-Fundamental}}{\text{Output Signal+Fundamental}} \times 100$$

Because the amplifier may exhibit different distortion characteristics at different frequencies, and at different signal levels, it is more significant to develop a family of readings. These are accomplished quite rapidly once the equipment is connected.

Use of the equipment is straightforward and logical, once the technician has an overall concept of what is happening. As in a fine camera, ch control and adjustment affects picture; when properly made inished product represents the ct of interest. The chain-like ment in Fig. 1 shows a logical flow of signal from a good audio signal generator to the amplifier under test and to the distortion meter. The scope is highly desirable, but not essential to the tests. The scope does enable the observation of what is being measured. Hum, noise and other spurious or parasitic response can be seen and to some extent the meter readings can be interpreted and become even more meaningful.

Before showing how to twist the knobs, it is well to keep in mind what the distortion analyzer does. Essentially it traps out the fundamental frequency of the test signal from the amplifier output and permits everything else to be measured by the meter circuit. The response curve of the analyzer in Fig. 2 shows a very sharply tuned trap, and relatively flat response to all frequencies above the second harmonic. The purpose of the knob twirling then is to adjust the trap to the fundamental frequency. The meter circuit measures the signal with and without fundamental, and is calibrated to indicate percentages, db, and volts. Of course it stands to reason that the harmonic content of the test signal from the generator must be significantly lower than the harmonic distortion of the amplifier for the readings to be meaningful. A generator's signal can be cleaned up by using appropriate filters if necessary. It is also essential that the amplifier's input and output impedances be properly terminated.

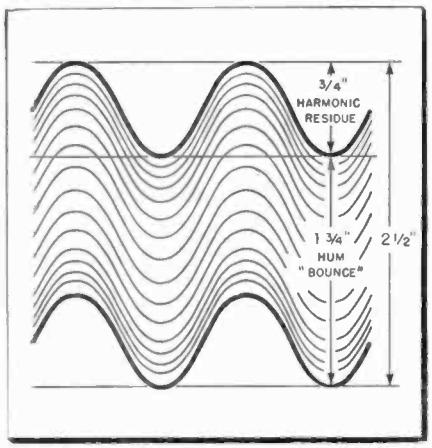
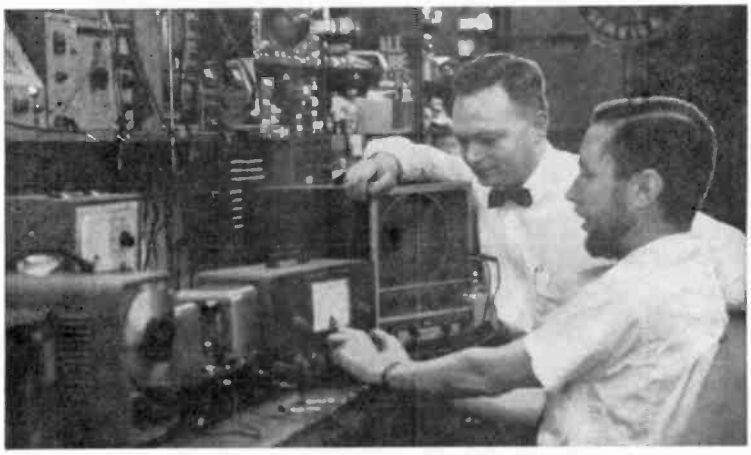


Fig. 4—To estimate the amount of hum in the harmonic meter reading determine the ratio of hum bounce to the total peak-to-peak amplitude, and multiply it by the meter

Adjust the generator's output level to obtain the desired power output from the amplifier. Assuming that 25 watts is desired, and the resistive load used to match the amplifier's output impedance is 16 ohms, the output voltage required is 20 volts. This is easily derived from the power equals E^2 over R formula. Fig. 3 is a functional diagram of a distortion analyzer showing the operating controls.

Voltage can be measured by the audio VTVM function of the distortion analyzer. To use this function it is necessary to select the proper

(Continued on page 34)



Authors Cornell and Crowhurst (l to r) put an amplifier through its paces. Sometimes it takes two hands to obtain minimum reading one on the frequency selector and the other on the balance control.

1958 TV-Electronic Industry Statistics

TELEVISION

New sets	5,900,000
$ volume at retail	$1,080,000,000
Sets scrapped	2,800,000

TELEVISION SETS IN USE

U.S. homes* with b & w sets	42,800,000
Secondary sets in above homes	4,800,000
Sets in business places, institutions	2,700,000
Color sets (included above)	360,000
Total TV sets in U.S.	50,300,000

RADIO

New sets	12,300,000
$ volume at retail	$ 452,000,000

RADIO SETS IN USE

U.S. homes* with sets	52,900,000
Secondary sets in above homes	50,400,000
Sets in business places, institutions	13,100,000
Automobile sets	42,800,000
Total radio sets in U.S. (including 14,500,000 FM)	159,200,000

**Includes all dwellings such as apartment hotels, etc.*

ANNUAL RETAIL BILL FOR SERVICING

190,000,000 replacement receiving tubes	$ 340,000,000
6,600,000 replacement picture tubes	$ 260,000,000
Antennas, components, parts, instruments	$ 840,000,000
Labor	$1,170,000,000
Total servicing bill	$2,610,000,000

INDUSTRIAL ELECTRONICS

Industrial electronics, factory sales	$1,450,000,000
Industrial electronic & communications maintenance (22.8% of outlets)	$ 76,000,000
Industrial electronics & communications, sales through 6.8% of service outlets	$ 12,900,000

TV-ELECTRONIC TECHNICIANS

Major service outlets	63,500
Parts jobber business accounted for	68%

TUBES MANUFACTURED

Picture Tubes

Number made (including 3.4 million rebuilts)	12,500,000
% used for replacement	52.8%

Receiving Tubes

Number made	430,000,000
% used for replacement	44.2%

TRANSISTORS

Number made	45,000,000
% used for replacement	6%

TELEVISION STATISTICS 1946-1956

Year	Sets Manufactured	Total Sets in Use	TV Stations on Air
1946	10,000	8,000	5
1947	250,000	230,000	20
1948	1,000,000	1,000,000	44
1949	3,000,000	3,800,000	100
1950	7,500,000	10,500,000	107
1951	5,600,000	15,750,000	108
1952	6,300,000	21,800,000	123
1953	7,300,000	28,000,000	350
1954	7,300,000	33,000,000	415
1955	7,800,000	39,000,000	465
1956	7,300,000	43,900,000	495
1957	6,800,000	47,240,000	512
1958	5,900,000	50,300,000	526

AUDIO

Home Hi-Fi Service (74.5% of outlets	$ 114,000,000
PA Installation & Repair (37.1% of outlets)	$ 59,000,000
Phonographs sold	4,500,000
Phonographs $ volume at retail	$ 365,000,000
Phonographs in U.S.	37,100,000
Tape recorders sold	550,000
Tape recorder $ volume at retail	$ 102,000,000
Hi-Fi audio $ volume	$ 230,000,000

ELECTRONIC TECHNICIAN statistics are an industry reference, used each year by such authoritative sources as the *World Almanac*.

(Continued from page 33)

position of the function switch, and the proper range. Sometimes a separate set of terminals are provided for this purpose. If preferred, a separate audio voltmeter could be used. Once the input frequency and level is set to get the desired output voltage, turn the function switch to the "calibrate," or "set-level" position, making sure that the range switch is at 100%. Adjust the input control of the distortion analyzer so that it reads full scale. This sets the gain of the analyzer so that the next measurement can be related and expressed as a percentage of the first reading, and not just another voltage reading. Next place the func-

(Continued on page 52)

Norman Crowhurst emphasizes the importance of having appropriate equipment for hi-fi servicing. Selection of kits or factory made testers depends upon individual preference and need.

The Lowdown On Small Business Administration Loans

Who May Borrow? How To Obtain A Loan

LARSTON D. FARRAR *

• Many small electronics firms have been getting loans from, or with the aid of, the Small Business Administration (SBA). Commercial banks have become very choosy about the businesses to which they will extend adequate credit.

Inquiries about loan policies were tabulated and presented to SBA officials for their answers. The questions and answers do present most of the pertinent general information. For specific cases it may be desirable to contact the nearest field office, the address of which can be obtained by writing to the Small Business Administration, 811 Vermont Ave., N. W., Washington 25, D. C.

Q. What type or types of loans are available from the SBA, and what businessmen are eligible?

A. Small Business Administration loans are available to small companies in the manufacturing, wholesaling, retailing and service fields.

There are four types of SBA loans. These are: (1) Participation; (2) Direct; (3) Limited Loan Participation, and (4) Disaster.

A Participation Loan is one made jointly by the SBA and banks or other private lending institutions. Two thirds of the agency's loan approvals are in this category. In many cases of bank-participation loan agreements, the bank will assist the potential borrower with the filing of the loan application.

A Direct Loan is one in which there is no bank participation. All of the funds are advanced by the Government. It is the policy of the SBA to make direct loans only after the possibility of negotiating a bank-participation agreement has been exhausted. The SBA will not make any type of loan, Direct or Participation, until the potential borrower has tried, unsuccessfully, to obtain a regular bank loan. By law, the SBA can make loans to small firms only when financing is not otherwise available on reasonable terms. If the bank will not make a loan even with the SBA participation, the businessman may then apply for a direct loan from the SBA. His application must be accompanied by a letter from the bank stating that it is unable to make the loan. If the businessman's firm is located in a city of 200,000 population or more, his application to the SBA must be accompanied by letters from two banks stating that they cannot grant the requested loan.

A Limited Loan Participation loan is designed especially to assist small retailers, wholesale distributors and service establishments, although other types of business loans are also available to them. As a rule, small concerns in these fields have very little in the way of tangible collateral which they can pledge for a loan. However, they often have a good earnings record, competent management, and a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate with a bank in a loan to a firm up to a maximum of $15,000, or 75 per cent of the total amount of the loan, whichever is the lesser. Generally, the participating bank's share in the loan must represent additional exposure on the part of the bank equal to not less than 25 per cent of the total amount of the loan. The maximum maturity on Limited Loan Participation agreements is five years. Maturity of other types of SBA loans may be as long as 10 years.

A Disaster loan is made to businessmen, home-owners, and individuals, in areas designated as "disaster areas" by a federal agency, for any of a number of reasons. These are low-interest loans—three per cent—made to tide over those stricken by disaster until they can get on their feet.

Q. Is it any easier to get a Small Business Administration loan if I can arrange for partial private financing?

A. Naturally, if a local bank, which is familiar with a small firm's credit record and its day-to-day operations, is willing to share in an SBA loan to the firm, helps to assure the Agency that the loan is a good risk. Further, since the bank has done more of the necessary credit investigation before the loan request is submitted to the SBA, the Agency can usually process this type application more quickly.

Q. What are the maximum amounts available to me?

A. The amount which you may borrow from the SBA depends upon how much you need to carry out the intended purpose of the loan. However, under the Small Business Act of 1953, which created the Agency, the largest loan the Small Business Administration can make to any one borrower is $350,000.

Q. What are the terms of repayment on a loan?

A. SBA's business loans usually are repayable in regular monthly

(Continued on page 67)

---

of "Washington Lowdown."

Extend VOM Or VTVM For

Reactance Measurements

Voltage Divider Circuit Enables Quantitative Evaluation

AL DIAMOND

• The use of a capacitance and inductance bridge and other quantitative checkers are of advantage in many instances of radio, TV and industrial electronic servicing. Peaking and other wave-shaping circuits, tuned circuits, etc., are usually critical of the value of the reactive components therein. A VOM or VTM, in addition to the host of other functions, can be used to measure inductive and capacitive reactances. Some meters are already calibrated for this purpose, but most of them are not. Even those that are, can have their range and versatility extended by knowing and applying some of the pertinent principles and techniques.

In addition to the meter, an a-c voltage source is required. A 60-cycle power line or a signal generator could be used. Except for the difference in calibration, the same general rules apply to both capacitive and inductive reactance measurements. Straight voltage-divider action takes place when two or more elements are placed in series with a voltage source, as shown in Fig. 1. It is possible to substitute resistors for the known reactive elements, and still obtain similar divider action. On the other hand, it is not desirable to mix inductive and capacitive elements in the same voltage divider test circuit except for special known cases—under these circumstances phase changes and resonant conditions could cause misleading interpretation.

The action of the divider is seemingly simple. If the unknown component is equal to the known component (standard) then the voltage across each will be exactly half. In the case of capacitors, the larger the unknown the less reactance it has,

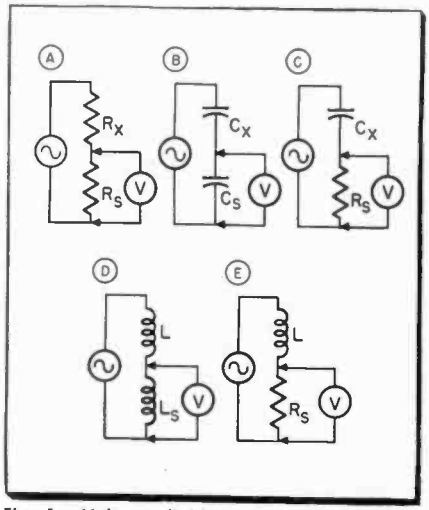


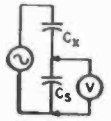
Fig. 1—Voltage divider action permits reactance measurements with the VOM or VTVM.

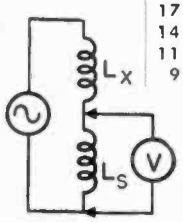
and the more voltage is impressed across the standard. The converse is true of inductors and resistors. Table 1 contains a series of percentages of

(Continued on page 65)

Table 1—Percent of applied voltage developed across the standard in the voltage divider without meter loading.

Unknown X_L in mh X_C in µf	0.01 L_s	0.01 C_s	0.1 L_s	0.1 C_s	1.0 L_s	1.0 C_s
0.001	91	9				
0.002	83	17				
0.004	71	29				
0.005	67	33				
0.006	63	37				
0.008	55	45				
0.01	50	50	91	9		
0.02	33	67	83	17		
0.04	20	80	71	29		
0.05	17	83	67	33		
0.06	14	86	63	37		
0.08	11	89	55	45		
0.1	9	91	50	50	91	9
0.2			33	67	83	17
0.4			20	80	71	29
0.5			17	83	67	33
0.6			14	86	63	37
0.8			11	89	55	45
1.			9	91	50	50
2.					33	67
4.					20	80
5.					17	83
6.					14	86
8.					11	89
10.					9	91





Tables 2 & 3—Reactance values, in ohms, of inductors and capacitors at indicated frequencies. Top table calls out approximate size of resistors which may be substituted for L_s and C_s.

	L_s & C_s Reactance In Ohms							
L in mh C in µf	60 cps X_L	60 cps X_C	400 cps X_L	400 cps X_C	1,000 cps X_L	1,000 cps X_C	500 kc X_L	500 kc X_C
0.01	0.0038	265,000	0.026	40,000	0.062	16,000	32	32.
0.1	0.038	26,500	0.26	4,000	0.62	1,600	320	3.2
1.0	0.38	2,650	2.6	400	6.2	160	3,200	0.32

L in mh C in µf	60 cps X_L	60 cps X_C	400 cps X_L	400 cps X_C	1,000 cps X_L	1,000 cps X_C	500 kc X_L	500 kc X_C
0.001	0.0004	2,600,000	0.0025	398,000	0.006	159,000	3	320.0
0.005	0.002	531,000	0.015	80,000	0.03	32,000	6	65.0
0.01	0.004	265,000	0.026	40,000	0.06	16,000	32	32.0
0.02	0.008	133,000	0.05	20,000	0.15	8,000	62	16.0
0.05	0.02	53,000	0.15	8,000	0.3	3,000	155	6.5
0.1	0.04	27,000	0.25	4,000	0.6	1,600	320	3.2
0.25	0.1	10,600	0.65	1,600	1.6	640	800	1.3
0.5	0.2	5,300	1.5	800	3.2	300	1,600	0.65
1.0	0.4	2,700	2.5	390	6.2	160	3,200	0.3
2.0	0.75	1,300	5.0	200	12.5	80	6,200	0.
4.0	1.5	660	10.0	100	25.0	40	12,500	0
5.0	1.8	525	15.0	80	32.0	32	16,000	
8.0	3.0	330	20.0	50	50.0	20	23,000	
10.0	3.8	260	25.0	40	62.0	16	32,000	

Difficult Service Jobs Described by Readers

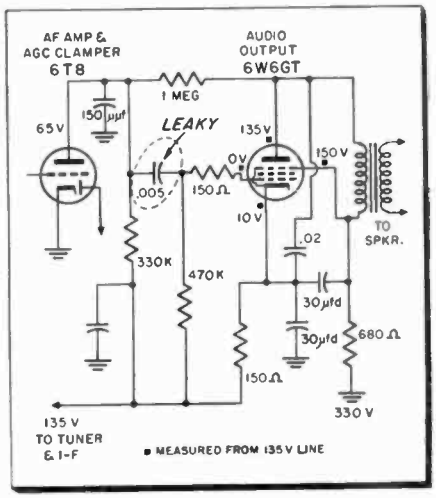
Dynamic Voltage Divider

This particular tough dog, a Westinghouse TV chassis V-2216-1, was brought in with a complaint that, "it loses the picture when the channels are changed."

Our three operating channels were checked. Good video, audio and sync were present. Tubes were tapped and visual inspection was made, but no trouble symptoms showed up. After about fifteen minutes of operating, the set was checked again. This time when another channel was switched in, a severe case of overload with complete loss of sync developed. Tubes were substituted along the video signal path without improvement. When the 6T8 audio amplifier and agc clamper tube was removed from its socket the picture became normal.

A new tube was installed and the picture still remained normal. I thought that was it; that is until I tried changing channels—the trouble came right back again. At this point the schematic was studied. A keyed agc is used, and the audio output tube acts as a B+ voltage divider. The 135 volt line from the cathode of the 6W6 supplies the i-f and tuner stages. The 6T8 was removed and again the picture recovered. Suspecting a defect in the delay circuit, I monitored the tuner agc voltage with the tube in and out. There was no change. From past experience I have learned the merits of the oscilloscope and waveform measurements when everything seems to be normal, and still a trouble persists, and so I put it to use in this problem.

The scope showed a normal keying pulse at the plate of the agc tube but the composite video signal at the control grid was barely 25 volt peak-to-peak instead of 30 volt peak-to-peak. Going back to the output of the video detector a 3 volt peak-to-peak signal was present instead of the normal 5 volt signal.



Defect in grid circuit of audio output tube was cause of intermittent loss of video.

Assuming that the signal strength at my bench is normal and if agc is below normal, an even greater output at the detector would occur rather than smaller. Proceeding further, B+ voltage checks were made in the i-f stages which led to what was supposed to be the 135 volt line from the cathode of the audio output tube. It was down to 110 volts. The plate and screen voltages on the 6W6 tube were normal which meant a greater than normal voltage drop existed across the tubes. A bias measurement next showed 30 volts instead of the normal 10 volts. A search for defective components in the grid circuit paid off by finding a leaky 0.005 μf coupling capacitor. Replacing the capacitor cured the trouble. As to why the picture seemed to behave with the 6T8 removed—the excessive bias was the result of direct current from the plate of the 6T8 tube through a parallel path around the plate load resistor through the leaky coupling capacitor and the 470,000 ohm grid resistor. Reduced B+ voltage to the tuner and i-f stages was just enough to make this an excellent borderline case.—*Robert Samodell, Cleveland, Ohio.*

Screw Loose Hum

A 17-inch Admiral model 21F1 had a 60-cycle hum bar in the picture. At times it would upset both horizontal and vertical sync. All tubes including the CRT were checked for shorts and leaks—none existed. The scope indicated the presence of hum as far back as the cathode of the first video i-f stage. This modulated the current flow through this tube and was amplified at each succeeding stage. Hum was also present at the low end of the 47-ohm cathode resistor, which meant that the i-f chassis itself had a hum potential. Further inspection showed that the i-f string was mounted on a copper-plated steel sub-chassis secured to the main chassis by four self-tapping screws; two at the detector end and two at the first i-f end. First I tightened the screws at the output end, but these were already down solid. The other two screws did give some, enough to eliminate the hum.—*Max L. Levy, Alexandria, Va.*

TOUGH DOGS WANTED!

ea[illegible] for acceptable items. Use drawings to illustrate [illegible] never necessary. A rough sketch will do. Photos the[illegible]esirable. Unacceptable items will be returned. [illegible] your entries to "Tough Dogs" Editor, ELECthe [illegible] TECHNICIAN, 480 Lexington Ave., New subje[illegible] N. Y.
arrange[illegible]

Radio-Frequency Induction And

Industrial Electronics Employs RF Energy To Apply Controlled

ALLAN LYTEL

• Radio frequency energy is used in industry for heating materials, both conductors and insulators. Induction heating is employed when working with conductive materials, and dielectric heating is used when the work is a non-conductor.

Induction Heating

Induction heating is a method for obtaining localized and controlled heat by induced currents. Because the metallic work piece has both eddy-current and hysteresis losses the temperature increases in it in much the same manner as heat is produced in a transformer core. Typical advantages of induction heating over other methods are: controlled areas of heating, rapid application of heat, precise control of the amount of heat, and uniformity of heat application. The principle disadvantage is high cost. This may limit applications to specialized cases which can not be done in other less convenient or less expensive ways. Applications include: surface hardening and other types of metal heat treating, soldering, and brazing, paint drying, etc. The intensity of a magnetic field depends upon current, number of turns, and core material. Fig. 1 shows a cross-section of a work-coil heating a metallic bar. Magnetic materials heat up faster than non-magnetic materials because they have both eddy-current and hysteresis loss; non-magnetic materials have only eddy-current loss.

Induction heating encompasses a wide range of power and frequency. Frequencies extend from 60 cycles to 50 megacycles. Table 1 shows a course breakdown of this range, its uses, and sources. Use of different frequencies provide for a variation

Frequency	Application	Equipment
60 CPS—10 KC	Low-temperature heating, annealing, and melting.	Rotating A-C Generators
10 KC—500 KC	Surface heating metals.	Vacuum Tube Oscillators and Spark-gap Converters
500 KC—50 MC	Surface heating of small objects.	Vacuum-tube Oscillators

Table 1—Frequencies used in induction heating, 60 cps to 50 mc, are selected according to work and equipment requirements.

Fig. 1—Electromagnetic field around load coil used in induction heating penetrates work to varying depths depending upon frequency.

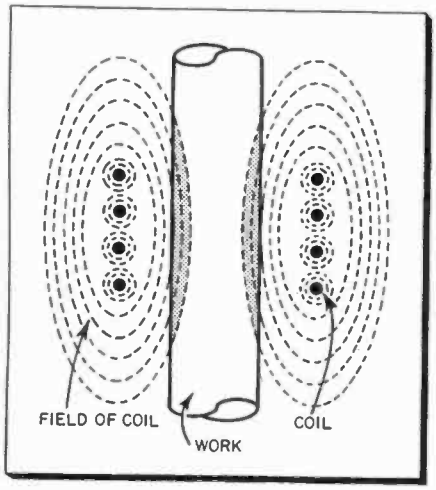
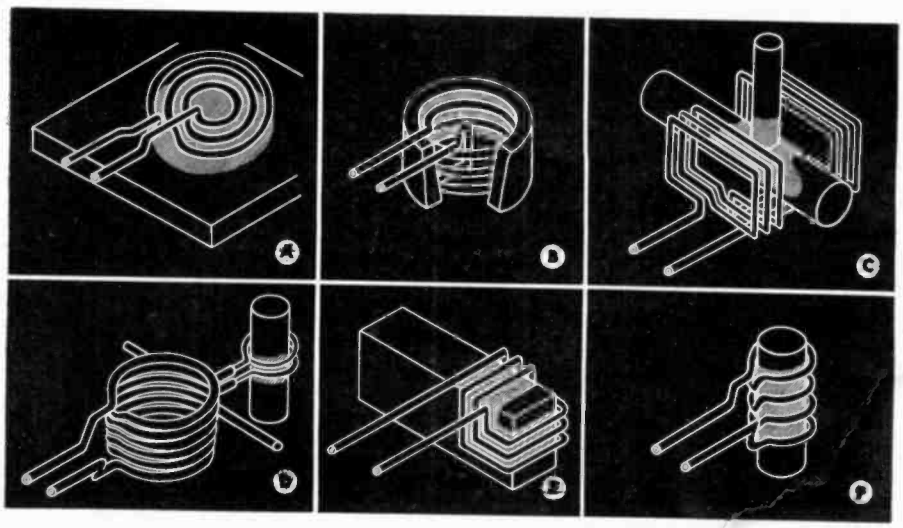


Fig. 2—Different shaped work coils are specifically designed for each application. Shapes include: pancake, round internal and external, square, rectangular, combination, transformer type, etc.



Dielectric Heating

Heat For Bonding, Sealing, Drying, Etc.

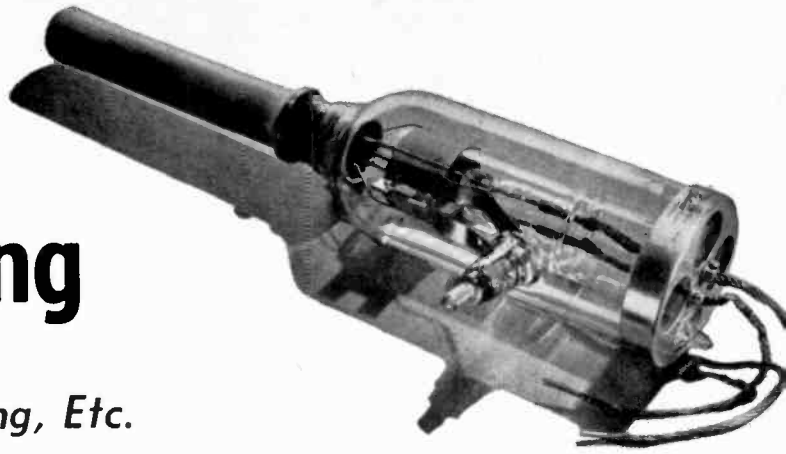


Fig. 5—Induction heating type tubes are designed to pass large amounts of curent.

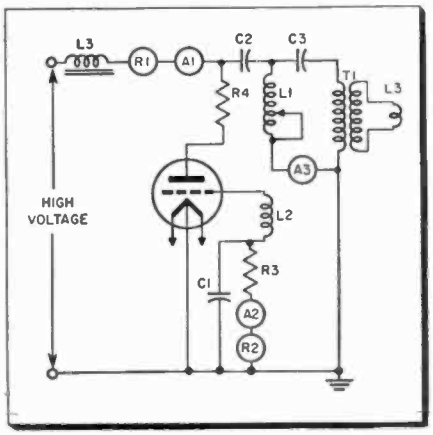


Fig. 3—Vacuum tube r-f generator. As resonance grid current increases, B+ plate current decreases, and r-f output current increases.

in depth of electronic heating. Skin effect causes high-frequency current to travel on the surface. This same effect also manifests itself somewhat at lower frequencies where some of the current flow is on the surface, and some is below. This effect can be used to control the depth of induction heating. For example, heating with a 2 kc current will cause a penetration of about 0.125 inches but a frequency of 200 kc will only heat a layer 0.020 inches deep. The thinner the layer desired, or the more shallow the penetration, the higher the operating frequency. The depth of penetration varies as the square root of the frequency. Heating depends upon several other factors; the characteristics of the metal work, the amount of power used, and the design of the shaped coil surrounding the work.

The work-coil is inductively coupled to the oscillator tank circuit, and acts like the primary of a transformer. The work-piece acts like the secondary. Cooling is used to prevent the work-coil from melting. Single-turn coils are used to heat narrow areas. The size and shape of the work determines the number of turns and shape of the coil. Fig. 2 illustrates some of the common types of coils.

