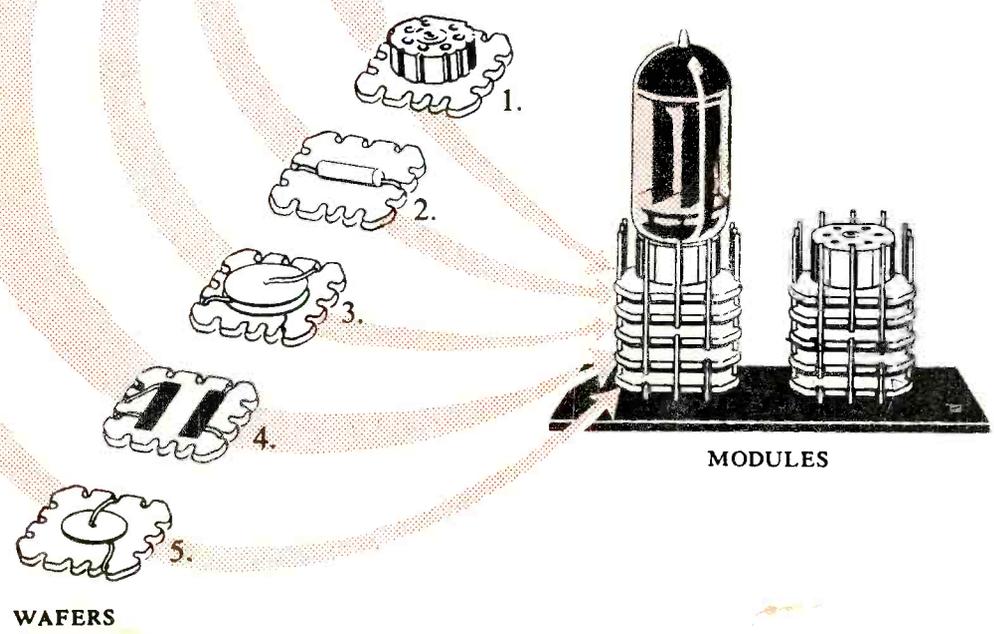
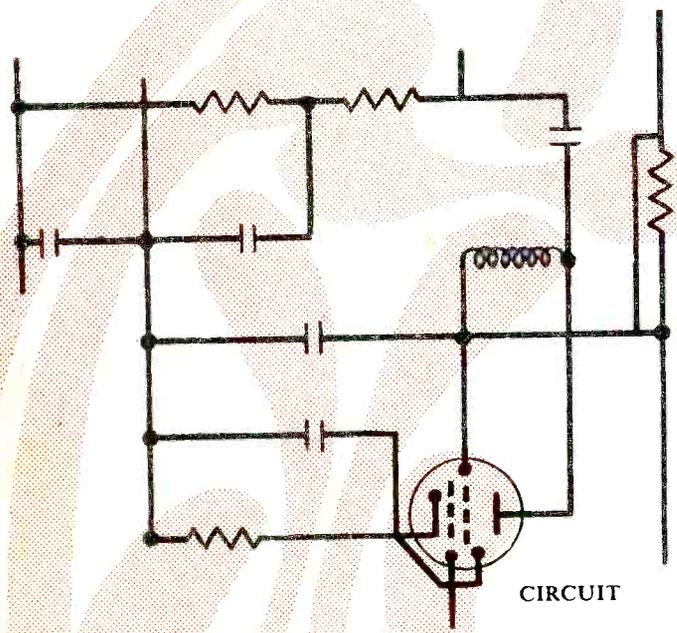
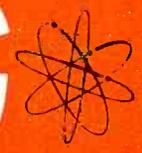




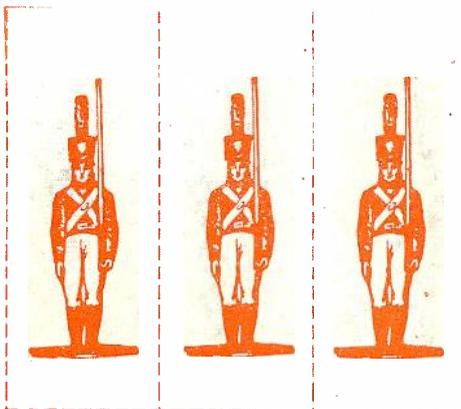
SERVICE DEALER & ELECTRONIC SERVICING

NOVEMBER
1956
50¢



NCB Colortennas
 Understanding Tone Controls
 Automation for Electronics
 Flat Frequency Antennas
 Marine Electronics
 AGC in Color Receivers

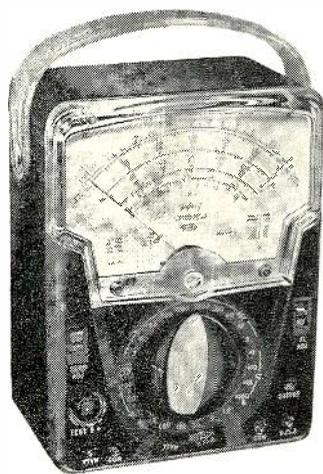
performance matched
test equipment



basic

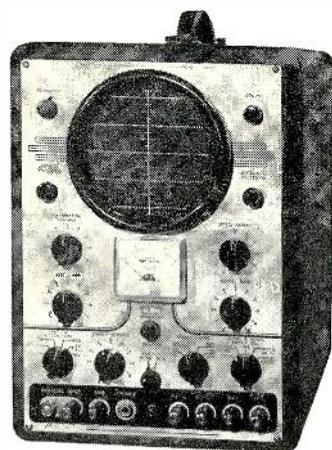
fundamental

essential



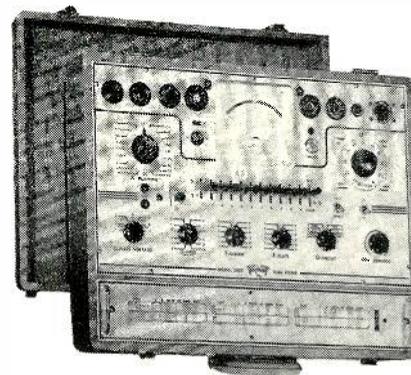
**MODEL 631
VOM-VTVM**

two in one tester for 100% service—VOM covers 90% of your usage, battery operated VTVM available for the other 10% when you need it. **\$59.50**



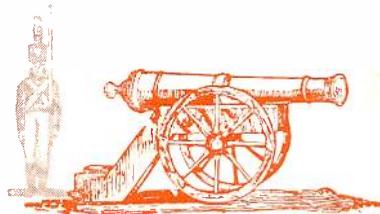
MODEL 3441-A

three in one scope—oscilloscope, peak-to-peak meter, audio oscillator—essential for more than 50% of your Black and White Servicing—all Color Servicing. 10 mv sensitivity. 4.5 mc bandwidth. **\$249.50**



MODEL 3423

four in one—mutual conductance tube tester, transistor tester, germanium diode tester, selenium rectifier tester—checks for accuracy as circuit demands depending on the tolerance of the circuit. The patented circuit for the tube testing employs actual signal (4KC) for grid and DC bias voltage making it independent of line voltage hum. It also has a complete coverage of all tube types—six plate voltages (including 0-10 variable). Micromhos scales read 0-1,800, 0-6,000, 0-18,000 and 0-36,000. Leakage measured directly on meter 0-10 megohms. **\$199.50**



BURTON BROWNE ADVERTISING

TRIPLET

These three units provide the ideal basis for the complete servicemen's test setup. Don't make a mistake! Before you buy, ask your parts distributor to demonstrate these and many other Triplet units. Buy performance matched equipment!

TRIPLET ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO



631
Combination
V-O-M—VTVM



630-NA
For Best Testing
Around the Lab,
Production Line
or Bench



630
The Popular
All-Purpose
V-O-M



630-A
A Good Lab and
Production Line
V-O-M



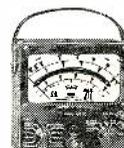
310
The Smallest
Complete V-O-M
with Switch



630-T
For Telephone
Service



666-HH
Medium Size
for
Field Testing



625-NA
The First V-O-M
with 10,000
Ohms/Volt AC



666-R
Medium Size
with
630 Features

EDITORIAL STAFF

Sanford R. Cowan Publisher
Samuel L. Marshall Editor
Oscar Fisch Assistant Editor
Robert T. Dargan Technical Editor
Charles W. Gardner, Jr. Editorial Production Manager
San D'Arcy Contributing Editor
Paul Goldberg Contributing Editor
Elbert Robberson Marine Communications Editor
Lawrence Fielding Hi-Fi & PA Editor

BUSINESS STAFF

Advertising Sales

**New York
and
East**

Richard A. Cowan
Jack N. Schneider
300 West 43rd Street
New York 36, N. Y.
JUdson 2-4460

**Chicago
and
Midwest**

Jim Summers
400 North Michigan Ave.
Chicago 11, Illinois
SUperior 7-1641

**West
Coast**

Ted E. Schell
2700 West 3rd Street
Los Angeles 57, Calif.
DUnkirk 2-4889

David Saltman

..... Advertising Production Mgr.

CIRCULATION

Harold Weisner Circulation Manager
Carol J. Binderman Ass't Circulation Mgr.

SERVICE DEALER and ELECTRONIC SERVICING (formerly Radio-TV Service Dealer) is published monthly by Cowan Publishing Corp., 300 West 43rd Street, New York 36, New York, JUdson 2-4460. Subscription Price: \$3.00 one year, \$5.00 two years in the United States, U.S. Possessions, Canada and Mexico. Elsewhere \$1.00 per year additional. Single copies 50¢. Second Class Mail privileges authorized at New York, N. Y.

POSTMASTER: SEND FORM 3579 TO SERVICE DEALER and ELECTRONIC SERVICING, 300 WEST 43rd STREET, NEW YORK 36, N. Y.

SERVICE DEALER



and ELECTRONIC SERVICING

VOL. 17, NO. 11

Member

BFA

NOVEMBER, 1956

FEATURE ARTICLES

Automation for Electronics , by Allan Lytel	10
Introduction to the backgrounds of a new era in electronic manufacturing and servicing.	
Understanding Tone Controls, Part 1 , by Lawrence Fielding	12
Basic principles of tone control as applied to Hi-Fi reception.	
Are You Using the Right Tape?	15
Applications of different colored tapes in wiring and servicing.	
AGC Circuitry in Color TV Receivers , by Bob Dargan and Sam Marshall	20
Discussion of agc circuits used in color TV receivers.	
The JFD NCB Colortenna Series , by Simon Holzman	22
Development of a new series of helical antennas designed for broadband reception.	
Marine Electronics, Part 5 , by Elbert Robberson	30
Location of radiotelephone equipment involves many such considerations as the placement of the ship's compass, length of power leads, fusing, etc.	
Flat Frequency Response in Single Dipole Antennas , by John F. Guernsey	38

CIRCUIT AND SERVICE FORUM

Complete Manufacturer's Schematics Hotpoint Chassis "MM" and "U" lines	25 to 28
Video Speed Servicing Systems Raytheon 21T42	33, 34
Sylvania 1-521	35, 36
The Answerman Philco 7E10	18
Crosley 472	19
Workbench RCA KCS82	16

DEPARTMENTS

S. R. Cowan Ad Libs	2	Rider Speaks	41
Trade Flashes	8	Contact	48
Association News	17	Advertisers' Index	Cover III

THIS MONTH'S FRONT COVER

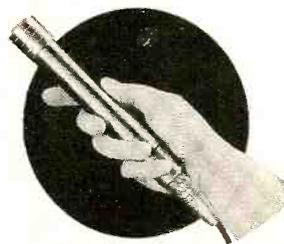
Photo by U. S. Bureau of Standards. See page 10 for article on Automation, explaining significance of these new units.

Entire Contents Copyright 1956, Cowan Publishing Corp.

COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

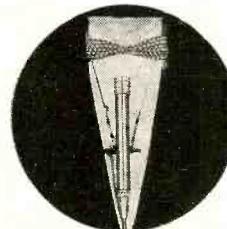
SERVICE DEALER and ELECTRONIC SERVICING • NOVEMBER, 1956

what kind of microphone do you need?



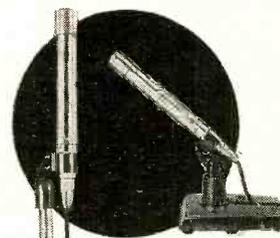
a hand held microphone?

The Slendyne "535"



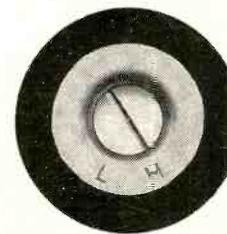
a lavalier microphone?

The Slendyne "535"



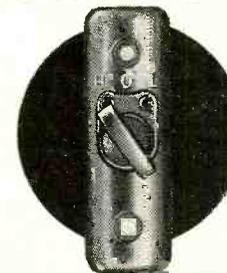
a desk or floor stand microphone?

The Slendyne "535"



a dual-impedance microphone?

The Slendyne "535"



a microphone with ON-OFF switch?

The Slendyne "535"

The Slendyne can be transferred from one application to another—in seconds—without disconnecting the cable.

The Slendyne "535" is an omni-directional dynamic probe microphone with a frequency range of 60 to 13,000 cps.

It is a rugged unit, designed to provide fine-quality performance for years—without deviation from its original critical standards.

SHURE

List price \$70⁰⁰

The Mark of Quality

SHURE BROTHERS, INC. • Microphones • Electronic Components
206 Hartrey Avenue • Evanston, Illinois



S. R. COWAN

Ad Libs

More LARGER Schematics

When we changed format last May we believed the Complete TV Manufacturers Schematics section would be improved and the diagrams easier to read. Experience proves we were wrong. So, starting with our January 1957 issue we will revert to our old style, which with modifications, should vastly improve this department. More important is this additional fact: whereas we have in the past only carried 4 or 8 pages of TV schematics monthly, starting in January each issue will carry 16 pages.

"Contact" starts this issue

A vitally important new department makes its bow in this issue. Called "Contact" this department will serve to bring together Service Firms which seek appointment as Factory Service Branches for manufacturers of all types of industrial electronics and commercial communications equipment, and for Manufacturers of that equipment who seek to appoint qualified service firms or independent servicemen as their Branch Service Depots. In addition "Contact" will open the way for industrial firms which use various types of automation and electronics devices to obtain the services of quali-

CHANNEL MASTER PUTS NEW SELL IN

DEALERS HAVE SOLD MORE *CHANNEL MASTER* T-W AND SHOWMAN ANTENNAS DURING THE PAST 60 DAYS THAN ANY OTHER ANTENNA DURING ANY 60 DAY PERIOD IN TV HISTORY
Isn't it time you called your Channel Master distributor?

- ★ Full-Color Ads
- ★ 2-Page Spreads
- ★ Full-page Ads

Month after month... all thru the prime TV buying months... this continuing series of sales-stimulating ads is creating loads of lively new prospects... right in your own selling area.

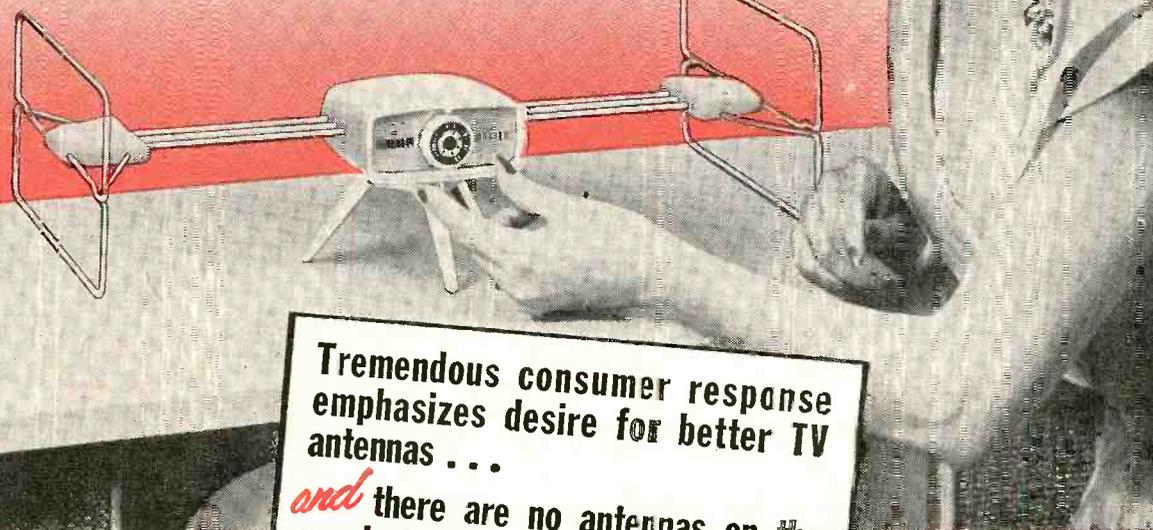
55,000,000
ads building new
customers and sales for you!

NATIONAL ADVERTISING TV ANTENNAS!

"Showman" INDOOR ANTENNA FOR VHF OR VHF-UHF

This smartly styled antenna overcomes consumer objection to ugly "rabbit-ear" antennas. Exclusive "Metro-Dyne" electronic tuning brings in pictures sharp and clear on all channels. Tuning knob with channel markings just like a TV set makes channel selection so easy. It's the most powerful indoor antenna ever developed . . . and it's backed with an **UNCONDITIONAL MONEY-BACK GUARANTEE**. Engineered for Black and White and **COLOR**.

model no.	description	type
3900	Mahogany & Co c	"H"
3901	Bond & Gold	"H"
3902	Ebony & Silver	"H"
3905	Mahogany & Cel	"H-UHF"



Tremendous consumer response emphasizes desire for better TV antennas . . .

and there are no antennas on the market today that compare with these fabulous new Channel Master models.

T-W OUTDOOR ANTENNA

The revolutionary new T-W is the very first TV antenna to use the "Traveling Wave" principle. This unique design electronically *reinforces* signals . . . *eliminates* "ghosts" and "snow" . . . *rejects* all unwanted signals and interference. In gain, front-to-back ratio, and mechanical strength, the T-W is unequalled by any other Broad Band antenna. Engineered for Black and White and **COLOR**.

model no.	description
350	7-element
350-2	7-element stacked
351	5-element
351-2	5-element stacked
352	3-element
352-2	3-element stacked



CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

fied servicemen who operate near their locales.

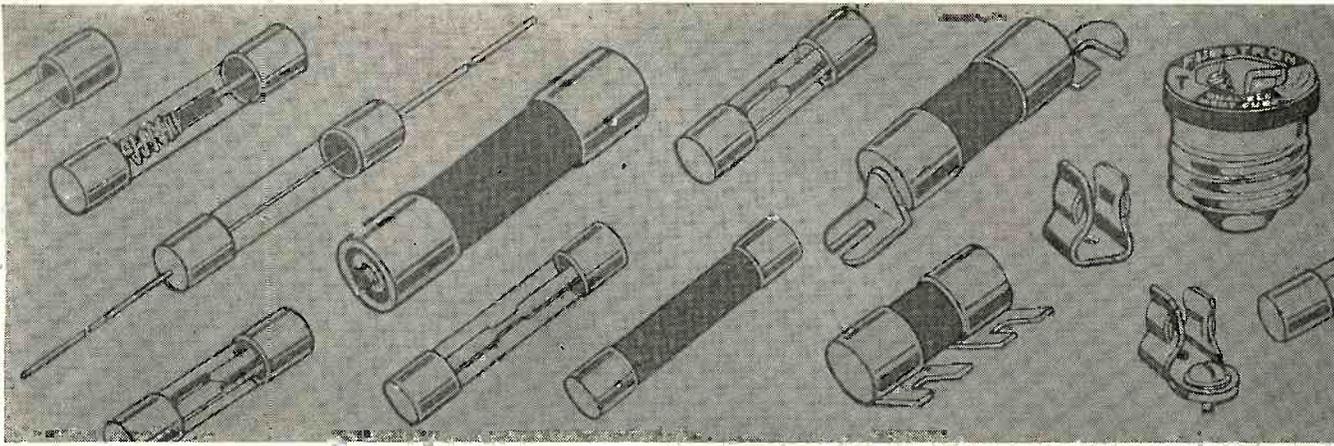
To date hundreds of service firms have written us asking to be put in touch with electronics equipment manufacturers and users of such equipment who seek field service agencies, and this liaison work is being attended to, without cost or obligation, as the occasion arises. To those of you who intend to write us so your available services may be listed, may we suggest that full details be given.