Generators

Motor - generators, vacuum - tube oscillators and spark-gap converters may be used to develop a-c energy

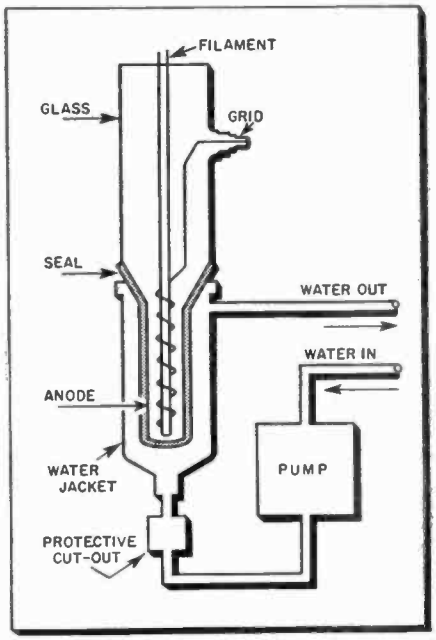


Fig. 4—Water cooling system maintains proper tube operating temperature. Anode portion fits into a specially constructed jacket.

for induction heating. Motor generators are usually used at frequencies between 2 kc and 10 kc, with power ratings from 5 kw to 500 kw. Their prime use is for deep heating. Spark-gap converters have a frequency range from 25 kc to 250 kc, with power ratings ranging from 5 kw to 50 kw. This is power input and because efficiency is only 50% these units are comparable to other types of generators rated at 2.5 kw to 25 kw. Vacuum-tube oscillators have frequency capabilities ranging from 100 kc to 1 mc and higher, with power outputs from 1 kw to 400 kw or more. Their greatest use is in the range from 150 kc to 500 kc at 5 kw to 50 kw.

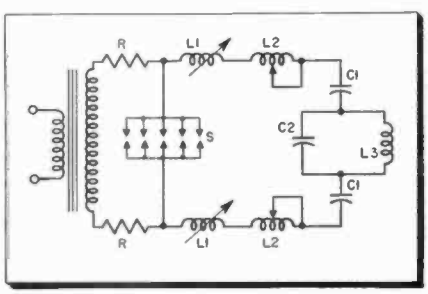
A simplified vacuum-tube oscillator type generator circuit is shown in Fig. 3. A power triode is connected in a plate-to-grid inductive feedback circuit. Resistor R3 and capacitor C1 provide grid leak bias; T1 is the r-f output transformer; the work-coil is L3; blocking capacitor C2 prevents the high plate voltage from reaching the output and ground; capacitor C3 and inductors L1 and T1 form a resonant tank circuit; and choke L3 prevents rf from getting into the plate power supply. Component values depend upon operating frequency.

Variations in the work-coil load are reflected back into the tank circuit. Adjustments of the tank inductance set the oscillator at the desired frequency. At resonance, grid current increases, B+ plate current decreases, and r-f output current increases. Ammeters A1, A2, and A3 are used to monitor circuit operation and also help trouble-shoot when trouble sets in.

Protective devices form a large part of the circuit as they do with many industrial circuits. In the plate supply a series resistor R4 limits current, relay R1 opens if the current rises to an excessive value. In

(Continued on page 56)

Fig. 6—Up to 1,000 amperes can flow through the work coil in the spark-gap oscillator. Tungsten Disk gaps must be carefully adjusted.



Heterodyning Sine And

Harmonic Content Of A Square Wave Can Be Determined By

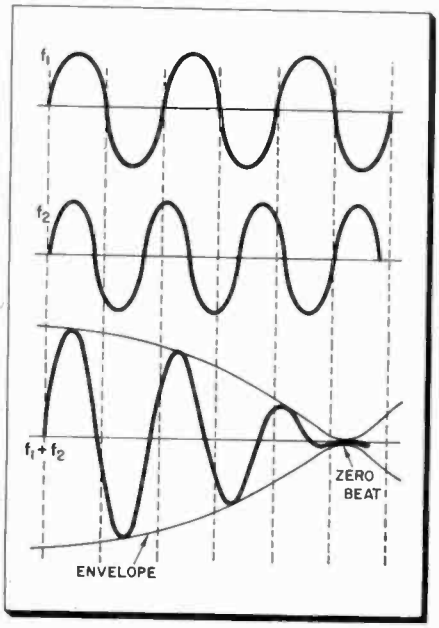
1. *What harmonics are contained in a square wave?*
2. *How can these harmonics be seen on a scope?*
3. *Does a square wave possibly contain many more frequencies than is commonly supposed?*
4. *Is the indicated harmonic content of a square wave, a function of the response characteristics of the test circuit?*
5. *Does a square wave seem to contain all frequencies under some conditions?*

ROBERT G. MIDDLETON

• Modern electronic equipment would not exist, if it were not for the phenomenon of heterodyning. In its most elementary forms, heterodyning is a simple process. On the other hand, when complex waves, such as square waves or pulses heterodyne with sine waves, an interesting and sometimes surprising domain is entered.

Heterodyning two sine waves, as shown in Fig. 1, is well known. They are in phase at one time, and out of phase at another. The resultant peak voltage variations or envelope frequency is equal to the difference in frequency between the two sine waves. If these waveforms are passed through a demodulator probe, half of the envelope would be displayed on a scope screen, as shown in Fig. 2.

Fig. 1—Varying phase conditions when mixing two sine waves results in a zero-beat.



The output from a sweep generator is an f-m voltage. When it is mixed with a sine wave as from a marker generator, and passed through a demodulator probe the beating voltages appear as a marker on the scope as shown in Fig. 3. The marker occurs at the point where the FM voltage and the marker voltage have the same frequency. At this point, a low-frequency envelope is formed.

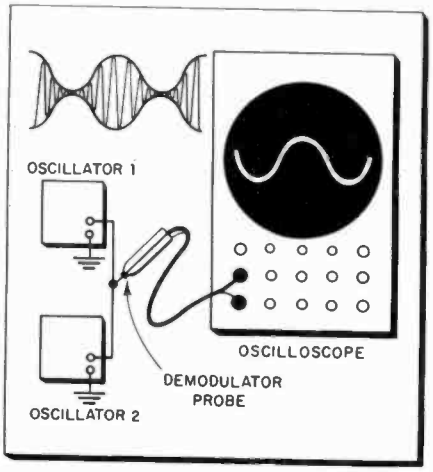


Fig. 2—A demodulator probe removes half the signal and high frequency component.

Since the probe passes low a-c frequencies only, the zero beat point appears as a "bug marker" on the scope. If more than one cw frequency is mixed with the swept frequency more than one marker will appear on the scope, as shown in Fig. 4. This illustration should be kept in mind when the beating of sine waves with complex waveforms is discussed.

It is generally recognized that a square wave can be built up or synthesized by adding together a large number of sine waves. Fig. 5 shows how a square wave can be developed by adding a fundamental, a third harmonic at one-third voltage, a fifth harmonic at one-fifth voltage, etc. If enough odd harmonics are added, the results will be a reasonable facsimile of a square

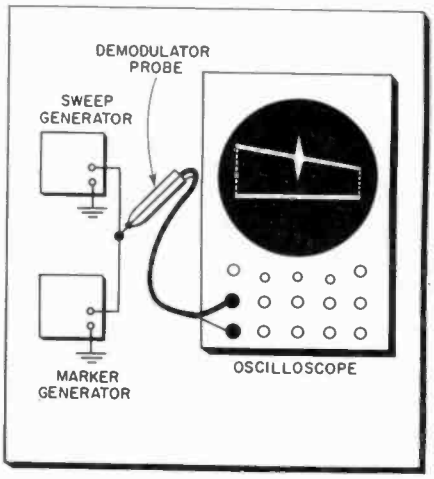
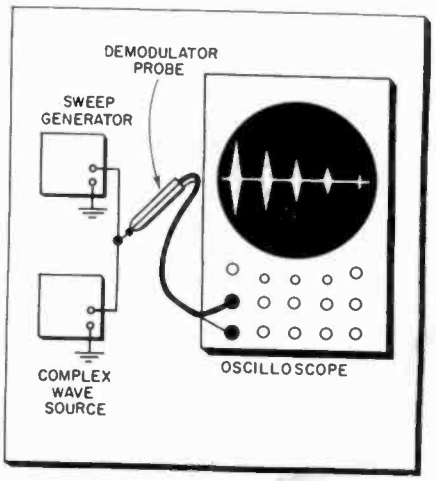


Fig. 3—Marker appears at the point where the two signals are of the same frequency.

wave. A perfect square wave requires the addition of an infinite number of odd harmonics. However, in practice, the voltages of the higher harmonics eventually become less than the errors of observation and circuit response, and are not too essential for their study and application. If a square wave can be built up by adding different frequency sine waves, it can be stated that a square wave contains these sine waves. If a square wave contains these different frequency sine waves, it follows then that it should be possible to find beats at these frequencies if a cw signal voltage is mixed with a square-wave signal voltage. This is true, not only of

Fig. 4—One method of mixing an FM search voltage for waveform analysis.



Complex Waveforms

Several Methods Of Interpretation — Some Of Them Conflicting

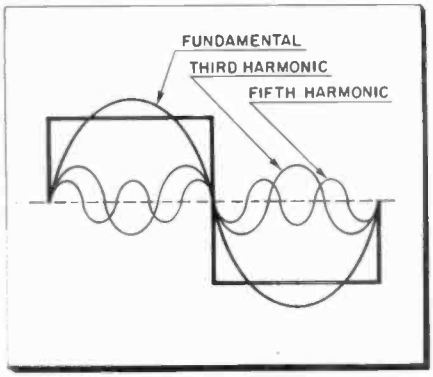


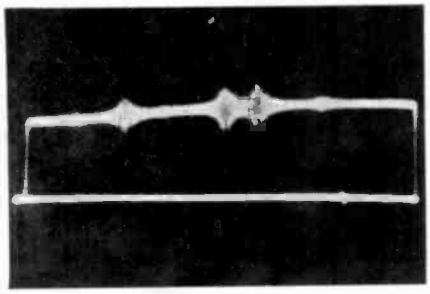
Fig. 5—Square waves can be developed by adding many odd harmonic sine waves.

square waves, but of any complex wave form. For example, Fig. 6 shows the harmonic content and relative amplitude of a complex wave when it is mixed with a swept frequency. This is the principle used in the electronic spectrum analyzer.

How does this beating out process take place? Consider the fundamental frequency of a square wave, as depicted in Figs. 7 and 8. As the f-m search voltage changes in frequency, it passes through the square wave's fundamental frequency. As it nears zero beat it will be out of phase with the square wave, and a bit later it will be in phase. These situations are shown in Fig. 7. As the search voltage falls out of phase, the peak beat voltage falls to a minimum value. Then, as the search voltage comes into phase the peak beat voltage rises to a maximum value.

If the square wave is regarded as an approximation of a sine wave, the beating process may be easier to understand. It is clear that heterodyning generates an envelope voltage which will have zero frequency at

Fig. 6—Multiple markers identify harmonic content of complex waveforms.



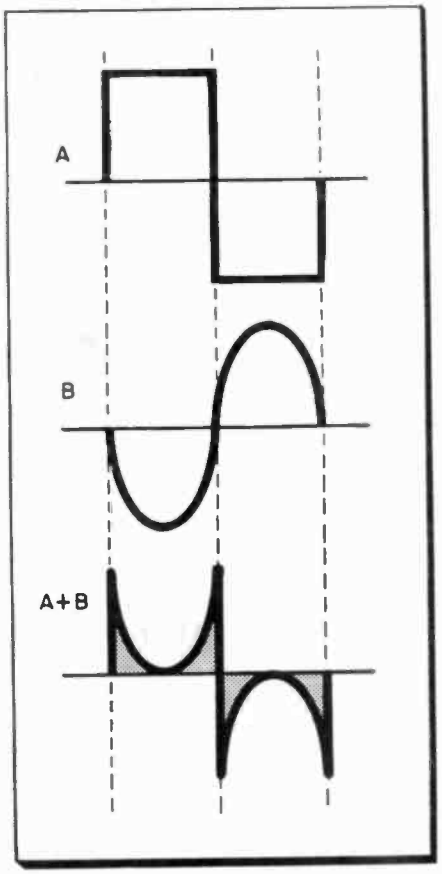


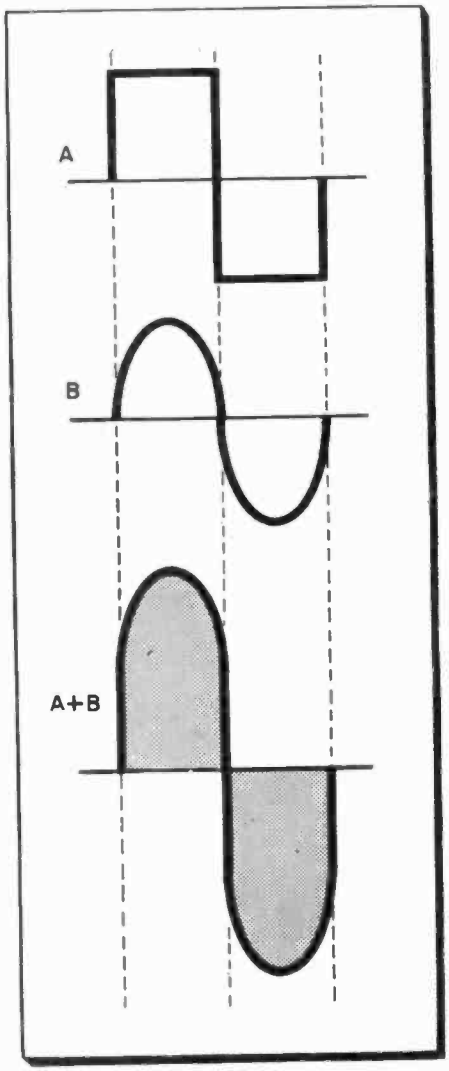
Fig. 7—Out-of-phase search voltage causes minimum average peak voltage. See Fig. 8.

the zero-beat point, when the search voltage has a period which is identical to the square-wave period. Since a square wave has no even harmonics, zero beat should not be expected when the search voltage passes through the second-harmonic frequency of the square wave. To understand why this is so, examine Fig. 9 which shows the result of mixing a second-harmonic with a square-wave voltage, first in phase, and then 180° out-of-phase with the leading edge. It is evident that the rms voltage of the mixed waves does not vary, as the second harmonic passes from 0° through 180° of phase change, since it is proportional to the area under the mixed waveform. Because this area is the same, regardless of the second-harmonic's phase, no beating process can take place.

Just as the absence of the second harmonic failed to provide a beat note, the presence of the third harmonic will result in a beat signal in a search-voltage test. This is demonstrated in Fig. 10. The rms voltage is higher when the third harmonic is in phase with the square wave's leading edge, and lower when it is out of phase. This difference in rms voltage is evident from the difference in areas under the waveforms. A demodulator probe responds to the difference of these rms voltages, and provides a bug-marker indication. This analysis can be continued in the same manner for the fourth, fifth, and other harmonics.

(Continued on page 43)

Fig. 8—When signals are in phase, maximum average of peak voltages develops. Difference results in a marker indication.



Cumulative Article Index

All feature articles appearing in ELECTRONIC TECHNICIAN

From January through December 1958

(Continued from page 41)

Harmonic Interpretation

Many interpretations as to the harmonic content of a complex waveform are possible. Mathematicians discovered many years ago that complex waveforms can be theoretically built up from sine waves. Hence, there is a mathematical interpretation. Later, it was discovered that tuned circuits can pick out the harmonics from a complex wave, and thus indicate these harmonic frequencies and voltages on a meter or a scope. This electrical interpretation is based upon the the ringing properties of tuned circuits. From the basic material just presented, it can be seen that complex waves can also be electrically analyzed or interpreted by heterodyning with an f-m search type voltage. There are still other methods of electrical interpretations—some of them often overlooked.

It is easy to demonstrate that a square wave has only odd harmonics. It is also surprisingly easy to show that a square wave seemingly has all frequencies including even harmonics. If a square wave is applied to a tuned circuit having a very high Q, it will develop a sustained ringing voltage which will last all the way across the top and bottom of the square wave. The flywheel effect of the tuned circuit carries over the ringing voltage from one leading edge to the other, past the trailing edge of the square wave. Under these circumstances the square wave will ring the high-Q circuit only for the fundamental and odd harmonics.

On the other hand, if this test is repeated with a low Q tuned circuit where the ringing is damped and dies away in the interval between the leading and trailing edge, an entirely different response is obtained. The lower Q circuit can now

(Continued on page 72)

Fig. 9—Different phase condition obtained by mixing a second harmonic sine wave with a square wave shows no marker because the average of the peak amplitudes remains constant.

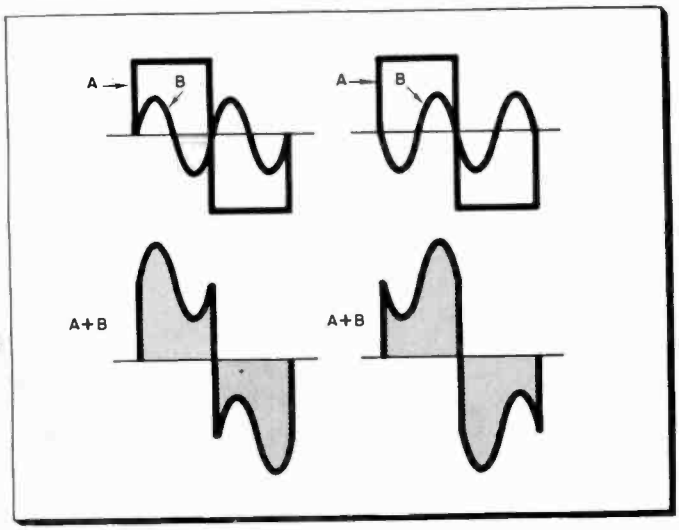
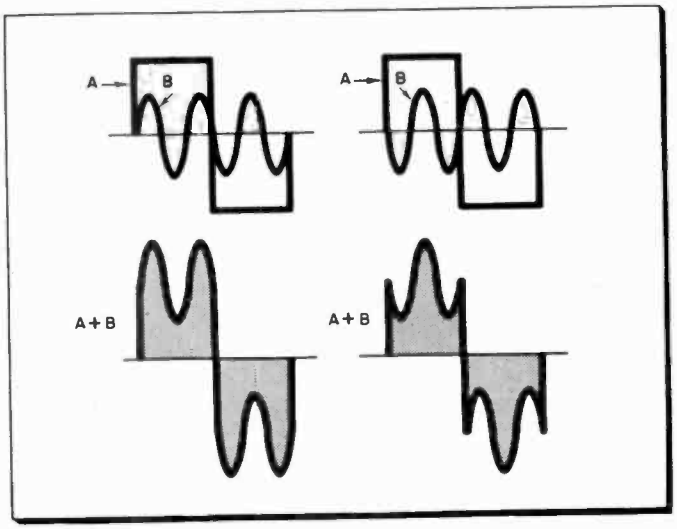


Fig. 10—Markers can be obtained by using the 3rd and other odd harmonic search voltages. As in the case of the fundamental, differences in resultant voltages cause the beat notes.



THE VOICE OF MUSIC

V-M NATIONAL ADVERTISING MEANS LOCAL BUSINESS FOR YOU!

V-M 'Stere-O-Matic' Record Changer, Model 1201 . . . . . $50 List.*
Model 1202 has 4-pole motor and plug-in head for G-E and other magnetic monaural and stereo cartridges at the same price. Both available on matching bases as Models 1226 and 1228.
*Slightly higher in the West

This is the *new* Voice of Music Stere-O-Matic® stereo/high-fidelity automatic record changer your customers will be reading about from now through Spring in an integrated series of hard-hitting advertisements in POPULAR MECHANICS, POPULAR SCIENCE, HI-FI & MUSIC REVIEW and SATURDAY REVIEW.

Cash-in on the demand these national ads will create in *your* market. Feature this newest and finest V-M changer. Stress its nation-wide acceptance by nearly all major phonograph manufacturers. Promote it, display it, *sell* it.

SELL THESE FEATURES: • COMPLETELY WIRED FOR STEREO WITH STEREO CARTRIDGE INSTALLED! • FURNISHED WITH DUAL OUTPUT JACKS AND STEREO-MONAURAL SWITCH. • RUMBLE: —45 DB. • WOW AND FLUTTER: ¼RMS. • TURNTABLE BALANCED FOR CONSTANT SPEED. • MINIMUM NOISE AND FRICTIONAL DRAG. • CONSTANT, POSITIVE MOTOR SPEED FOR TRUE PITCH. MAXIMUM 2° TRACKING ANGLE VARIATION. • AUTOMATIC SHUT-OFF. • RECORD INTERMIX. • PLAYS ALL SIZES, ALL SPEEDS.

See, hear, order and SELL the quality stereo/high-fidelity automatic changer with transcription turntable performance!

V-M CORPORATION • BENTON HARBOR, MICHIGAN • WORLD FAMOUS FOR THE FINEST IN PHONOGRAPHS, TAPE RECORDERS AND RECORD CHANGERS

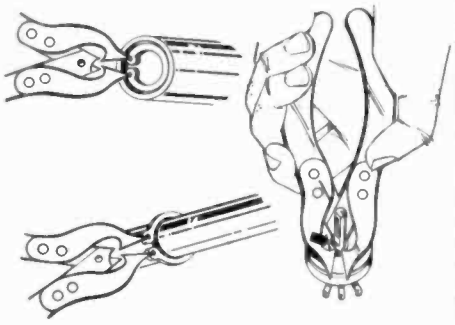
Pyramid R-C BRIDGE TESTER

Resistance - Capacity - Ratio Bridge, Model RC-1, is a portable tester designed for radio-TV service. It features special 3 volt amplifier for checking electrolytics used with transistors; ranges from 10 μμf to 2000 μf; 0.5 ohm to 200 megohms; ratio test ranges from

0.05 to 20. It also tests leakage of micas, papers and electrolytics. Size: 7" x 11½" x 5". Continuously variable capacitor test voltages, 0 to 500 v. dc. 117 volts, 60 cps. ac only. Dealer net, $44.95. Pyramid Electric Co., 1445 Hudson Blvd., N. Bergen, N. J. (ELECTRONIC TECHNICIAN 1-3)

Walsco "C-RING" TOOL

A new tool for the insertion and removal of "C" washers and retaining rings is designed to answer the troublesome servicing problem involved in removing and replacing "C" washers and retaining rings on tuners,



detents, control and switch shafts, etc. Constructed of high grade steel, nickel plated, this tool will give many years of service. Walsco Electronics Mfg. Co., 100 West Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 1-23)

1. Circle numbers of free literature desired.
2. For more data on new products and bulletins described in this issue, write in ELECTRONIC TECHNICIAN code number found at end of each item.
3. Fill in name and address. Mail to ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

FREE LITERATURE

To receive the literature below without charge, simply circle the numbers on the coupon corresponding to the items of interest. Cut out and mail to ELECTRONIC TECHNICIAN.

1 Wire: 382 new stock items are offered in catalog No. 859. All wires are grouped by type and application. Each type is illustrated; and electrical characteristics and construction details are shown for each item. (1B1: Belden Mfg. Co.)

2 Home Study Course: A new course on servomechanisms, computers, machine control, and instrumentation is completely outlined in a circular, (2B1: Capitol Radio Eng'g Institute)

3 Auto Radio: A new 4-page replacement guide lists: auto maker; radio mfr.; radio model, original part, and replacement part numbers; and prices. (3B1: Centralab)

4 2-Way Radio: Parts, kits, chassis, test equipment, and accessories are described and illustrated in the 1959 Communications Buyers Guide. Contains new sections and items. (4B1: Motorola, Inc.)

5 Rectifiers: A new line of flat type Siemens selenium rectifiers is described in Bulletin 268, a 6-page technical brochure. Provides sizes, operating characteristics and prices. (5B1: Radio Receptor Co.)

6 Antenna Accessories: A 20-page catalog covers a new line of standoffs; roof, chimney, and wall mounts; twin lead-in; masts and other items needed for TV antenna installations. (6B1: Philco Corp.)

7 Yokes: Service aid PTM No. 3 points out time-savings in servicing horizontal sweep components. Contains a discussion of yoke problems, with photos of the raster. A two-color double page explains the yoke in photos and diagrams. (7B1: Triad Transformer Corp.)

8 Tubes: A new, 4-page, 6" x 9", substitution guide lists approximately 150 tubes and shows the possible substitutions. Designed to be used in conjunction with the firm's test equipment, testers, and merchandiser. (8B1: Vis-U-All Products Co.)

9 Transceiver: New literature describes model CUB-1-MT-1 remote controlled citizens band transceiver. Designed to eliminate the signal losses incurred when operating series JRC citizens band transceivers with a base station antenna. Details on specifications, controls, tubes, dimensions, and weight are given. (9B1: Vocaline Co. of America)

CUT HERE

This coupon must be used before February 20, 1959

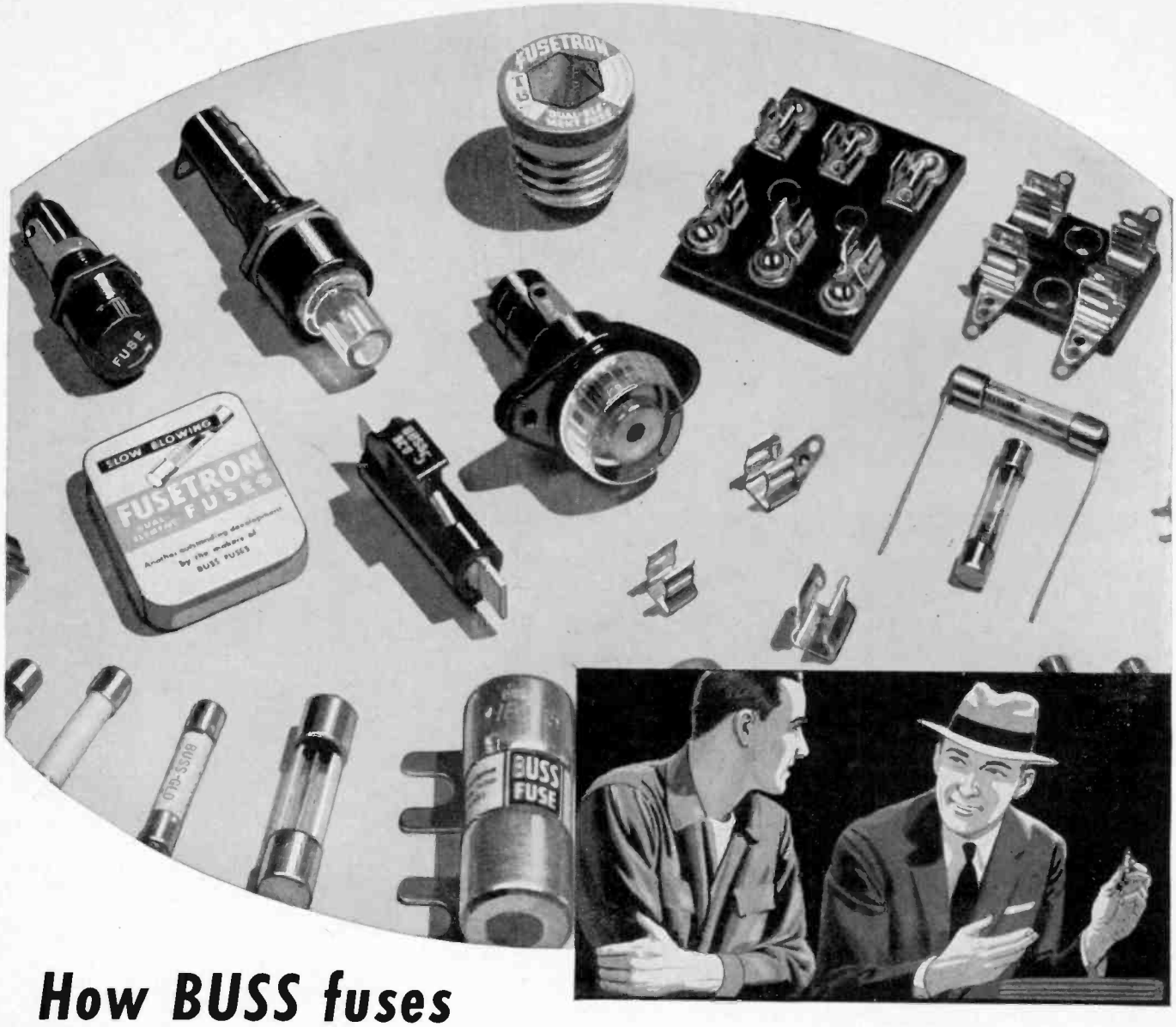
1. Circle free literature numbers. 1 2 3 4 5 6 7 8 9
2. For more data on new products and bulletins write in code numbers .....
3. Fill in your name and address. Mail promptly.