Facts & Figures worth having

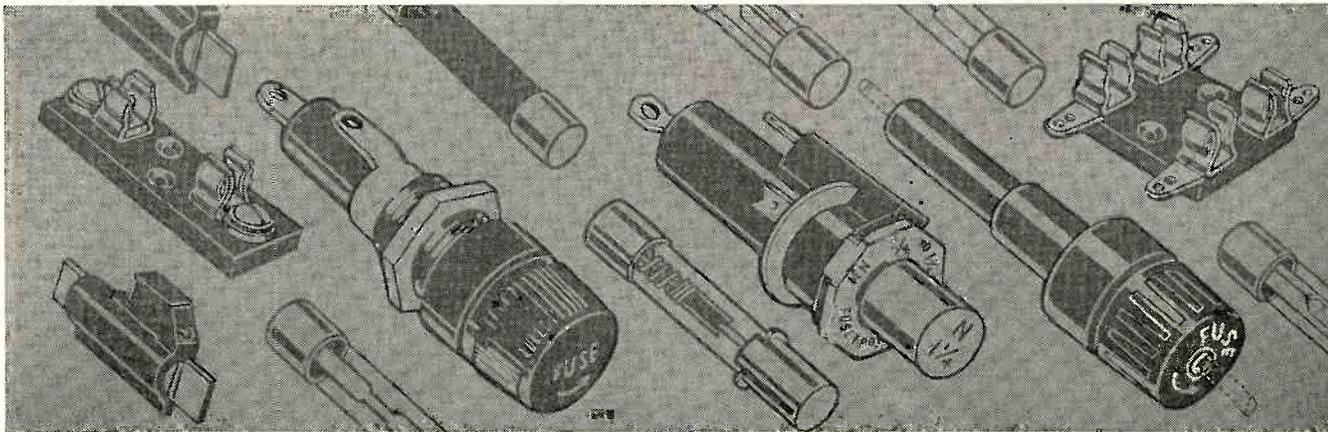
RETMA's 1956 edition of The Electronics Industry Fact Book (50¢) has just been released. Unless we are mistaken RETMA figures are based upon a fiscal year period running from July 1st to June 30th and the new Fact Book gives radio-TV-electronic production, sales and service statistics from 1922 to June 30, 1956.

The Fact Book statistics together with statements recently made by such authorities as Dr. Allen B. DuMont, Mr. H. L. Atkinson (Mgr. Sales Services, RCA) and Dr. W. R. G. Baker (Pres. of RETMA and V.P. of G.E.) point to the stupendous (no other word suffices) earnings potential which lies ahead for all men engaged in all phases of civilian, industrial and military electronics equipment servicing. You owe it to yourself to digest carefully the following facts, some of which are quoted from the Fact Book, others from recent utterances by the aforementioned authorities:

1) — **Civilian Radio-TV:** Since 1922 over 244 million radios have been produced. Approximately 142 million are now in use. Last year auto radio production exceeded 6 million units for the 1st time and upwards of 40 million auto radios are now in cars but only 75% are in operating condition. Phonograph



Whenever you need fuses...



you'll save time and trouble by turning **FIRST** to **BUSS!**



Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

By relying on BUSS as your source for fuses, you can quickly and easily find the type and size fuse you need. The complete BUSS line of fuses includes: Standard types, dual-element (slow blowing), renewable and one-time types . . . in sizes from 1/500 amp. up—plus a companion line of fuse clips, blocks and holders.

BUSS fuses are made to protect— not to blow needlessly

When you sell or install BUSS fuses—you can be sure that users receive maximum protection against damage due to electrical faults. And just as important, users are safeguarded against irritating, useless shut-downs caused by faulty fuses blowing needlessly.

BUSSMANN MFG. CO. (Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

There are no kicks or complaints from your customers about the operation of BUSS fuses. Servicemen avoid costly, unnecessary call-backs. That's why it pays to rely on dependable BUSS fuses.

Capitalize on the BUSS trademark



The universal trade and consumer acceptance of BUSS fuses is based on the millions upon millions of BUSS fuses used in homes, on farms and in industry over the past 42 years. Sales are easier to make when you handle BUSS . . . the *Known* brand of fuses.

For more information on BUSS and Fusetron small dimension fuses and fuseholders... Write for bulletin SFB.



sales in 1955 were 2.2 million units (over 4 times greater than any previous year) and approximately 20 million phonograph players are now in use. Television set sales in 1955 exceeded 7.4 million units (or over 7 million for the 3rd consecutive year) and now over 41 million TV sets are in use. (Almost 80% of homes in U.S.A. have 1 set or more). Nearly 200 thousand color TV sets are now in homes with every likelihood that 1 million will be in by Christmas of 1957. (Color telecasts run up to 30 hours per week in some cities and that fact has stimulated color set sales tremendously).

So much for Civilian radio-TV sales figures. Now for the Civilian radio-TV service figures: There are over 110 thousand divers types of retailers of radios and TV but less than 17 thousand of these retailers operate their own service departments. There are approximately 25 thousand service firms. Service Dealers and Service Firms combined employ 58 thousand full-time technicians. Stated another way approximately 100 thousand men earn their living from and are engaged in full-time servicing of civilian radios and TV sets. One can guess, but no one knows positively, just how many part-time independent or part-time employed servicemen there are.

Last year servicemen paid to Mfrs. over \$850 million for the replacement tubes, components, etc. which they bought. Servicemen actually spent \$1.3 billion buying the stuff from Jobbers with the difference going into Jobbers' cash-registers. The nation's service firms and service dealers received about \$600 million from the set-owning public for services rendered.

2)—Military Electronics—quoting from Fact Book, "Vast quantities of radio equipment, from million watt transmitters to pocket size receivers, form the life line of military communications. Guided missiles are making piloted aircraft obsolete for many purposes. It is estimated that missiles and rockets will replace piloted aircraft in 50% of strategic and 30% of tactical missions." Every year since 1952 the Gov't has purchased about \$2.5 billion worth of electronics gear per annum and expects to continue to buy that volume annually for the next several years.

Heretofore the great bulk of all military electronics equipment was serviced and maintained by members of the Armed forces. In ever-increasing degree civilians are taking over the service of military electronics equipment. The \$ figures are not available.

3)—Industrial Electronics—This subject is covered so well by the Fact Book

that entire paragraphs are worth quoting, and every serviceman should analyze their import, keeping in mind how he fits into the picture. Says the Fact Book, ". . . electronic devices sort, control, measure and count . . . mold plastic and metal products, find flaws in textiles." Data process equipment, X-ray machines, heating apparatus, microwave relays, and radiation instruments make possible the abundance of modern production. "Two-way radios direct the taxicab, summon the police, provide protection against forest fires. Nearly 900 thousand mobile, base and portable transmitters are operated by 19,000 FCC licenses to provide two-communication for railroads, buses, emergency vehicles, etc.

"Automation is the technique of improving human production, in the processing of materials, energy and information by utilizing elements of control and of automatically executed programming. From simple photoelectric counters to huge data computers, automation is rapidly expanding industrial electronics.

"During 1955 industrial electronic apparatus sales were \$700 million—a three-fold increase over 1948. Industrial electronics will exceed \$1.2 billion by 1960 and \$2 billion by 1965." Our market research indicates that there are approximately 700 firms engaged in making the various types of automation, industrial electronic and commercial communications equipments that are being used by industry. Only a handful of these manufacturers hold the maintenance and servicing of it under their control while it is in use. In other words 99% of all industrial electronics and commercial communications installations equipment is today being serviced and maintained by the firms that own and use it or by service firms and independent service contractors whom they engage to do the work for them. To the best of our knowledge there are less than 4000 such independent industrial electronic equipment service specialty firms. But there is a great shortage of qualified servicing manpower and most all experienced radio-TV servicemen can service industrial electronic installations using their present knowledge and test equipment.

In all industrial electronic devices the components are of closer tolerance and better quality than those used in mass-produced radios. But the circuitry is basically the same. Most parts jobbers stock the needed replacement tubes and components. Whereas jobbers sold servicemen \$1.3 million worth of replacement components and tubes for mainte-



TAKE THE RIGHT STEP TO TIME-SAVING PROFIT-BUILDING BUSINESS: Sign up with your Parts Distributor to get PHOTOFACT Folder Sets automatically each month.

DO IT NOW!

Free!

to Service Technicians Only

THE NEW SAMS INDEX TO PHOTOFACT FOLDERS

it keeps you up-to-the-minute on receiver coverage

PHOTOFACT Folders give you the world's finest Service data on TV and radio models just as soon as they hit the market. Now—with the new INDEX SYSTEM to PHOTOFACT, you locate the *latest* PHOTOFACT coverage *immediately*.

If you're a Service Technician, you can get the new Sams Index FREE. Here's how it keeps you up-to-date on receiver coverage: The Master Index (36 pages—issued twice yearly) is the complete reference to *all* PHOTOFACT Folders produced up to the date of its issue. In addition, you get an Index Supplement each month covering that month's releases of PHOTOFACT Folders. Thus, the Master Index *plus* the supplements keep you right up with current PHOTOFACT coverage. (The Index Supplements also appear each month in "PF Reporter" Magazine.)

It's easy to get your complete Index service to PHOTOFACT at NO COST to YOU. If you're a Service Technician, just fill in the coupon and mail to us today. It will bring the Master Index direct to your shop, and monthly supplements will be mailed to you regularly thereafter. YOU'LL KEEP RIGHT UP-TO-THE-MINUTE ON PHOTOFACT COVERAGE—you'll be able to locate the data you need on over 30,000 models, as well as on CURRENT MODEL RELEASES.

Mail coupon today for your free subscription to the Sams Photofact Index

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc.
2209 E. 46th St., Indianapolis 5, Indiana

Send me your FREE Master Index to PHOTOFACT Folders (twice yearly), and put me on your mailing list to receive all Index Supplements. My letter-head and/or business card is attached.

I am a Service Technician: full time; part time.

My Distributor is: _____

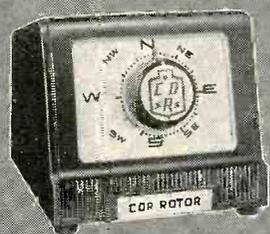
Shop Name _____

Attn: _____

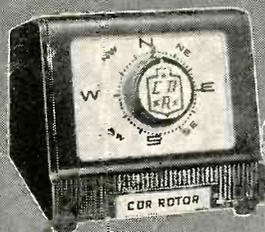
Address _____

City _____ Zone _____ State _____

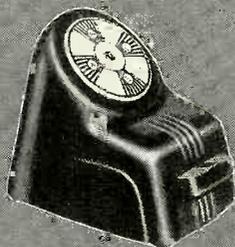
Free!
TO SERVICE
TECHNICIANS



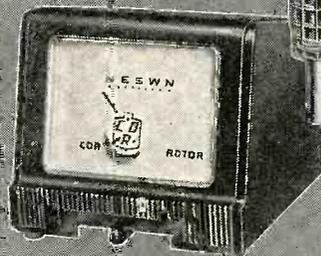
AR 1 and 2



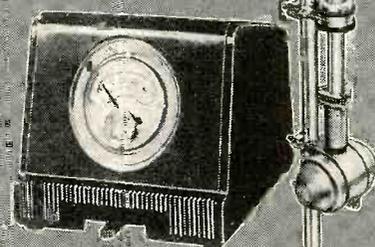
AR-22



TR-2



TR-4



TR 11 and 12



CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

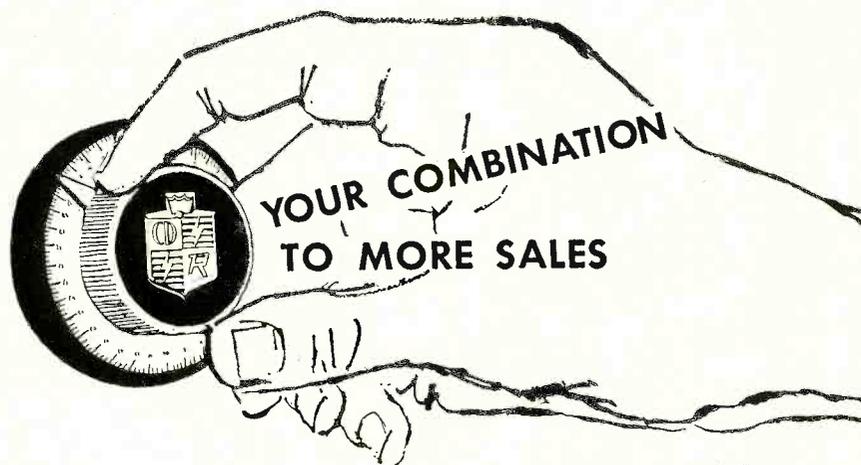


THE RADIART CORP.
CLEVELAND 13, OHIO

Everything You Need for Profitable Rotor Sales

CDR ROTORS

have EVERYTHING



THE COMPLETE LINE

... a model for every need... whatever the application there is a CDR Rotor that meets the situation best!

PRE-SOLD FOR YOU!

The greatest coverage and concentration of full minute spot announcements on leading TV stations in every major rotor market is working for YOU...pre-selling your customers!

nance of radios and TV sets last year, they also sold upward of \$1 billion worth of replacement tubes and components to be used solely for the maintenance of industrial electronic and commercial communications installations. In coming years that figure will spiral upward. No wonder every radio and television serviceman is desirous of going into the vast new vista called industrial electronics servicing!

Paradoxes

Here are some (of the many) things, published in newspapers recently, that puzzle me: A crack Pennsy train is derailed killing several people, injuring 72 others and the newspapers report the incident, in 2 brief paragraphs buried in the middle of the issue. In contrast, the same day a small privately-owned plane cracks up and although the event is of no import, except to the injured pair who were in it, yet the newspapers blast the event into front page and headline news.

Next item: Two of the radio industry's largest manufacturers, each having several thousand people on their payrolls, merge and the newspapers don't even report the transaction. That same day a "schlock" radio manufacturer is sued for divorce by his wife and the split-up is reported in newspapers from coast-to-coast as though it were a history-making event.

Finally, item three: Over 150 thousand radio-TV servicemen, in a routine day's work, repair upwards of a million receivers without a single word of publicity or praise being published by newspapers. Again, in contrast, newspapers blatantly report the story about a humble serviceman who is fined \$5 by a magistrate because he (the serviceman) refused to give the repaired set to its owner when the latter insisted he would not pay the bill that was presented to him "until he had taken the set home to try it out and make sure a good job was done." Seems to me we live in a cock-eyed world wherein editors permit much really important news to be relegated to the background while "dud" material hits front pages. By the same token I believe the aforementioned magistrate is a "goof" who should be reprimanded for not using common sense. I hope the next serviceman he calls on "fixes" his set by "giving him the business."

"Super" Size Format

Our decision to broaden the editorial policy of this magazine so that *all phases* of industrial electronic and commercial communications equipment servicing could be covered along with radio-TV servicing techniques was, as we've said before, resolved for us by you, our subscribers.

Since the program has been in effect, not one single solitary letter of complaint or objection about our new editorial policy has come in. As a matter of fact, between June 15th and September 5th, upwards of 1,700 unsolicited letters of praise and commendation have been received—and for that we are grateful. Dozens of subscribers also suggested that we make available binders in which copies can be retained for filing.

But life is not a "bowl of cherries." We must confess that to date 82 complaints, 71 of them on postcards, have arrived from subscribers who state frankly, and in some instances very vehemently, that they do not find the present "super size" format to their liking. The big gripe is that the 11¼" width of our magazine makes their copies extend over edges of shelves that are 9" deep. We've tried to be courteous and in business-like fashion have replied directly to every complaining reader, going to the extreme, offering to cancel the balance of their subscription and making a pro-rata cash refund. Not a single one has accepted that offer. Not one subscriber has asked for the offered refund.

However, from the mail received, we know that practically all of our subscribers retain their copies, using them for reference over a long period of time. That being the case, we are now looking for a binder supplier who can furnish durable but inexpensive binders which will hold and protect copies of our magazine. We will let you know what success we have. ■ ■

We Are Moving!

Effective Nov. 23, 1956, Cowan Publishing Corp. offices will be located at 300 W. 43 St., New York City, New York.

An Open Letter To Independent TV & Radio Service Dealers

Way back in the forties when you had only to combat the suspicion and mistrust of the public — a mistrust created through unfavorable and unfair criticism in press and magazine — the Raytheon Manufacturing Company, recognizing this threat to your existence, started the Raytheon Bonded Electronic Technician Program in a sincere effort to help you survive. This program has helped thousands upon thousands of independent service dealers from coast to coast to establish themselves as reputable businessmen, increase their profits and gain the full respect of their customers.

The program has been carefully controlled. Membership in the Raytheon Bonded Dealer group has been kept limited and selected for 2 reasons: (1) Raytheon wants only the finest service organizations to bear this proud distinction, and (2) it represents a substantial investment for every dealer registered.

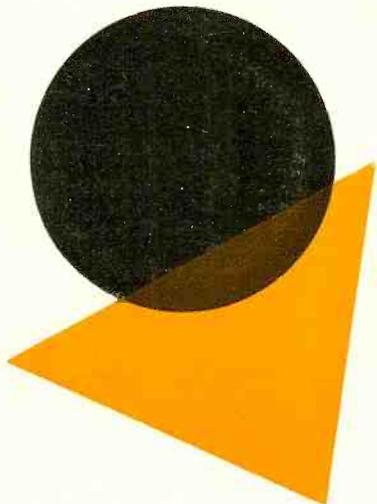
Today, the growth of Manufacturers' Service Organizations creates new problems for you in maintaining and increasing the business you have worked so hard to earn. To help you win and keep customer confidence, we are going to lift the quotas on the number of Bonded Dealers we will back. We know that many of you operate to standards that will enable you to qualify for the Raytheon Bond. We recognize your need for this support and gladly offer this helping hand.

We regret that this offer can be made for a limited time only. If you are interested in getting the help of the Raytheon Bond, get in touch with your Raytheon Sponsoring Bonded Tube Distributor right now. He will be delighted to show you how the Bond will help you build your business. And helping you — the independent service dealer — to prosper is something we at Raytheon are dedicated to do.



Receiving and Cathode Ray Tube Operations
Newton, Mass.





**W
A
N
T
E
D**

TV and Electronics Servicemen

If you are interested in contracting for servicing and maintaining manufacturers' equipment in the following electronic fields or in becoming established as official service depots or service representatives for manufacturers in these fields, please advise us of your facilities.

Electronics Fields

Mobile Radio
Garage Door Openers
Marine Radio—Airplanes
Industrial Electronic Maintenance
Sound Installation and Maintenance (PA)
Intercommunication Systems (Home and Industrial)
Radiation Electronics
Broadcasting
Closed Circuit TV

We will forward all inquiries to Manufacturers who are interested in obtaining such service.

Service Dealer and Electronic Servicing

COWAN PUBLISHING CORP.
300 W. 43 ST., DEPT. S, N.Y. 36, N.Y.

*ANOTHER COWAN PUBLISHING SERVICE

Replacement of transistors in portable radios and other electronic equipment may never be necessary if they are used within the limits set by the manufacturer, a General Electric engineer suggested. In addition he said transistors are rugged enough to withstand the jolt of being fired from a mortar and still operate at full ratings.

Over 3,000 distributor and dealer service men have been trained by Admiral Corporation in the installation and servicing of the company's color TV receivers thus far this year. According to Joe Marty Jr., general manager of the electronics division, the men received their training in special schools held in 35 major cities. The training program will continue until all cities providing color programs have been covered, Marty said.

The first in a series of color TV lectures sponsored by Cowan Publishing Corp., and prepared by Samuel L. Marshall, Editor of Service Dealer and Electronic Servicing, was delivered before the Associated Radio Television Servicemen of New York on Wednesday, Oct. 17, 1956. This series consists of unit lessons prepared on color slides accompanied by a tape recorded presentation of the subject matter covered.



Shown from left to right are: Wm. Feingold, Sandy Cowan (rear), Marty Boxer—Corres. Sec., Oscar Fisch, Sam Marshall, Pete La Presti—Pres., Bob Dargan, and Jacob Allen—Rec. Sec.

Assisting Mr. Marshall in his presentation were Robert T. Dargan and Oscar Fisch, Assistant Editors, and William Feingold, Emerson color engineer. Mr. Feingold conducted a question and answer period following the presentation. More than 150 servicemen were present, all of whom expressed their approval and appreciation of the manner in which the program was initiated.

trade

An unusual alliance announced between organized TV servicemen and Philadelphia's up-coming Channel 35 promises easy, reasonable arrangements for area viewers to convert local sets to the UHF band before WHYH-TV gets on the air in November. Albert M. Haas for the Television Service Advisory Council of Philadelphia and Richard Burdick for WHYH signed a joint proclamation calling for close teamwork adapting area sets so they can pick up the ultra high frequency signal of Channel 35.