Name .....

Position ..... Firm .....

Address .....

City ..... Zone ..... State .....



How BUSS fuses help protect your profit and reputation

There are no time-consuming call-backs or adjustments or customer complaints when you sell or install BUSS fuses. BUSS fuses stay sold and your customers stay satisfied because . . . BUSS fuses are trouble-free. They open only to protect — never needlessly.

Every BUSS fuse you sell or install is tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

BUSS fuses have ready customer acceptance

Over the past 43 years, millions upon millions of BUSS fuses have provided dependable electrical protection in homes, industries and on farms. As a result, BUSS quality is unquestioned. Furnishing BUSS, the Known brand of fuses, saves you time and helps you build your reputation for service and reliability.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders, write for bulletin SFB.

BUSSMANN MFG. DIVISION,
McGraw-Edison Co.
University at Jefferson, St. Louis 7, Mo.

159

BUSS fuses are made to protect — not to blow, needlessly

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSS MAKES A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

SHOP HINTS

Tips for Home and Bench Service

TV Oscillator Alignment

When aligning the lower channels of some wafer type tuners using series-type inductors it is sometimes necessary to compress or expand the oscillator coils to obtain the correct frequency. It is quite easy to mutilate the coils after a few attempts of first expanding and then compressing. I have found the following method to be quick accurate and minimizes manipulation. Loosely couple a marker generator to the antenna or oscillator tube, center the set's fine tuning control and leave it there. Connect a wire from the grid of the mixer tube in the tuner, to the top of the set's volume control, and tune for zero beat. Start with the highest channel, and work down. It is important that the generator be properly set to the oscillator frequency of the channel being aligned. It is also desirable to disable the sound i-f section. This can be done by pulling one of the sound i-f tubes, or shorting the sound i-f signal to ground if the set is of the series string type.—*Adam Adams, Williamsport, Pa.*

Test CRT Yoke Support

I have always had trouble holding the yoke coil against the test CRT on the service bench. I have seen many ideas on this and have tried them all but this, in my opinion, is the best. The clamp shown is a wooden clothes pin, used by telephone men and electricians for holding cables while connecting and soldering. The opening is about the same size, when closed, as the neck of the tube. It is made of hard wood and the spring tension is about right for holding the yoke without breaking the neck of the tube. Enough of the clothes pin sticks out past the yoke to serve as a rest for the CRT, and in most cases just at the proper angle. If desirable two clothes pins may be used to prop up the tube at other angles. They can be easily modified to suit most situations by

Large wooden clothespins, such as used by electricians and linemen may be modified to support both the yoke and test CRT.

cutting down, or by adding small rubber tack bumpers to the ends. If the opening is too large, it can be built up with felt, if it is too small, or if spring tension is too great, the opening can be enlarged and then lined. *Harlan Dewitz, Wisner, Nebr.*

Tape The Complaints

A customer relations manager in the form of a tape recorder serves most effectively as a check on the service work our men do on TV, radio, tape recorders, appliances, etc. When a customer comes in to make a complaint, we flip on a tape recorder as soon as he begins his tirade. Not that there is any objection to his knowledge that his remarks are being recorded. Sometimes they welcome the idea. However, the average customer won't talk as freely when he knows his words are being recorded.

The recording then becomes a valuable asset in preventing future complaints, on pinpointing the responsibility for an inefficient repair job, etc. It is played back to the technician who serviced the job. Many of the recordings offer valuable information when holding sales meetings to help reduce complaints.

Our whole idea is to satisfy our customers so they will continue to do business with us.—*Stan Clark, East Bradenton, Fla.*

Remote Control Jammed Channel Selector

The channel drive motor armature may become engaged in the gear train during shipment. When this condition exists, the channel selector knob cannot be turned and breakage may result if forced. Normally, the armature will release or dis-engage the first time the remote drive is used. If the unit does not free itself when the remote drive is used, it will be necessary to remove the cabinet back and inspect the armature to determine what is preventing it from releasing. On some receivers it has been found that the switch on the end of the motor was twisted. This causes the switch leaf to ride on the side of the armature shaft and causes the armature to bind. Be sure the switch is positioned so that the insulated part of the switch leaf rides on the end of the armature shaft, and the two screws through the switch stack are tightened securely.

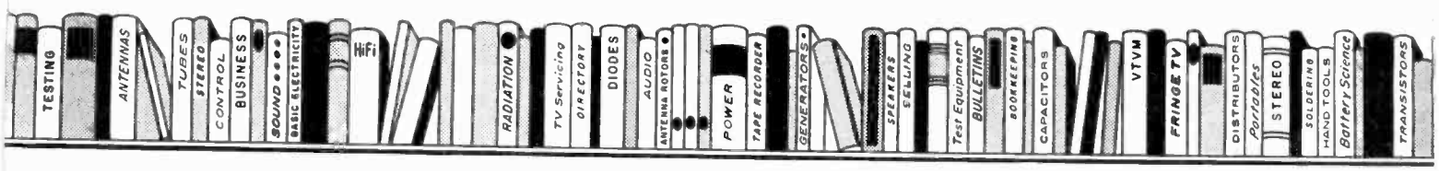
Caution: The switch is connected to the a-c power line and, if the uninsulated part of the switch touches the armature, the chassis will be at a-c line potential. *RCA Service Co., Camden, N. J.*

SHOP HINTS WANTED!

$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. Send your entries to "Shop Hints" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

Improve Your Skills By

Building a Technical Library



HOME AIR CONDITIONING INSTALLATION & REPAIR

By J. Derman, F. Makstein & H. Seaman. Both theory and practical construction designs are examined, along with maintenance techniques and procedure for determining size of air conditioner required. Covers motors, compressors, condensers, evaporators, regulating valves, circuits and other system elements. Soft cover, 160 pages. Price $3.50.

INDUSTRIAL CONTROL CIRCUITS

By Sidney Platt. Excellent starting point for TV technician interested in learning about industrial electronics. Non-mathematical text explains circuitry and operation of power controls, relays, timers, photoelectric devices and instrumentation found in factories. Practical applications shown. Soft cover, 200 pages. Price $3.90.

REPAIRING HI-FI SYSTEMS

By David Fidelman. How to find and correct troubles in hi-fi equipment with either little or elaborate test equipment. Among the many subjects covered are servicing amplifiers, preamps, tuners, tape recorders, changers, pickups and speakers. Construction and custom installations are discussed. Soft cover, 212 pages. Price $3.90.

PORTABLE AND CLOCK RADIOS

By Ben Crisses & David Gnessin. Written from a practical viewpoint with theory kept to a minimum, this practical volume emphasizes repair, design, replacements, alignment, current drain and related circuit problems. Dial stringing, clock mechanisms and transistorized circuits are covered. Soft cover, 128 pages. Price $2.75.

SHOOT TV & RADIO TROUBLE FAST

By Harry G. Cisin. The first part of this book relates to symptoms, faults and remedies for ac-dc radios. The second part covers TV, with each practical test and repair explanation related to a specific problem. Printed circuits are discussed. Soft cover, 40 large pages. Price $1.50.

BASICS OF DIGITAL COMPUTERS (3 vols.)

By John S. Murphy. Using the easy-to-learn picture book technique, these three volumes explain the theory and functions of digital computers. Very little mathematics. Covers counting systems, computer language, programming, memories, logic diagrams, flip-flops, clamping, input-output and data processing. Soft cover, 416 pages. $7.50/set.

IMPEDANCE MATCHING

By Alexander Schure. Divided into five major sections, this informative book covers power transfer, impedance matching devices, matching at audio and r-f, and matching in transitor circuits. Complete with tables, schematics and computation examples. Soft cover, 128 pages. Price $2.90.

RADIO OPERATOR'S LICENSE Q & A MANUAL

By Milton Kaufman. This sixth edition gives you the information you need to pass FCC license examinations. In question and answer form similar to actual FCC tests, all eight elements are covered, including law, radiotelephone, radiotelegraph, aircraft and ship radar. Abbreviations, code, etc. included. Hard cover, 736 pages. Price $6.60.

HOW TO SERVICE TAPE RECORDERS

By C. A. Tuthill. Starting with basic magnetic principles, the text goes through the recording operation, recorder mechanisms and circuitry. In addition to an explanation of the functions of the various recorder elements, the techniques for repairing various troubles and making tests are presented. Soft cover, 160 pages. Price $2.90.

BASIC PULSES

By Irving Gottlieb. Pulses play a vital role in practically every electronic device, including TV, radar and industrial electronics. Using easy-to-understand pictures and no complex math, this book explains pulse wavetrains, dc restoration, Fourier analysis, networks, waveshaping, generators and many others. Soft cover, 176 pages. Price $3.50.

STEREOPHONIC SOUND

By Norman Crowhurst. This first assessment of the new stereo techniques sweeping the hi-fi field starts with the basics of binaural listening, and then concentrates on actual systems. Subjects include radio, disc, tape, recording procedure, speaker placement, system construction and theatre systems. Soft cover, 128 pages. Price $2.25.

FUNDAMENTALS OF TRANSISTORS

By Leonard Krugan. Here is a data-packed new revision of the 1954 edition, now including such material as surface barrier, intrinsic, drift, avalanche and spacistor types. Amplifiers and oscillators are covered. End of each chapter has helpful questions and suggested references. Soft cover, 176 pages. Price $3.50.

ELECTRONICS IN INDUSTRY

By George Chute. How various electronic devices operate, and how they are employed in industry is clearly explained with little use of mathematics. Subject matter includes rectifiers, time delays, gas tubes, welding controls, ignitrons, heat and light relays, thyratrons, motors, servos and others. Hard cover, 431 pages. Price $8.00.

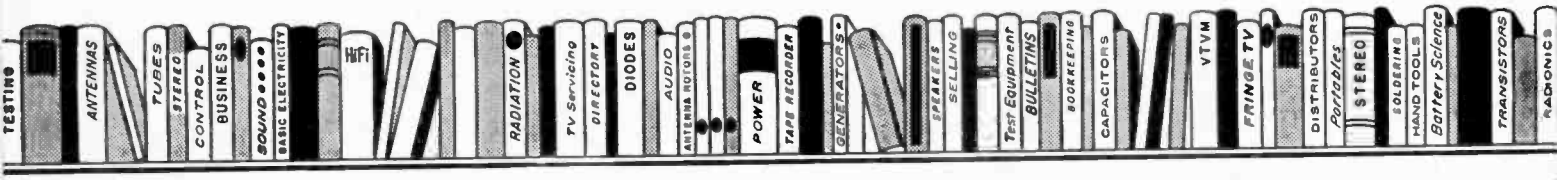
OBTAINING & INTERPRETING TEST SCOPE TRACES

By John F. Rider. This handbook shows how to get the most out of your oscilloscope. Over 800 traces are shown, including sine, square, rectangular, trapezoid, sawtooth differentiated and integrated types. Explains scope connections, manipulating controls and test setups. Soft cover, 190 pages. Price $2.40.

SMALL APPLIANCE SERVICING

By P. T. Brockwell, Jr. This volume gives you professional small appliance servicing techniques and business procedures. Illustrated instructions tell how to test units. Covers irons, toasters, mixers, roasters, coffee makers, waffle irons, rotisseries and others. A profitable sideline for TV technicians. Hard cover, 180 pages. Price $4.50.

ELECTRONIC TECHNICIAN editors have carefully selected these books by the world's leading technical publishers. Order direct from our Book Department. Fill in coupon or separate sheet. Money-back guarantee.



PINPOINT RECORD CHANGER TROUBLES

By P. Sheneman. Bound in a plastic lay-flat binding, this servicing book covers changers used in phono systems made by some 95 manufacturers. There are over 400 time saving photos and illustrations, and 58 trouble check charts. Adjustments and service hints are given for each company. Soft cover, 330 pages. Price $3.95.

HOW TO RUN A SMALL BUSINESS

By J. K. Lasser. Here is a basic business guidebook for service dealers and other operators of retail and small manufacturing firms. Covers record keeping, avoiding frauds, tax management, credit sales, insurance programs, how to buy an established business, financing and other important topics. Hard cover, 400 pages. Price $4.95.

INDUSTRIAL ELECTRONICS HANDBOOK

By William D. Cockrell. This is practically an encylopedia of industrial electronics, containing data from over 100 authorities. Covers computers, instrumentation, regulators, transducers, geiger counters, controls, automations and much more. For advanced technicians. Hard cover, 1408 pages. Price $22.50.

TV DOCTOR

By Harry G. Cisin. This compact text presents the basic practical knowledge required to recognize and remedy TV receiver troubles. Chapters are also devoted to color TV, easy checks, antenna techniques, UHF and circuit symbols. A helpful servicing starter. Soft cover, 37 large pages. Price $1.

Also See New Books On Page 61

FREE!!

STATION LISTINGS BOOK

With every book order for $7.50 or more, you will be sent—without charge—a copy of the 64-page reference book, "Jones North American AM-FM-Radio-TV Station Listings." It lists over 5000 stations from official FCC information. Covers the United States and possessions, Canada, Cuba, Mexico and West Indies. Stations are cross-referenced by geographic location, by frequency, and by call letters. Lists AM and TV network affiliations and AM operating power. A wealth of broadcasting information!

Books Described in Previous Issues

BASIC TELEVISION (5 vols.)	$10.00
INTRODUCTION TO PRINTED CIRCUITS	$ 2.70
BASIC ELECTRONICS (5 vols.)	$10.00
INTRODUCTION TO COLOR TV	$ 2.70
INTRODUCTION TO UHF CIRCUITS & COMPONENTS	$ 7.50
PROFITABLE RADIO TROUBLE-SHOOTING	$ 5.95
ELEMENTS OF MAGNETIC TAPE RECORDING	$ 7.95
MANDL'S TELEVISION SERVICING	$ 6.50
CLOSED CIRCUIT & INDUSTRIAL TV	$ 4.95
ELECTRONIC MUSICAL INSTRUMENT MANUAL	$ 7.50
REPAIRING RECORD CHANGERS	$ 5.95
TRANSISTORS IN RADIO AND TELEVISION	$ 7.00
HANDBOOK OF BASIC CIRCUITS, TV, FM, AM	$ 7.50
PINPOINT COLOR TV TROUBLES IN 15 MINUTES	$ 5.95

To order above books, write in title and price on coupon.

CUT HERE

ELECTRONIC TECHNICIAN Book Dept. 1-59
480 Lexington Avenue
New York 17, N.Y.

I plan to build my technical library. Please send me the books I have indicated below. You will pay postage. I understand that if I am not satisfied with any book for any reason, I may return it to you prepaid in good, clean condition within 7 days of receipt and receive a complete refund. If my order is for $7.50 or more, I will receive a free copy of the Station Listings Book.

Enclosed is my check or money order, in full payment, made out to ELECTRONIC TECHNICIAN.

___Home Air Conditioning Installation & Repair ..... @ $3.50
___Industrial Control Circuits .... @ $3.90
___Repairing Hi-Fi Systems ..... @ $3.90
___Portable and Clock Radios ... @ $2.75
___Shoot TV & Radio Trouble Fast ..... @ $1.50
___Basics of Digital Computers .. @ $7.50
___Impedance Matching ..... @ $2.90
___Radio Operator's License Q & A Manual ..... @ $6.60
___How to Service Tape Recorders @ $2.90
___Basic Pulses ..... @ $3.50
___Stereophonic Sound ..... @ $2.25
___Fundamentals of Transistors .. @ $3.50
___Electronics in Industry ..... @ $ 8.00
___Obtaining and Interpreting Test Scope Traces ..... @ $ 2.40
___Small Appliance Servicing ... @ $ 4.50
___Pinpoint Record Changer Troubles ..... @ $ 3.95
___How to Run a Small Business @ $ 4.95
___Industrial Electronics Handbook ..... @ $22.50
___TV Doctor ..... @ $ 1.00

BOOKS IN PREVIOUS ISSUES:

Enclosed is total payment of $——— .....@$ .....
(If you have New York City address, add 3% sales tax)

Name _____

Address _____

City _____ Zone ____ State _____

SHIPPED ON APPROVAL

an IN-CIRCUIT CONDENSER TESTER THAT DOES THE WHOLE JOB!

The CT-1 actually steps in and takes over where all other in-circuit condenser testers fail. The ingenious application of a dual bridge principle gives the CT-1 a tremendous range of operation . . . and makes it an absolute 'must' for every serviceman.

IN-CIRCUIT CONDENSER TESTER Model CT-1

Model CT-1 — housed in sturdy hammertone finish steel case complete with test leads....only **$34.50** Net

in-circuit checks:

- Quality of over 80% of all condensers even with circuit shunt resistance present . . .(leakage, shorts, opens, intermitents)
- Value of all condensers from 200 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the abiilty to hold a charge)
- Transformer, socket and wiring leakage capacity

out-of-circuit checks:

- Quality of 100% of all condensers . . .(leakage, shorts, opens and intermittents)
- Value of all condensers from 50 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the ability to hold a charge)
- High resistance leakage up to 300 megohms
- New or unknown condensers . . . transformer, socket, component and wiring leakage capacity

OUTSTANDING FEATURES

● Ultra-sensitive 2 tube drift-free circuitry ● Multi-color direct scale precision readings for both quality and value . . .(in-circuit or out of circuit) ● Simultaneous readings of circuit capacity and circuit resistance ● Built-in hi-leakage indicator sensitive to over 300 megohms ● Cannot damage circuit components ● Electronic eye balance indicator for even greater accuracy ● Isolated power line

Check all power rectifiers in-circuit whether SELENIUM, GERMANIUM, SILICON, etc. with the

IN-CIRCUIT RECTIFIER TESTER Model SRT-1

With the growing trend towards compactness, portability and low price, TV manufacturers are resorting more and more to producing series-string TV sets employing selenium, germanium or silicon power rectifiers. Now the need for an in-circuit rectifier tester is greater than ever.

Model SRT-1—housed in sturdy hammertone finish steel case complete with test leads.....only **$29.50** Net

THE SRT-1 CHECKS ALL POWER RECTIFIERS IN-CIRCUIT AND OUT-OF-CIRCUIT WITH 100% EFFECTIVENESS FOR:

✓ Quality ✓ Fading ✓ Shorts ✓ Opens ✓ Arcing ✓ Life Expectancy

OUTSTANDING FEATURES

- Checks all types of power rectifiers rated from 10 ma. to 500 ma. (selenium, germanium, silicon, etc.) both in-circuit or out-of-circuit.
- Will not blow fuses even when connected to a dead short.
- Large 3" highly accurate multi-color meter . . . sensitive yet rugged.
- Separate meter scales for in-circuit and out-of-circuit tests.
- Cannot damage or over heat rectifier being tested.

SIMPLE TO OPERATE

Just clip SRT-1 test leads across rectifier under test right in the circuit without disconnecting rectifier from circuit. Press test switch and get an instant indication on the easy-to-read three-color meter scales . . .

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR

The extremely low prices are made possible because you are buying direct from the manufacturer.

TRANSISTOR TESTER Model TT-2

Every day more and more manufacturers are using transistors in home portable and car radios . . . in hearing aids, intercoms, amplifiers, industrial devices, etc. Since transistors go bad the need for TRANSISTOR TESTER is great. They can develop excessive leakage, poor gain, shorts or opens. The TT-2 is an inexpensive quality instrument designed for accurate and dependable tests of all transistors and diodes — quickly and accurately.

OUTSTANDING FEATURES

● Checks all transistors, including car radio, power output, triode, tetrode and unijunction types for current gain, leakage, opens, shorts, cut-off current ● Checks all diodes for forward to reverse current gain ● All tests can be made even if manufacturers' rated gain is not available ● Less than half a minute required for tests of either transistors or diodes ● Large 3" meter is extremely sensitive yet rugged . . . with multi-color scales designed for quick easy readings ● Power is supplied by an easy to replace 6-volt battery — current drain so small, service life almost equal to shelf life. Battery cannot be drained due to accidental shorting of test leads ● Cannot burn-out its own meter or damage transistor or diode under test ● Long test leads and insulated test clips enable tests without entirely removing transistor from circuit ● Test leads are identified by E.I.A. color code so that connection to the correct terminal is assured ● Comes complete with replaceable transistor set-up chart that fits into a special rear compartment.

IMPORTANT FEATURE: The TT-2 cannot become obsolete as the circuitry is engineered to enable you to check all new type transistors as they are introduced. New listings will be furnished at no cost.

Model TT-2 — housed in sturdy hammertone finish steel case complete with test leads . . . only **$24.50** Net

EASY TO BUY IF SATISFIED
see order form on facing page

FOR 10 DAY *FREE* TRIAL

try them for 10 days before you buy . . . only then, when satisfied, pay in easy-to-buy monthly installments — without any financing or carrying charges added.

Convince yourself at no risk that CENTURY instruments are indispensable in your every day work. Send for instruments of your choice without obligation . . .

STILL THE BEST SELLING TUBE TESTER IN THE FIELD

FAST-CHECK TUBE TESTER

Model FC-2

The greatest testimonial ever paid an instrument . . . over 20,000 sold in a little more than a year—and still selling as fast as we can produce them. See for yourself at no risk why so many servicemen choose the FAST-CHECK above all other tube testers — regardless of price.

Model FC-2 — housed in hand-rubbed oak carrying case complete with CRT adapter . . . only **$69.50** Net

SIZE: W: 14⅝" H: 11¼" D: 4⅜"

Just 2 settings on the FAST-CHECK TUBE TESTER tests over 700 tube types completely, accurately — AND IN SECONDS!

PICTURE TUBE TEST ADAPTER INCLUDED WITH FAST-CHECK

Enables you to check all picture tubes (including the new short-neck 110 degree type) for cathode emission, shorts and life expectancy . . . also to rejuvenate weak picture tubes.

No other tube tester made at any price can match the value of the FAST-CHECK.

RANGE OF OPERATION

- ✓ Checks quality of over 700 tube types, employing the time proven dynamic cathode emission test. This covers more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes. 0Z4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

IMPORTANT FEATURES

● No time consuming multiple switching . . . only two settings are required instead of banks of switches on conventional testers ● No annoying roll chart checking . . . tube chart listing over 700 tube types is located inside cover. New listings are added without costly roll chart replacement ● Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale ● 41 phosphor bronze beryllium tube sockets never need replacement ● 7-pin and 9-pin straighteners mounted on panel ● Large 4½" D'Arsonval type meter is the most sensitive available, yet rugged — fully protected against accidental burn-out ● Special scale on meter for low current tubes ● Compensation for line voltage variation ● 12 filament positions ● Separate gas and short jewel indicators ● Line isolated — no shock hazards ● Long lasting etched aluminum panel.

NOTE: The Fast-Check positively cannot become obsolete . . . circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.

NEW . . . For those looking for a real *ECONOMY* MULTIPLE SOCKET TUBE TESTER without sacrificing *ACCURACY, SPEED and VERSATILITY*

MINI-CHECK TUBE TESTER

Model MC-1

Here is a multiple socket tube tester designed to meet limited budgets. Although low in price it boasts a unique circuitry that enables you to check over 600 tube types — and has a range of operation that far exceeds others in its price class.

Model MC-1 — housed in sturdy wrinkle finish steel case ..... only **$39.50** Net

SIZE: W: 9" H: 8½" D: 2¾"

OUTSTANDING FEATURES

● Checks emission, inter-element shorts and leakage of over 600 tube types. This covers 0Z4s, series-string TV tubes, gas regulators, auto 12 plate volt, hi-fi and foreign tubes ● 3 settings enable a test of any tube in less than 10 seconds ● Employs dynamic cathode emission test principle ● 3½" D'Arsonval type meter — most accurate type available . . . its greater sensitivity means more accuracy . . . its jewel bearing means longer life ● 17 long lasting phosphor bronze tube sockets ● Combination gas and short jewel indicator ● 9 filament positions ● Handy tube chart contained in special back compartment ● New tube listings furnished periodically at no cost ● Detachable line cord

plus these BONUS FEATURES . . . found in no other low price tube tester

✓ Checks for cathode to heater shorts ✓ Checks for gas content ✓ Checks all sections of multiple purpose tubes . . . will pickup tubes with one "Bad" section ✓ Line isolated — no shock hazard ✓ Variable load control enables you to get accurate results on all tubes ✓ Positively cannot become obsolete as new tube types are introduced.

CONVENIENT TIME PAYMENT PLAN — NO INTEREST OR FINANCING CHARGES

CENTURY ELECTRONICS CO., INC.

CHECK INSTRUMENTS DESIRED

- ☐ Model CT-1 In-Circuit Condenser Tester..... $34.50 — $9.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model SRT-1 In-Circuit Rectifier Tester..... $29.50 — $4.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model TT-2 Transistor Tester..... $24.50 — $4.50 within 10 days. Balance $5 monthly for 4 months.
- ☐ Model FC-2 Fast-Check Tube Tester..... $69.50 — $14.50 within 10 days. Balance $11 monthly for 5 months.
- ☐ Model MC-1 Mini-Check Tube Tester..... $39.50 — $9.50 within 10 days. Balance $6 monthly for 5 months.

Prices Net F.O.B. Mineola, N. Y.

111 Roosevelt Avenue, Dept. 501, Mineola, New York

Please rush the instruments checked for a 10 day free trial. If satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. If not completely satisfied I will return the instruments within 10 days and there is no further obligation. It is undestood there will be NO INTEREST or FINANCING charges added.

Name..... Please print clearly

Address.....

City..... State.....

Harmonic Distortion

(Continued from page 34)

tion switch in the read harmonic position. This places a tunable-notch filter in the circuit. Adjust the frequency control and balance control for minimum reading on the meter. As the reading decreases, adjust the range switch to read the lower voltages accurately. Rock the frequency and balance controls to be certain that the reading will not go any lower. The filter circuit inside the analyzer has now removed all of the fundamental frequency from the meter circuit, and only the harmonics, or other spurious components are left. To ascertain that the bridge does balance out the fundamental, make sure that both the frequency and balance controls cause the reading to increase when they are moved either way from the null position. The meter reading now indicates the total harmonic content.

Caution: If something in the amplifier, or the signal generator setting is changed to take another reading, be certain that the range switch is returned to the 100% scale, otherwise the meter needle will fly hard against its end stop.

Remember that the analyzer controls were set for null under a given set of conditions and if only 2% distortion is indicated, 98% of the original signal is being kept out of the meter circuit. Change any of the conditions and the chances are that the signal will come out of the null position with a bang. Once the range switch has been turned up, then the frequency, output level, or some other amplifier adjustment can be made, and another reading obtained by repeating this sequence.