A new Rider service offers TV technicians the opportunity of buying TV servicing information on specific television receivers at the most economical price. Announcement has been received from John F. Rider, President of John F. Rider Publisher, 116 West 14 Street, New York 11, N. Y., that they have launched a new TV receiver diagram service called S-D-O (pronounced ess-dee-o) aimed to satisfy the "Single Diagram Only" needs of the servicing industry. The S-D-O service is sold through electronic parts distributors. This new service presently covers the products of the 8 largest producers of television receivers active during the past 5 years, inclusive of present production. They are: RCA, Philco, Admiral, General Electric, Emerson, Motorola, Crosley and Zenith. Other manufacturers will appear later. The service information is very detailed yet right to-the-point, including schematic, voltage data, tube layouts, alignment information, trimmer locations, adjustments, parts lists, etc.

Completion of an integrated automatic test and inspection system for the evaluation of a wide variety of electronic components and other products has been announced by Electronic Control Systems, Inc., of Los Angeles, an affiliate of Stromberg-Carlson, and a subsidiary of General Dynamics Corporation. This new system automatically transports, tests, and physically sorts for quality components such as semiconductor diodes, and, in addition, keeps records on punched paper tape. It also automatically assembles over-all quality statistics. This new integrated system will be exhibited to the public for the first time at the Third Annual International Automation Exposition to be held in New York City, November 26-30, 1956, according to Bernard Elbinger, Manager of Special Products at E.C.S.

flashes

Public confidence in the nation's television service technicians is one of the most important factors in the tremendous growth of the television industry, Frank M. Folsom, President of the Radio Corporation of America, declared in presenting the "President's Cup" to winners of RCA's national competition for achievement of TV customer satisfaction. The trophy, awarded annually by Mr. Folsom, was presented to one independent distributor of RCA consumer products and to four branches of the RCA Service Company. The winning distributor was Louis E. Randle, President, Associated Distributors, Inc., of Indianapolis, Ind.

Bill Mallingly has just written a two page open letter titled "Wake up Mr. Independent Serviceman." This interesting letter points out many practices which are working hardships upon the electronic servicing business. Bill says, "Electronics is in its infancy and the surface of electronic servicing has just been scratched." In dealing with various aspects of the electronic service business, he emphasizes the big need for independent servicemen to join the service association of their choice. The letter was written by an independent serviceman who feels that in this small way he can contribute some time and effort to help promote the cause of the independent serviceman. Bill Mallingly is the operator of Matt's Radio and Television Sales and Service Co., 21401 Fenkell Ave., Detroit 23, Michigan.

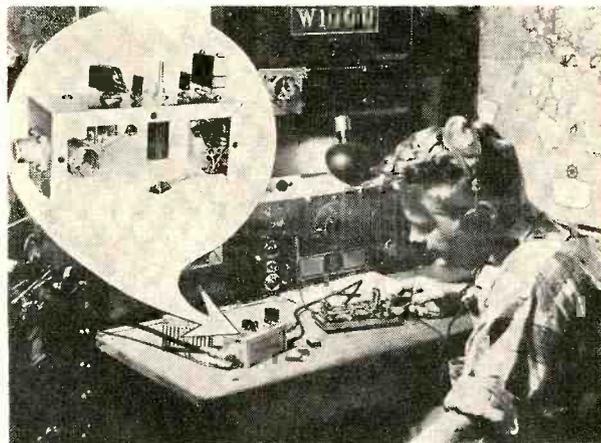
With the appointment of Bill Ashby as Director of Service Engineering, Cornell-Dubilier Electric Corporation has injected another bright new spark into its constantly expanding program of jobber assistance. An "engineer's engineer" (as well as a raconteur second only to George Jessel), Bill has logged an astronomical record in his last five years of service engineering. He has traveled well over 250,000 miles and discussed service problems with a small army of servicemen—50,000 in 600 meetings!

Clarostat Mfg. Co. has received an award of merit conferred by the President of the United States through the President's Committee on Employment of the Physically Handicapped for the company's contribution toward providing equal opportunity for employment to the

physically handicapped. The award is the second received by Clarostat since the company moved to Dover in 1949.

E. P. Atcherley, merchandising manager for Sylvania Electric Products Inc., told the National Alliance of Television and Electronic Service Associations (NATESA) convention that television service technicians must re-examine and re-vitalize their approach to the public in this ever advancing field. Atcherley compared television service today to the automobile service station of yesteryears. Citing his own experience as a customer, he assured his audience that in their daily calls there is always more to sell than is asked for or meets the eye. The Sylvania executive cited numerous examples where good planning, courtesy and skilled performance spelled success for the independent serviceman. He called selling a full time project where the manner in which service is performed determines the probability of repeat business.

Three Raytheon "hams" using two Raytheon 2N113/CK761 Transistors wrote radio history recently when they made the first transatlantic contact ever achieved with a transistorized transmitter. Operating on the 20-meter amateur band, they exchanged messages with a fellow "ham" in Denmark, a distance of 3,800 miles. Scarcely larger than a



package of cigarettes, the transmitter uses two Raytheon 2N113/CK761 fusion-alloy transistors powered by one penlight cell and two six-volt batteries—the equivalent of nine ordinary flashlight cells.

Manufacturers, Distributors and Users of Electronic Equipment

Thouand of financially sound, qualified electronic servicemen and service organizations are desirous of affiliating themselves with manufacturers as official service depots or service representatives. If you are interested in employing the services of these capable experienced technicians on a permanent or contract basis, please advise us of your needs and requirements, and we will forward you the names and addresses of such individuals and organizations in any area you specify.

This is a free service of Service Dealer and Electronic Servicing.

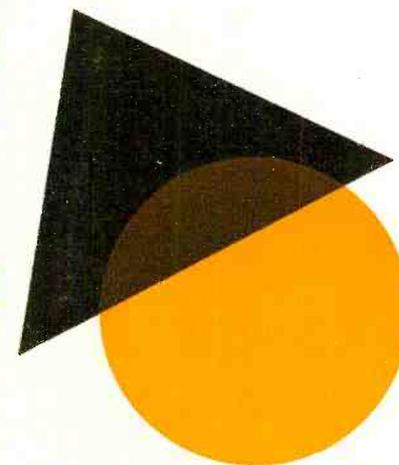
Service Dealer and Electronic Servicing

COWAN PUBLISHING CORP.

300 W. 43 ST., DEPT. S, N.Y. 36, N.Y.

*ANOTHER COWAN PUBLISHING SERVICE

W
A
N
T
E
D



Automation for Electronics

Many different electronically controlled operations are automatically producing, with a minimum of human handling, a new electronic component, the Module.



by ALLAN LYTEL

Supervisor, Technical Information, Electronics Lab,
Electronics Park, General Electric Co.

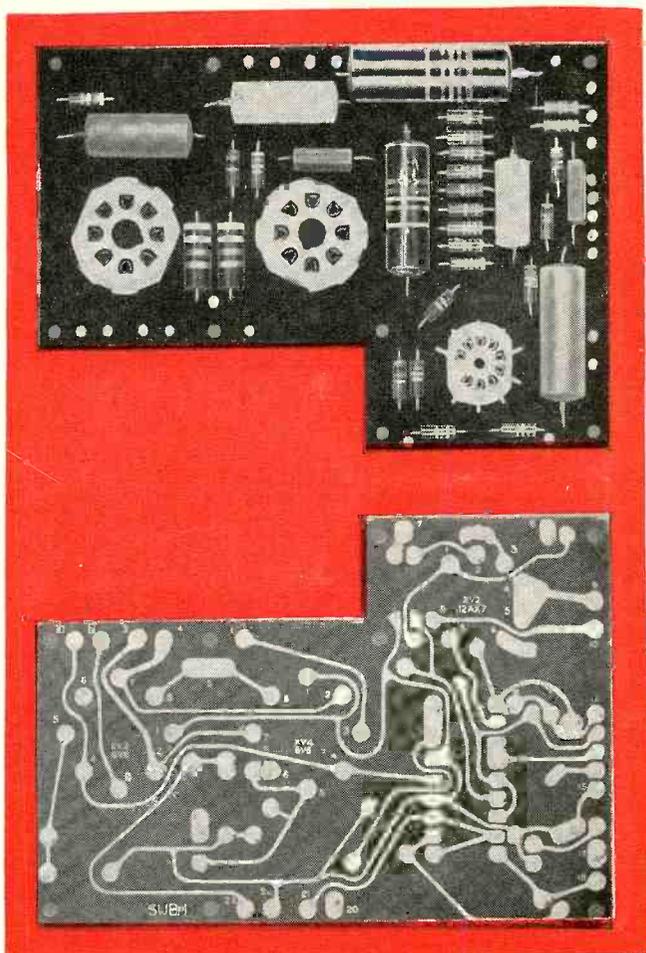


Fig. 1—Etched-wiring board of audio amplifiers, from *Broadcast News*, Aug. 1955, used with permission.

AUTOMATION refers to the increased use of machines, and the techniques of control of these machines in the process of production. It is now not only feasible for these machines to cut, drill, shape, and polish, but they also can shape to a given master, indicate when a drill requires replacement, and control some of their own machine operations by means of external electronic circuits using feedback. Finally, these machines can be inter-connected and related to other machines to make an integrated system of control and production, with a minimum amount of human intervention. This is, in essence, the meaning of the word Automation as it is now used.

Where We Are Today—1956

Electronics, as an industry, has a special problem in Automation. The techniques of electronic controls are so firmly fixed in our technology that there is no other system for the control and op-

eration of the tools of production, including all types of machine-tools. Electronics itself, however, was until quite recently, almost backward in its use of production machines for manufacturing. The normal chassis, say of a television receiver, or of a radar system, with the maze of wires and the great number of individual hand-operations, was behind other industries from the production viewpoint. As a rough comparison, the electronics industry of 1950 was quite like the automobile production of 1930. Machines were used for some isolated functions but, by far the greatest number of operations were done by hand.

There are now three separate areas which seem to point to the more advanced type of automatic production, which will come as a result of the present studies and engineering work in many organizations. These are, Mechanization, Modularization, and Digital Computer Control-Techniques. In each division there has been, and will continue to be, important developments. They could lead to complete machine production from start to finish without any more than nominal human

intervention. The basic parts of Automation for electronics are here now.

Mechanization

The design of electronic equipment for the greatest use of machines, that is, mechanization, is the first step. This includes the use of printed-circuit boards, (Fig. 1), which are now almost standard in advanced engineering groups. Upon phenolic base materials, a circuit design is made where copper-plated areas provide the connections between the components. Photography is being used, part in the production of these boards. This has the great advantage of repeatability. Once a master is made, the entire production run of boards is the same within very close tolerances.

Components are inserted in the boards, through holes located by a standard-grid system. Machines to drill the holes are now in production. By means of a program, the machine will locate and drill the proper holes. Components are inserted, with their leads through the holes, so that the components are connected in the circuit. The entire unit is then dip-soldered. Machine

insertion of components has been developed by several independent groups. In the present techniques, components are fed into the machine, either by magazine or by means of a hopper. As the printed board passes under the head, a component is inserted in a predeter-

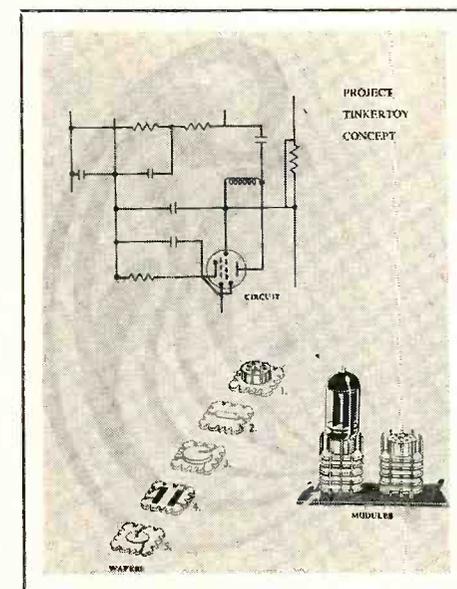


Fig. 2—Project Tinkertoy Concept, courtesy of the National Bureau of Standards, used with permission.

mined spot on the board. As the boards pass through a line of machines, their components grow in numbers, until all have been inserted. The completed boards are then removed and soldered.

This technique requires components which have certain standards with respect to lead size, component size, and lead mountings, because of the hole-pattern and because of the requirements of the insertion heads.

The boards themselves, their construction, materials, handling, and platings, require study and testing. Techniques for photo-reproduction of printed-wiring require investigation, and the translations of the engineering schematics to the final printed-wiring are still undergoing improvement.

Testing of the printed circuits is important and there are several methods used. Some of these are automatic and others are simpler.

All of these are methods and techniques which may be called mechanization; the use of machines to produce individual circuits from which equipment may be built. This far many engineering groups have gone; not all manufacturing activities use machine insertion of components. For a large number of printed-circuits, however, the component-insertion by mechanical
[Continued on page 46]

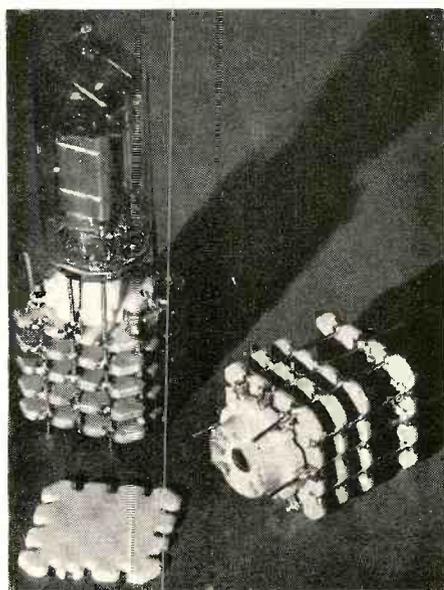


Fig. 3—Project Tinkertoy Module, courtesy of the National Bureau of Standards, used with permission.



here's how you can get more service calls ...repeat customers

Garry Moore is advertising your special "Picture Tube Clean-Up" September 14 through November 23.

When your telephone rings and you're asked for the Garry Moore "Special Picture Tube Clean-Up," grasp the opportunity. Clean the picture tube faceplate and protective glass. Then check the set for any needed service. But be sure you have CBS tubes in your caddy. Your customer will want them if tubes have to be replaced.

CBS Tubes, through the Garry Moore "Special Picture Tube Clean-Up," get you into new television homes where you can check sets for necessary service. What's more, CBS is building "every-six-months check-ups" for you.

NEW PICTURE TUBE CLEANER

in the handy easy-to-use squeeze bottle

Just S-Q-U-I-S-H it on and wipe it off! It's the perfect cleaner for the picture tube faceplate and protective glass. Quickly dissolves accumulated grime, dust and smoke. Gets glass clean. Leaves no annoying reflective film.

Just right for your caddy . . . won't break or leak. Now available in the big 6 oz. squeeze bottle at your CBS Tube distributor's.

6 oz. squeeze bottle only **39¢** net

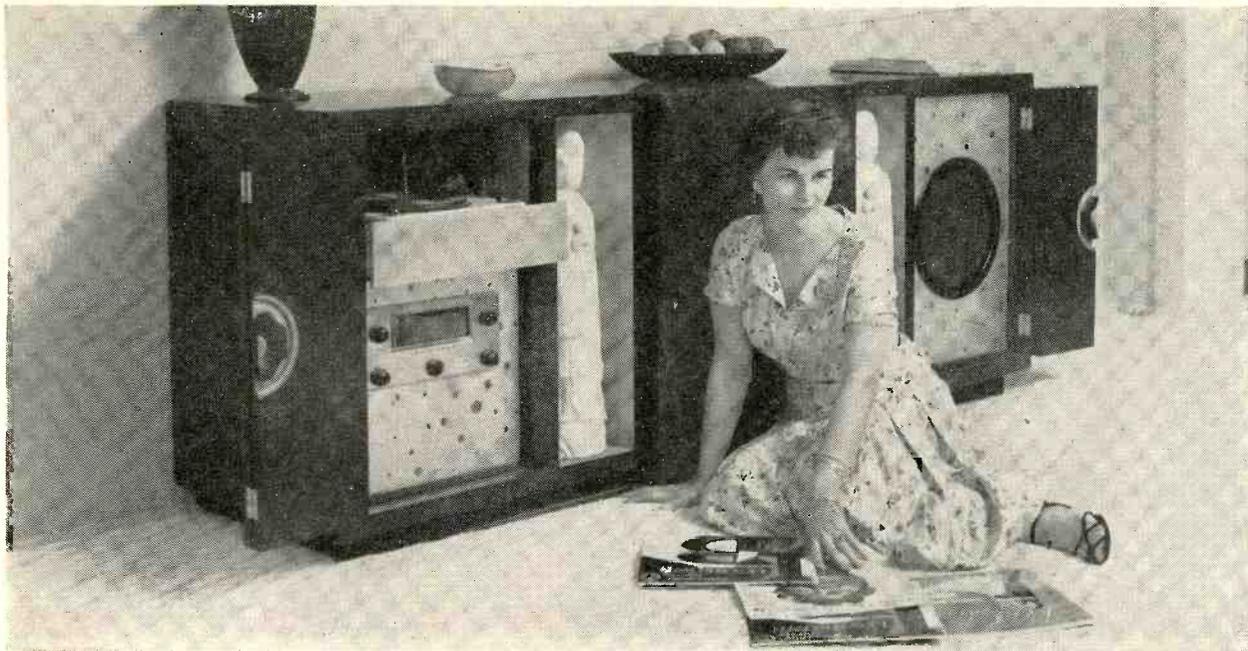
Ask your CBS Tube distributor for your **FREE** trial bottle



CBS-HYTRON
Danvers, Massachusetts

A Division of
Columbia Broadcasting System, Inc.

See Garry Moore building new business for you . . . Fridays 10:30 to 10:45 A.M., EST, over the CBS Television Network. Tie in . . . get new business and more profits.



Part One discusses the importance of tone controls, their desirability in high fidelity sound reproduction due to such variables as the volume control settings, room acoustics, etc.

Understanding Tone Controls

Part One

by LAWRENCE FIELDING

PROBABLY the first difference between mediocre sound reproducing systems and higher quality systems that one notices, is the presence of a set of two tone control knobs on the so-called "better" high-fidelity equipment. Off-hand, this might seem like a direct contradiction to our earlier definition of high fidelity. You will recall that we stated an amplifier should have uniform, or "flat" response, at least throughout the audible range (20 to 20,000 cycles per second). Yet, in the very next specification listed in manufacturers' advertising literature we find statements such as the following:

"Separate bass and treble controls provide as much as 20 db of boost or attenuation at 50 and 10,000 cycles respectively." Why does the manufacturer take such pains to make a flat-response amplifier only to allow the "uneducated" customer to promptly upset this response by the use of such

wide range tone controls? Actually, tone controls serve a great many useful functions. Before explaining their operation, the various types available, and the servicing problems they may create, let us investigate the need for tone controls in the first place.

The Purpose of Tone Controls

It is well known that at low levels of hearing, the human ear does not respond with equal intensity to all the frequencies of audible sound. That is, at low volume, our ears respond less to the extremely low and high frequencies than to the middle frequencies. This fact would not necessarily be serious if all of us could listen to music exactly as it is played in a concert hall. However, since most of us play a recording of a symphony at considerably lower level than the original performance, the relative balance between lows, middles, and highs, is up-

set. This is due not so much to the equipment, but rather to our hearing mechanism itself. It would be desirable in such cases to emphasize, or "boost" those tones which our ears are attenuating at a disproportionate rate at low listening levels. This action is particularly needed for the very low frequencies, and gives rise to the so-called *bass boost* type of control shown in Fig. 1.