Nothing difficult about the procedure, but some snags may be encountered when trying to obtain distortion measurements on the order of 0.1%, or other very low figure. If the reading indicates 1.5% or so, not all of it may be due to the amplifier under test. Check the audio signal generator by transferring the connection to the distortion meter from the output of the amplifier to the output of the generator, and follow the same procedure. An almost identical reading suggests that the amplifier is performing according to specification.

There are several ways to overcome this problem. Of course a

(Continued on page 54)

ROHN TOWERS on the MARCH to bring you NEW, EXPANDED PROFITS!

✳ NEW TOWERS

ROHN engineering presents new, dramatic tower lines for your consideration. Be sure to get complete catalog details on this as they are proving to be *tremendous* profit-makers!

✳ MORE DESIGNS

Outstanding, well-engineered designs of various types are available to suit your *every* requirement.

✳ COMPLETE SELECTION

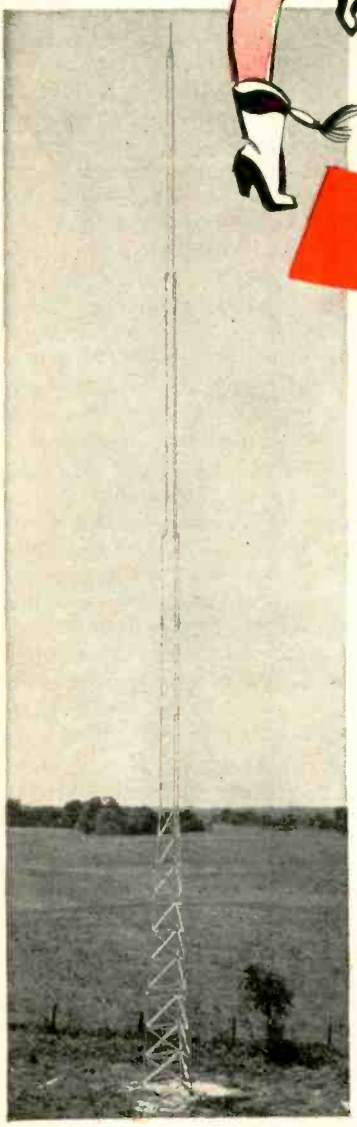
The ROHN tower line is now one of the *largest* (and growing larger daily) tower lines of its kind in the nation! By selling and servicing the ROHN line you capitalize on *many* fields and markets that others *cannot* possibly fulfill.

✳ MORE SALES FEATURES

ROHN towers and its full line of accessories offer *more* sales features and *sooner* than anyone else! Careful inspection always proves the superiority of ROHN towers. Why settle for less than the best? All ROHN products have the *finest* of finishes too . . . completely hot-dipped galvanized *after* fabrication!

✳ BIGGER PROFITS

It all adds up to the indisputable fact that ROHN towers make jobber, dealer, serviceman and user *more* money. ROHN has the proof . . . ask to be shown!



FABULOUS ROHN "SS" TOWER

A Completely Self-Supporting Tower to 130′ in a Completely Different Design!

This special self-supporting tower is constructed by using 13 different tower sections of varying weight, size, structural strength and taper. Using all 13 sections gives a heavy-duty self-supporting 130 foot tower. However, the individual sections of this tower can be used in various combinations to build a tower to practically any height from 130′ on down, and of *specific* strength in order to handle the *particular* antenna that is to be placed on the tower. This means that you can have a ROHN tower *exactly* to meet *your* requirements. Shipping this tower is convenient and installation is simple.

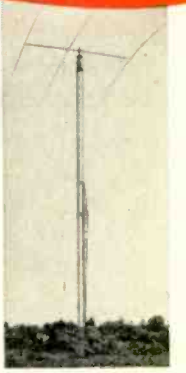
NO. 50 TOWER

This tower is a special one utilizing sections of the "SS" tower and is suitable for installations of guyed heights up to 450 feet.

NO. 60 TOWER

Special tower using above "SS" tower sections and is suitable in guyed heights up to 600 feet!

NO. 25 FOLD-OVER TOWER



This general-purpose communication tower with the zig-zag cross-bracing design is now available as a "fold-over" tower. Amateurs and others requiring a "fold-over" tower are invited to inspect this tower to see its superiority and its many advantages that it has to offer you.

ROHN LINE ALSO INCLUDES:

NO. 40 TOWERS—the communications tower having a structural strength so as to be installed in guyed heights up to 300′. . . thousands are in use today for all types of communication and industrial uses.

NO. 30 TOWER—similar to the above No. 40 tower but utilizing different design.

NO. 6 TOWER—the widely used tower with the "magic triangle" especially suitable for home television reception.

P. T. TOWERS—package towers for easy shipping and storage.

ROOF TOWERS—especially designed short height roof installations.

TUBING—complete line.

BASES—for practically every use.

Also, guying and installation accessories of all types to give **complete** television, amateur or communication towers.

See your ROHN representative in your area, your distributor or contact:

ROHN *Manufacturing Company*

116 Limestone, Bellevue
Peoria, Ill. Phone 4-9156

ROHN MANUFACTURING COMPANY
116 Limestone, Bellevue
Peoria, Illinois

GENTLEMEN: Please send me the catalog and information on the following:

☐ TV Towers
☐ Communication Towers
☐ Amateur Towers
☐ Full line of Rohn products

NAME _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____

MAIL THIS COUPON NOW!

(Continued from page 52)

cleaner signal to start with would be a solution. As mentioned earlier a band-pass filter can be placed between the generator and the amplifier to clean up most of the generator's residual distortion. To use the filter, it is necessary to tune the generator to the proper frequency of the filter. Then only the fundamental passes through at maximum level. Another method employs an oscilloscope waveform interpretation technique. For a rapid overall distortion check of the amplifier without trying to verify the minimum factory or rated specification, it isn't necessary to resort to the finer techniques. The chances are that if the distortion readings from the generator and the amplifier are almost the same it is usually an indication that the amplifier distortion is well below the amount measured even though it may or may not be at, or below the rated value. Most of the time when the readings are this low, the distortion is low enough. Occasionally, the presence of hum presents another problem when trying to measure low distortion at maximum output. This is one very good reason for using the scope on the output. Not only because it enables the observation of the signals being measured, but the presence of hum can be readily detected. The pattern will dance up and down quite rapidly, instead of remaining steady. Some hum at a low-level distortion measurement is usually not serious enough to worry about, but it does invalidate the readings. This can be overcome by estimating from the scope how much of the reading is hum and how much is distortion.

For example, suppose the meter reading on the analyzer is 1.5%, and the scope shows the harmonic waveform to be ¾", and the "hum bounce" 1¾", for a total height of 2½", as shown in Fig. 4. This indicates that the hum component is about 0.7 and the harmonic about 0.3 of the total peak-to-peak amplitude. The harmonic distortion then is only 0.45%, and hum is 1.05%. If the output is 1 volt, the hum voltage is only 10.5 millivolts, which is acceptable even though it may look bad in this test.

Another advantage of using the scope connected to the meter's output terminals is that it can be used for troubleshooting purposes. Proper interpretation of the display produced can help locate the source of abnormal distortion. It can also be used to monitor the adjustment for balance or matching of push-pull output tubes. •

SAVE 1/2 THE TIME

in TV Trouble-Shooting

Make Twice The Profit!

THIS EASY
SIGNAL INJECTION
POINT-TO-POINT
DIRECT VIEWING
WAY

MODEL 1075

B&K TELEVISION ANALYST

New Technique Makes TV Servicing Easier, Faster, More Profitable

Thousands of service technicians already save thousands of hours every day with the amazing B&K TELEVISION ANALYST. Enables you to inject your own TV signal at any point and watch the resulting test pattern on the picture tube itself. Makes it quick and easy to isolate, pin-point, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync, and sweep sections of black & white and color television sets—*including intermittents*. Makes external scope or wave-form interpretation unnecessary. Enables any serviceman to cut servicing time in half, service more TV sets in less time, really satisfy more customers, and make more money.

MODEL 1075 TELEVISION ANALYST. Complete with standard test pattern, white dot, and white line crosshatch pattern slide transparencies, and one clear acetate. Net, **$259.95**

See your B&K Distributor or Write for Bulletin ST21-T

R.F. AMPLIFIER
Complete r.f. signal at all VHF channels. Isolates tuner trouble to the r.f. amplifier, converter, or to the r.f. oscillator stage.

4.5 MC AUDIO I.F.
Provides FM modulated 4.5 mc sound channel. This audio carrier is modulated from the built-in 400 cycle tone generator.

AUDIO AMPLIFIER AND AUDIO OUTPUT
Injection of 400 cycle tone signal simplifies trouble-shooting this section. Isolates the defect instantly.

CONVERTER

1st, 2nd, 3rd I.F.
Signals available at 20 mc and 40 mc i.f. Checks A.G.C. action. Isolates trouble to individual defective stage, i.f. transformer, or other component.

VIDEO DET. **VIDEO AMP.**
Reproduces test pattern on picture tube. Injects signals into video detector or video amplifier stage of TV receiver for fast, visual trouble-shooting and correction. Makes it easy to check bandwidth, resolution, shading and contrast.

R.F. OSC.

SYNC
Composite sync signals available for checking of these stages.

VERTICAL — Provides separate driving pulse to isolate defect between vertical oscillator and vertical output stage.

HORIZONTAL — Driving pulse applied to output stage produces full sweep and high voltage if output system is working. Eliminates uncertainty of B+ boost affecting horizontal oscillator operation.

B & K MANUFACTURING CO.
3726 N. Southport Ave. • Chicago 13, Illinois
Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont.
Export: Empire Exporters, 458 Broadway, New York 13, U.S.A.

B&K

RF Heating

(Continued from page 39)

the grid circuit an over-current relay R2 is used. The tank-coil, capacitor, work-coil, tube and other parts which carry heavy r-f currents may be water-cooled. Fig. 4 shows a water-cooled jacket arrangement for a vacuum-tube triode. The tube can be seen in Fig. 5.

Spark-Gap Oscillator

A spark-gap oscillator or converter resembles a very early radio transmitter. The simplified schematic in Fig. 6 shows the major components of this type of r-f generator. The input line voltage is stepped up by a transformer, resistors R limit the current flow, and S is a series of spark gaps and inductors. L3 is

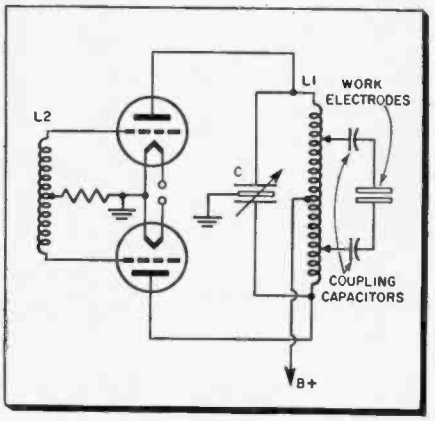
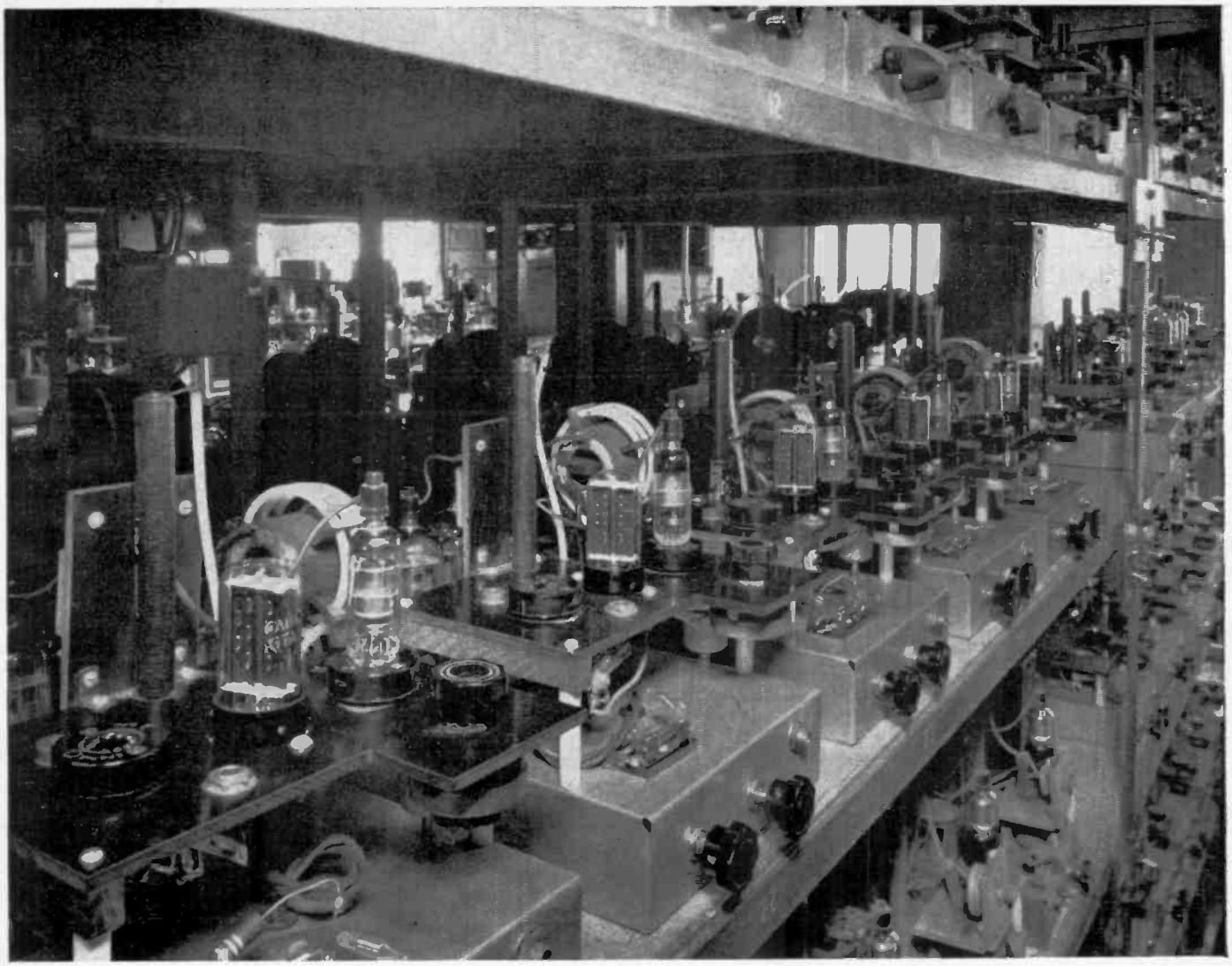


Fig. 7—Dielectric heating generator's frequency range is from 5 mc to over 100 mc. Work load consists of insulator type of materials.

a work-coil which forms a parallel resonant tank circuit with capacitors C2. This tank is in turn connected into a series resonant circuit which includes inductors L1 and L2, and blocking capacitors C1.

The spark-gaps are a series of air-cooled or water-cooled gaps, or combinations of both. Tungsten disks about one-inch in diameter are used to form the gaps. Gap clearance must be carefully adjusted with a feeler gauge. Variable coils L1 and tapped coil L2 are adjusted for the desired frequency. An r-f ammeter is coupled to the output circuit to observe tuning adjustments for maximum r-f current in the work-coil. The blocking capacitors are used to keep the high voltage from the output coil. These capacitors are made up of several capacitors in parallel, as are the capacitors in the tank circuit. The work-coils are at

(Continued on page 58)



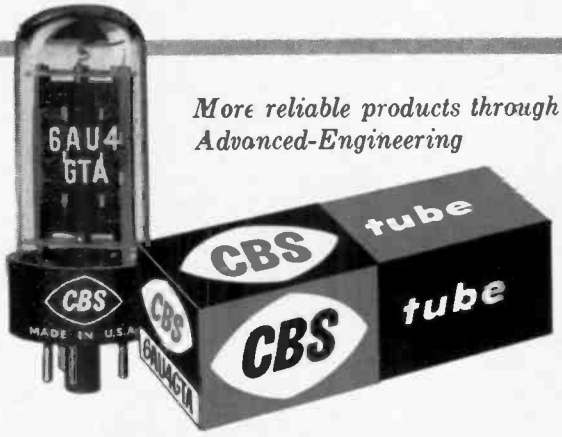
NEW CONTROLLED

Dynamic Life Tests...

...ASSURE UNIVERSAL TUBE REPLACEMENTS Testing tubes in sets is good . . . but not the best way. We life-check tubes dynamically in TV sets . . . in addition to many other extensive tests for materials, production, design and static life. But there are interaction problems in set testing which obscure the causes of tube failure. And some models of TV sets operate tubes conservatively. CBS-Hytron has, therefore, developed controlled dynamic life tests to examine all important characteristics under the most stringent TV set conditions.

...HELP PINPOINT AND CORRECT FAULTS Day in, day out, tubes are cycled and checked under accelerated conditions at low (105 v) and high (140 v) line voltages. Components and dynamic operating conditions are controlled to point the finger unrelentingly at the exact nature of tube failures. They may be opens, shorts, gas, gradual deterioration of electrical characteristics, etc. Once the tests locate the fault, the correction is invariably the same: improvement of tube design or manufacturing techniques.

...CUT YOUR CALL-BACKS. This new controlled dynamic life testing is your answer for dependable, universal replacement tubes for all TV sets. It is a big reason why CBS-Hytron tubes can cut your call-backs. Be sure to ask for CBS-Hytron tubes.



More reliable products through Advanced-Engineering

CBS-HYTRON, Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.

(Continued from page 56)

ground potential for safety. They are made of copper tubing to permit water to circulate through them, even while current is applied. In some cases currents as high as 1,000 amperes can flow through the work-coil. Greatest output is obtained when both circuits are resonant at the same frequency. If a different frequency is desired because of the depth of penetration requirements, the series tuning inductances are adjusted to this frequency. The work-coil and tank capacitors would then be operated off resonance. To correct this condition it is possible to change either L or C, or both to bring the parallel tuned circuit back to resonance.

Dielectric Heating

In dielectric or electrostatic heating the equipment is used to heat plastics, rubber, wood, paper, ceramics, and other non-conductors. The work is placed between two electrodes. The electrodes act like the plates of a capacitor, and the work behaves like a dielectric. Charging and discharging the capacitor causes a re-arrangement of the molecules in the dielectric. The opposition to these changes results in heat. In a capacitor it is referred to as dielectric losses. In a capacitor these losses are undesired but in dielectric heating they represent the output of the equipment.

The frequency of operation depends upon the power factor of the work material. Frequencies range from 5 mc to 100 mc and even higher. While dielectric equipment resembles induction heating devices, it requires higher frequencies and a different type of output. Fig. 7 is an example of the circuit used for dielectric heating. The output from the oscillator is capacitively coupled to the work electrodes. The resonant frequency is determined by the inductor L1, capacitors C, and the loading effect of the work. Adjustment of capacitors C compensates for different dielectric constants of different materials.

Dielectric heating has many applications; two important ones are sealing plastic and glueing plywood. The widespread use of plywood is due, in part, to the speed and economy of this type of heating. Sheets of thin wood are placed one on top of the other with the grain going in alternate directions, glue is spread between each sheet, pressure is used to hold the sheets together until the glue sets and dielectric heating is

(Continued on page 60)

Superior's New Model 80

20,000 OHMS PER VOLT ALLMETER

THE *ONLY* 20,000 OHMS PER VOLT V.O.M. SELLING FOR LESS THAN $50 WHICH PROVIDES *ALL* THE FOLLOWING FEATURES:

✓ **6 INCH FULL-VIEW METER** provides large easy-to-read calibrations. No squinting or guessing when you use Model 80.

✓ **MIRRORED SCALE** permits fine accurate measurements where fractional readings are important.

✓ **CAPACITY RANGES** permit you to accurately measure *all* condensers from .00025 MFD. to 30 MFD. in addition to the standard volt, current, resistance and decibel ranges.

✓ **HANDSOME SADDLE-STITCHED CARRYING CASE** included with Model 80 Allmeter at no extra charge enables you to use this fine instrument on outside calls as well as on the bench in your shop.

NOTE: The line cord is used only for capacity measurements. Resistance ranges operate on self-contained batteries.

Features:

- A built-in Isolation Transformer automatically isolates the Model 80 from the power line when capacity service is in use.
- Selected, 1% zero temperature coefficient metalized resistors are used as multipliers to assure *unchanging* accurate readings on all ranges.

Specifications

7 D.C. VOLTAGE RANGES:
(At a sensitivity of 20,000 Ohms per Volt)
0 to 15/75/150/300/750/1500/7500 Volts.

6 A.C. VOLTAGE RANGES:
(At a sensitivity of 5,000 Ohms per Volt)
0 to 15/75/150/300/750/1500 Volts.

3 RESISTANCE RANGES:
0 to 2,000/200,000 Ohms. 0-20 Megohms.

2 CAPACITY RANGES:
.00025 Mfd. to .3 Mfd., .05 Mfd. to 30 Mfd.

5 D.C. CURRENT RANGES:
0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

3 DECIBEL RANGES:
— 6 db to + 18 db. + 14 db to + 38 db
+ 34 db to + 58 db

Model 80 Allmeter comes complete with operating instructions, test leads and portable carrying case. Only **$42.50**

SHIPPED ON APPROVAL
NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied *then* send $12.50 and pay balance at rate of $6.00 per month for 5 months—*No interest or Finance Charges Added*. If not completely satisfied, return to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. 569 3849 Tenth Ave., New York 34, N. Y.

Please rush one Model 80. If satisfactory I agree to pay $12.50 within 10 days and balance at rate of $6.00 per month. If not satisfactory, I may return for cancellation of account.

Name .....
Address .....
City ..... Zone ..... State .....
All prices net. F.O.B., N.Y.C.

(Continued from page 58)

used to raise the temperature to hasten drying.

Bonding thermoplastic sheets can be accomplished by an "r-f sewing machine." Thermoplastic materials melt when they are heated and can be joined or welded when conditions of heat, feed and pressure are controlled. Pliofilm, Koroseal, Saran, etc., are synthetic materials produced in thin film forms, and lend themselves to these bonding techniques. About 150° C of heat is applied to the sheets to be joined by rotating electrodes which also apply proper pressure and maintain proper feed.

Servicing Caution

The FCC requires a strict control to prevent excessive r-f radiation. All induction and dielectric heating generators and oscillators produce large amounts of r-f power which could cause interference. Commercial equipment is well shielded to prevent radiation interference with radio and TV receivers. The servicing technician must be sure that this shielding remains intact after any repairs have been made. •

New Books

Books marked with an asterisk (*) may be obtained prepaid from Electronic Technician

LOUDSPEAKERS. *By Gilbert A. Briggs. R. E. Cooke, Technical Editor. Published in England by Wharfedale Wireless Works. Available in U.S. from British industries Corp., 80 Shore Rd., Port Washington, N.Y. 336 pages. Hard cover. $4.50.*

This fifth edition authored by a renowned audio engineer has been expanded and brought up to date. The text contains a wealth of practical data, made all the more lively by the personal touch of the author. Among the many topics covered are magnets, housings, cones, coils, impedance, phase angle, frequency, distortion, db, power, resonance, cabinets, transients, electrostatics, crossovers, feedback and lots more. There are some 190 informative illustrations Coverage of stereo is brief, and more on this would have been welcome. For any technical man interested in audio, this book is a valuable—and interesting—source.

***A-C CIRCUIT ANALYSIS.** *Edited by Alexander Schure. Published by John F. Rider Publisher. 104 pages. Soft cover. $1.80.*

Here is a fine basic book on a fundamental electronic function, alternating current. After discussing principles and sinewave values, the text explains resistance, inductance, capacitance, series and parallel circuits. Of notable value is the clear explanation of the "j" operator in vectorial a-c presentations. Review questions and answers at the end of each chapter show how technicians can work out a-c circuit problems.

TELEVISION ANALYZING SIMPLIFIED. *By Milton S. Kiver. Published by B&K Mfg. Co., 3726 N. Southport Ave., Chicago 13, Ill. 104 pages. Soft cover. $1.*

This detailed explanation of how to troubleshoot TV receivers by using the B&K "Television Analyst" is slanted entirely from the technician's practical viewpoint. This instrument a kind of miniature broadcast station, generating test patterns and r-f, i-f and video signals. After explaining limitations of conventional signal tracing techniques, the text goes on to tell how the Analyst is used to troubleshoot the audio, i-f system, front end tuner, sweep sections and agc. Other uses include servicing intermittents and color, as well as auxiliary functions covering linearity, size, r-f sensitivity and use for display. This book offers worthwhile information for every TV service technician.

(Continued on page 66)

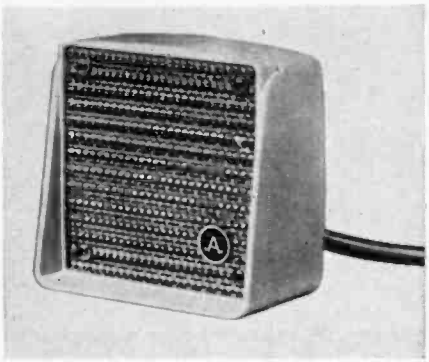
Specially Selected
List of Electronic Books
See Pages 48 & 49

NEW AUDIO PRODUCTS

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 45

Astatic MICROPHONE

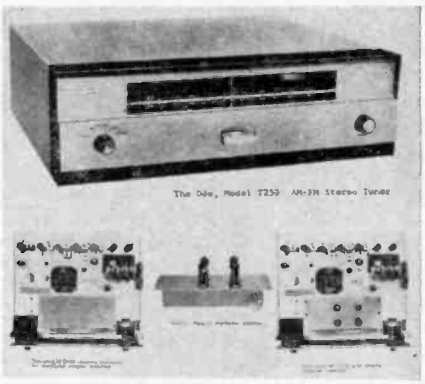
"Recorder Mike" Model M-150 is claimed to be the "lowest priced American-made microphone on the market today." List price is $6.50. Primary market for the new microphone is as replacement mike for tape recorders. The



Model M-150 has a —44 db output, frequency range of 30 to 10,000 cps. It employs a crystal element. It has a high impact, ivory plastic body with gold, rigidized metal grille. It comes equipped with five feet of flexible, single conductor, shielded cable. Astatic Corp., 250 Harbor St., Conneaut, Ohio. (ELECTRONIC TECHNICIAN 1-28)

Harman-Kardon MULTIPLEX TUNER

A new AM/FM tuner, the Ode, Model T250, is an integrated multiplex reciever providing space for the MA250 multiplex adapter to plug directly into the chassis. The FM front end is a new "shaded grid" VHF tetrode which combines the low noise characteristics of a triode with the great sensitivity of a



pentode. Included are a "gated beam" limiter with zero time constant grid circuit and wideband Foster-Seeley discriminators. A new electronic tuning bar functions on AM and FM. Price of the T250 is $149.95; enclosure TC50 is optional at $12.50. The new MA250 Multiplexer Adapter is $49.95. Harman-Kardon, Westbury, N. Y. (ELECTRONIC TECHNICIAN 1-30)

25,000 HOURS

..and still like new

New Westinghouse **Gold Star** Picture Tube

"Torture-Tested" an amazing 25,000 hours to prove it is ready to build customer confidence in your selling picture!

The most grueling test in TV history. To prove that this amazing new tube would live up to our engineers' predictions, a stock model Gold Star Tube actually underwent 25,000 hours of continuous operation . . . was still 80% as good as new! Then—and only then—was it approved for distribution, to make it the most reliable, most profitable tube you can sell.

In addition to testing standards never matched before, you'll find two other great advances in new Westinghouse Gold Star Tubes—advances which will greatly curtail call-backs and replacements that have dimmed your profit picture so long. They are . . .