A secondary function of boosting the bass or lower tones arises from the fact that although the amplifier and other electronic parts of a high-fidelity system may be perfectly "flat," the loudspeaker usually is not. A small amount of bass boost, applied correctly in this case, can approximate correct relative response of the entire system. The action of this circuit is very desirable because the boost occurs only at low settings of the associated volume control. That is, at high listening levels the

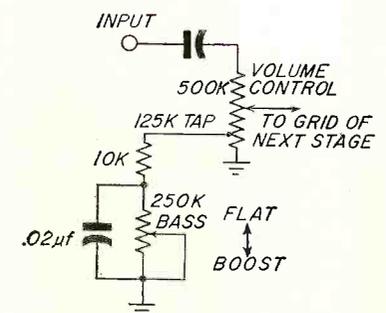
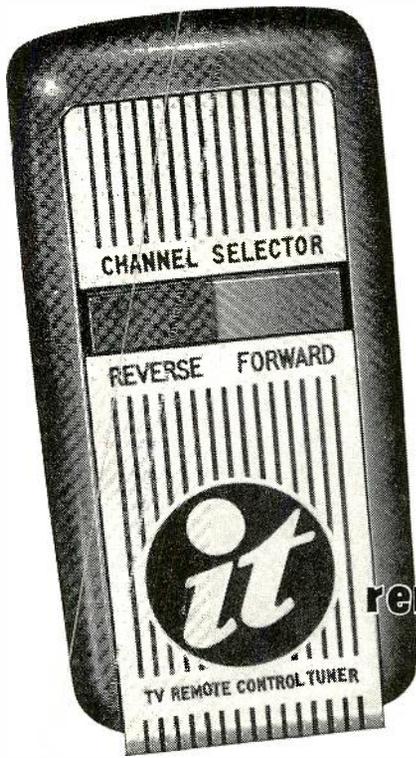


Fig. 1—The bass boost control can at low settings of volume control provide 17 db of boost adjustment.

boost capabilities of the control are virtually negligible. As the user reduces the setting of the *volume* control to correspondingly lower listening levels, the range of the bass boost control becomes increasingly greater.

Certain combinations of systems, when played at loud listening levels, may actually seem to have *too much* [Continued on page 50]

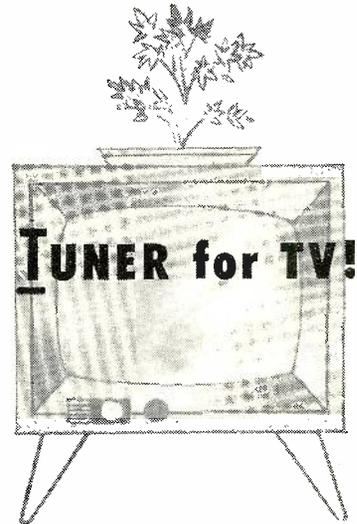


New gift idea!

... Terrific TV traffic-builder for Christmas!

remote CONTROL INSTANT TUNER for TV!

changes channels from your easy chair!



DON WILSON—RADIO AND TV'S GREATEST SALESMAN WILL BRING CUSTOMERS IN DROVES!

Don Wilson, one of America's long-time favorite radio and TV announcers, will lend his strong support to help you sell **I-T** Remote Control *Instant Tuners* on television. So place your order now for a big stock of **I-T's** and capitalize on this big advertising campaign... timed for Christmas.



Goes On Practically Any Set!

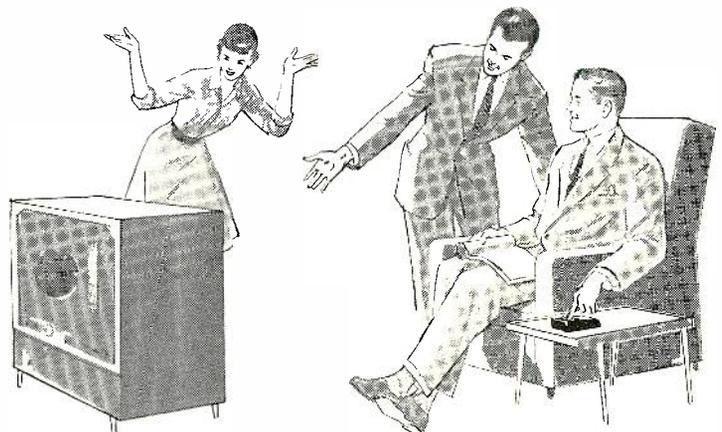
The **I-T** Remote Control Instant Tuner is engineered to go on practically any set—new or old. Your market is wide open!

No Installation Problems!

Customers can install **I-T** themselves in less than 3 minutes! It's easy—no tools needed—no electrical connections. And, there's no service problem!

HERE'S HOW **it** SELLS!

I-T sells like hot cakes! All you have to do is demonstrate it—and you'll sell **I-T's** by the bushel! Almost every TV set owner is a red hot prospect. IN ADDITION—**I-T** is the perfect gift for every occasion—Christmas, wedding, housewarming! You name it—and you'll sell **I-T**!



I-T IS SOLD AND FULLY GUARANTEED BY

THE ALLIANCE MANUFACTURING CO., INC., ALLIANCE, OHIO

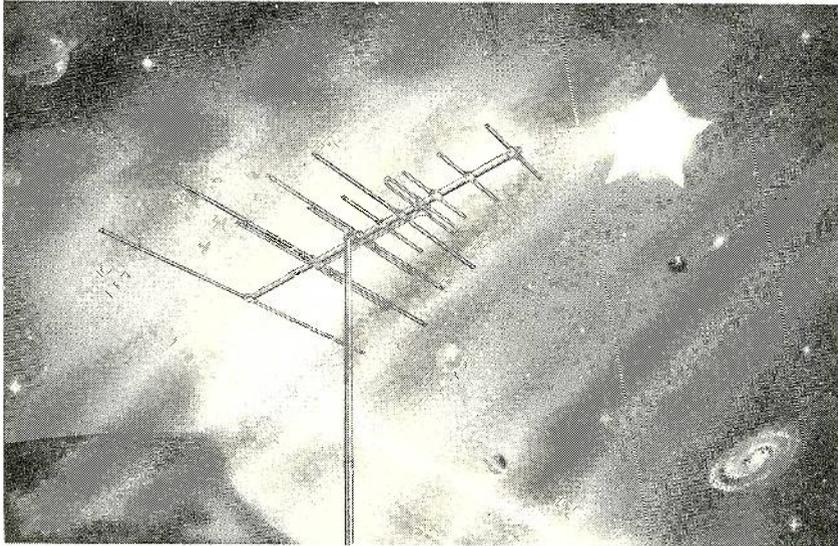
(Division of Consolidated Electronic Industries Corp.)

In Canada—Alliance Motors, Schell Ave., Toronto, Ontario

WRITE, WIRE, OR CALL NOW FOR INFORMATION ON HOW YOU CAN ORDER and PROFIT with **I-T** Remote Control INSTANT TUNER!



INTRODUCTORY ONCE-ONLY OFFER!



The new VEE-D-X SKY-STAR for fringe and super-fringe areas.

One of Each of These Famous VEE-D-X ANTENNAS

can now be purchased DIRECT

USE THIS ADVERTISEMENT

The VEE-D-X antenna type line is nationally known and is sold exclusively through many electronic parts jobbers. *That policy will not be changed!* However, some jobbers have not carried our line and some service dealers have not yet tried VEE-D-X products.

To induce you to try VEE-D-X, here is a startling **INTRODUCTORY OFFER**. One time only we will sell and ship direct to Service Dealers, at rock-bottom prices, one of any VEE-D-X antenna types. There are 7 types, each in single or double bay, so you can buy up to 14 antennas, at the prices shown. This offer expires February 1, 1957.

Try these antennas. Prove to your satisfaction, as thousands of Service Dealers already have, that VEE-D-X makes fine electrical performers, rugged in mechanical design, dependable in every respect. After this initial trial order—direct from the factory—your future needs will be met by your regular parts jobber at his standard trade discounts.



The antennas you order will be shipped direct to you F.O.B. from the VEE-D-X factory. Each will be individually boxed in its regular VEE-D-X carton.

NOVEL PRODUCTS CORP.
19 West 44th St., New York 36, N. Y.

Ship 1 each of the VEE-D-X antenna types checked (maximum order 14). This offer expires Feb. 1, 1957. Check or M.O. must accompany order.

NAME

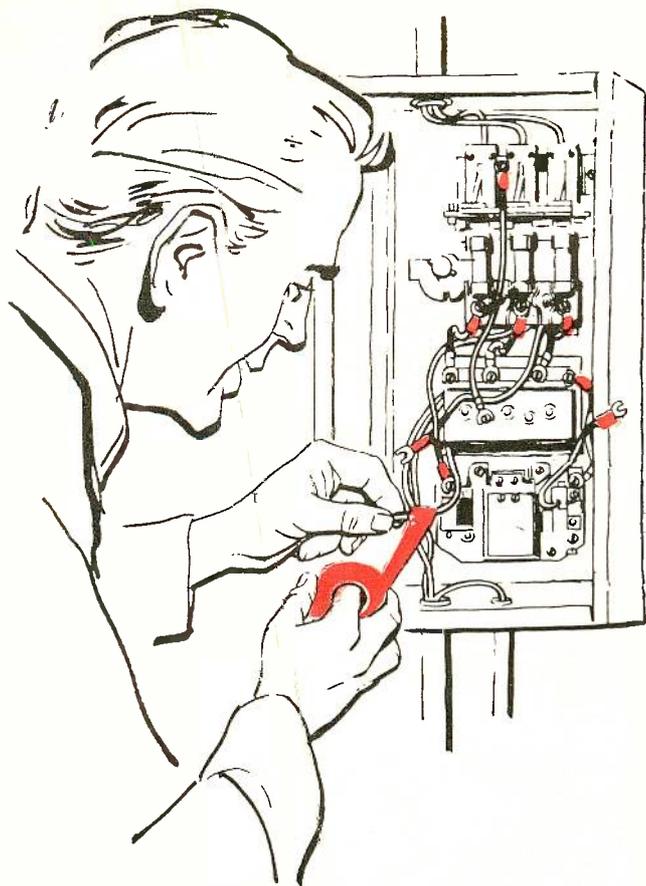
CITY

STATE

TYPE	SINGLE BAY	DOUBLE BAY
VDX SKY STAR	<input type="checkbox"/> \$ 8.70	<input type="checkbox"/> \$18.00
VDX SKY FLASH	<input type="checkbox"/> \$13.25	<input type="checkbox"/> \$26.50
VDX SKY CHAMP	<input type="checkbox"/> \$ 9.60	<input type="checkbox"/> \$19.25
VDX SKY STREAK	<input type="checkbox"/> \$ 7.00	<input type="checkbox"/> \$14.50
VDX SKY SCOUT	<input type="checkbox"/> \$ 7.25	<input type="checkbox"/> \$14.60
VDX SKY RAY	<input type="checkbox"/> \$14.25	<input type="checkbox"/> \$28.50
VDX SKY RAIDER	<input type="checkbox"/> \$ 7.40	<input type="checkbox"/> \$14.80

ARE YOU USING THE RIGHT TAPE?

The important characteristics and specific applications of four different types of insulating tape are presented in this article.



Quick identification of switches, terminals, and controls is possible by using vinyl color tape on control panels.

VARYING requirements in the trade call for different kinds of insulating tape. Some are needed for holding and protecting, others for their fusing and insulating properties, and others for color coding. Still other tapes offer resistance to weather, oils, grease, acids, and alkalis.

The Johns-Manville Co. manufactures four different types of tape to meet these particular needs. The following description of these tapes will help the serviceman select the tape which best meets his requirements.

Plastic Tapes

Plastic tapes offer maximum versatility and performance. They stretch readily to irregular surfaces, resist galvanic corrosives, and stand up to severe weather conditions. They are not affected by oil, grease, acids, and alkalis. These tapes are available in different thicknesses for identification purposes.

Plastic tapes offer maximum versatility and performance. They stretch readily to irregular surfaces, resist galvanic corrosives, and stand up to severe weather conditions. They are not affected by oil, grease, acids, and alkalis. These tapes are available in different thicknesses for identification purposes.

in general use, heavy duty, or extra heavy duty applications, such as those where abrasion and wear are encountered.

Friction Tape

Friction tape provides positive insulation protection under severe climatic conditions. It provides economical insulation whether used alone or in conjunction with rubber tape. A single layer of this tape resists voltages from 1000 volts to as high as 2000 volts, depending on the particular variety used.

Rubber Tape

Rubber tape fuses to itself instantly without the application of heat. It forms an all-around sealed, protective rubber insulation with more than 18,000 volts dielectric strength per thickness of tape. It stretches to conform to irregular shapes, cushions corners and projections, and fills voids and low spots.

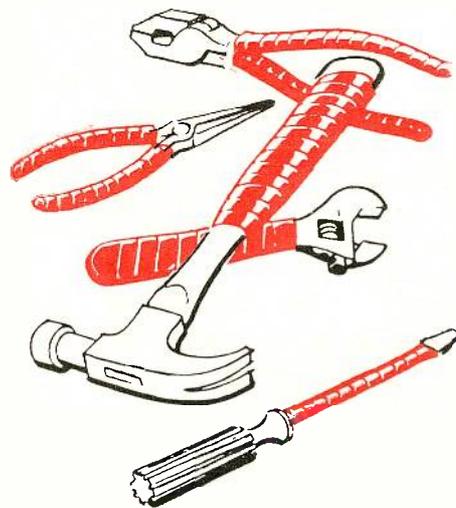
Rubber tape is non-corrosive to electrical conductors, elastic, and easy to work with at all climatic temperatures and weather conditions. It offers a safe completely sealed and fused protective covering for dependable insulation.

Vinyl Tape Color Tapes

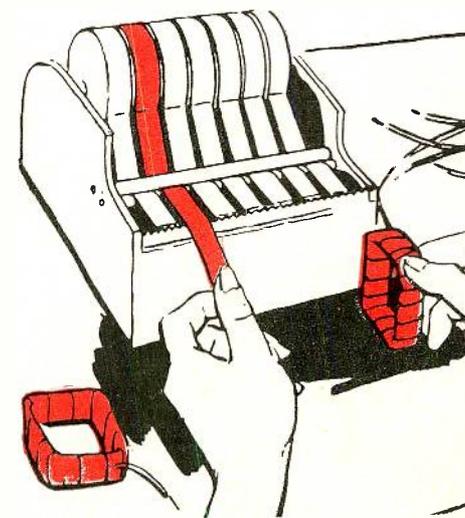
The vinyl color tapes are true electrical insulating tapes in colors which can be used for color coding terminal strips and splices while providing 6000 volts of dielectric resistance. This corresponds to more than 1,000 volts per mil of thickness. This tape is moisture

proof, fungus and mildew proof. It also resists both fresh and salt water, oil, grease, acids, and corrosive chemicals. In addition, it is a flexible tape, and as such, conforms readily to irregular surfaces.

Vinyl tape is available in a choice of colors. These include red, green, yellow, blue, black, brown, white, gold, and silver. The color is all through the vinyl film backing and so will not fade or wear off. A pressure sensitive adhesive with quick grab and holding power is permanently bonded to the film backing. It will not pull off and leave bare spots.



The non-slip surface and insulation insurance makes vinyl color tape ideal as a tool handle wrap.



Color coding tapes on the assembly line may be used to identify parts and circuits with ease.

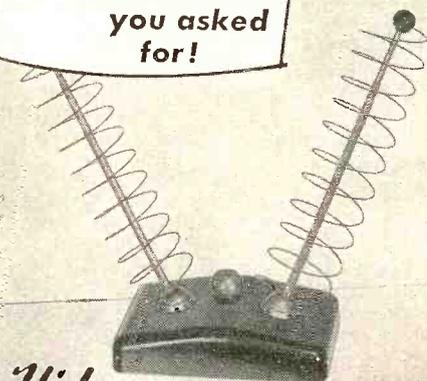
\$100,000

GUARANTEED PERFORMANCE

Each and every Hi-Lo is backed by a money-back guarantee. For the best reception, unsurpassed clear pictures, specify Hi-Lo, with the exclusive highest gain, spiral designs which are covered by the following U.S. patent numbers: 2,495,579; 2,583,745; 2,724,773; 2,748,387; 2,755,466; and Canadian Patents 1951 and 1956; other patents pending.

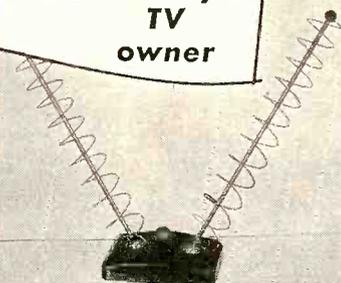
Hi-Lo is covered by a \$100,000.00 insurance policy issued by one of the largest insurance companies.*

New...
Just what
you asked
for!

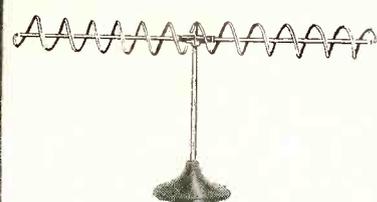


Hi-Lo Model 505 — Channels 2-83
The spiral antenna that is designed for maximum performance featuring the NEW TELESCOPING DIPOLES. This versatile antenna swivels on ball and socket in any direction. Gold spirals, plastic base blend with any room. LIST... \$14.95

New...
For every
TV
owner



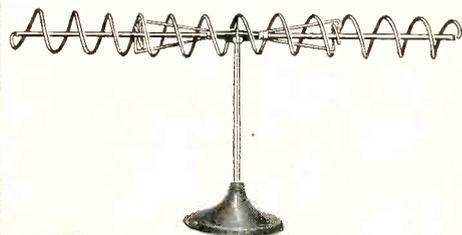
Hi-Lo Model 404 Channels — 2-83.
NEW INDOOR ANTENNA that swivels with a gentle touch of your little finger. Dipoles swivel on ball and socket in every direction. Golden spirals and decorative plastic base blend with all furniture. RECEPTION IS GUARANTEED. LIST... \$12.95



Hi-Lo Model 101 — Channels 2-13.
The original and world famous antenna that is wanted, demanded and used for GUARANTEED FINEST RECEPTION. No rods to adjust. Provides clear pictures faster. LIST... \$9.95



Hi-Lo Model 303 — Channels 14-83.
The UHF ANTENNA with the highest signal gain that is specially designed for ALL UHF areas. Luxurious gold upright and crossbar. LIST... \$5.95



Hi-Lo Model 202 — Channels 2-83
PEAK PERFORMANCE which is unsurpassed is guaranteed with this antenna... for ANY and EVERY area. The gleaming gold upright, shiny spirals, bakelite base, aluminum bars, modern design

... all make this YOUR BEST ANTENNA BUY.

LIST... \$9.95

INSIST ON THE GENUINE Hi-Lo Spiral Antennas!
Known and accepted everywhere, Hi-Lo is manufactured and GUARANTEED by the best antenna manufacturer in the world. Hi-Lo is consumer accepted and approved.

Hi-Lo TV ANTENNA CORP.
3540 North Ravenswood Avenue
Chicago 13, Illinois

THE WORK BENCH

Unusual Service Problems And Their Solutions

by PAUL GOLDBERG
Service Manager

This Month's Problem:
AGC Circuits

THIS month's installment is devoted to an *agc* problem. A thorough knowledge of the receiver circuitry is necessary in order to solve problems in these circuits.

RCA Chassis KCS82

The receiver was turned on and it was observed that the picture was hooking at the top. The horizontal hold was adjusted but it had little effect on the hooking. The synchroguide transformer *T114* was also adjusted but the hooking remained. The *agc* control *R154* was next adjusted. It was noted that when the picture was set at a low contrast point, the picture did not hook, but as soon as the *agc* control was set properly, the hooking appeared. It was also seen that the picture had a tendency to overload when the channels were changed.

Knowing these facts, *V111*, *12AU7*, *V112* *6SN7*, and all the video and tuner tubes were replaced individually but without effect. The *agc* control *R154* was adjusted from minimum to maximum. This varied the video gain in such a way as to cause us to believe that this was a horizontal sync problem rather than an *agc* problem.

The scope was then set up and the wave shape was measured at the grid pin #7 of *V111B*, $\frac{1}{2}$ *12AU7*, the horizontal sync separator. The wave shape was correct at this point.

A similar measurement was next taken at Pin #6 plate of *V111B*. Here the wave shape was too small. Thus the trouble was in this tube's circuitry.

Voltage checks were next made at the plate, grid and cathode of *V111B* and all were approximately correct. We thought at this point that a slight condenser leakage might not show up in the voltage checks. Condensers *C146*,

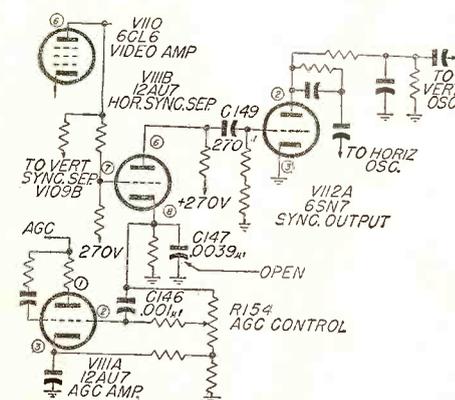


Fig. 1—Partial Schematic of the RCA KCS 82 showing *agc* circuit.

C149 and *C147* were therefore all checked, but showed no leakage.

At a loss for an idea for the moment, the diagram was studied. In this receiver, the composite video signal is fed directly from the plate of the video amplifier, *6CL6*, *V110* to the grid of *V111B*. *V111B*, $\frac{1}{2}$ *12AU7*, is so biased as to permit only the horizontal sync pulses to cause this tube to conduct. Thus, only the horizontal sync pulse appears at the plate of *V111B*. With these facts in mind the horizontal sync separator circuitry was again examined.

As we had not checked for condensers being open, *C147* was clipped out of the circuit and a new .0039 uf condenser was installed. When this was done the receiver instantly functioned properly. The *agc* control was sent back to the proper point and

When *C147* opened the cathode voltage to the grid volt making the horizontal circuit degenerative. The normal age of *V111B*, thus

SERVICE DEALER and ELECTRONIC SERVICE

the receiver was reset by the customer. It caused the age of *V111B*, thus

ASSOCIATION NEWS

by SAMUEL L. MARSHALL

Associated Radio Television Servicemen of New York (ARTSNY)

On Sunday, October 14, 1956, a committee of ARTSNY travelled up to Bridgeport, Conn. to meet with other Associations of the New England States. The major portion of the discussion centered around manufacturers going into the service business and other phases of the service industry.

Radio and Television Guild of Long Island

One of the numerous "man sized" jobs associated with the forthcoming Electronics Fair to be sponsored by the Guild in December is the formulation of a lecture program. Many people have already pledged their participation and a partial list of speakers and topics is as follows:

Mr. Samuel L. Marshall, editor of Service Dealer magazine, will speak on "The Outlook for Servicemen Handling Color TV and Industrial Electronics Servicing."

NATESA

The National Alliance of TV & Electronic Service Associations has declared war on Captive Service.

So that there can be no mistake in what NATESA considers captive service, the following definition was adopted by unanimous vote of the membership: Services offered to consumers on a fee or no charge basis by a TV and/or radio receiver manufacturer, their subsidiaries, agents or segment of a receiver distribution other than the retail merchandiser.

TESA, St. Louis

At a recent meeting reports on progress in cooperation made with distributors in fighting "Captive Service," were made. Also a report by Howard Freiner on the NATESA convention was presented.

[Continued on page 44]

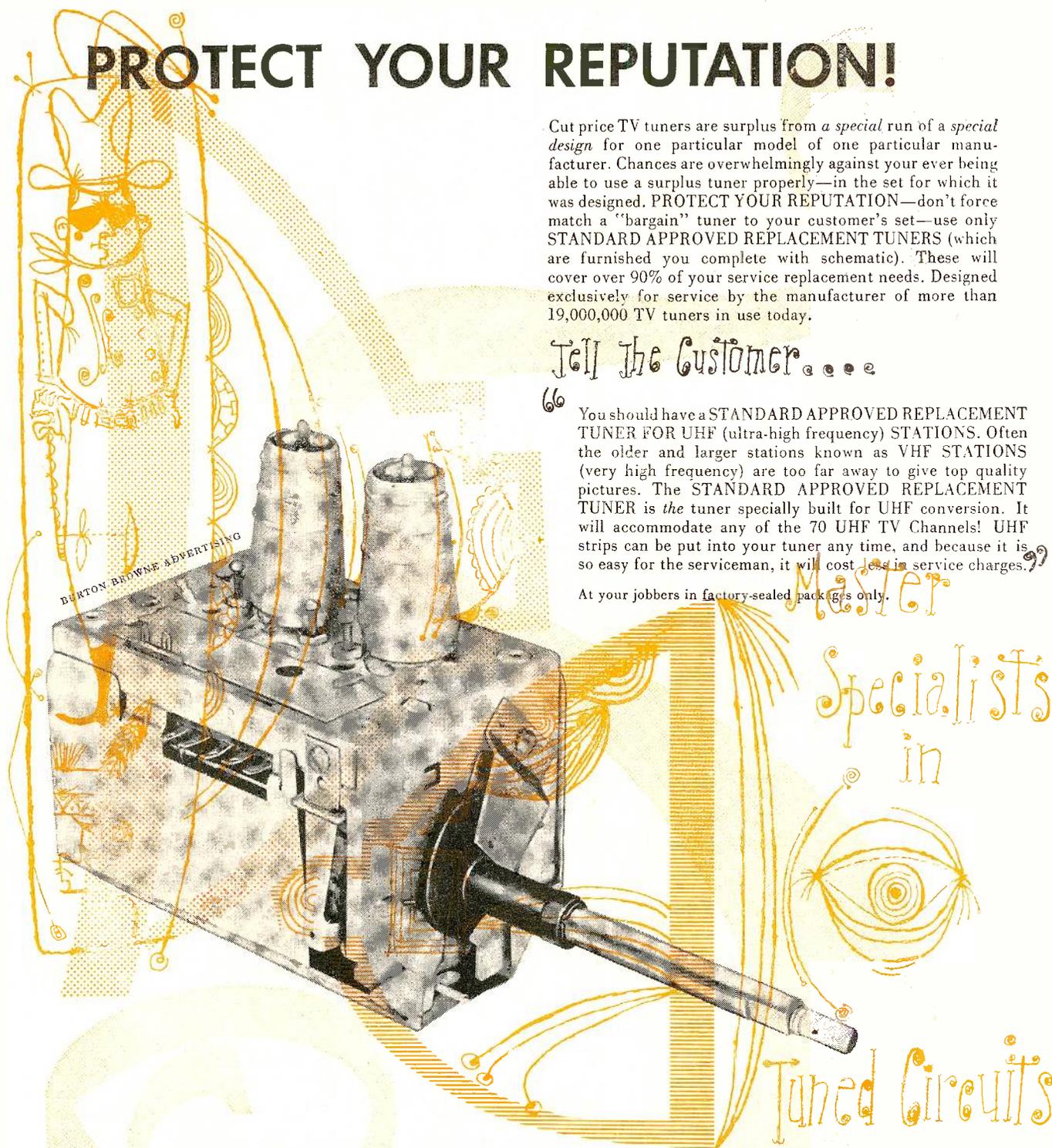
PROTECT YOUR REPUTATION!

Cut price TV tuners are surplus from a special run of a special design for one particular model of one particular manufacturer. Chances are overwhelmingly against your ever being able to use a surplus tuner properly—in the set for which it was designed. PROTECT YOUR REPUTATION—don't force match a "bargain" tuner to your customer's set—use only STANDARD APPROVED REPLACEMENT TUNERS (which are furnished you complete with schematic). These will cover over 90% of your service replacement needs. Designed exclusively for service by the manufacturer of more than 19,000,000 TV tuners in use today.

Tell the Customer

You should have a STANDARD APPROVED REPLACEMENT TUNER FOR UHF (ultra-high frequency) STATIONS. Often the older and larger stations known as VHF STATIONS (very high frequency) are too far away to give top quality pictures. The STANDARD APPROVED REPLACEMENT TUNER is the tuner specially built for UHF conversion. It will accommodate any of the 70 UHF TV Channels! UHF strips can be put into your tuner any time, and because it is so easy for the serviceman, it will cost less in service charges.

At your jobbers in factory-sealed packages only.



Master
Specialists
in
Tuned Circuits

CHICAGO—LOS ANGELES—BANGOR, MICH.—NO. DIGHTON, MASS.

Export Agent: Scheel International, Inc., Chicago

ORIGINATORS of the Turret Style Tuner

ORIGINATORS of the Standard Cascade Tuner

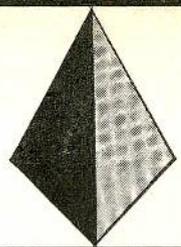
ORIGINATORS of the Standard Pentode Tuner

ORIGINATORS of the New Neutrode Tuner

Master Specialists in Tuned Circuits

World's Largest Manufacturer of Electronic Components

Standard COIL PRODUCTS CO., INC.



NO.66

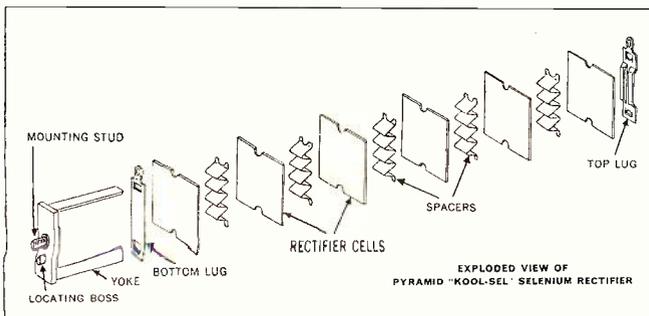
PYRAMID technical bulletin

SELENIUM RECTIFIERS

General:

The trend toward component miniaturization with attendant increase in equipment compactness has resulted in a steadily rising ambient operating temperature. Selenium rectifiers are particularly critical in this respect because much depends on their ability to maintain a high output voltage over extended periods of time. A major limiting factor in this respect has been the "Center-support" type of construction of conventional rectifiers and the tendency of this construction to concentrate the generated heat within a relatively small area. The Pyramid patented-type construction, known as the "Kool-sel," is a significant break-through of this heat barrier.

An exploded view of a Pyramid rectifier is shown below. Note that the center support has been eliminated completely; instead, the individual selenium rectifier coils are supported at their outer edges. A molded phenolic yoke forms the main supporting member, with a mounting stud and locating boss molded into the yoke. In this way, they become integral parts of that yoke. The lugs of the rectifier are slotted to accommodate the two arms of the yoke and the rectifier cells and spacers are notched to fit snugly on the yoke arms. Clinching lips are provided on the top lug so that when it is pressed on the yoke, all components are locked together to form a rigid assembly. During assembly, the spacers are flexed slightly to insure that the unit remains tight under all normal environmental conditions.



ADVANTAGES OF "Kool-sel" CONSTRUCTION:

Mechanical:

1. Cells and lugs are locked in place and cannot rotate.
2. Locking together of the components is accomplished without the current pickup contacts exerting excessive pressures on the cell counter electrode. Too much pressure may produce three detrimental effects: First, it may decrease the reverse resistance and thereby lower rectifier efficiency. Second, there is a cold flow of the counter electrode from under the pickup contacts. Third, fracture or damage to the counter electrode adjacent to the pickup contacts may occur.
3. The locating boss, being an integral part of the yoke, is always in the correct position.
4. Pulling on the positive lug cannot crack or break the alley (counter electrode) of the adjacent rectifier cell.
5. This particular mechanical construction results in fewer component parts.

Electrical:

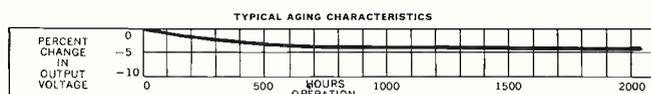
1. There is a high dielectric strength between the "live" components (i.e., cells, spacers, and lugs) and the mounting stud. The normal insulation thickness over the mounting stud is $\frac{1}{16}$ ".

2. There is high resistance to burnouts on current surges.
3. The current pickup points are distributed over the full width of the rectifier cell. This means that heat is dissipated rapidly and the temperature rise of the rectifier cells during the flow of current surges is relatively low.

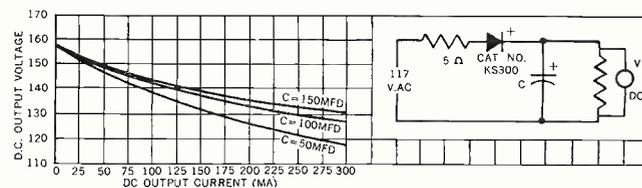
CHARACTERISTICS:

Illustrated below is a typical aging Characteristics Chart, showing percentage change in output voltage vs hours of operation.

CATALOG NUMBER	KS-65	KS-75	KS-100	KS-150	KS-200	KS-250	KS-300	KS-350	KS-400	KS-500
Maximum RMS Input Voltage	130	130	130	130	130	130	130	130	130	130
Maximum Inverse Peak Voltage	380	380	380	380	380	380	380	380	380	380
Maximum Peak Current (MA)	650	750	1000	1500	2000	2500	3000	3500	4000	5000
Maximum RMS Current (MA)	162	187	250	375	500	625	750	875	1000	1250
Maximum DC Current (MA)	65	75	100	150	200	250	300	350	400	500
Approximate Rectifier Voltage Drop	5	5	5	5	5	5	5	5	5	5
Minimum Series Resistance	22	22	22	15	5	5	5	5	5	5
Maximum Operating Plate Temperature	85°C	85°C	85°C	85°C	85°C	85°C	85°C	85°C	85°C	85°C



Voltage Regulation: The voltage regulation curves for a 300 ma selenium rectifier in a half-wave circuit with 117-volt rms input shown below. Suitable voltage regulation curves for all Pyramid "Kool-sel" selenium rectifiers are available upon request.



APPLICATIONS:

Radios and Radio-Phonographs: Low-cost, efficient rectifiers for radios and radio-phonograph combinations are "Kool-sel" KS-65, KS-75, and KS-150. The needs of most 5-tube chassis are met by the KS-65, while the KS-75 and KS-150 are used in sets with larger current requirements.

Television Receivers: High-voltage power supplies in television receivers—including color sets—use "Kool-sel" numbers KS-200, KS-250, KS-300, KS-350, KS-400, and KS-500. These rectifiers, used in voltage doubler or voltage tripler circuits provide the proper B-plus voltage, eliminating the size, cost, weight and hum problems of power transformers. "U" shaped brackets are available which permit the rectifiers to be mounted either in vertical or horizontal positions.

Radio Accessories: TV boosters, UHF converters, phonograph oscillators, inter-coms and the like can usually be powered suitably by a "Kool-sel" KS-65 rectifier.

Laboratory Instruments, Power Supplies, Amplifiers: Rectified high voltage through the use of voltage doubler and tripler circuits, for equipment where current requirements run as high as 500 ma, may be provided with "Kool-sel" rectifiers. Types KS-200 through KS-500 will be found useful for laboratory power supplies, DC filament supplies, motion picture projectors, amplifiers, test equipment and other specialized uses.

THE ANSWERMEN

BY SERVICE DEALER & ELECTRONIC
SERVICING TECHNICAL STAFF

Dear Mr. Answerman:

I have a Philco 7E10 TV chassis that has poor horizontal and vertical sync operation. The circuits have been gone over in the chassis quite thoroughly and the cause of this condition has not been determined. Actually, it takes a period of time for the trouble to appear, which makes locating the trouble even more difficult.

T. C.
Newark, N. J.

As can be noted in Fig. 1 a dual selenium diode is employed to perform horizontal phase comparing action. On occasion these combination selenium diodes have been known to fail causing a variety of troubles. When a dual diode becomes faulty the horizontal oscillator frequency goes out of sync. In most instances when one side or the other is open the condition is permanent and can be determined easily with an ohmmeter. This is the more easily determined type of trouble encountered with dual selenium diodes.

If the diode section that connects to ground should short internally the horizontal and vertical pulses to their respective circuits will be reduced, caus-

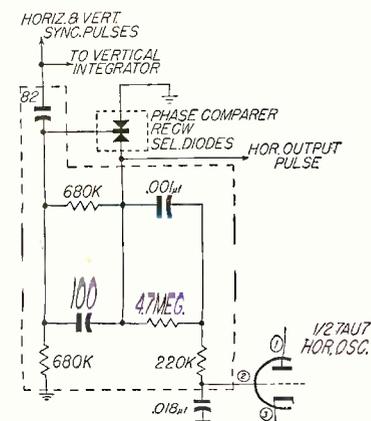


Fig. 1—Partial schematic of Philco 7E10

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

ing loss of, or poor, horizontal and vertical sync.

Many of these troubles appearing in the new receivers occur during the receiver warm-up process. In one particular known case the receiver drifted out of the horizontal hold control lock-in range in about 20 minutes.

Dual selenium diodes such as shown in the Philco circuit of Fig. 1 are also being employed by many other manufacturers in their receivers. These dual diodes have been a source of some trouble causing weird effects such as poor vertical sync and others. On some occasions replacement diodes have not been available. In these instances a pair of 1N60 or similar crystals have been temporarily substituted to allow the receiver to be operated so as to troubleshoot other difficulties. This type of substitution is not generally desirable as the correct replacement part should be used for best results. A match between the diode sections is desirable.

Care should be used when installing the dual diode type of component just as with other type of crystal units. Employ as small an amount of heat as possible and permit no tension to exist on the pigtails.

Mr. Answerman:

I am having a problem of obtaining a sufficiently bright picture on a TV receiver I am servicing. The picture tube voltages have been checked and seem to measure about normal. A new picture tube was substituted with no improvement. Have you any suggestions. The chassis is a Crosley 472.

W. T.

Los Angeles, Cal.

[Continued on page 29]



One gift you can give yourself...

PROFITS FROM YEAR-END RCA BATTERY SALES

More portable radios will be found under the Christmas trees this year than ever before. And just as sure as there's a Santa, there's a clause that says portables need batteries—RCA Radio Batteries. So, give yourself a gift of year-end battery profits. Ask your RCA distributor to fill in your stock with consumer-accepted RCA Radio Battery types. Then, play up your RCA Battery line. Promote yourself into a big share of both the new-set business and the replacement business that's coming as sure as '57. And, with RCA's national advertising and colorful promotional material supporting your efforts, you're sure to wrap up a cheerful package of profits for yourself this year.



RADIO BATTERIES

RADIO CORPORATION OF AMERICA • CAMDEN, N. J.

AGC CIRCUITRY IN COLOR TV RECEIVERS

by **BOB DARGAN** and
SAM MARSHALL

From a forthcoming book entitled
"Fundamentals of Color Television"

AUTOMATIC gain control (*agc*) is designed to maintain a constant video signal level at the CRT grid for a given setting of the contrast control, despite variations of input signal at the antenna terminals.

Block Diagram Analysis

There are many types of *agc* circuits, however, the one most often used in color TV receivers is *keyed agc*, shown in block diagram form in Fig. 1. This type of *agc* provides the most effective control for possible signal variations and

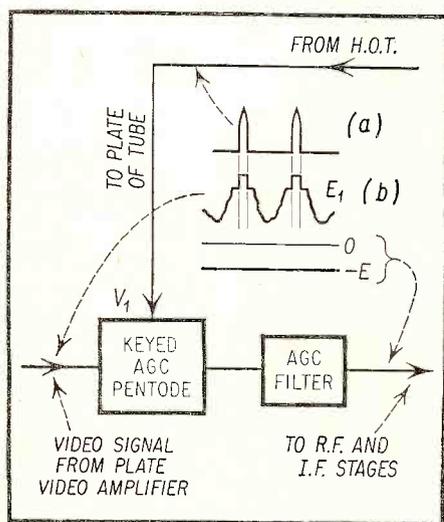


Fig. 1—Block diagram of keyed AGC systems.

noise interference because its action depends on the sync pulse amplitude of the signal which is constant, rather than the average value of the video signal which varies continuously.

This characteristic provides a fixed value of signal level against which signal deviations may be compared and corrected. Another advantage of keyed *agc* is its quick action in following rapid signal variations such as those caused by airplane reflections. This quick action is effected by means of fast acting RC filters in the circuit.

As shown in Fig. 1, the operation of the keyed *agc* circuit is centered around a pentode tube the input of which is fed positive sync video signal information from the plate of the video amplifier, and the plate of which (top) is fed a high amplitude positive pulse from the horizontal output transformer. When this pulse is present at the plate and the grid bias is of the right value, tube conduction takes place. Thus, tube conduction can only occur during sync pulse intervals. Under these conditions noise present during the actual video signal interval will not affect the *agc*.