40% More "Getter" in Electron Gun. Revolutionary design distributes 40% more protective material over inside of tube. Greatly reduces aging . . . keeps picture brighter longer.

New Aluminizing Method affords absolute maximum reflection . . . more usable light from the screen . . . a 20% brighter, sharper picture with greatly improved contrast.

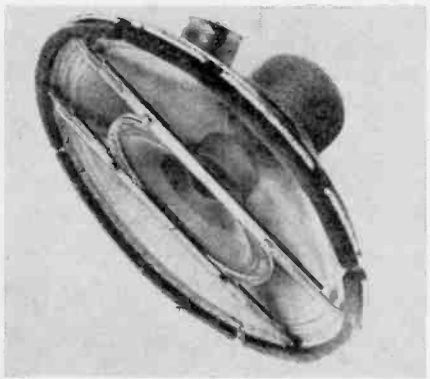
Start rebuilding your profits now. Call your Westinghouse Distributor about new Gold Star Tubes today.

YOU CAN BE SURE...IF IT'S **Westinghouse**

Electronic Tube Division • Elmira, New York

Sonotone LOUDSPEAKER

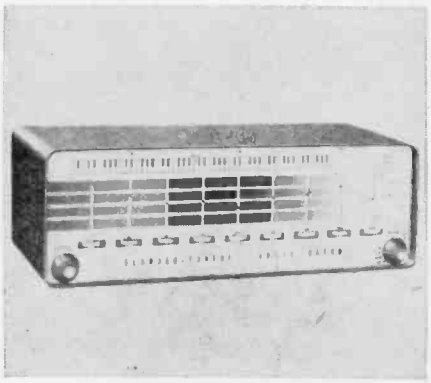
CA-12A 12" coax speaker provides reproduction of 35 to 20,000 cycles. List price is $27.50. It combines a woofer and new tweeter with crossover frequency of 2,000 cycles. The crossover network, built-in and preset, is an inductor-capacitor design. The woofer magnet developed a high flux density, 12,000 gauss,



in the gap. For multiple speaker systems, this woofer, the W-12, is available separately for $16.00 list. The lightweight tweeter voice coil works in a 9,500 gauss flux density. The CA-12A, an improved version of the CA-12, is rated to handle 40 watts of average program material. Electronic Applications Div., Sonotone Corp., Elmsford, N. Y. (ELECTRONIC TECHNICIAN 1-31)

Blonder-Tongue "AUDIO BATON"

The Audio Baton, Model B-9, provides a tone control for each of the nine octaves in the sound spectrum, from 20 to 20,000 cycles. Controls allow the user to amplify or reduce any sound in any octave. It is useful for eliminating some forms of noise and distortion, and for an infinite number of compensation settings. In PA systems, reducing the level



of the proper octave control virtually eliminates feedback. Colorful front panel. The nine octave control knobs turn up or down to display an overall response curve. Two function switches are provided. It is easily installed between the preamp and amplifier stages of the user's present system. Audiophile net $119.50. Blonder-Tongue Labs., 9 Alling St., Newark 2, N. J. (ELECTRONIC TECHNICIAN 1-27)

Reactance Measurements

(Continued from page 36)

total applied voltage that would theoretically be indicated on the meter. It is only necessary to multiply the applied a-c voltage by the indicated percentage. The same results could be obtained by substituting a resistor for the standard; rounded slide-rule values are shown in Table 2. Caution: do not attempt to apply low inductive reactance and low value resistors across the lower line. Also,

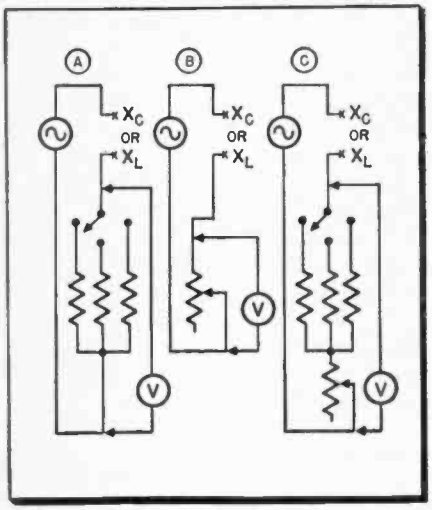


Fig. 2—Different resistors and a potentiometer may be switched in to extend the range of measurements. The control may be calibrated to compensate for meter loading characteristics.

do not test electrolytic capacitors in this manner. Electrolytics will pass excessive currents when polarity is reversed. Small inductors may be measured at higher frequencies and lower voltages, whereas larger capacitors are easier to measure at the lower frequencies.

Most a-c meters draw enough current to load down the circuit, and make many of these readings invalid, particularly on the low range scales. Should such be the case with a particular instrument on hand, it is possible to calibrate and compensate for this condition by measuring known capacitors and inductors, and noting the reading.

Substituting resistors can be carried one step further by utilizing a switching arrangement, a potentiometer, or both, as shown in Fig. 2. The combination hookup is convenient for extending and spreading the range. Use of the potentiometer enables a slightly different technique. By adjusting the potentiometer so that the meter indicates the same voltage

(Continued on page 66)

(Continued from page 65)

drop across the reactance, as appears across the resistance, the resistance will then be equal to the reactance, and the loading effect of the meter can be disregarded. From the formulas:

$$x_L = 2\pi fL$$

$$x_C = \frac{1}{2\pi fC}$$

the value of inductance or capacitance can be readily determined. For convenience, Table 3 lists rounded values for various reactances at different frequencies. To save time, a knob pointer and dial on the potentiometer can be calibrated to indicate direct readings in terms of capacitance and inductance, and the meter used to indicate when a condition of balance exists. Of course, the reading would only be correct if the tests are made at the same frequencies as those used for calibration. Some VOM and VTVM instruction manuals do show specific applications of these concepts. •

For more information on the loading effects of the VOM, see author's article on page 34 of the October 1958 edition of ELECTRONIC TECHNICIAN—Ed.

(New Books. Continued from page 61)

***VACUUM TUBE CHARACTERISTICS.** *Edited by Alexander Schure. Published by John F. Rider Publisher. 96 pages. Soft cover. $1.80.*

With far more than a billion vacuum tubes in use today in the U. S., a thorough understanding of these basic electronic building blocks would appear essential. This book on fundamentals does an excellent job of telling how diode, triode and multi-element tubes function. Electron emission, characteristic curves, amplification factor, plate resistance, transconductance and much more are fully explained. If the experienced technician thinks this volume cannot teach him plenty, he is wrong. Could you plot a load line on a family of curves? And plot harmonic distortion by this method? And understand variable-mu pentodes? This compact book is to be well recommended.

***TRANSISTORS, THEORY & PRACTICE.** *By Rufus P. Turner. Published by Gernsback Publications. 160 pages. Soft cover. $2.95.*

This informative second edition has been expanded to include thyristors, four-layer diodes, spacistors, double-based diodes and phototransistors. As with the first edition, semiconductor theory, various circuits, applications and tests are presented.

(LOANS . . . *Cont'd from p. 35*)

installments, including interest on the unpaid balance. General business loans may be for as long as 10 years, loans under the limited loan participation plan for a maximum of 5 years, and pool loans for a maximum of 20 years.

The interest rate on the SBA's direct business loans has been set by the Agency's loan policy board at 5½% per annum. In participation loans, the private lender may set the rate of interest on the entire loan, provided it does not exceed 5½ per cent per annum.

Q. How long must I wait, normally, for action on a loan?

A. The SBA acts promptly on all applications and in most cases a decision can be given within about three weeks. However, the time required to process a particular application depends in part upon the care with which the businessman has prepared his loan request, the completeness of the information he has furnished, and the amount of work necessary for the SBA to give full consideration to all elements of the application.

Q. How can I determine whether I qualify as a small business?

A. There are two important considerations here. First, as defined in the Small Business Act, your firm must be independently owned and operated and not dominant in its field. Second, you must meet the SBA's criteria in regard to dollar volume of business. In general, the Agency classifies a wholesale concern as small if its yearly sales are $5,000,000 or less, and a retail or service trades firm as small if its yearly sales or receipts are $1,000,000 or less.

Q. What sort of records and information will I need to present?

A. In considering an application for either a participation or a direct loan, the SBA will want the same kind of information that a bank needs when weighing a loan request. The Agency will want to know the proposed purpose of the loan; your financial condition; how you propose to repay the loan, and the available collateral.

Q. Where do I go to apply for an SBA loan? Whom do I see?

A. You should first see your local bank about a bank loan, or a bank-SBA participation loan. If the bank cannot extend the financing on its own, or in participation with the SBA, you may then apply to the Agency for a direct Government loan. The local bank most likely can

(Continued on page 71)

Association News

California

Los Angeles Area Appliancers attend vital licensing hearing. APA is trying to obtain approval for its members to make connections off a gas line from the wall side out only, to replace and repair a garbage disposal, to install moisture exhausts on dryers and combinations, and similar work. APA officials made it clear that they are not asking for a blank check for their members. They themselves insist that any appliancer must pass rigid tests, set up and supervised by City officials, and including questions relating to the code itself, before a license can be issued.

District of Columbia, Washington

The Service Committee of the Electronic Industries Association concluded a Dec. 16 meeting in New York City by approving a program designed to stimulate and achieve overall industry cooperation with the nation's independent electronic technicians. The plan was contained in a report of the Service Industry Relations Subcommittee, under chairman S. R. Mihalic, of General Electric Co. The EIA Service Committee stands ready to work and cooperate with all segments of the electronic service industry, in the knowledge that mutual benefits and improvements can come by working together.

For its part, the EIA Service Committee plans, within its limits as a trade association, to supplement its basic and advanced vocational training program, now widely accepted by the technical and vocational schools of the nation, with a program of:

1. Welcoming opportunities for discussion of mutual problems with electronic service leaders.
2. Being represented at service association conventions.
3. Promoting press articles and public relations publications which will enhance the prestige, reputation, and public understanding of the independent service industry.
4. Providing and distributing articles of technical, professional and business interest to independent service.

Florida

The Radio-TV Technicians Guild reports that a new service group is being formed in Broward County. Those interested in becoming associated with the new group should

contact Bob Austin, Community TV, 711 South 21st Ave., Hollywood, Fla.

The Better Business Bureau of Tampa has been and is still conducting an "Operation Test Pattern" such as was done locally by the Miami-Dade County Better Business Division several years ago and the Radio Television Technicians Guild in which fraudulent practices by a few service shops were exposed through the local press and TV stations. In the Tampa operation, two men were recently found guilty on two counts of petty larceny involved in TV repair practices and were sentenced to pay fines of $600 each or 90 days in jail. According to the BBB in Tampa, a list of 15 names was submitted to the police about persons advertising TV repairs in the newspapers and telephone book, who had no occupational license to conduct such businesses. The BBB in Tampa is still receiving complaints at the rate of 125 or more per month and "Operation Test Pattern" will be maintained there for an indefinite period.

Illinois

Joseph Blink, Director, TESA-Chicagoland writes—"I believe that the state association idea is the biggest obstacle we have in our efforts to keep the Independent Service Industry healthy. Too many people in our industry across the country are not only un-informed but also misinformed as to what is going on in NATESA's effort to combat the problems in the industry. Too many sections of the country are fiddling with state groups in preference to NATESA while the industry goes down hill due to national problems. There must be a lot of 'Big fish in a little pond' thinking in the minds of those who prefer state over national groups.

"Let's consider the problem of captive and factory service which has been creeping and now has begun to gallop. How many people in the industry know the NATESA way of fighting the problem? What is NATESA doing about it?

"After a free exchange of ideas on the subject at the last NATESA convention it was unanimously agreed that the only language that the factory service competitors understand was the 'pocket-book'. Spelling it out, here is what it means to me—'Mr. Manufacturer, I refuse to be a customer of yours while you are acting as a competitor of mine. Also, I shall keep you in mind when my customers ask me for my professional opinion as to which maker's products are most desirable.'

(Continued on page 70)

(Continued from page 69)

"I am certain that NATESA's way is the best way of fighting captive service. I am also certain that the rank and file of service people everywhere would agree and act accordingly if only they were informed of our efforts in this direction. State groups outside of NATESA are at a disadvantage in this effort. Experience with service associations indiciates that we can not afford the time and money needed to support local, state, and national groups. TV Service Associations are 'poor man' associations. We should concentrate our strength where it does the most good. Locals are a must for local problems and the national is a must for national problems. I doubt that we can afford any luxuries.

"Through the SCOPE and through the bulletins from the NATESA office to the affiliates, NATESA members are the best informed service people in the country. You have got to be informed before you can even begin to act. Time is running out while service people quibble.

"When are we going to really get together and make a fight for a healthier service industry?"

Michigan

Aggressive national association leaders met in an Independent Dealers Emergency Action (IDEA) committee session, to map a continuing campaign to roll back captive service operations, and inboard service pricing policies of TV set manufacturers. Karl Heinzman, TSA Michigan Proxy, emerged the 1959 permanent Chairman, with the resignation of temporary chairman, Tilman Babbs. In assuming his duties, Heinzman said, "This committee is now acting for 74 independent service dealer associations. Letters are still pouring in, and although not yet tabulated, it is apparent that we can expect the support of from 50 to 100 more fighting-mad service dealer groups. These people are stirred up like a hive of bees. They are demanding to know why these manufacturers are introducing cut-throat methods to compete with the already adequate service facilities of independent service dealers." A sub committee composed of Tilman Babbs of TEA Texas; John Graham of ARTSD Ohio; and M. B. Magers of Kansas City NARDA President; and three other sub committees were created. Serving on the legislative committee are chairman: John Hemak of MINISE Minnesota; John Geoghegan Sr. of TELSA Connecticut; W. C. Pecht of TEAM St. Louis; and Wayne Cleim of TV Bureau Elkhart, Indiana. On the finance committee are Chairman Bob Steers of TELSA Connecticut; Len Smith of TEA Texas; and Don Wilson of ARTSD Columbus, Ohio. On the communications committee are Jack Barton of TSA Michigan; Bob Sickets of IESA Indiana; and Hal Chase, Editor of TSA News.

IDEA was presented to the press in New York by Connecticut and Michigan Association Leaders, Karl Heinzman, Peter Lucas, Dick Duplensky, Bob Steers, and Bill Stanek. Service associations in every corner of the country are becoming alerted to the importance of fighting captive service.

See page 29 and 83 of the November issue of ELECTRONIC TECHNICIAN for more information on the subject.—Ed.

At the annual stock holders meeting of Telectro Service Associates, Inc., the following board members and officers were elected: Pres., E. J. Barton; V.P., Harold Chase; Sect'y., P. Fabian; and Treas., E. Brown. The balance of the board consists of E. Carozzo, and C. Hibbert. Telectro was organized by the independent service dealers of TSA to pro-

(Continued on page 73)

(LOANS . . . *Cont'd from p. 67*)

give you the address of the nearest of the SBA's 37 field offices, which are located in major business centers across the nation. Or, if you live in or near a large city, you might check the "U. S. Government" sections of its telephone directory to see if a SBA office is located there.

Q. Can I use a part of such a loan to liquidate other indebtedness against my business?

A. Many of the business loans approved by the SBA are used to pay off various types of indebtedness that the businessman has incurred. It often is advantageous to the borrower to consolidate all of his debt obligations in this manner.

Q. Is it possible, instead of obtaining a formal written refusal from a bank or insurance company, that I can have a real estate broker furnish a letter to the effect that specific banks and insurance companies have refused to accept a mortgage loan against my business property?

A. No. The SBA requires that the prospective borrower first visit his bank of account and discuss the possibility of obtaining a private loan before he can apply for a Government loan. In larger cities he is required to try to obtain the funds from one other bank in addition to his bank of account.

Q. Can I make a loan to improve my business structure, expand it, re-equip it, renovate it, or otherwise to make it more modern?

A. Yes. Many SBA loans are made for these purposes. Loans are made by the SBA to finance business construction, conversion or expansion, to finance the purchase of equipment, facilities, machinery, supplies or materials, and to supply working capital.

Q. If I am turned down by a regional office, can I appeal to the Washington headquarters office?

A. It is not necessary to make such an appeal since regional offices, while they have authority to approve the smaller SBA loans, do not have authority to decline them—they can only recommend to the Administrator in Washington that they be declined. Such loans are always reviewed in Washington. When a loan application is declined by the Washington office, the businessman may appeal for reconsideration if he can show that he can successfully overcome the objections that the SBA had for refusing the loan. •

(Heterodyne . . . *Cont'd from p. 43*)

be rung by the square wave, regardless of the frequency to which it is tuned. Since the low-Q tuned circuit does not have enough flywheel effect to carry the ringing energy from the leading edge past the trailing edge of the square wave, it can be triggered by the trailing edge as well as the leading edge. By the time the trailing edge comes along, the tuned circuit is quiescent and can be swung into action by the trailing edge, without reference to the leading edge. Under proper circuit conditions, it is possible to sustain oscillations at any frequency including the even multiples of the square wave. From this it could be concluded that a square wave contains all frequencies.

It could therefore seem that the harmonics attributed to a square wave are in fact only the characteristics of the circuits which are energized by the square-wave voltage. Some circuits respond as if a square wave contained only odd harmonics, while others contained all frequencies. The circuit application must be known before harmonic content of a square wave can be interpreted. •

Reps & Distributors

JOHN F. RIDER PUBLISHER, INC., announces the appointment of JAMES MALCOLM FLORA as their new representative in the state of Michigan.

WESTINGHOUSE Electronic Tube Div. has appointed MORRIS F. TAYLOR CO. as sales rep for tubes and semiconductor devices in Fla., Ala., Ga., and central Tenn.

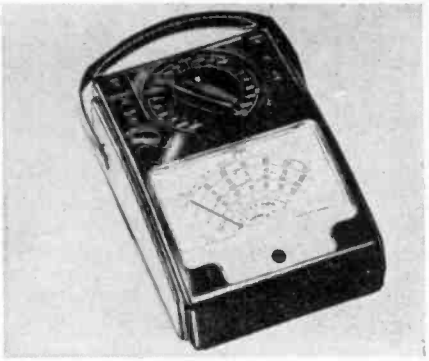
ELECTRONIC REPRESENTATIVES ASS'N. (ERA) has been adopted as the new name for the trade association of sales reps in the electronics field, formerly known as "The Representatives" of Electronic Products Mfrs.

PHILCO DISTRIBUTORS, INC., announces the following appointments: CHARLES HAKIMIAN, general manager, in charge of all factory branches; and GEORGE R. HICKMON, general manager, Chicago.

SERVICE INSTRUMENTS CORP. has appointed the following sales reps: JAMES FLORA; J. W. LEHNER; and STEVE FISHER, to cover Michigan; Ohio; and metropolitan New York and northern New Jersey respectively.

Hickok VOM

The 5" meter of this portable VOM, Model 457, has easy-to-read scales and single Function-Range control. Improved physical design offers inclined panel so it lies flat in normal use. Specifications are: Sensitivity: 20,000 ohms per volt dc, 1,000 ohms per volt ac; 0 to 1,200 v. in 6 ranges, ac and dc; resistance, 0 to 100 megohms in 4 ranges; center scale ranges, 5, 500, 5,000, 500,000 ohms; current, 50 microamperes, 1, 10, 100, 1,000 ma, 10 amperes; db range, —18 to +57 in 5 ranges. Battery operated. $43.95. The Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, O. (ELECTRONIC TECHNICIAN 1-2)



Association News

(Continued from page 70)

mote and contract service for the independent service industry.

Minnesota

Ever since the inception of the Minnesota Television Service Engineers, Inc. there was interest by its members to strengthen the organizations by affiliating with a national group. They report that in 1955, MINTSE was not eligible to join NATESA because it "conflicted with local associations" when in fact it supplemented local participation. On this discriminatory position NATESA kept from expanding in Minnesota. Later, in August of that year, a UNITY meeting was held in Pittsburgh and another in October in Indianapolis. The purpose was to unite the many associations that were unaffiliated into one unified body. A resolution was passed that any group wishing to affiliate with NATESA could do so upon application to the NATESA office. Once again MINTSE was discriminated against. The reason given was that the application was a day late. This was certainly not in harmony with the many associations who took the time and expense to have a National Representation.

Missouri

TSE Officers Elected. The 1959 Slate of TSE Officers elected are: Pres., Don F. Ellis; V.P., William E. Mears; George William Walker; Sect'y., John Alex Earp; Treas., William A. Pewitt; Chairman of the Board, Earl J. Steffes; and board members Robert E. Stephan, Robert W. Hester, and Smithy Preston.

North Carolina

The North Carolina Federation of Electronic Associations held their first meeting and elected: Pres., Garland E. Hoke; V.P., Joe Wood; Sect'y., Charles S. McBroom; Treas., Edmund F. Barbour; Board of Directors Kenneth Larue, Herbert Griffin, R. B. Corn, and Editor of the state paper, Dave Drage.

New York

Attorney General Louis J. Lefkowitz reports that as a result of a meeting of a committee appointed by him to promote fair practices and ethical standards in the TV supply and repair industry for the benefit of the consumer as well as the legitimate businessman, three major problems facing the industry will be explored:

1—How can the industry insure greater confidence in TV servicemen?

2—How can the problem of deceptive advertising by some TV repairmen be met?

3—How can the industry cope with the problem of defective radio and TV tubes which have been rejected by manufacturers as not meeting the standards of their companies?

Members appointed to the committee are: Temporary Chairman, Arthur Startz of the Better Business Bureau; Robert Larsen of Empire State Federation of Electronic Technicians Assn.; Philip Fleischman of Metropolitan Electrical Appliance Dealers Assn.; Peter H. Cousins of Electronic Industries Assn.; Samuel E. Ewing of Radio Corp. of America; Harry Esdale of National Electronics Distributors Assn.; Robert Powell of Fordham Radio Supply Co.; Gerald Sohne of National Tube Testers Assn.; Martin Boxer of Associated Radio & Television Servicemen of N. Y.; and Irving Sarnoff of Bruno-New York.

New Products

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 45

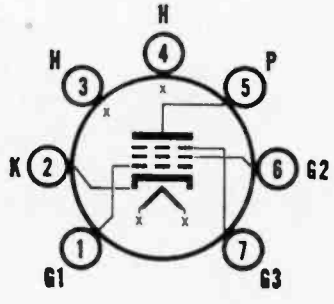
Shell TUBE TESTER

Model T-18 "Test-O-Matic" tests each side of multi-purpose tubes, and 6 and 12 volt vibrators. Uses just 18 sockets to emission test all tube types. New sockets conform to MIL spec. Assures positive contacts and longer wear.

Covers more than 800 tube types. It has three easy-to-use controls, simple directions and meter. Operates on 110-120 volt ac. Table model, $91.85 dealer price. Also, not shown, L-18 with legs, $99.95. Shell Electronic Mfg. Corp., 1688 Utica Ave., Brooklyn, N. Y. (ELECTRONIC TECHNICIAN 1-5)

CBS PENTODE

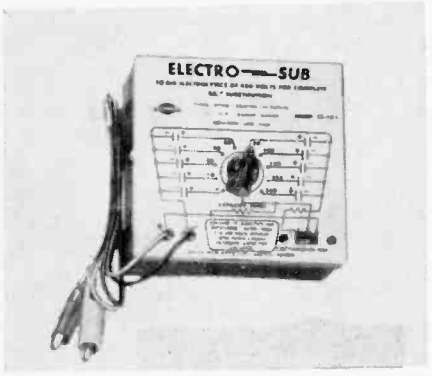
Three heater versions of a wideband, high-frequency pentode are sharp-cutoff types 3DK6, 4DK6 and 6DK6. They are particularly suited for use as i-f amplifiers in TV receivers; they feature a high transconductance of 9800 micromhos. Plate resistance is 0.35 meg, Class A plate current 12 ma. The 3DK6



and 4DK6 are designed for use in 600-ma and 450-ma series—string sets respectively; and the 6DK6, for parallel heater operation. Plate voltage is 300 v. max., 125 v. class A. Plate dissipation 2 watts. (Bulletin E-315.) CBS-Hytron, Parker St., Newburyport, Mass. (ELECTRONIC TECHNICIAN 1-9)

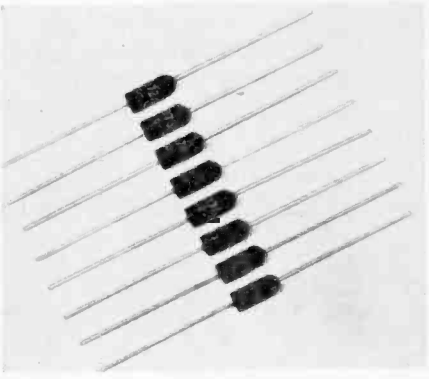
Sencore
ELECTROLYTIC SUBSTITUTION

Electro-sub Model ES 102 is designed to substitute for electrolytics in any circuit between 2 and 450 v. Range includes 10 separate electrolytics from 4 to 350 μf. New surge protector circuit prevents capacitors from arcing during charge or discharge, and prevents capacitor healing while paralleling an intermittent electrolytic. Release of surge protector switch automatically discharges electrolytic within seconds, thus insuring user protection. $15.95. Service Instrument Co., 171 Official Rd., Addison, Ill. (ELECTRONIC TECHNICIAN 1-4)



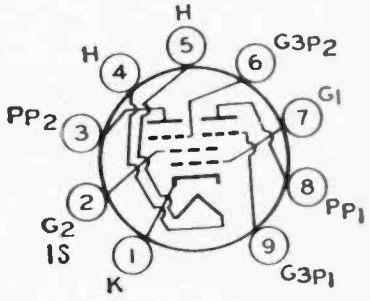
Tung-Sol SILICON RECTIFIERS

A line of eight silicon rectifiers ranging from peak inverse voltage of 50 to 500 volts for radio and TV sets have been assigned type numbers 1N2072 through 1N2079. The new units are diffused junction silicon rectifiers enclosed in epoxy resin cases with flexible pigtail leads. In configuration they closely resemble small capacitors. The 1N2078, with a peak inverse voltage of 400 v., has wide application for radio and TV. It provides the low forward voltage drop and low leakage current. Flexible leads may be soldered into any piece of equipment, no additional hardware required. Tung-Sol Electric, Inc., 95 8 Ave., Newark 4, N. J. (ELECTRONIC TECHNICIAN 1-12)



RCA TWIN PENTODE →

The 4BU8 is a sharp-cutoff twin pentode of the 9-pin miniature type intended for use in agc and sync circuits of TV receivers. The 4BU8 utilizes a common cathode, a common grid No. 1, a common grid No. 2, two grids No. 3, and two plates. Each of the grids No. 3 has a separate basepin terminal and may be used independently as a control electrode. Except for a 4.2-volt/450-ma heater having controlled warm-up time, the 4BU8 is like its companion types, the 3BU8, which also has controlled warmup time, and the 6BU8. Electron Tube Div., Radio Corp. of America, Harrison, N. J. (ELECTRONIC TECHNICIAN 1-35)

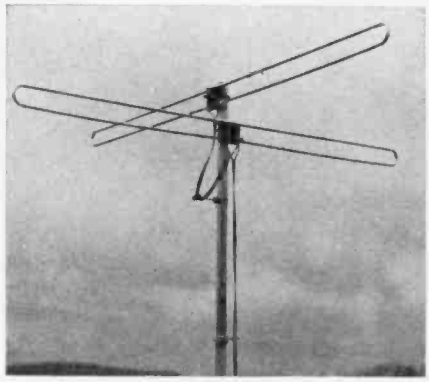


Paxton GARAGE DOOR OPERATOR

Electronic garage door operator is designed to operate all types of overhead doors. It is controlled from the car transmitter or pushbuttons in house or garage, combined with a radio receiver in a compact unit no larger than a portable radio. Installation is simple, with only three lag screws used to secure the unit to the header beam above the garage door. No tracks, rods, or posts are required. System employs frequencies in FCC approved 200 to 400 kc band, with triple-lock r-f/a-f and burst coding between transmitter and receiver. Five-year warranty. Paxton Products, 929 Olympic Blvd., Santa Monica, Calif. (ELECTRONIC TECHNICIAN 1-20)

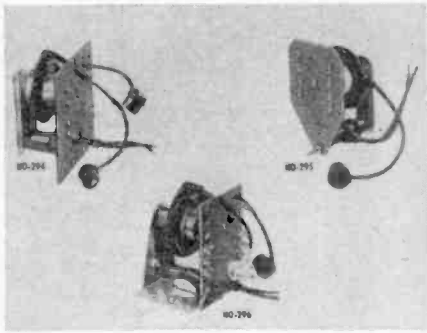
Taco FM ANTENNA

A modernized version of the "Turnstile" type FM antenna is gold-anodized for improved life and appearance. The G 666 has two folded-dipoles mounted at right angles to each other. The terminal boards of the two dipoles are made of high dielectric, high tensile strength material. The terminals are connected electrically by means of a tuned transmission line for maximum efficiency throughout the FM spectrum. Terminal impedance of the antenna assembly is 300 ohms. The G 666 is designed for omnidirectional reception in strong to medium signal areas. $9.25 list. Technical Appliance Corp., Sherburne, N. Y. (ELECTRONIC TECHNICIAN 1-21)



Stancor FLYBACKS

Transformer line has been expanded to include exact replacement flybacks for use in Emerson TV sets (see photo). HO-294 is a replacement for Emerson part numbers 738103 and 738109 in 32 chassis and 65 models. HO-295 replaces Emerson numbers 738106, 738107, and 738111 in 16 chassis and 71 models. HO-296 replaces Emerson 738119, 738122, 738128, 738129, and 738140 in 16 chassis and 31 models. (Bulletin 550.) Also, not



shown, two replacement flybacks for Hoffman sets are flyback HO-291 for Hoffman part 5118A in 65 models of 6 chassis, and Stancor HO-292 to replace Hoffman part numbers 5154A and 5154-3 in 49 models of six chassis. (Bulletin 549.) They require no chassis or circuit alterations. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill. (ELECTRONIC TECHNICIAN 1-10)

G-C AUTO RADIO CONTROLS

A new line of exact factory auto radio replacement controls has just been made available to the electronic parts replacement market. It was developed in response to requests from service technicians to secure original factory replacements, reports the company. 98 different controls are being offered, which

the first claims will service 199 different automobile makes and models. To make the service job easier, a handy replacement guide folder gives full replacement information such as part numbers, car makes, and list prices of each control. G-C Electronics Mfg. Co., (div. G-C Textron Inc.), 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 1-25)

Vocaline TRANSCEIVER

This 465 mc remote controlled Citizens Band transceiver is designed to eliminate the signal losses incurred when operating series JRC Citizens Band transceivers with a base station antenna. The CUB-1/MT-1 delivers the full power to the antenna because the antenna is built into the remote transceiver. The CUB-1 control unit (r) can be placed up to 500 feet from the MT-1

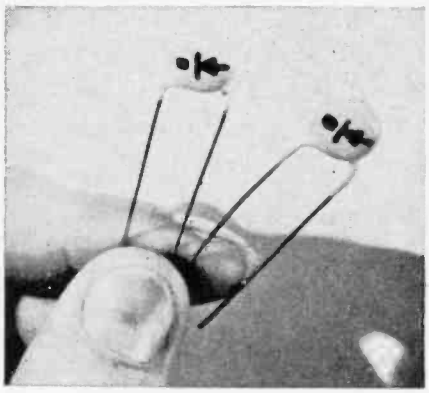
transceiver (1), allowing the transceiver to be mounted as high as possible for maximum performance. The weatherproof MT-1 remote transceiver is supplied with 100 feet of 6 conductor control cable. Up to 400 feet of cable may be added if required. Incorporates a variable squelch control. $179.50 complete. Vocaline Co. of America, Inc., Old Saybrook, Conn. (ELECTRONIC TECHNICIAN 1-22)

Centralab CONTROL →

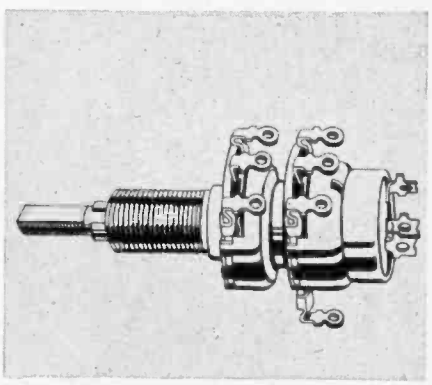
A new line of auto radio exact replacement controls covers all popular makes and models of auto radios in use today. Private label brands are included, as well as auto manufacturers' brands. In announcing the new line, it was stated, "Auto radio repair is a very lucrative field, in which many of our electronic technicians have not previously attempted to be active. With this new exact replacement control line, however, the technicians can go after more of this profitable business." Centralab, 900 E. Keefe Ave., Milwaukee 1, Wis. (ELECTRONIC TECHNICIAN 1-33)

Mallory SILICON RECTIFIERS

A new silicon rectifier gives service technicians a commercial unit with high quality at prices claimed to be substantially lower than comparable silicon rectifier types. Type TSR has a diffused junction and is designed for 85°C ambient temperature. PIV is 400 v.; 500 ma max. dc load; 0.5 v. forward drop; 0.2 ma reverse leakage. In addition, a plug in unit, Type PSR is a low cost unit

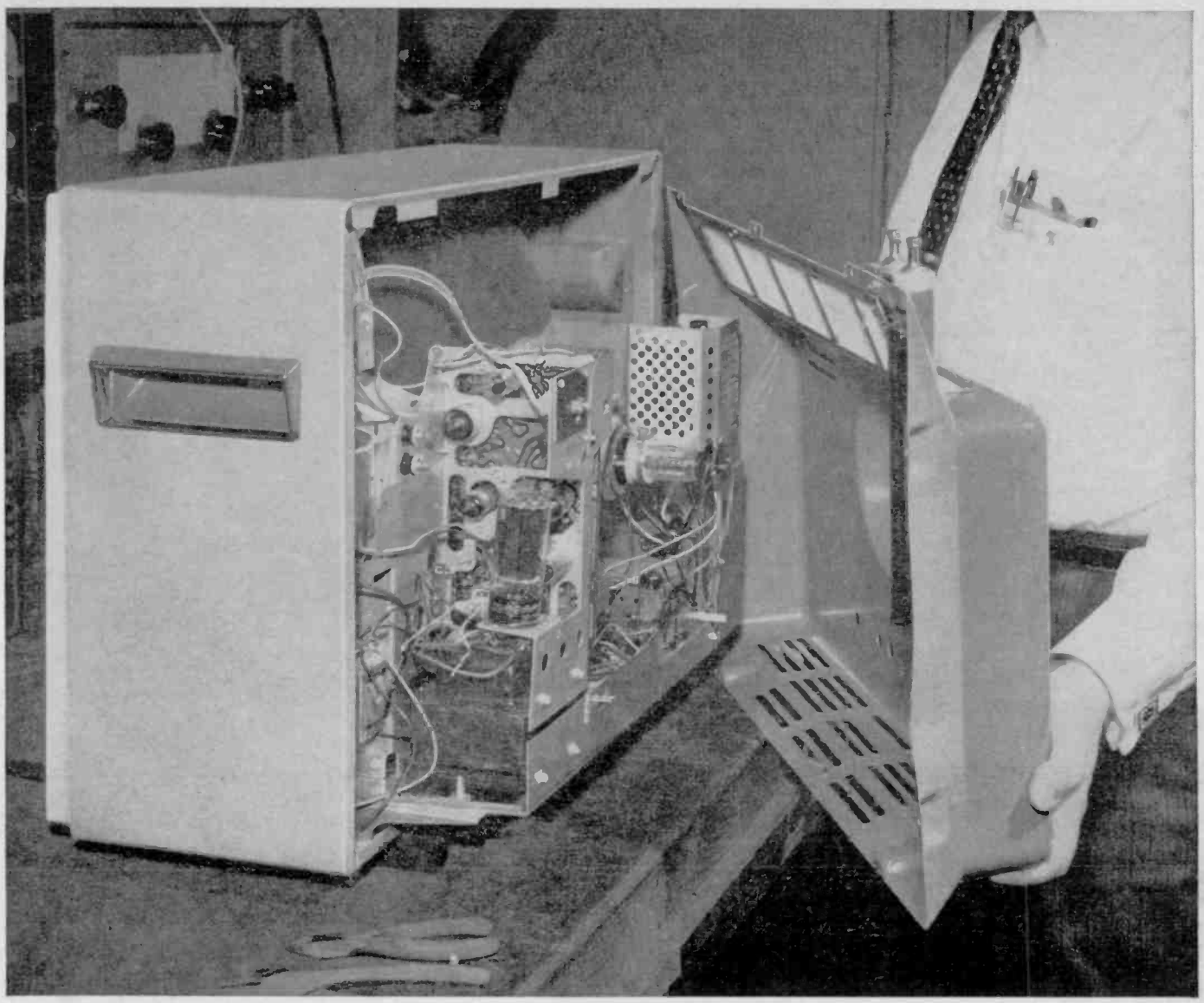


for sets already converted to silicon rectifiers; a top hat, Type ESR for severe industrial applications; and a stud, Type SSR, also for industrial and military applications. Convenient conversion kits for replacing selenium rectifiers in radio and TV are available in both Type TSR and PSR. P. R. Mallory & Co., 3029 E. Washington St., Indianapolis 6, Ind. (ELECTRONIC TECHNICIAN 1-34)



INDEX TO ADVERTISERS
January, 1959

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.



Take the back off the General Electric "Designer" TV set and you can **do 85%-90% of service jobs without pulling the chassis**

You cut your time-per-repair by up to 40% . . . make more calls—and money—in the same amount of time!

Take off the back and there you are—in easy reach of up to 90% of service jobs. Look at the chart!

Look inside! Both sides of the reliable printed circuit boards are easy to reach for service.

No series string filaments—no extension cables needed . . . the new "Designers" are certainly the easiest-to-service sets in all television. You'll wish *every* set was a General Electric "Designer."

Progress Is Our Most Important Product

GENERAL ELECTRIC

TEN TYPICAL JOBS THAT CAN BE DONE WITHOUT REMOVING THE CHASSIS

JOB	G-E "Designer"	Set A	Set B	Set C
Replace most resistors	yes	no	no	no
Replace most capacitors	yes	no	no	no
Replace deflection yoke	yes	no	no	no
Replace video detector	yes	yes	no	no
Replace audio detector	yes	no	no	yes
Replace horizontal phase detector	yes	no	yes	yes
Replace power rectifier	yes	no	no	yes
Adjust tuner oscillator	yes	no	yes	yes
Replace inter-stage transformers	yes	no	no	no
Replace size and linearity controls	yes	no	yes	yes

General Electric Co., Television Receiver Dept., Syracuse, N.Y.

January • 1959

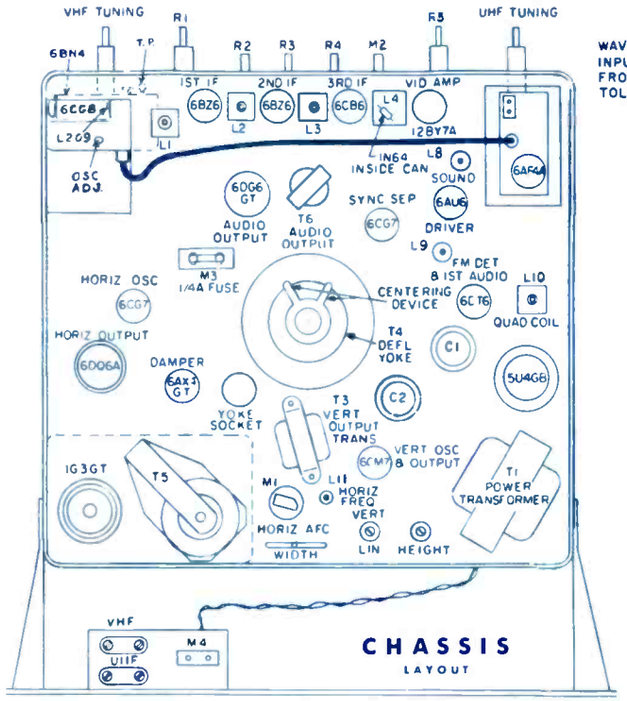
ELECTRONIC TECHNICIAN 466 CIRCUIT DIGEST

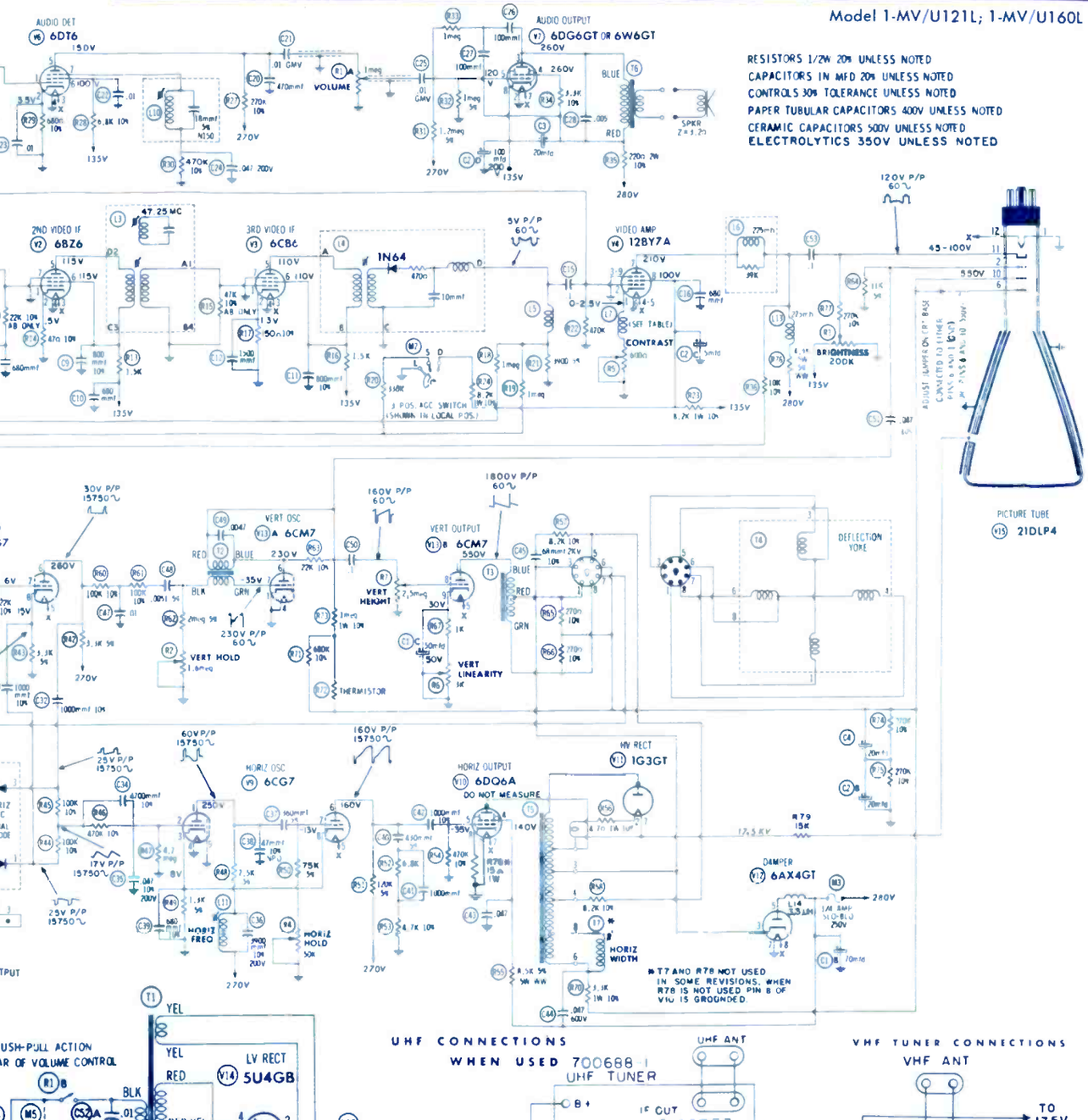
MAGNAVOX
Chassis 28 Series

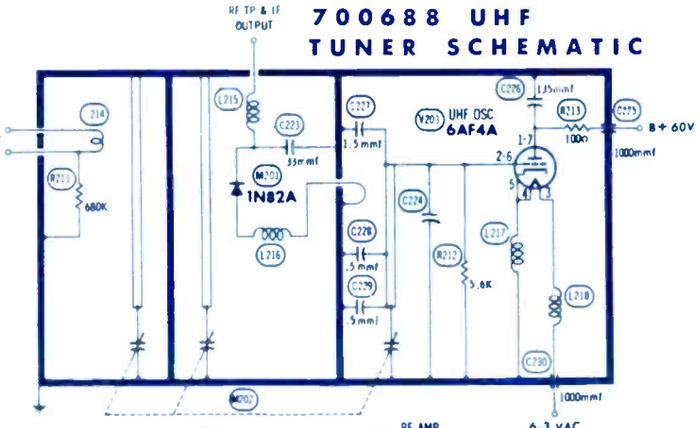
Model 1-MV/U121L; 1-MV/U160L

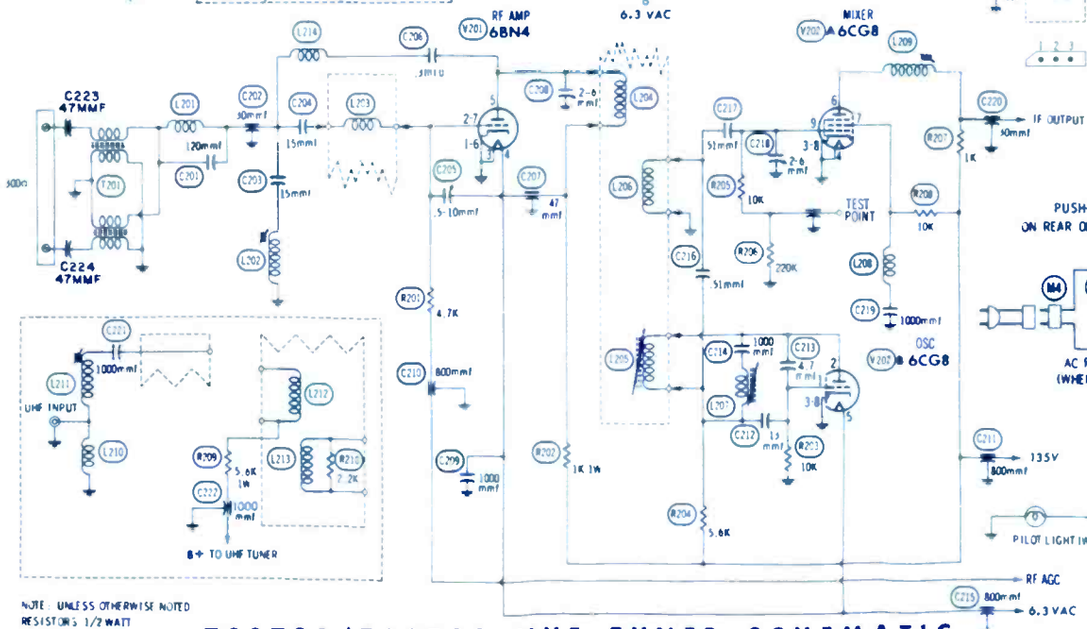
WAVEFORMS & P/P VOLTAGES MEASURED WITH AVERAGE SIGNAL INPUT, CONTRAST CONTROL AT MAX.; D.C. VOLTAGES MEASURED FROM CHASSIS GROUND WITH V.T.V.M. LINE VOLTAGE 117V. TOLERANCE OF ± 20% NORMAL ON ALL READINGS.

RESISTORS 1/2W 20% UNLESS NOTED
CAPACITORS IN MFD 20% UNLESS NOTED
CONTROLS 30% TOLERANCE UNLESS NOTED
PAPER TUBULAR CAPACITORS 400V UNLESS NOTED
CERAMIC CAPACITORS 500V UNLESS NOTED
ELECTROLYTICS 350V UNLESS NOTED

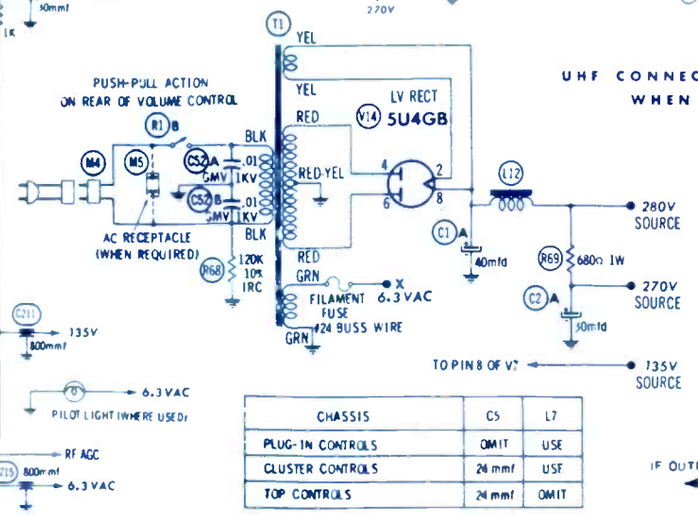






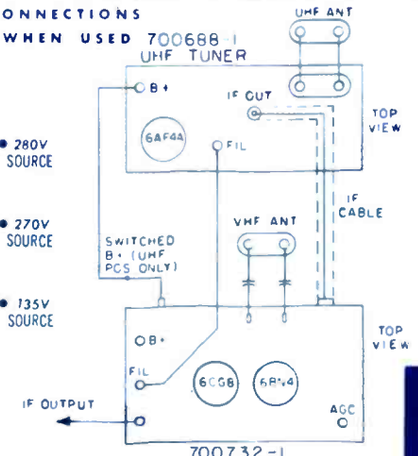


700731/700732 VHF TUNER SCHEMATIC

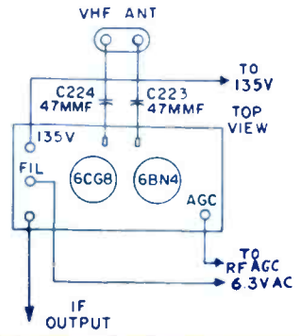


CHASSIS	C5	L7
PLUG-IN CONTROLS	OMIT	USE
CLUSTER CONTROLS	24 mmf	USE
TOP CONTROLS	24 mmf	OMIT

UHF CONNECTIONS WHEN USED 700688-1 UHF TUNER



VHF TUNER CONNECTIONS



An Editorial Service of ELECTRONIC TECHNICIAN, INC. ☆ 480 Lexington Ave., New York 17, N.Y.

Electronic Technician CIRCUIT DIGEST 466

ELECTRONIC TECHNICIAN CIRCUIT DIGEST 467

ADMIRAL Chassis 14YP3D

Model T170, T171, T172AL, T173AL, T1710

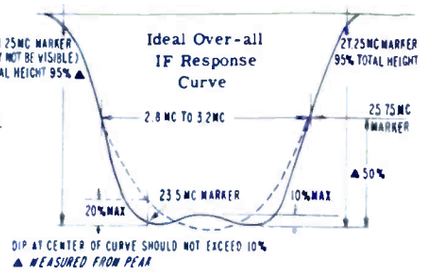
RUN CHANGES

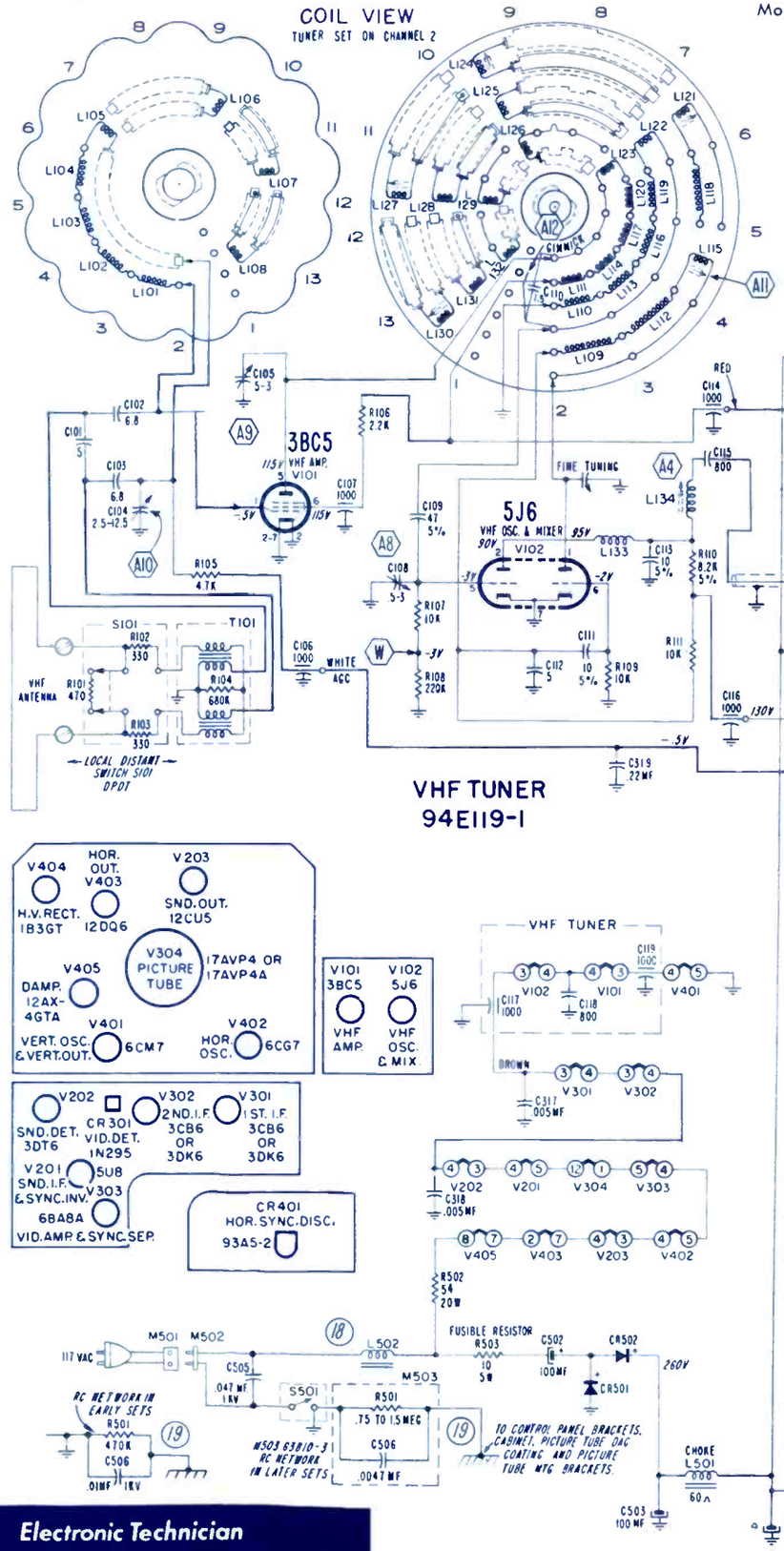
(16) For improved sync, C429, C430, R444, and R445 were added, R419 changed from 47K to 27K, R420 changed from 330K to 150K, R421 changed from 3300 to 1500, R423 changed from 6.8K to 3.3K, R424 changed from 3300 to 1500, R422 was removed. Printed circuit boards A5290 and A5291-8 used in Run 15 sets.