When no signal ($E_1 = 0$) is present at the grid of the *agc* tube (antenna is disconnected) the control grid is highly negative with respect to cathode. Even the presence of a large positive pulse at the plate from the horizontal output

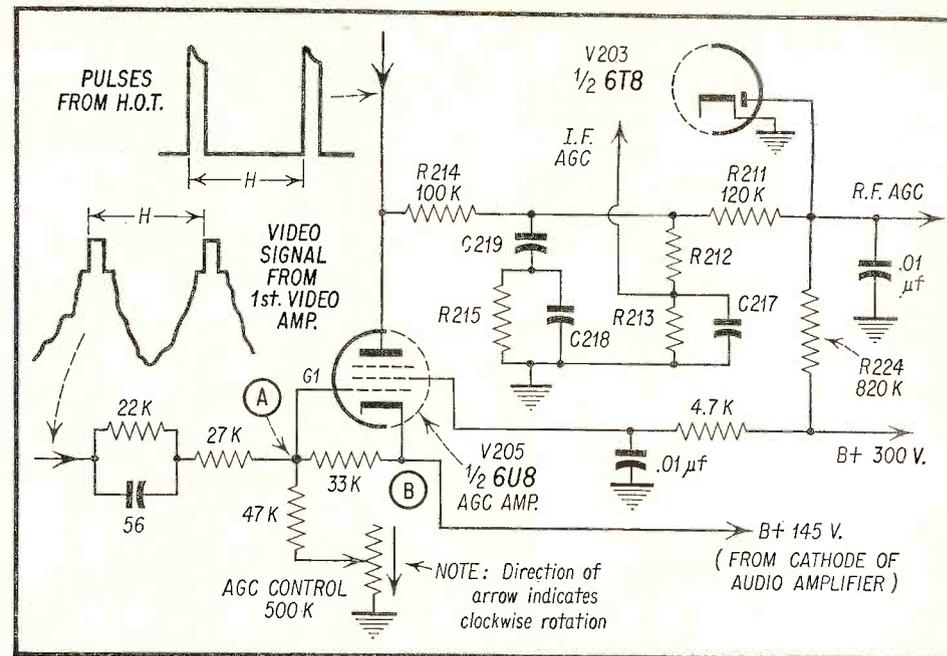


Fig. 2—Simplified schematic of AGC circuit used in RCA color receiver.

transformer is not adequate under these conditions to produce a flow of plate current. With no plate current flowing, there is no *agc* voltage developed, and the tuner and *if* stages are in a maximum gain condition, that is, zero bias.

Now consider the condition where a very small video signal is applied to the antenna terminals. Under these conditions a small signal, E_1 , is applied to the input of the *agc* tube. This signal, we will assume, is too small to produce conduction, that is, plate current in V_1 . As the signal increases in amplitude, a critical value will be reached which will cause V_1 to go into conduction. This conduction will produce plate current which gives rise to an *agc* voltage applied to the *rf* and *if* stages.

Now as the antenna signal increases still further, the increased *agc* bias will reduce the tuner and *if* stage gains in direct proportion to the increased antenna signal. Under these conditions E_1 remains constant, as does the signal level at the video detector output, thus producing the desired *agc* action.

Notice that conventional B plus voltage is not applied to the keyed *agc* tube. Instead, a positive pulse from the horizontal output transformer is fed to the plate. This pulse triggers or "gates" the tube into conduction during the time interval in which the sync pulse is ac-

tive as shown at (a) and (b). Thus, the signals appearing at the plate are amplified negative versions of the positive sync tips at the grid. These plate pulses are smoothed out by the fast acting filter network connected in the plate circuit, thereby providing a negative *dc* voltage which is applied to the grid returns of the *rf* and *if* stages. In this manner variations in *rf* signal strength are transformed into variations of negative *dc* voltage, the *dc* voltage variations being applied to the grids of the *rf* and *if* tubes.

If, for some reason or another, the incoming *rf* signal should suddenly increase, the grid bias on the *rf* and *if* tubes would also increase, thereby reducing the gain of these tubes by an amount that would bring the video signal at the CRT input back to its original value. Similarly, if the antenna signal should suddenly decrease, the *agc* bias would also decrease, thereby increasing the *rf* and *if* tube gains; again bringing the video signal back to its original value.

Circuit Analysis

A typical *agc* circuit used in color TV receivers is shown in Fig. 2. The video signal from the first amplifier is fed into G1 of V205 via the parallel combination comprising the 22K resistor and 56 μmf condenser, both in series

with the 27K resistor. Fixed operating bias for this tube is provided by the network comprising the 33K and 47K resistors, and the *agc* control.

The latter adjusts the conducting level of the *agc* tube for the most powerful station being received. In practice, when making this adjustment, the most powerful station available is tuned in, and the control is rotated until the picture contrast and sync appears normal.

The action taking place during these adjustments is as follows: Starting with the control arm in its maximum clockwise position (grounded) the *dc* voltage drop across the 33K resistor between grid and cathode is a maximum. In this position of the control the bias on the tube is very high, and even during the application of the plate sync pulse the tube is cut off. When the control arm is in its maximum counterclockwise position the voltage drop across the 33K resistor is a minimum, and the tube becomes conductive (that is, during sync pulse intervals).

Relative output *agc* voltages produced by a given signal amplitude for different settings of the *agc* control are shown in Fig. 3. The net *dc* operating points shown at (A) and (B) are the resultant grid to cathode voltages developed by the combined setting of the *agc* control, the plate voltage of the video amplifier, and the reference supply voltage (in Fig. 2 it is 145 volts).

Observe that the same amplitude of input signal (signal 1 and signal 2) can produce different *agc* control voltage values, depending on the setting of the *agc* control. Thus, signal 1 produces plate current pulse 3; and signal 2 produces plate current pulse 4. These plate current pulses in turn produce different *agc* voltages.

In weak signal areas, the best setting of the *agc* control corresponds to (A) of Fig. 3. Under these conditions little plate current swing and corresponding *agc* bias is developed. In strong signal areas, the best setting of the *agc* control is in the vicinity of point (B). Under these conditions the *agc* sensitivity is much higher than at (A), and the same value of incoming signal will produce higher *agc* voltages than at (A). Thus, a strong signal will produce a very high

[Continued on page 44]

AS MODERN AS TOMORROW...



the
WING
DIPOLE
and
WING
DIRECTOR

The **MOST POWERFUL** combination
ever designed

FOUND ONLY IN THE TRIO ZEPHYR LINE



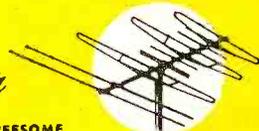
ZEPHYR
MITE
POWER PACKED PAIR

FOR DISTANCE



Zephyr
POWER PACKED THREESOME

FOR EXTREME DISTANCE



ZEPHYR ROYAL
POWER PACKED FOURSOME

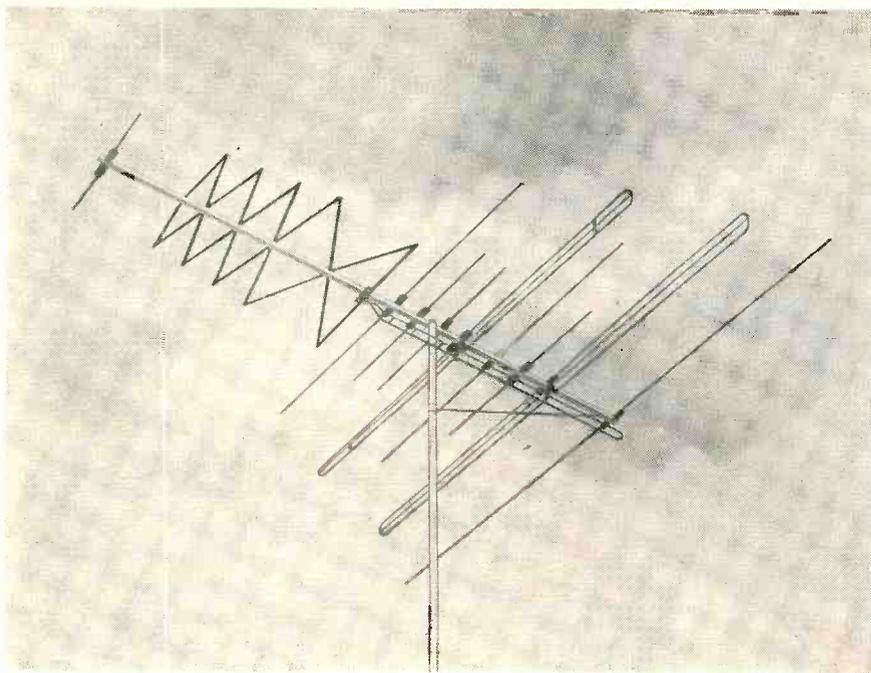
FOR THE MAXIMUM

Trio's Zephyr and Zephyr Royal, the leaders of the 1956 season, are brought to you in the 1957 models improved and perfected, and destined to remain the champions. This famous antenna family is expanded by the Zephyr-Mite, newest addition to the Zephyr family. Trio's Zephyr family features the "Wing" dipole—the composite dipole that brought the power of the Yagi to every channel! Add to this the "Wing" director, the revolutionary new director specifically designed to enhance the power and sensitivity of the "Wing" dipole—and you have a combination that is unequalled in the TV antenna field today for the maximum in performance. The "Wing" dipole and "Wing" director are exclusive features of the Trio Zephyrs—features that make Trio "the choice antenna line."

Trio's recognized quality construction features the internationally famous Insta-Lok clamps—the clamps that 'protect' the element!

TRIO[®] Manufacturing Company
GRIGGSVILLE, ILLINOIS

COPYRIGHT 1956 TRIO MFG CO. EXPORT SALES DIV., SCHEEL INTERNATIONAL INC., 4237 N. Lincoln Ave., Chicago, U.S.A. Cable Address: HARSHEEL



The Wonder-Helix, Model WX811, particularly suitable for deep fringe areas. It features high gain on both bands and a high average front to back ratio.

The antenna is a vital link in the satisfactory reception of color TV signals. This article describes the JFD NCB (non color blind) series of antennas, for color and monochrome reception.

By Simon Holzman
Chief Engineer,
JFD Antenna Development Division



The JFD NCB Colortenna Series

WITH the advent of compatible color television, it became obvious that an important decision had to be made. The importance of the choice of an antenna could not be overestimated. The best of color

sets cannot give satisfactory results unless the signal at the tuner input is of good quality. Many antennas which gave good performance on black and white transmission would be unusable for color due to fre-

quency hiatus, gain and beamwidth characteristics, and high VSWR.

Rather than attempt to recheck all models and publish a listing, showing which of our present antennas are suitable for color reception, it was decided to design a complete, distinctive series of antennas which would be ideal for both color and monochrome and would cover the problems encountered in most locations from metropolitan to deep-fringe areas. This

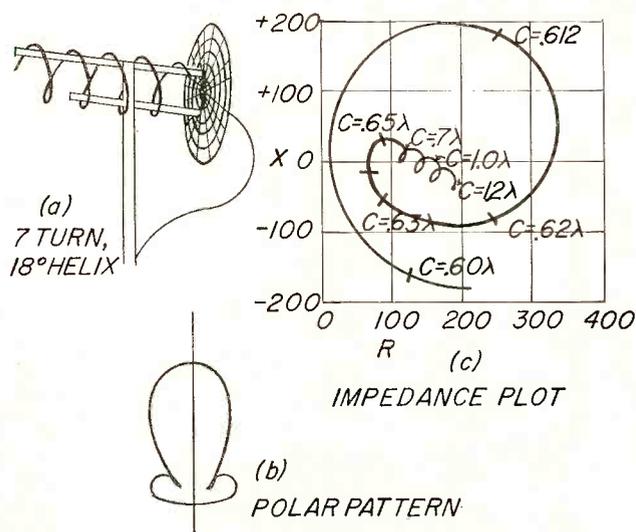


Fig. 1—The circular helix antenna showing construction, and both polar and impedance plots.

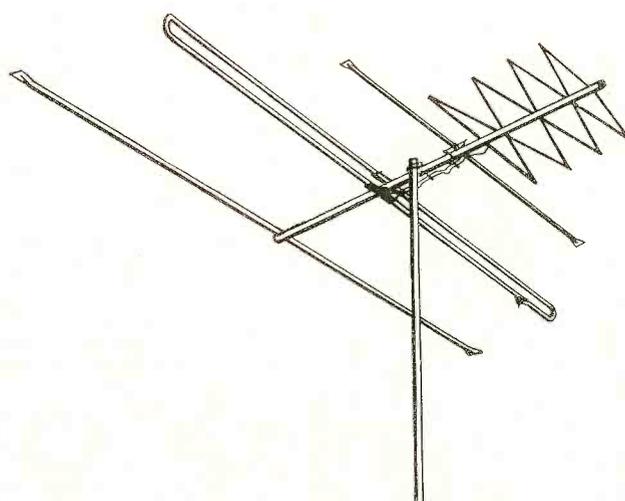


Fig. 2—The Junior-Helix, Model JX311, designed for average strong signal metropolitan areas.

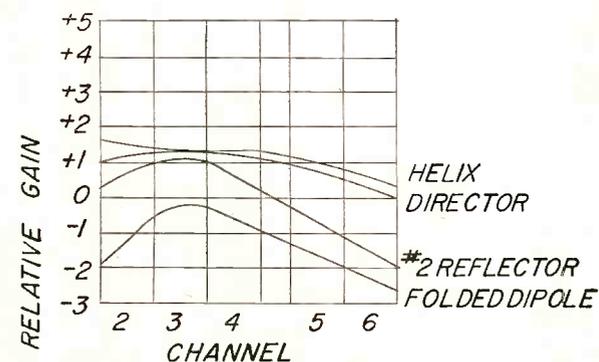


Fig. 3—The reflector in the Junior Helix serves to bring up the gain on Channel 2.

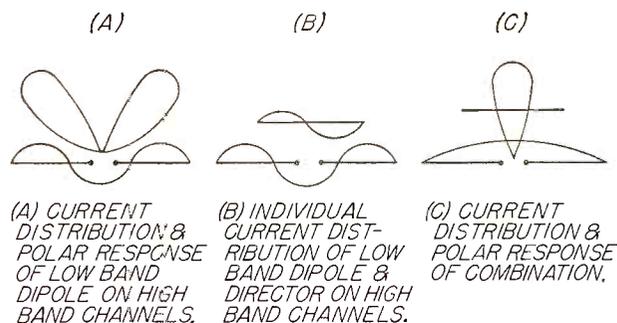


Fig. 4—Current distribution and polar response of individual and combined elements.

group was given the designation of the NCB (non color-blind) Colortenna* series.

The flat-plane helix was chosen as the distinctive high-band receiving element for the entire series. The operation of this element may best be understood by the consideration of the circular helical antenna (Fig. 1). The true, or circular helix, has a diameter of $1/\pi$ wavelengths, at least 3 turns, and a spacing of approximately $1/4$ wavelength. The polar pattern and impedance characteristic is as shown in Fig. 1. It will be noted that this antenna has an almost constant impedance of 150 ohms resistive for circumferences between $3/4$ and $4/3$ wavelengths. The bandwidth is such that the gain is down only 1 db. at 150% of center frequency. The gain at center frequency is about 8 db.

The major disadvantage of this array from the point of view of television reception is the fact that it is circularly polarized. It will, then, not only receive horizontally polarized television signals, but a good deal of random noise arriving at polarization angles other than horizontal.

By flattening the original cylinder so that the high current points are adjacent to each other, and tapering the dimensions, an element was obtained having high inherent gain, narrow polar pattern, and an extremely flat bandpass characteristic making it ideal for the reception of color as well as monochrome television. The entire NCB series utilize this element, making them instantly recognizable to the service-dealer and the public. Thus, there need be no confusion as to the suitability of an antenna for color reception.

The first antenna in the NCB series is the Junior-Helix, model JX311 (Fig. 2). This was designed for use in average strong-signal metropolitan areas. The Junior-Helix uses a 4-turn helix for the high band. The low band element is a 300 ohm dipole cut for the video carrier of Channel 3. The reflector brings the gain up at Channel 2 (Fig. 3). The looped element in front of the folded dipole has a dual function. On the low band, it acts as a Channel 5-6 director, flattening the gain curve. On the high band, it acts as a

* Trade name registered.

If it's worth Engineers' time . . .

. . . It's worth Engineered Cable

Belden

INTERCOMMUNICATING
AND
SOUND SYSTEM CABLES

Indoor-outdoor, phones
or speakers—there is a
Belden engineered cable
to meet your needs for
a permanent, trouble-
free installation.

"Items from the
Complete Belden Line"

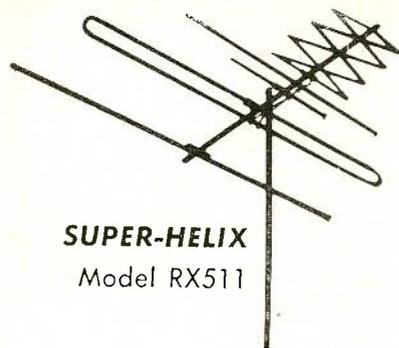
Intercommunications systems in
the Statler Hilton in Dallas,
and other leading hotels
with intercommunications
systems, are wired by Belden.

Belden

WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

10-8

Magnet Wire • Lead and Fixture Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires
Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable



SUPER-HELIX
Model RX511

Fig. 5—The Super-Helix, Model RX511, for suburbs.

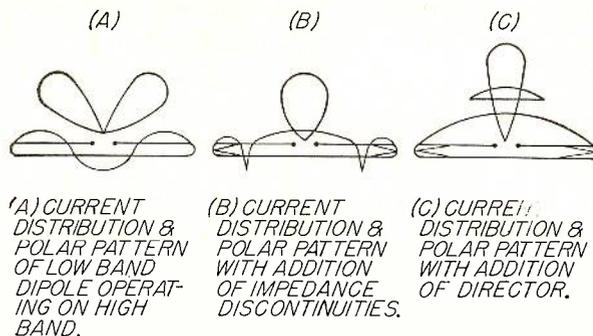


Fig. 7—Third harmonic response is changed to half wave response on low band dipole.

full-wave element blocking the folded dipole and preventing lobe response on the highs (Fig. 4). The helix is connected to the takeoff points of the folded dipole thru a length of open wire transmission line in such a manner that the loop formed by the harness and the last section of the helix acts as a stub cancelling a good portion of the reactance of the folded dipole on channel 5 and 6, thereby giving a relatively flat response curve on both high and low bands.

The second antenna in the series, the Super-Helix model RX511, was designed for use in near suburban areas and ghostly metropolitan areas (Fig. 5). The 4-turn helix in this case is combined with a half-wave reflector. This has the dual function of increasing high-band gain and sharpening the polar pattern. The low-band folded dipole has both a Channel 2-3 reflector and a full sized Channel 5-6 director, resulting in a similarly sharpened pattern and somewhat higher gain. The harness length was changed to compensate for the variation in impedance caused by the different loading characteristics of the parasitic elements. The narrower polar pattern is of use in minimizing ghost pickup in reflective areas.

The popular Star-Helix, Model SX711, Fig. 6, is a semi-fringe to fringe area antenna. It may be used for master installations in the city and, with appropriate attenuators, in extremely ghostly neighborhoods. The Star-Helix has a full 5-turn helix augmented by a half-wave reflector. In this antenna, full use is made of the high-band pickup of the low-band dipole. As shown in Fig. 7, the third harmonic response of the low band dipole is changed to half-wave response by the insertion of sharp impedance discontinuities at the half-wave points. This response is further increased by the use of a high-band director. The high band then, is effectively a helix and reflector in series with a folded dipole and two directors. On the low band, this antenna is equivalent to a four element stubbed yagi having two reflectors, a driven element, and a director, the whole being boosted by the stub formed by the harness and the last section of helix.

The Power-Helix, Model PX911, is next to the last antenna (Fig. 8). This antenna is an extremely high

gain fringe to deep-fringe model. It consists of a 5-turn helix with both a director and reflector. The low-band portion is a four element yagi utilizing the JFD poly-phase dipole, a stepped, T-matched broad-band element. This antenna has somewhat more gain and flatter response on the low band, and increased gain and directivity on the highs.

Here's the most recent addition to the Colortenna series, the Wonder-Helix model WX811 (Fig. 9). To date, most high-gain fringe area antennas were designed for maximum gain on the high band and only moderate to good low band response. The reasoning that justifies this approach is correct in that the higher frequencies are attenuated more rapidly with distance and are more easily absorbed by intervening man-made and natural obstructions. The design considerations are also somewhat simplified in this type of array since the low band loading is kept down and the harmonic response of the long elements may, as a rule, be added to the signal received by the high band elements. In some models, there is no separate 7-13 driven element. The total high band response is derived from the low frequency drivers by means of phase reversal elements and added parasitics.

In many areas of the country, it was found that the high channel gain was more than adequate, but there was a definite need for better low channel operation. With these facts in mind, the Wonder-Helix was designed.