(17) No changes made.

(18) To conform with FCC regulations for reduction of horizontal sweep frequency radiation, C501 was omitted, C505 and L502 were added.

(19) Coupling M503 used for RC network R501 & C506. C427 rating changed from 1.6 to 2kv for improved safety factor.





Electronic Technician CIRCUIT DIGEST 467

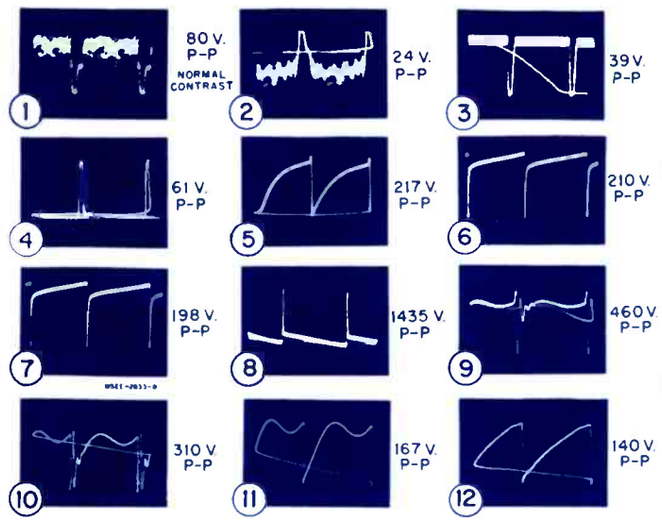
January • 1959

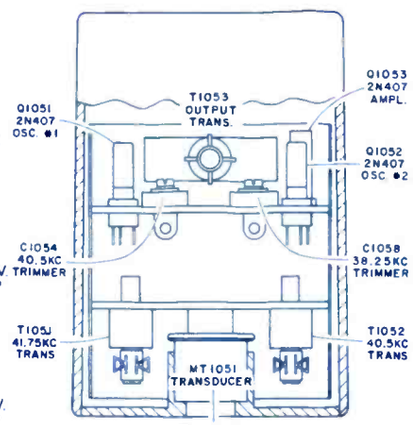
An Editorial Service of ELECTRONIC TECHNICIAN, INC. ☆ 480 Lexington Ave., New York 17, N.Y.

January • 1959

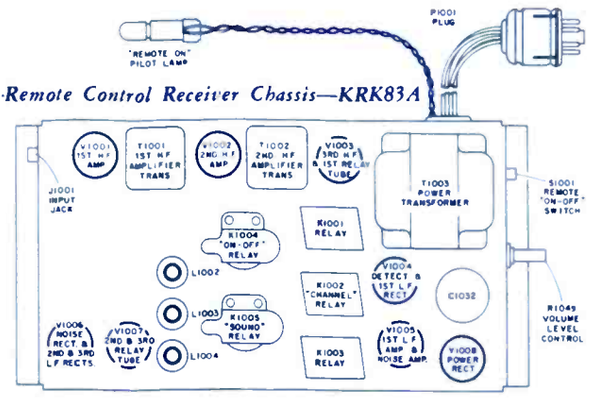
ELECTRONIC TECHNICIAN CIRCUIT DIGEST 468

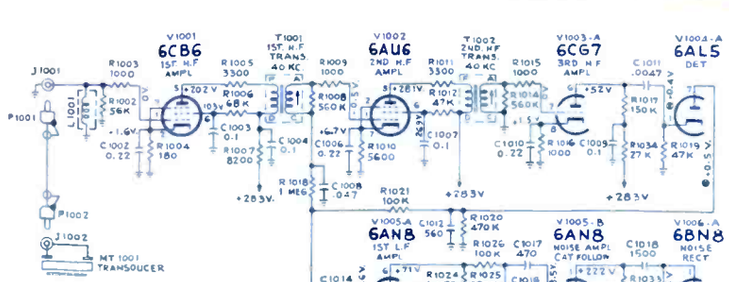
RCA TV
Chassis KCS121K, L, M, N

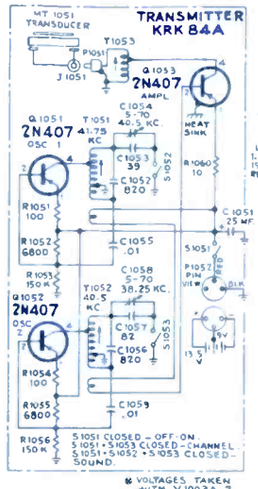


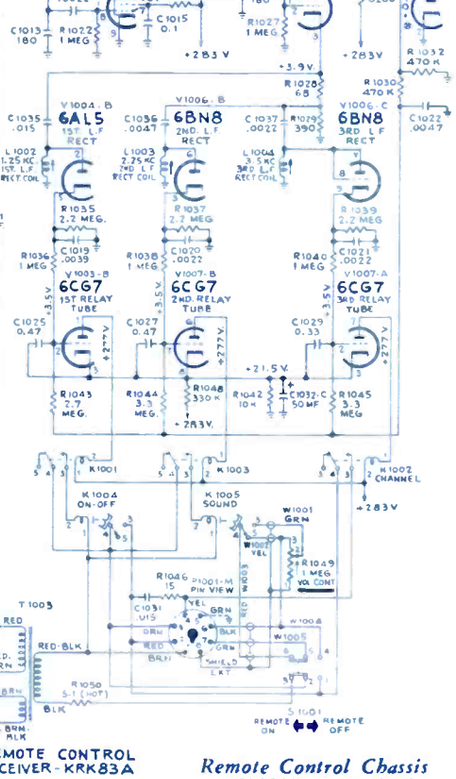


-Remote Control Transmitter Chassis—KRK84A

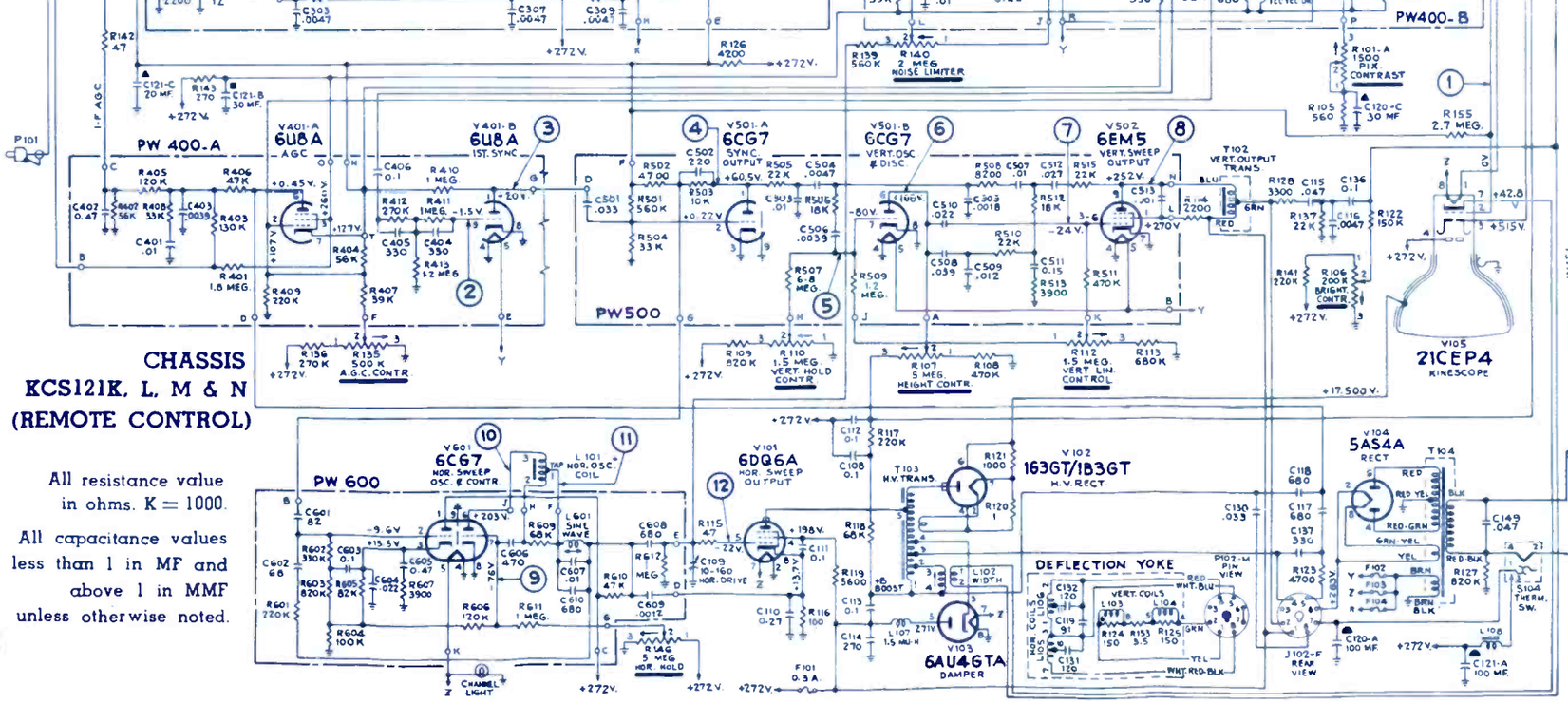








Remote Control Chassis KCS121K, L, M & N



Balloons ① ② etc., indicate points of observation of the waveforms shown

CHASSIS KCS121K, L, M & N (REMOTE CONTROL)

All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

*Measured with 1 megohm, ½ watt resistor in series with meter probe.

An Editorial Service of ELECTRONIC TECHNICIAN, INC. ☆ 480 Lexington Ave., New York 17, N.Y.

More Data on Reverse Side

Model 21-RD-9675-6, 21-RD-9677, 21-RD-9675U-6U, 21-RD-9877U, 21-RD-9690, 21-RD-9699, 21-RD-9690U, 21-RD-9699U

Electronic Technician CIRCUIT DIGEST 468

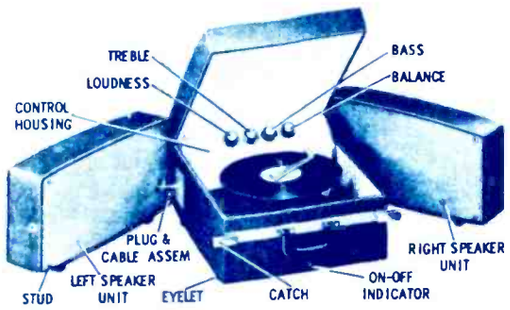
ELECTRONIC TECHNICIAN CIRCUIT DIGEST 469

January • 1959

MOTOROLA STEREO PHONOGRAPH

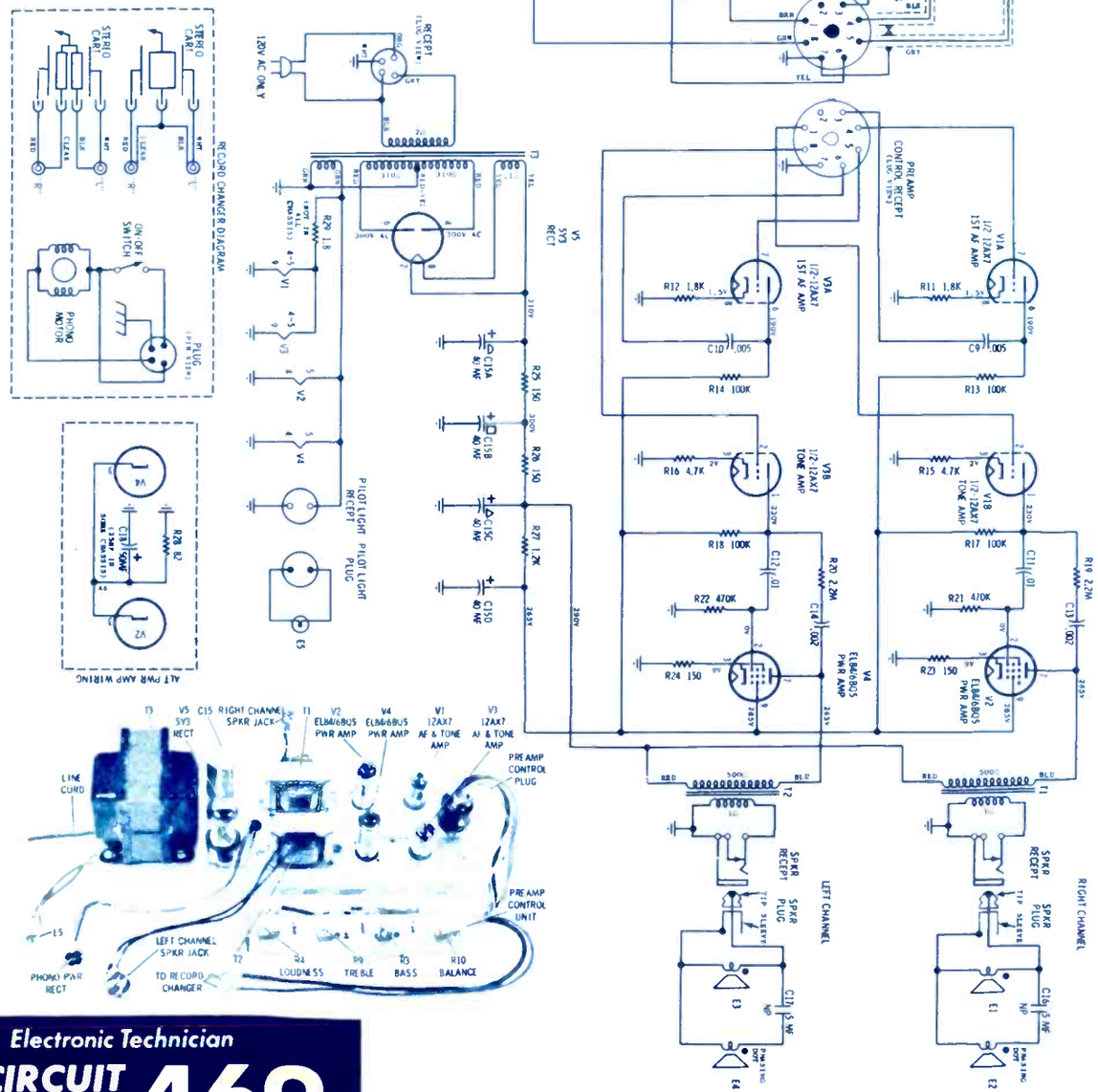
Chassis HS704

Model SH12E, SH12N, SH12S



NOTES:

CAPACITORS - Decimal values in MF, all others in MMF unless otherwise specified.
VOLTAGES - Measured from point indicated to chassis with a VTVM, ±10%. No signal in. Preamp connected.



RCA TV

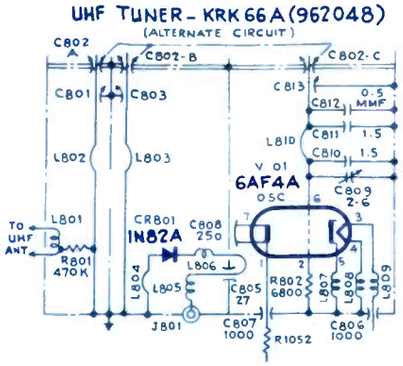
Chassis KCS121K, L, M, N

Electronic Technician

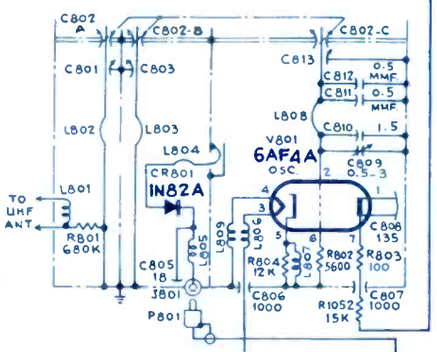
CIRCUIT DIGEST 468

UHF TUNER - KRK66A (962048)

(ALTERNATE CIRCUIT)

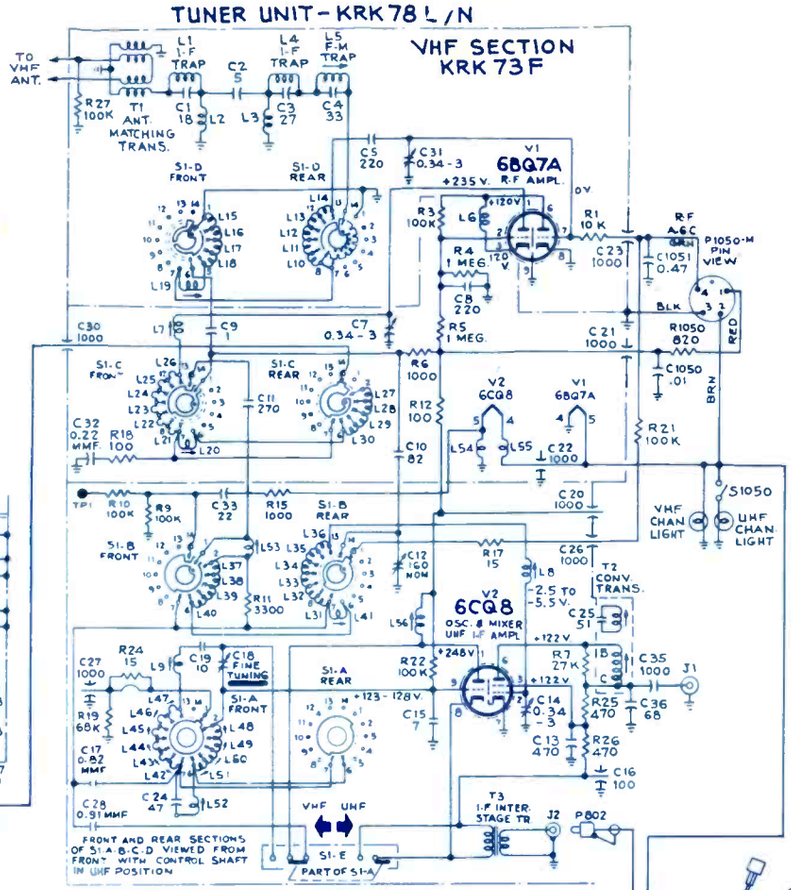


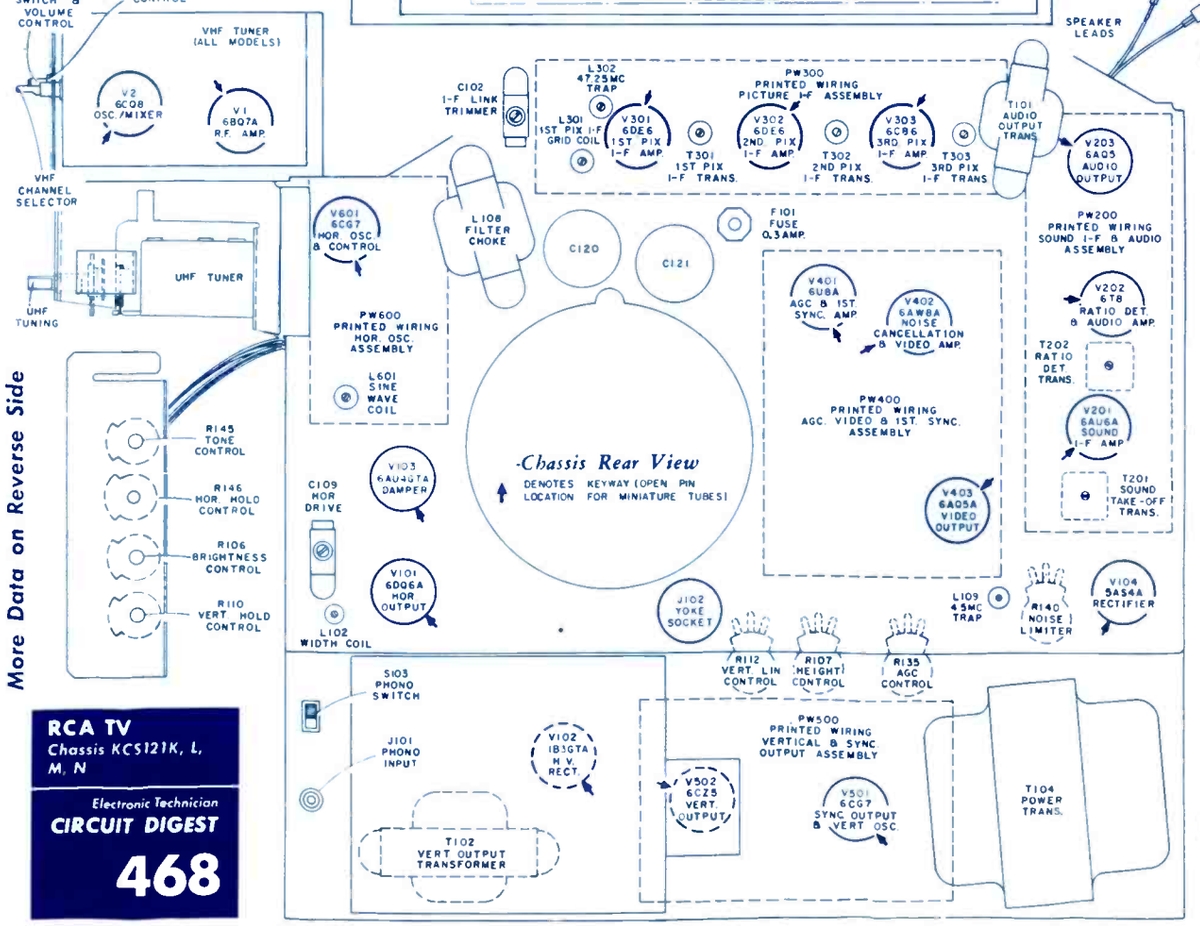
UHF TUNER - KRK66A (962047)



TUNER UNIT - KRK78 L/N

VHF SECTION KRK 73F





More Data on Reverse Side

RCA TV

Chassis KCS121K, L, M, N

Electronic Technician

CIRCUIT DIGEST 468

An Editorial Service of ELECTRONIC TECHNICIAN, INC. ☆ 480 Lexington Ave., New York 17, N.Y.

Electronic Technician

CIRCUIT DIGEST 469

ELECTRONIC TECHNICIAN CIRCUIT DIGEST 470

DOMINION ELECTROHOME (Canada)
TV Model Viscount, Viscount MK1, Viceroy, Viceroy MK1

V204 5AM8 · V203 3BZ6 · V202 3BZ6 · L401 · C401 2 x 1K · C402 1K · C403 1K
V205 12BY7A · V301 6CG7 · V302 12DT5 · V401 6CG7 · V402 12DQ6A · V404 12AX4GT
V104 3DT6 · V103 5U8 · V206 21CEP4A · V105 5AQ5 · V102 5X8 · V101 4BZ7
C404 10K 1.5KV · R401 25Ω 20W · INTERLOCK 117 V AC. · F401 SLO BLO 1¼ AMP · SW401
R403 6.8Ω 10W · E401 E 140 150V · C407 .1 600V
C405 10K 15KV · R402 270K · C406 1K 1.5KV · ISOLATED BRACKET

IN 60 CYCLE CHASSIS
B++ 250V · B+ 135V · R404 2800 10W · X401 · X402 · L402 · C408 1K
E402A E125 300V · E402B E125 300V · E402C E60 300V

IN 25 CYCLE CHASSIS
E404 E8 80V · R404 2800 10W · L403 · C408 1K
E403 E250 300V · E402A E125 300V · E402B E125 300V · E402C E60 300V
E401 E250 150V

L101 4.5 MC SOUND TAKE OFF COIL · C56 · C103 47 · R102 100K
V103A ½ 5U8 SOUND I.F. LIMITER 125V · C104 2 x 5K · R103 12K · R104 22K · R105 1K
T101 4.5 MC SOUND I.F. TRANS. · C15 · C15
V104 3DT6 SOUND DET. 175V · 114V. · 5V.
L102 4.5 MC SOUND QUAD. COIL · C107 18 N.P.O. · R108 100K · R110 1M · 4V.
C105 1K · R106 820 · C106 .047 200 · R107 560K · C106 5K · R109 4.7K · B+ BOOST
C110 10K · R109 1K 10% VOLUME CONTROL · E101A 40 350V
V105 5AQ5 AUDIO OUT. 210V. · 230V. · 114V. · R111 500K · R112 2W 330
T102 AUDIO OUT TRANS. · C111 4.7K 20% · E101B 20 300V · R113 470 2W
BLUE · RED · B++

V1 4BZ7 · V2 5X8 · FILAMENT CIRCUIT
V101 4BZ7 R.F. AMP · V102 5X8 OSC. MIX. · Z101 · L103 45 MC · IF OUT
V.H.F. ANT. · AGC · FIL. · B+ · B++ · R101 1K 1W · 230 V.
C202 18 5% · L201 · 43 MC · R226 7350 5% · C201 .47 200
V202 3BZ6 1ST VIDEO I.F. · T201 · 45.1 MC. · R208 51K 5% · R203 24K 5% · R204 56 5%
C205 1K · R205 470 · C204 330 10% · R206 150K · C206 1K · R207 150K · C208 1K
V203 3BZ6 2ND VIDEO I.F. · T202 · 45.1 MC. · R211 24K 5% · R209 27 5% · C207 820 10% · R210 470
L202 · 47.25 MC · 56 5% · C203 1K · R202 1K · R201 2.5M RANGE CONTROL · TO R421
V204 5AM8 3RD VIDEO I.F. · T203 · 44.2 MC. · VIDEO DET. · 5.5V. · 6V.
C209 1K 10% · R212 180 · R213 1.5K · C210 470 10% · C221 10K
AGC TEST POINT · R214 1M · C212 5K · C211 .22 200 · R215 270K
TEST POINT DIODE LOAD · R217 3.9K 5% · R218 1M · C216 68 · R219 47 · R220 500 CONTRAST
V205 12BY7A VID. AMP · C215 200 · 3.9 · 2V. · 145V.
C217 3.5T.025 · L206 4.5 MC TRAP · C218 27 N80 · R221 10K · L207 340 WHT.-RED
L203 YLO · L204 60 GREEN-BLACK · C213 5 · C214 5
L208 WHITE-YELLOW 340 · C219 400 · L208 340 WHITE-YELLOW · R222 3.9K 7W 10% · R223 220K · R224 300K BRIGHTNESS
TO R301 · TO R327 · 64V · YLO · V206 21CEP4A · ORANGE · B+++ · GR GROUND · GREEN · RED
112 V. · 30 ∿ · 6V. · 30 ∿

V302 12DT5 VERT. OUT. · 30 ∿ · 825V · 44V · 18V. · 30 ∿
T301 VERT. BLUE OUT. TRANS. · C309 .047 400 OIL FILLED · C311 01 600 OIL FILLED · R321 47K 1W
C313 4.7K 20% · R325 56K · C314 .022 600 · R324 2.7K · C315 0.1 400V · YLO
R329 18K · R320 56K · C308 .022 10% 600 OIL FILLED · C310 01 400 · C312 .01 200
TOP (SHAPING SOME MODELS ONLY) · R322 470K · R327 4.7M · TO R224
R325 2.5M VERT. LIN · R324 680K · R328 150K · B+++ · B++
V103B ½ 6CG7 SYNC. SPLIT · 90V. · 30 ∿ · 88V · 30 ∿ · V103 B ½ 5U8 SYNC. SEP.
TO R222 · R301 15K · R303 3.3K · R308 10K 2W · R310 22K · C306 2K · C306 10K
C301 .0022 400 · R303 330K · C302 270 · C303 24 · R302 1.5M · R304 47K · R305 47 · R306 1M
C304 .047 400 · 59V. · -40V. · 20V. · 118V. · 22V. · R307 2.2K
V301A ½ 6CG7 VERT. OSC. · R318 47K · 6.28V. · -70V. · R317 1M · R314 1.5M · R35 470K
R330 680K · C307 .0015 400 · R312 3.3M · R311 1M VERT. HOLD · R316 300K VERT. SIZE
24V. · 7875 ∿ · 42V. · 30 ∿ · 22V. · 7875 ∿

V401 6CG7 HOR. MULTIVIBRATOR · R414 27K 1W · C416 .1 400 · L404 STABILIZING COIL
C414 5M 4700 10% · R417 56K 1W · R413 8.2K 1W 5% · C412 47K 20% · C418 47K 20%
HOR. PHASE DET. SELENIUM DIODE · C410 1K 10% · R408 100K .5% · X405 · R403 100K .5% · R411 470K · R410 4.7M
C409 1K 10% · C413 .047 400V · C415 5M 330 · R416 270K · R412 1.2K 5% · R416 50K HOR. HOLD · C417 5M 330 · R418 4.7K
R405 27K · R406 15K 1W · R407 18K 1W · C411 4.7K ± 10% · 16.5V · 7875 ∿
8V. · 7875 ∿ · 175 V. · 7875 ∿ · TO R201 · R421 6.8M · R419 1M
V402 12DQ6A HOR. OUT. · R420 100 · R422 100 · R423 6.2K 2W 5% · C419 .1 400
T401 HORIZ. OUT. TRANS. · V403 1G3GT H.V. RECT. · R425 2.7K
C420 140 8KV · 1.5 MH · V404 12AX4GTA DAMPER · C421 .1 600 · C422 .047 400
R424 47K 1W · R426 56K · C428 .1 600 · 650 V. · B+++ 575V
BLACK · PURPLE BOOST · BLUE · YELLOW · RED · GREEN · BROWN · L301
THERMISTOR · 220 · 220

V302 HOR. STAB. COIL · V402 HOR. OUT. · V105 5AQ5 AUD. OUT. · V404 DAMPER
V401 6CG7 HOR. MULTI-VIBRATOR · V403 H.V. RECT. 1G3GT
V202 3BZ6 1ST VID. I.F. · V203 3BZ6 2ND VID. I.F. · V204 3RD VID. I.F. & VID. DET. 12BY7A · V205 VID. AMP.
V206 21CEP4A PIX TUBE · V104 3DT6 SND. DET. · V103 5U8 SND. I.F. LIM. & SYNC. SEP.
V301 6CG7 SND. I.F. LIM. & SYNC. SEP. · SYNC. SPLIT. & VERT. OSC.
SILICON RECTS. · HOR. A.F.C. DETECTOR · SLOW BLOW FUSE
V101 4BZ7 R.F. AMP · V102 5X8 OSC. MIX.