[Continued on page 37]

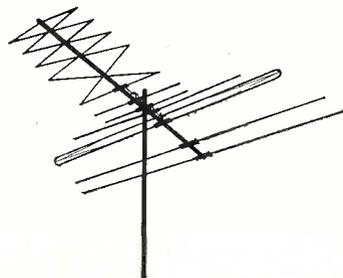


Fig. 6—The Star Helix, Model SX711, designed for fringe and semi-fringe applications.

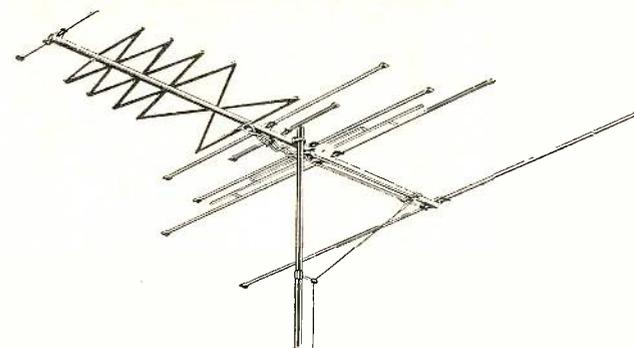


Fig. 8—The Power-Helix, Model PX911, a high gain antenna for fringe to deep-fringe areas.

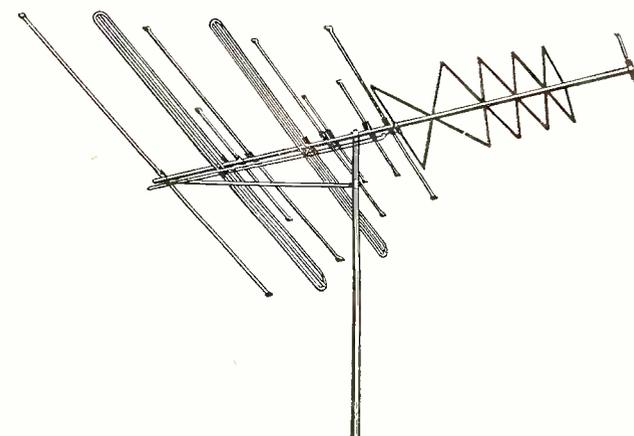


Fig. 9—The Wonder-Helix, Model WX811, designed primarily for deep-fringe areas.

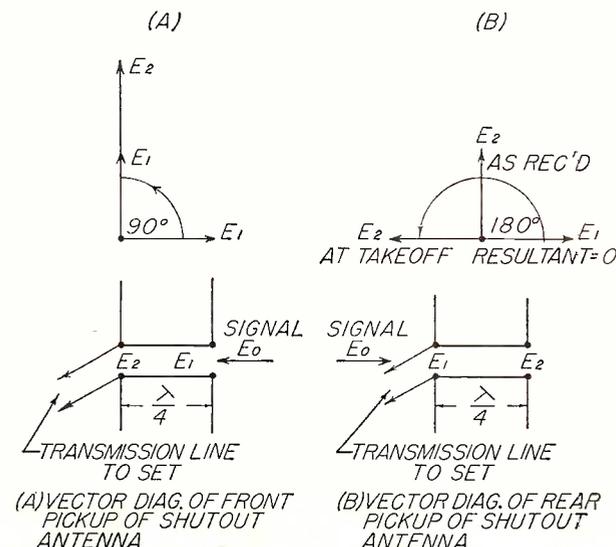


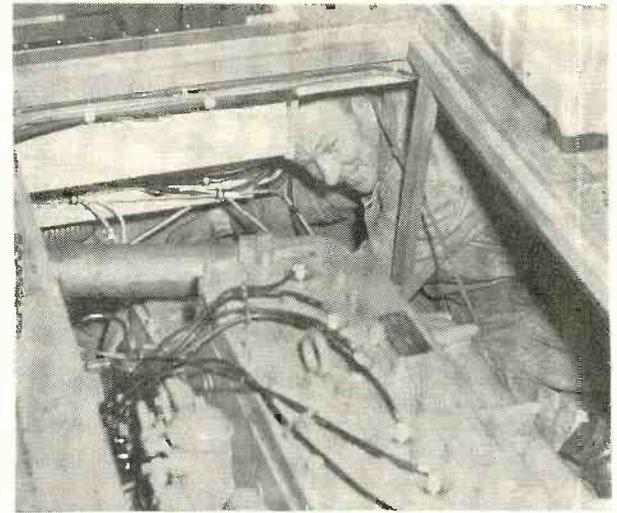
Fig. 10—Vector diagrams illustrating the operation of the Shut-Out Helix type of antenna.



▶ Placing equipment as shown allows concealed wiring within cabinet. It should also be convenient to batteries, antenna, and ground.



▶ Place equipment so that it is accessible for servicing. Heavy paper or a towel should be used to protect varnish finishes.



▶ The wiring on many boats is a scramble. Try to install yours so that it is safe and accessible. Use adequate clamps and supports.

MARINE ELECTRONICS

Part Five

by **ELBERT ROBBERTSON**

THE first, and often the most important step in installing any kind of marine electronic equipment is a preliminary survey, preferably conducted with the owner of the boat. After you have amassed a store of information and experience, this may not be essential in the case of every familiar stock boat, but, at first, the practice of conducting this initial survey should be strictly followed on every job.

The advantages are multiple. By agreeing exactly where and how the equipment and wiring is to be installed, chances of later disagreement and expensive rework is eliminated. Also, by looking the job over carefully in advance, the installer will not find himself planning to put a unit in a certain space, and then finding that under the panelling a pipe or some other object already occupies the space, or that, in order to get power wiring into the equipment, umpteen inaccessible hardwood panels must be pierced.

There are two sides to selecting the proper placement for marine electronic equipment: first the desires of the owner, which are concerned mainly with appearance and operational convenience, and, second, the technical aspects, which you are expected to know better than he. These may be at cross purposes, so that many installations represent a hard-won compromise.

For example, the radiotelephone location that is

Factors involved in the placement of marine radiotelephone equipment are discussed. Both technical considerations and the desires of the owner of the vessel are fully dealt with.



most convenient to batteries, ground connection, and antenna may be objectionable to the owner for some reason connected with the decor of his vessel, or it may not be convenient to operate while he is at the helm of the boat. In such cases, I have always tried to locate equipment so that technical requirements are best met, and then, if control of the gear at some other point is desired, to install a remote-control unit at this other point. Since this plan actually gives the purchaser better utilization of the investment he has made, I have found it good practice to "stick to your guns" as much as possible in holding out for locations which are technically the best.

In making the survey it is a good idea to have the actual equipment with you in order that it may be held in place, and the practicality of arrangements judged on the spot. If the equipment is heavy or bulky, using the empty cabinet alone for this purpose aids visualization far more than measurements with a ruler. An alternative to this method is to use a cardboard "mock-up" of the cabinet, which can be collapsible and easily carried.

From the technical standpoint, the item of next importance to proximity of batteries, ground, and antenna is the ease with which the gear can be serviced, once it is in place. Like any other electronic equipment, marine radiotelephones require periodic maintenance, and after the equipment has been installed, if it is almost impossible for a service man to have convenient access to all sides and parts of the set, keeping it operating will be a headache. For example, when I first started installing marine equipment, I screwed down a marine radiotelephone on a high shelf. By cocking an eye over the top of the panel I was just able to see the insides of the set to make adjustments. Several years later, the same boat came back to me for service, and I found, much to my chagrin, that my eyesight had changed, and with my face in the same spot at the top of the panel, my eyes would no longer focus on the tuning controls

inside. Be guided accordingly: give yourself working room!

It is often asked whether the installation of radiotelephone equipment will affect the steering compass. Technically, this is possible, and the only method of determining for sure, is to place the set in the proposed location, and at the same time, to note if the compass deflection is affected in any way. In case there is a question, this test should be made with the boat headed first north or south, and then with the boat headed east or west. From a practical standpoint I have found that conventional marine radiotelephone equipment does not materially affect the compass if a separation of at least a couple of feet is maintained from the compass.

The speaker magnet and steel cabinet are not the only possible sources of compass interference. The magnetic field around current-carrying wires can also affect compass accuracy if they are closer than this critical spacing. The least effect is attained when direct-current wires are twisted or else run very closely parallel. Since field area is relative to the spacing of the two conductors carrying the current, power feed lines should never be separated more than the thickness of the necessary insulation, especially in the vicinity of the compass.

Power Wiring

Voltage drop in power wiring depends upon conductor length, resistance and current flow. Thus, with a given current, a 115-volt load may be such as to cause a drop at an appliance of say, 2 volts—less than two percent—certainly nothing to be concerned about. However, at the common battery level of 6 volts, the same current load will cause an identical drop of 2 volts—or 33 1/3%—which is enough to lower transmitter output quite seriously. Therefore, marine-radiotelephone power leads must always be quite heavy. The maximum voltage drop, under full load, should never be more than 10%, and half this figure is much to be preferred. The gage of the conductors may be computed by the formula:

$$cm = \frac{10.75 \times I \times L}{E}$$

Where: cm = circular-mil area of conductor

I = load current in amperes

E = tolerance voltage drop at load in volts

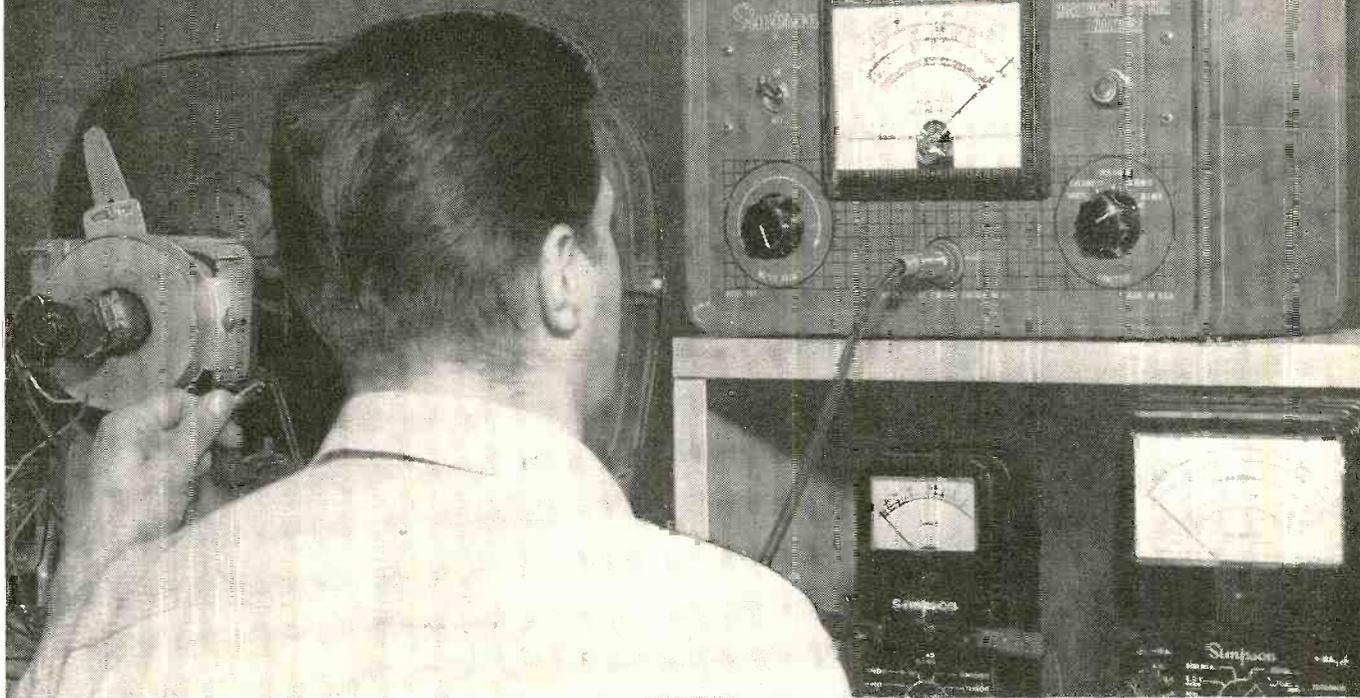
L = total length of wire. In a single wire system this length is equal to the distance between the equipment and the voltage source. In a two wire system this length would be *twice* the distance between the equipment and the voltage source.

The gage of wire for the required mil-area can be found in *Table 1*. In making the cable-length measurement, be sure you make allowance for all of the turns and zig-zags the wire must follow. As a general

NEW! Simpson

IN-CIRCUIT HORIZONTAL SYSTEM ANALYZER

MODEL 382



• saves time in running checks on TV horizontal deflection systems

• tests capacitors, too!

Model 382 is the world's most complete "testing package" for analyzing TV horizontal deflection systems. With this *one* instrument, you can:

- (1) Check any winding in the horizontal system (transformer or yoke) for *shorts* and *opens*. Even one shorted turn is clearly indicated on a large 4½" meter. Uses reliable, time-proven Q-type test.
- (2) Check flyback and yoke system IN-CIRCUIT (disconnect only plate cap of output tube). High-Q systems are checked on a quick-reading, Good-Bad scale (most present day sets use the High-Q system); low-Q systems on comparative logging scale.
- (3) Measure capacitance value (and check for open capacitors)—direct-reading scales indicate

from 10 mmf to 0.1 mfd—no bridge to balance. Measures capacitance to better than 10%.

(4) Make continuity checks of *any* wire-wound component, such as width coils, linearity coils, oscillator transformers; check capacitors for direct shorts; check out wiring harnesses, switch contacts, etc. Can check many other components for Q, either directly or by logging scale.

With Model 382, preliminary tests of horizontal systems can be made *in-circuit*. Then, if desired, individual tests can be made of each winding and component in the system. Over-all size of Model 382 is 7¼" x 8" x 11¾". Compare this complete IN-CIRCUIT Horizontal System Analyzer with any competitive unit, and you will choose the Simpson Model 382.

Model 382 with special test cable and Operator's Manual...

\$69⁹⁵



See Your Jobber, or Write for Bulletin No. 2082

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie Street, Chicago 44, Illinois • Phone: EStebrook 9-1121 • In Canada: Bach-Simpson Ltd., London, Ont.
WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

rule, the figures given in Table 2 can be used as a guide for choosing cable of the proper gage to prevent excessive voltage drop.

Two-conductor cable of the heavy gages usually required for marine radiotelephone power wiring is generally not available, so it is necessary to use two single wires to make up the power feed. In many instances, it is possible to route this cable so it will automatically be protected from sharp corners, contact with other metal, or abrasion from movable objects such as boat controls, drawers, etc. In such cable installations it is ordinarily sufficient to strap the cable in place, preferably with plastic or rubber-protected metal straps. Fastenings should be spaced closely enough to bear the mechanical weight of the cable and to prevent its looping down and getting out of place. However, in some spaces, it may be necessary to construct a wooden raceway or duct to make sure the cable is not exposed to any outside hazard.

Heavy-wall metallic conduit is not ordinarily used because it encourages condensation of water, which will collect in low spots and damage cable insulation. However, the newest types of thin-wall conduit are less susceptible to this trouble and in special cases, may be used to advantage. Easier to use, however, and about as effective for cable protection, is flexible non-metallic conduit or "loom." In spots where it is difficult to snake the power cabling past a number of projections, a piece of large flexible non-metallic conduit may first be routed through the cable path, after which the individual conductors may fairly easily be pushed through the conduit. This operation may be performed most easily by first pushing a heavy and strong lead wire or "snake" through the conduit, and then using this lead to pull the pre-cut pair of actual power wires on through. Then the non-metallic conduit may be formed into its final position and strapped securely in place.

The terminal connections of such heavy cable are quite often a problem. Connection must usually be made to screw or bolt-type terminals, and the size of the wire, of course, prevents simply wrapping the

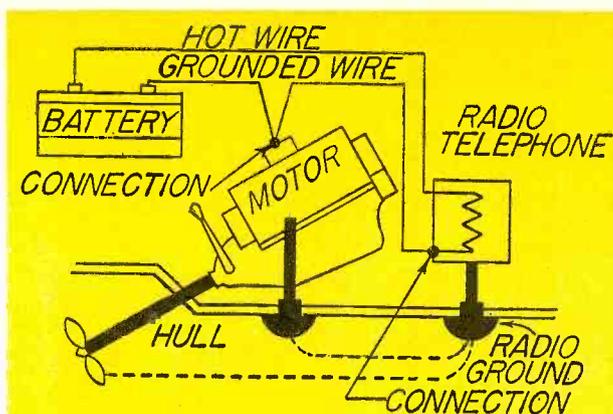


Fig. 1—The ground circuit should never be fused. A blown fuse places battery voltage between equipment ground and underwater parts, resulting in electrolytic deterioration.

cable around the terminal, and then tightening. It is therefore necessary to use lugs for connection. Soldering heavy connectors on a boat is a nuisance, although it can be done. A small alcohol torch will do the job, (suitably protected from breezes) and, naturally with great precautions as to the fire hazard. There are also chemically operated soldering irons which might be pressed into service. In emergencies, I have used a resistance-soldering arrangement using 6-volt battery current applied to the work through heavy cables, and a pointed carbon from a standard flashlight cell held in a pair of vise-grip pliers for the heat element. Connect one side of the battery to the heavy lug and the other to the vise-grip pliers holding the carbon electrode. Touch the electrode to the side of the lug and terrific heat will ensue, permitting solder to be run into the lug. Because this places quite a drain on the battery, this system should not be employed except in case of emergency, and be careful of your eyes—wear glasses, preferably dark tinted.

Much better is the use of terminal lugs of either the crimp-type or the screw-squeeze types. These require no heat and can be tightened with the crimp tool, or a pair of pliers or screwdriver. Several manufacturers produce suitable lugs and crimp tools.

Power cables should have no splices or other discontinuities. However, in the event that a splice is absolutely necessary, the safest place for it is on a terminal block, protected by a conduit-type splice box. Another fairly satisfactory splice can be made by using lugs on the ends of the wires, then bolting them together and protecting them with a heavy layer of plastic insulating tape. As a last resort, the wires may be twisted in the old Western-Union splice, then soldered by one of the above methods, and heavily taped.

Sometimes the equipment terminals are not heavy enough to accommodate cable of the size which must be used. In this case, the main cables can be terminated at a suitable connection block close by. The block

should be of a protected type so terminals will not be exposed to accidental grounding. Short lengths of lighter gage cable can then be used to connect across to the terminals on the equipment, or power source. This kink is often very useful for attaching heavy power leads to radiotelephone equipment which must be pulled out from its cabinet for servicing. It is much easier to manipulate the equipment when it is attached by comparatively light pigtails, than if the heavy cables are directly connected. As long as these pigtail cables are no longer than absolutely required for movement of the set (no more than a couple of feet), the voltage drop will not be significant.

Circuits

Power input to marine radiotelephones must be of the proper polarity, and it is easiest to make sure that no mistake will ever be made if the two feed wires are colored differently, or if one of them has some distinguishing feature, such as a tracer. Another means of marking cables for polarity is to affix tape bands on their ends. To make identification automatic, similar tape spots can be affixed to the corresponding equipment terminals.

Where to connect to the battery source is often a problem. As a general rule, cables should not be attached to the battery terminals themselves because there they will be exposed to acid and fumes, and may possibly be connected improperly if the battery is removed for charging or other servicing. A better spot to connect are the points on the engine to which the main battery cables are connected. One cable from the battery will be grounded to a point on the engine block. The other usually goes to the solenoid of the starter motor. If it is at all possible, connect your ground lead under the same engine stud that is used for the main battery lead. If this is not feasible, connect to a similar stud as close to the other as possible, in order not to have too much iron, corrosion, rust, and paint in the circuit. Now, suppose the solenoid terminal, or "hot" feed point, is already so overcrowded

[Continued on page 37]

Table 1—Wire Gage for Mil-Area:

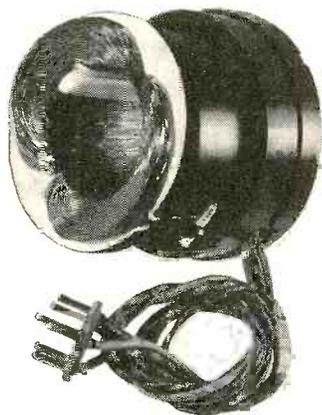
Wire Gage	Mil-Area
4/0	212,000
3/0	168,000
2/0	133,000
1/0	106,000
1	83,700
2	66,400
3	52,600
4	41,700
5	33,100
6	26,300
7	20,800
8	16,500
9	13,100
10	10,400

Table 2—Conductor Sizes for Amperes—Lengths:

Total Current in Circuit In Amps.	Length of Conductor in Feet from Source of Current to Most Distant Fixture										
	10	15	20	25	30	35	40	45	50	55	60
6 Volts Two-Wire—10% Drop											
5	14	14	14	12	12	12	10	10	10	10	8
10	14	12	10	10	8	8	8	8	6	6	6
15	12	10	8	8	8	6	6	6	4	4	4
20	10	8	8	6	6	6	4	4	4	4	3
25	10	8	6	6	4	4	4	4	3	3	2
12 Volts Two-Wire—10% Drop											
5	14	14	14	14	14	14	14	14	12	12	12
10	14	14	14	12	12	12	10	10	10	10	8
15	14	14	12	10	10	10	8	8	8	8	8
20	12	12	10	10	8	8	8	8	6	6	6
25	10	10	10	8	8	8	6	6	6	6	4



another
EXACT
REPLACEMENT
first



MDF-79 for exact replacement in over 50 Motorola models and chassis; equipped with plug. Another in the complete line of exact transformers, yokes and coils. Merit is the only manufacturer of transformers, yokes and coils who has complete production facilities for all parts sold under their brand name.