NOTE: ALL VOLTAGES AND WAVEFORMS ARE MEASURED AT 117 VOLTS LINE, NORMAL SIGNAL, VOLUME CONTROL ZERO, MAXIMUM BRIGHTNESS AND CONTRAST, OTHERS NORMAL
PROBES USED ARE LOW INPUT CAPACITANCE AND 10 MEG OHM INPUT RESISTANCE.
SCOPE SWEEP FREQUENCIES ARE DENOTED UNDER WAVE FORMS. ALL RESISTORS 10% UNLESS OTHERWISE SPECIFIED.

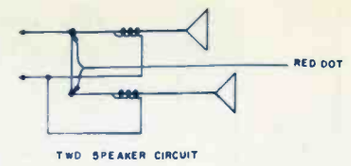
An Editorial Service of ELECTRONIC TECHNICIAN, INC. ■ 480 Lexington Ave., New York 17, N.Y.

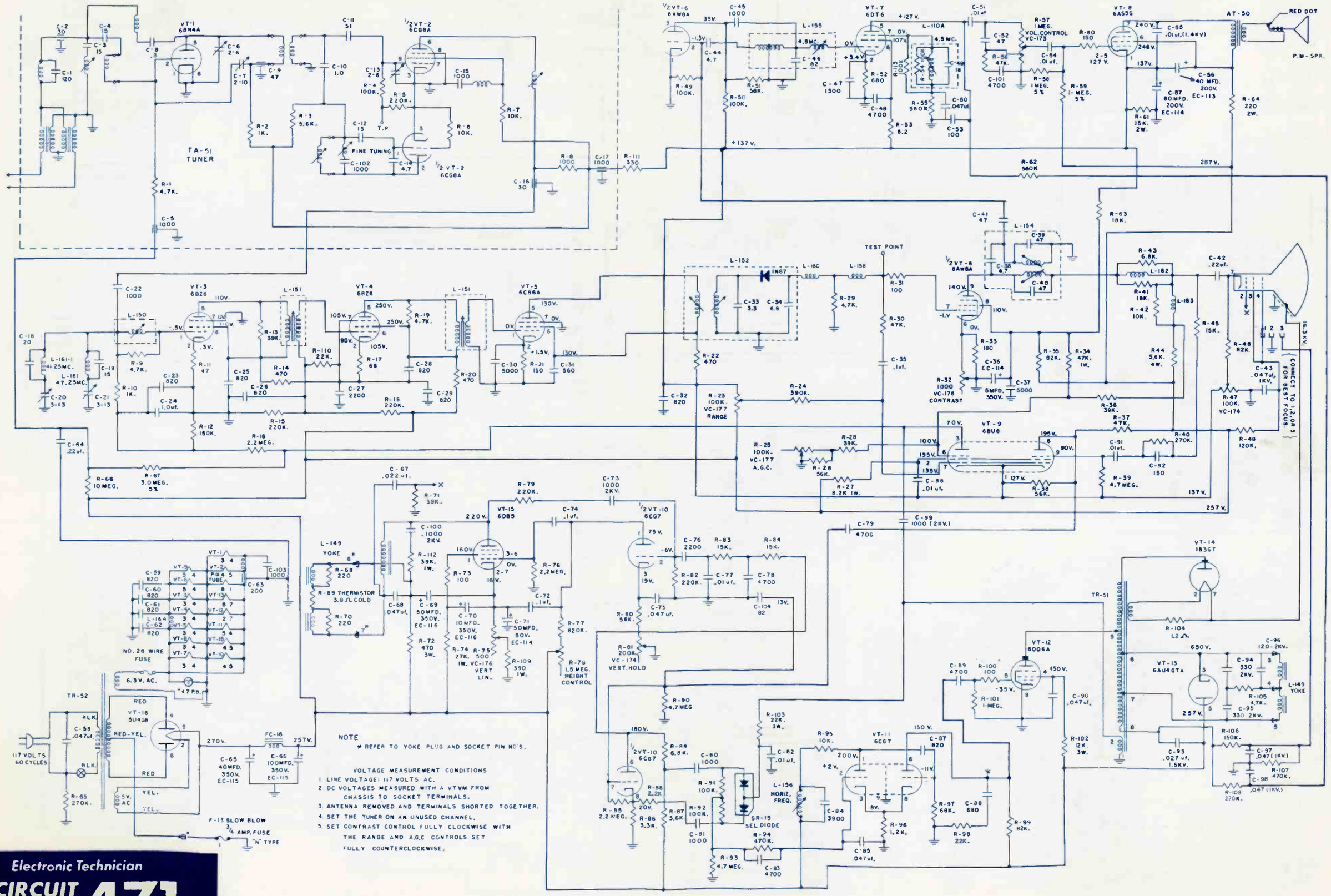
Electronic Technician CIRCUIT DIGEST 470

ELECTRONIC TECHNICIAN CIRCUIT DIGEST 471

TRAVLER
Chassis 1051-19

January • 1959





NOTE

* REFER TO YOKE PLUG AND SOCKET PIN NO'S.

VOLTAGE MEASUREMENT CONDITIONS

1. LINE VOLTAGE: 117 VOLTS AC.
2. DC VOLTAGES MEASURED WITH A VTVM FROM CHASSIS TO SOCKET TERMINALS.
3. ANTENNA REMOVED AND TERMINALS SHORTED TOGETHER.
4. SET THE TUNER ON AN UNUSED CHANNEL.
5. SET CONTRAST CONTROL FULLY CLOCKWISE WITH THE RANGE AND A.G.C. CONTROLS SET FULLY COUNTERCLOCKWISE.

Electronic Technician
CIRCUIT DIGEST 471

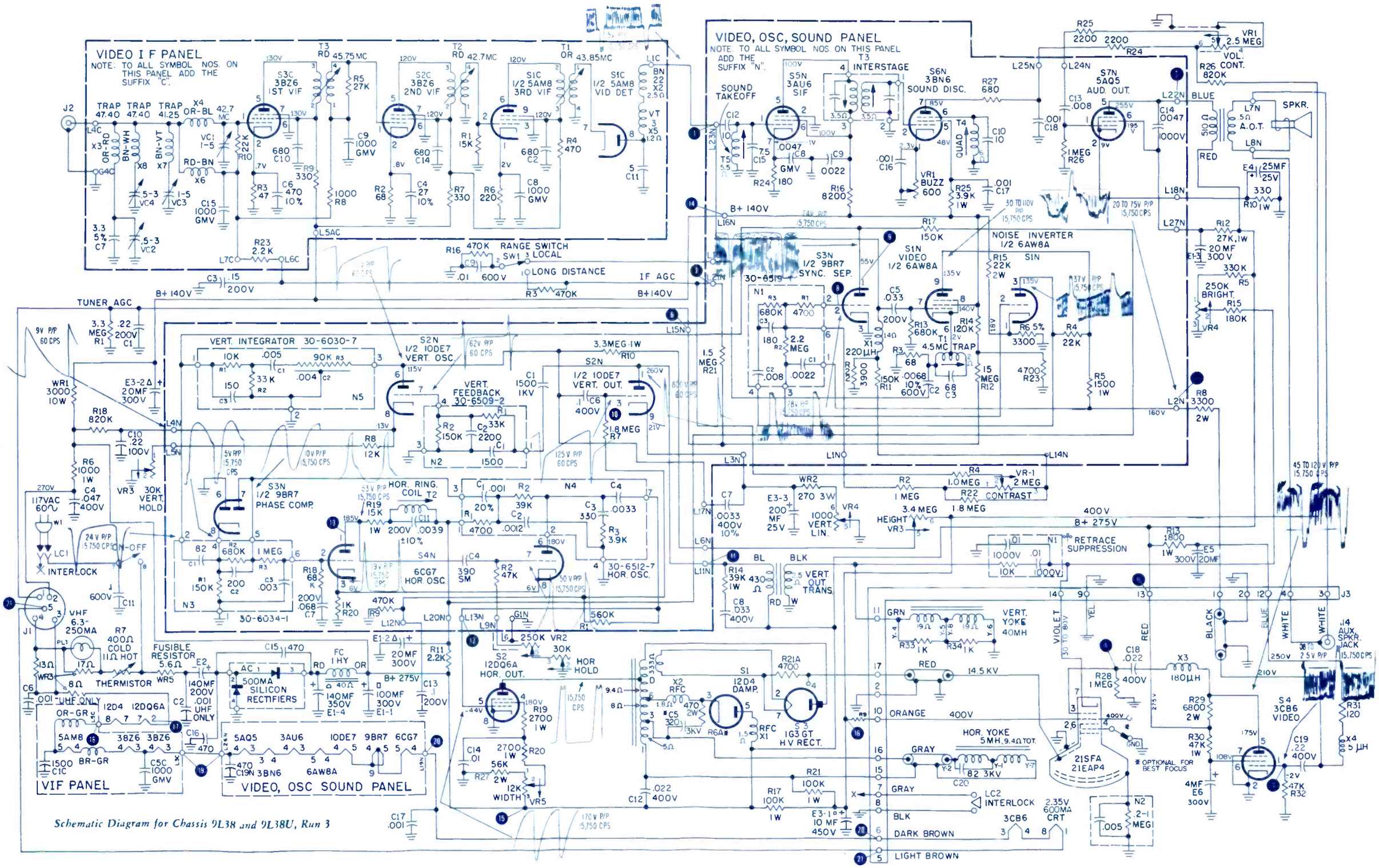
An Editorial Service of ELECTRONIC TECHNICIAN, INC. ☆ 480 Lexington Ave., New York 17, N.Y.

NOTES: All capacitor values greater than 1 are in MMF unless otherwise noted.
All capacitor values less than 1 are in MFD unless otherwise noted.
All resistors are ½ watt, 10%, carbon unless otherwise noted.

January • 1959

ELECTRONIC TECHNICIAN CIRCUIT DIGEST 472

PHILCO
Chassis 9L38, 9L38U



Schematic Diagram for Chassis 9L38 and 9L38U, Run 3

Arrow through control indicates clockwise rotation.
Voltages are DC from point shown to chassis unless otherwise noted.
Voltages were read using a V.T.V.M. Voltages were taken with no signal.

The receiver was adjusted for a good quality picture; i.e., normal contrast, brightness, width, height, vertical lin. and sound, picture in sync, then removed signal.

Coil resistances read with coil in circuit.
• Indicates a coil resistance of less than 1 ohm.
* Run 2 change
† Run 3 change

More Data on Reverse Side

An Editorial Service of ELECTRONIC TECHNICIAN, INC. • 480 Lexington Ave., New York 17, N.Y.

Electronic Technician CIRCUIT DIGEST 472

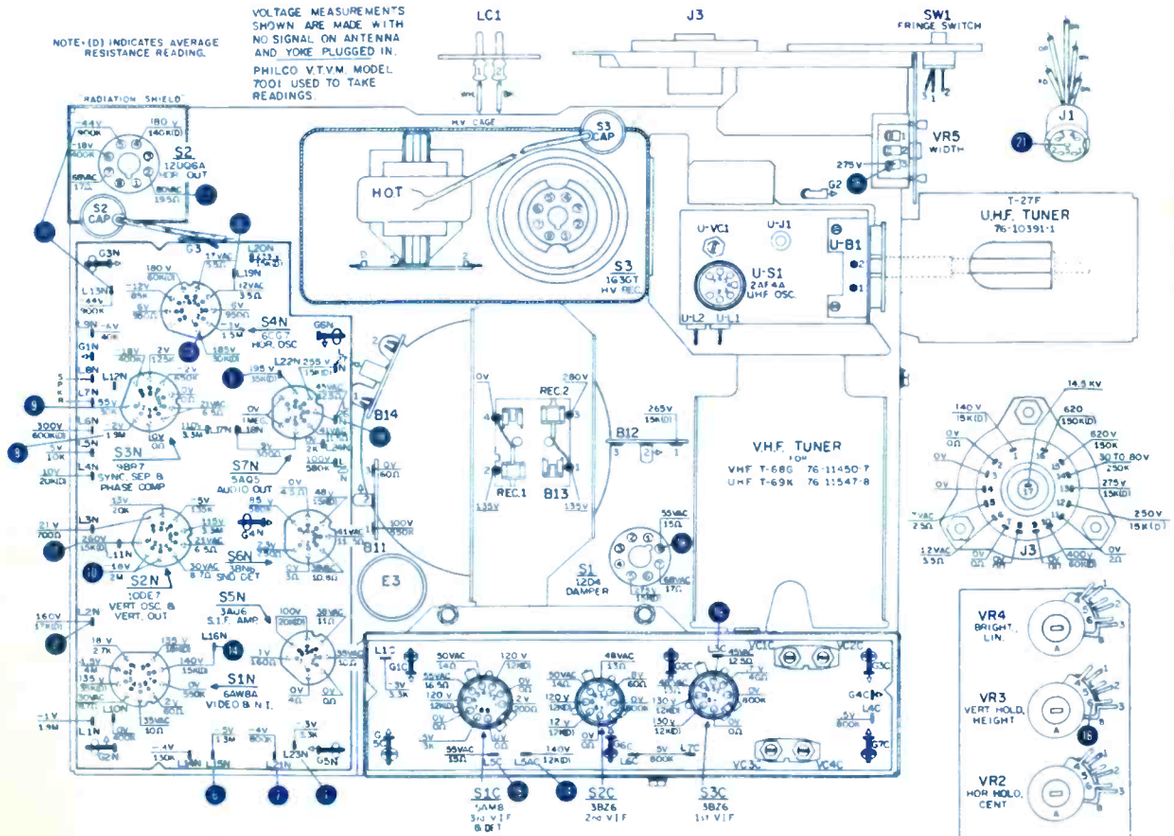
January • 1959

ELECTRONIC TECHNICIAN Trademark

CIRCUIT DIGESTS

77

In This Issue (No. 77)



9L38 Voltage-Resistance Readings—Top View

VARIABLE RESISTOR SETTINGS

VOLUME	FULL C.C.W.
CONTRAST, BRIGHT	FULL C.W.
WIDTH, VERT. LIN, HEIGHT, BUZZ POT	½ C.W.
VERT. HOLD, HOR. HOLD	NORMAL SETTING FOR PIC. IN SYNC.
FRINGE SW.	NORMAL

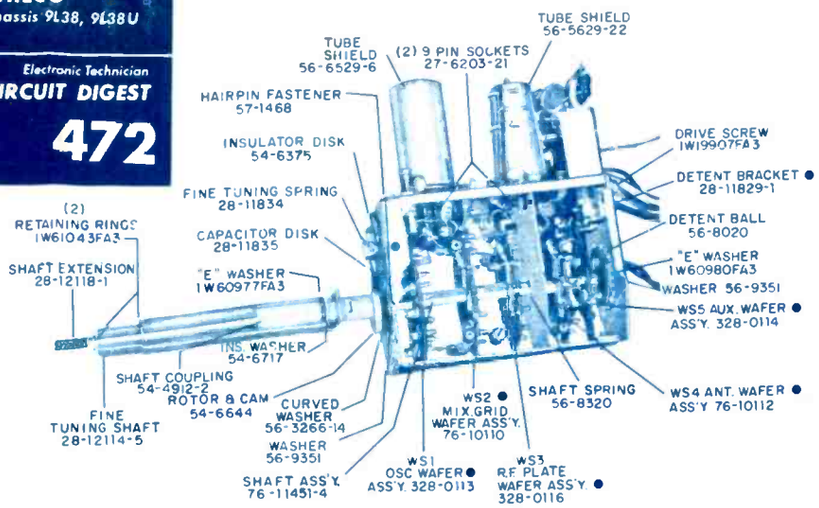
PHILCO
Chassis 9L38, 9L38U

Electronic Technician
CIRCUIT DIGEST
472

More Data on Reverse Side

PHILCO
Chassis 9L38, 9L38U

Electronic Technician
CIRCUIT DIGEST
472



9L38 and 9L38U Chassis — Main Chassis

Run 2—

A two lug wiring panel, B4A, was added next to and parallel to E5 on the chassis bottom. C5 was moved to wire from B2-9 to B4A-2. The value of C5 was changed from 240 mmf, 5KV, ceramic disk to 320 mmf, 5KV, ceramic disk, part number 30-1246-24. A resistor, R6A, was added from B4A-2 to S1-3. R6A is 470 ohms, 2 watts, part number 66-1476340. To reduce horizontal ringing.

Run 4—

Pilot lamp socket and cable assy. and tuner power socket and cable assy. lead lengths changed to improve cable dress.

Two .01 ufd tubular condensers and a 10,000 ohm resistor removed and a resistor-condenser network, N1, added in their place for retrace suppression. Part number of N1 is 30-6057-1. N1 wires to B6-3, B6-2 and B4-1. At this time R15 changed wiring points from B4-5 and B4-6 to B4-6 to B8-2. The blue lead from J4-14 changed from B4-5 to B8-2. To improve wiring and to use retrace suppression network.

Horizontal output transformer changed to 32-8881-1 to reduce ringing and lower operating temperature. This transformer is not interchangeable with the original 32-8877-1.

Run 6—

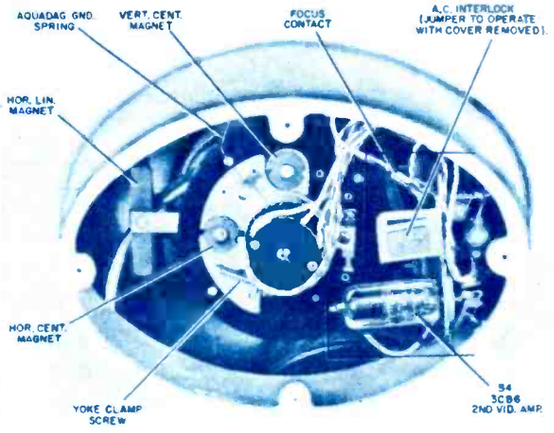
R11, the 2200 ohm hor. osc. de-coupling resistor, is removed from E1-1 and E1-2. C4, .047 ufd tuner B+ de-coupling condenser, is removed from B2-2 and B2-5. An orange lead is added between E1-2 and B2-5. This makes E1-2 the de-coupling filter condenser for tuner B+ and hor. osc. B+.

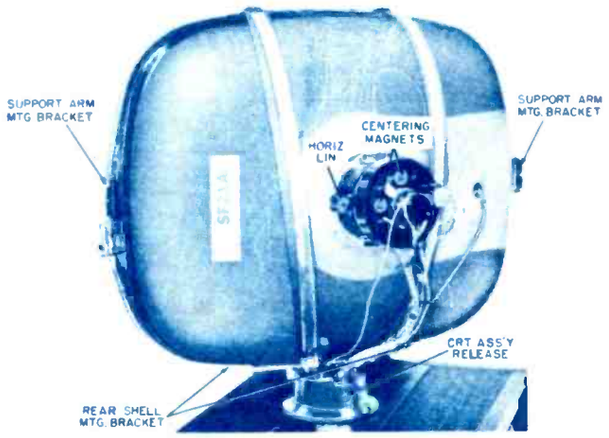
Run 5—

Horizontal output transformer changed to 32-8881-2. The 470 ohm, 2 watt resistor, R6A, added in Run 2 is removed. C5 changed to 240 mmf, 5kv, ceramic disk, part number 30-1246-23. The two lug wiring panel B4A is removed. To reduce horizontal ringing.

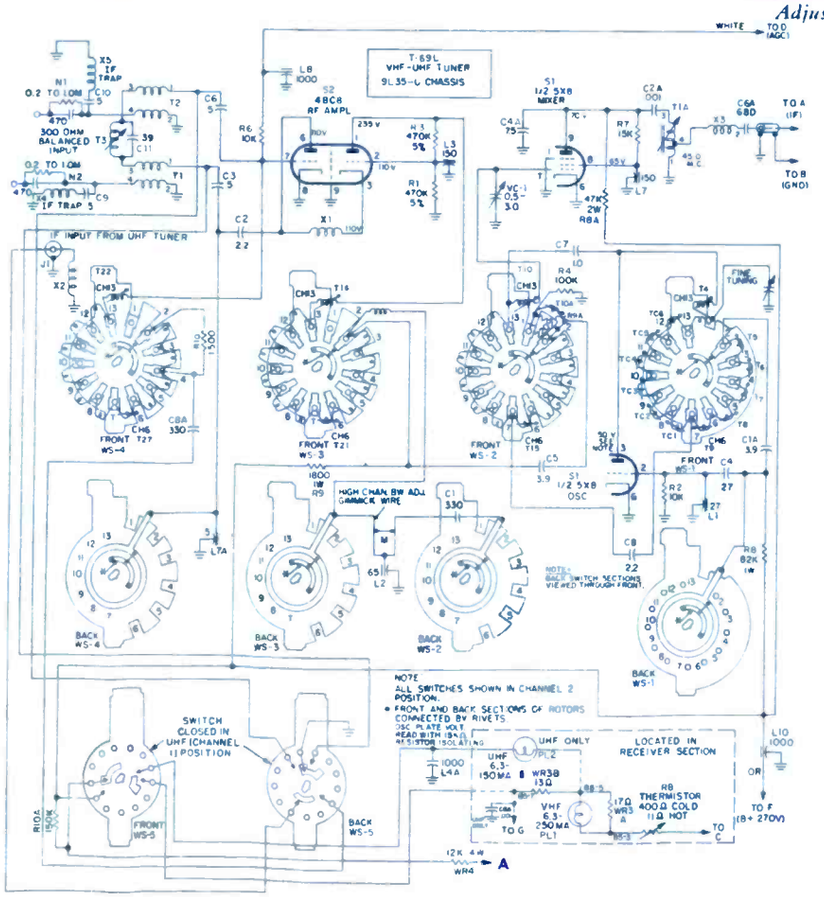
Run 6—

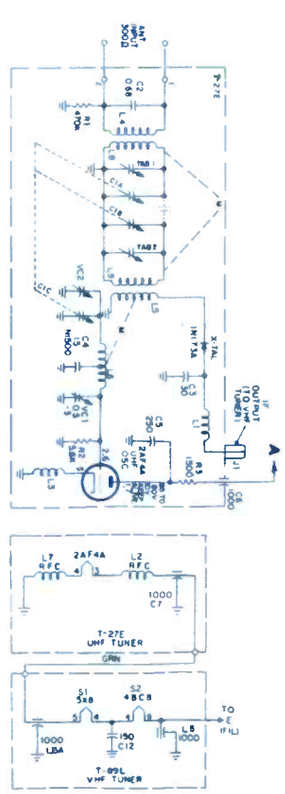
VR1, contrast/vol./on-off control changed to 33-9592-42. This changes the contrast section from 2 megohms to 1 megohm and removes R22 from across the contrast control.





Adjustment Access Cover Removed





DID YOU SAY $11.95 PUTS ME IN BUSINESS?

Yes, $11.95 Puts You in the BOOMING EXACT REPLACEMENT PORTABLE ANTENNA BUSINESS!

You bet. Only $11.95 earns you a king-sized share of today's 4 million dollar portable TV antenna replacement market. That's the amazingly low price for the new JFD Exact Replacement Portable TV Antenna Merchandising Kit that sets you up overnight in this thriving new business.

Look at what you get:

5 top-selling Exact Replacement antennas that cover 85% of portable TV's in use . . . the 1959 JFD edition listing every portable TV set by make, model, and antenna . . . a traffic-stopping window streamer . . . and a comprehensive portable antenna business building plan.

As a Portable TV Antenna Service Specialist, you can forget about competition with drug stores, auto accessory stores and the like, too. *You* make a handy profit on *every* sale.

Makes sense, doesn't it, to stop at your JFD distributor today for your Exact Replacement Portable TV Antenna Merchandising Kit?

JFD Exact Replacement Portable TV Antenna Merchandising Kit

No. PA500 Contents: **$11.95 Dealers Net**

No.	JFD Antenna Model	Exact Replacements for	List
1	TA154	Admiral-Westinghouse	$10.95
1	TA155	Zenith-Admiral	11.50
1	TA359	RCA, Motorola, Magnavox	12.95
1	TA360	GE, Hotpoint, Westinghouse	11.75
1	TA442	Emerson, GE, Olympic	10.95
		Total List	$58.10

1 1959 *catalog* of all Portable TV Sets by brand, model and JFD Exact Replacement Indoor Antenna.

1 "Exact Replacement Portable TV Antenna Headquarters" *streamer.*

1 Outline of complete dealer sales promotion *plan.*

Pioneers in Electronics since 1929

JFD ELECTRONICS CORP.

6101 Sixteenth Avenue Brooklyn 4, New York

JFD CANADA LTD.
51 McCormack Street
Toronto, Ontario, Canada

JFD INTERNATIONAL
15 Moore Street
New York, N.Y.

...RCA RECEIVING TUBES

The public doesn't look *behind* a TV set very often. But when they watch you at work, it's reassuring to see the familiar red and black carton with that RCA trademark. The one thing the public *does* know about electronics and electronic products is that RCA is the outstanding name and company in the field. To benefit from the confidence that lesser known brands could never instill in your customers, latch on to RCA's "built-in" reputation —your calling card to customer good-will. Your RCA Distributor carries a full line. Next time you order tubes, specify... RCA.

RADIO CORPORATION OF AMERICA

Electron Tube Division ***Harrison, N. J.***