MERIT

MERIT COIL AND TRANSFORMER CORP.
4427 N. CLARK ST., CHICAGO 40, ILLINOIS

Mfr: Raytheon

Chassis No. 21T42

Card No. RA 21T42-1

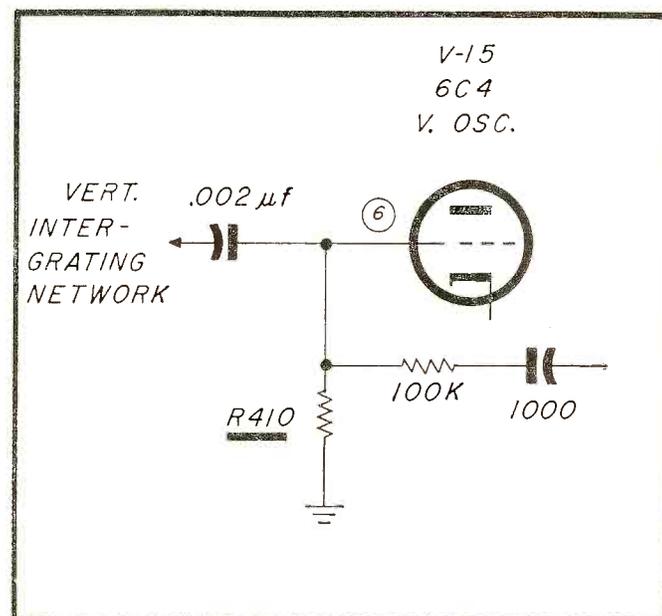
Section Affected: Sync

Symptom: Poor vertical oscillator stability.

Reason for change: To improve vertical oscillator stability.

What to do:

Change: R410 (47K) to 100K ohm.



Mfr: Raytheon

Chassis No. 21T42

Card No. RA 21T42-2

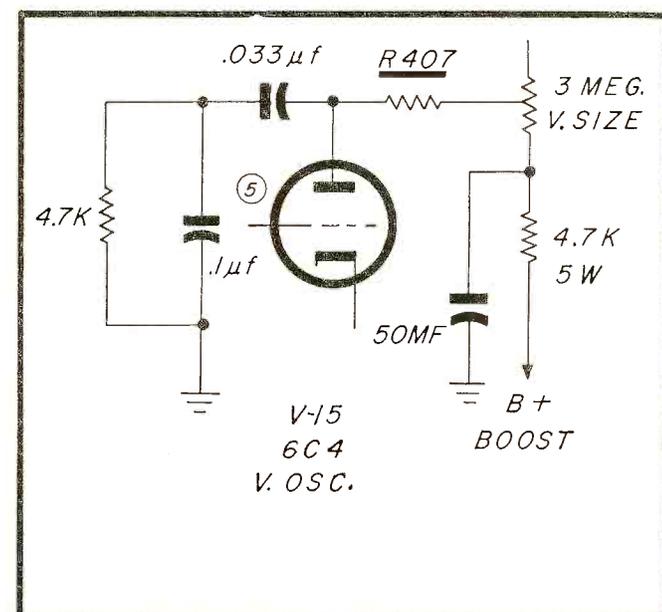
Section Affected: Raster

Symptom: Insufficient vertical size.

Reason for change: To increase vertical size.

What to do:

Change: R407 (3.9 megohm) to 3.3 megohm



Mfr: Raytheon

Chassis No. 21T42

Card No. RA 21T42-3

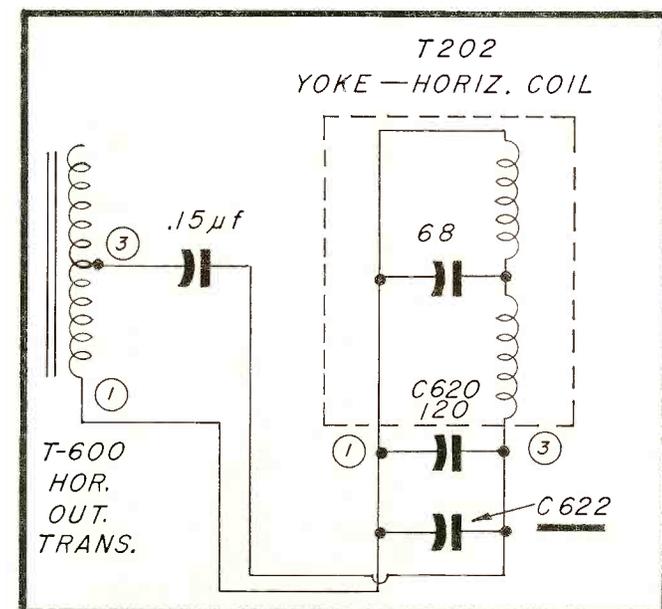
Section Affected: Raster

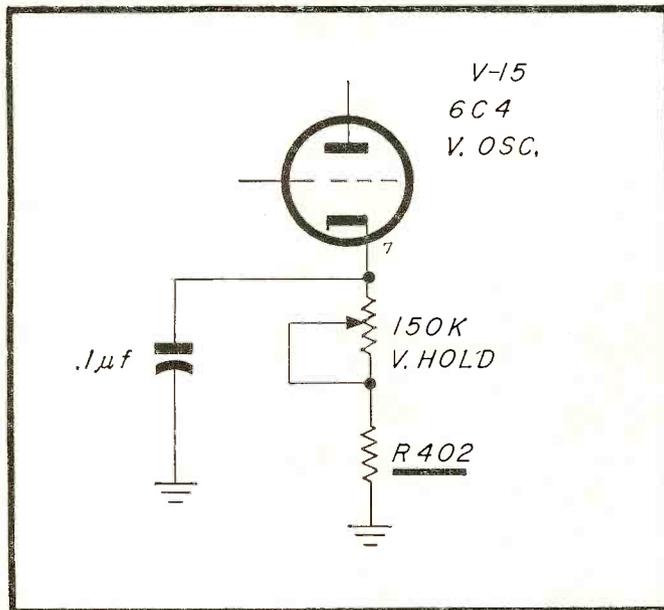
Symptom: Insufficient horizontal size.

Reason for change: To increase horizontal size.

What to do:

Add: C622 (22 μf, 5000 volt) in parallel with C620 across yoke winding.





Mfr: Raytheon

Chassis No. 21T42

Card No. RA 21T42-4

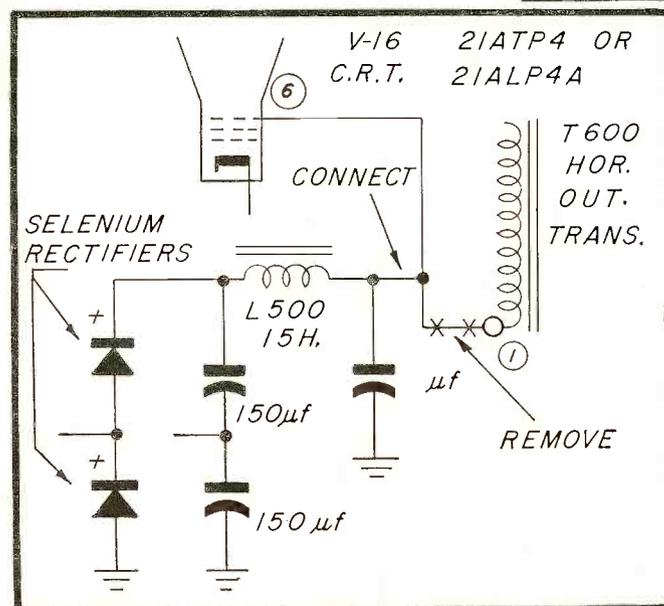
Section Affected: Sync

Symptom: Poor vertical sync.

Reason for change: To improve vertical sync.

What to do:

Change: R402 (68K) to 75K ohm.



Mfr: Raytheon

Chassis No. 21T42

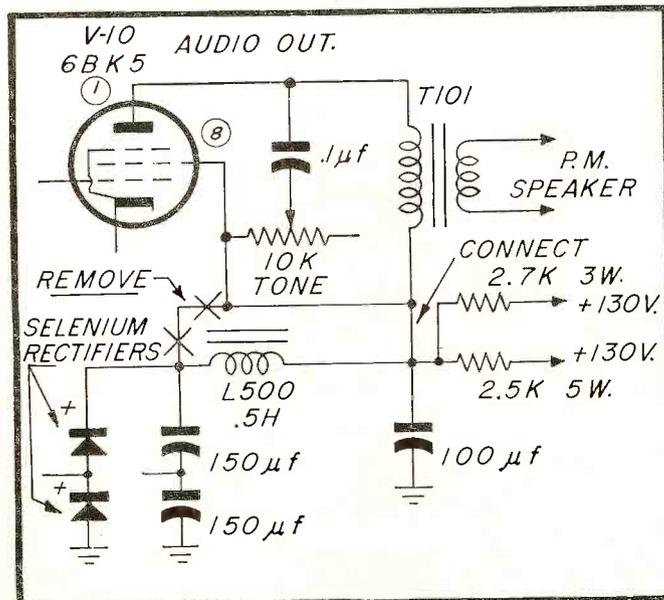
Card No. RA 21T42-5

Section Affected: Pix and/or raster

Symptom: Poor picture focus.

Reason for change: To improve picture focus.
(Chassis so modified are coded 725.)

What to do:

Rewire: CRT pin 6 from boost B plus to 245
volt B plus.

Mfr: Raytheon

Chassis No. 21T42

Card No. RA 21T42-6

Section Affected: Sound

Symptom: Audio hum.

Reason for change: To reduce audio hum.
(Chassis so modified are coded 935.)

What to do:

Rewire: Primary of audio output transformer
T101 from 255 volt B plus source to 240
volt B plus source.

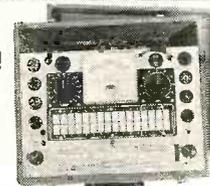
Choose from these

JACKSON 3

"Service Engineered"

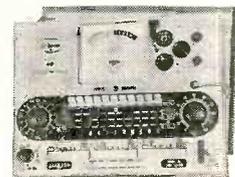
TUBE TESTERS

1 New
Features!
Model 648A
Dynamic
\$129.95 net



Fastest Dynamic Tube Tester made, yet it's fully flexible for all receiving types, new and old. The set-up time is actually less than the warm-up time of the tube. New Variable Sensitivity Shorts Test shows leakage up to 2.0 megohms. Metered plate current shows tube condition. Meter calibrated in Good-Bad as well as Percent of relative micromhos. Automatic Line Voltage Indicator, Life Line Indicator, New Zig Zag Roll Chart locates tube types much faster. Twenty-three heater voltage settings cover all series-stringing tubes.

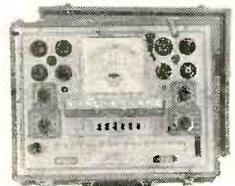
2 Low-Cost
Forty-Niner
with Plug-In
Accessories



\$49.95 net, Accessories extra

A good, basic tube tester, with plug-in accessories for performing a wide variety of additional tests. Accessories may be added any time, permit testing tubes for filament current and high resistance shorts, as well as checking selenium rectifiers. Lever action shows which pins are connected. Sensitive shorts test. Line Voltage Indicator. A tremendous value.

3 New,
Portable
Dynamic
Model 561
\$89.95, net



Employs famous Jackson Dynamic principle, applying separate voltages to each tube element. High voltage power supply for most accurate tests. Improved switching system gives simplified, fast operation. Filament voltages for the very latest TV types. Fully portable case finished in harmonizing gray and green, tough plastic fabric. Built-in roll chart, with free replacement service for one year.

Test Data on New Tube Types
for All Jackson Testers Appears
Monthly on Page 65 of PF Reporter
For more information, write:

JACKSON
ELECTRICAL INSTRUMENT CO.

"Service Engineered" Test Equipment

16-18 S. PATTERSON BLVD., DAYTON 2, OHIO
In Canada: The Canadian Marconi Company

FULL FIDELITY MUSIC ENJOYMENT

TWIN-CONES IN A SINGLE

F.R.S. SPEAKER
COVER THE
AUDIBLE RANGE



Norelco®

TWIN-CONE *FRS
*FULL RESONANCE
SPEAKERS

In a single speaker, Norelco has created an unusually efficient sound radiator. These twin-cone speakers incorporate a small cone for reproducing high frequencies and a large cone for lower frequencies. Both cones operate in conjunction from a single voice coil—producing balanced sensitivity and uniform sound for all ranges. Arrangement of both cones reflect and diffuse the sound while moving in phase to provide even sound distribution.

A deep air gap within a homogeneous magnetic field provides unusually large movement of the voice coil resulting in distortion-free reproduction over the entire frequency range. Impedance does not diminish with higher frequencies and volume is practically constant throughout the whole audible range.

Send today for your catalog on Norelco *FRS Twin-Cone Speakers. It contains specification data, sound distribution curves, frequency characteristics on these speakers as well as the new Norelco Speaker Enclosures.



Send to Dept. E-11 for more details

North American Philips Co., Inc.
100 East 42nd Street
New York 17, N. Y.

Mfr: Sylvania Chassis No. 1-521 series

Card No. Syl 521-7

Section Affected: Pix and sound

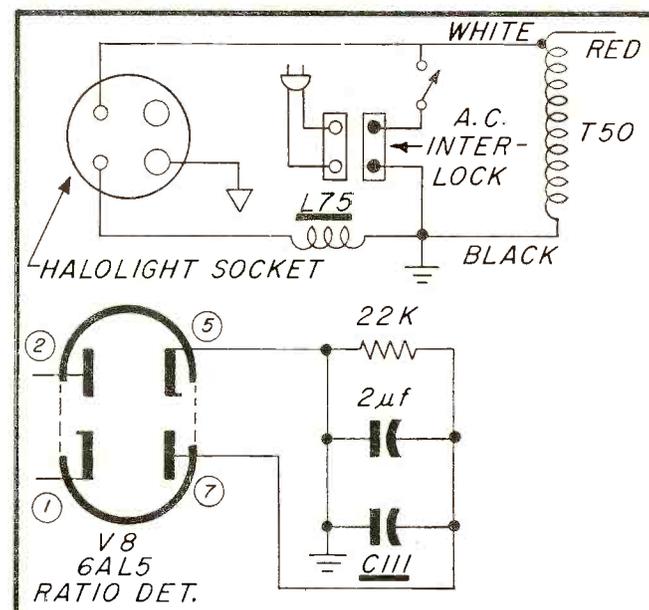
Symptoms: Oscillation on Channel 2 through 6, or Mush on Channel 4 when operating with built-in antenna.

Reason for change: Production change to improve circuitry and eliminate above described condition.

What to do:

Replace: C111 (150 μ f) with a .001 μ f.

Add: L75 choke in heater lead to Halolight socket. (Sylvania part number 147-0014)



Mfr: Sylvania Chassis No. 1-521 series

Card No. Syl 521-8

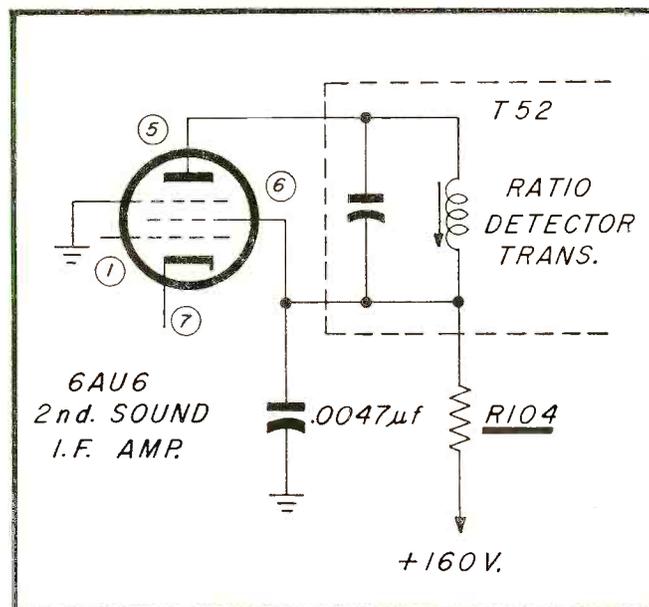
Section Affected: Audio

Symptoms: Sound output is low, picture information is normal.

Cause: The B plus feed resistor has increased in value decreasing the voltage to the 2nd sound if amplifier.

What to do:

Replace: R104 (2.2K ohms).



Mfr: Sylvania Chassis No. 1-521 series

Card No. Syl 521-9

Section Affected: Pix and raster

Symptoms: Ragged edge on raster and line tear.

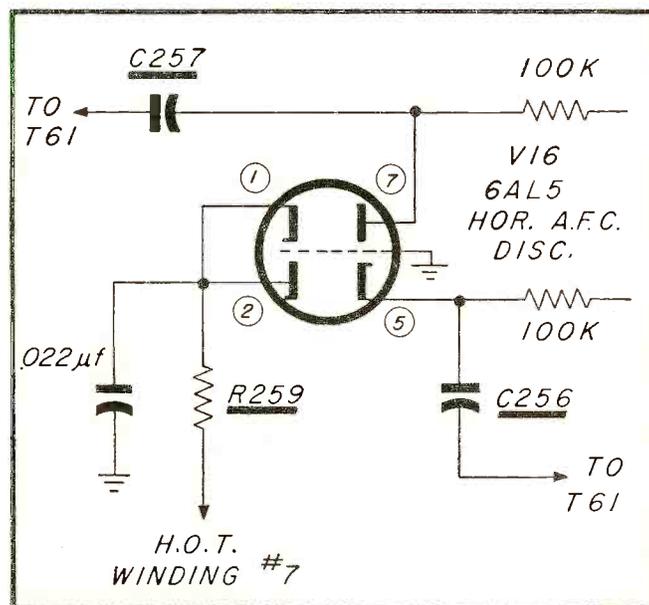
Reason for Change: The horizontal sync lock-in action is improved.

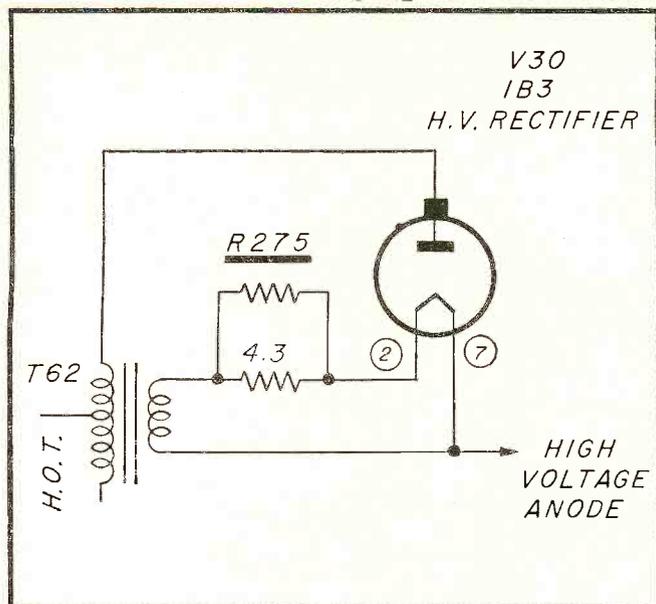
What to do:

Change: C256 (.001 μ f) to .01 μ f.

C257 (.001 μ f) to .01 μ f.

R259 (1.8K ohms) to 3.3K ohms.





Mfr: Sylvania

Chassis No. 1-521 series

Card No. Syl 521-10

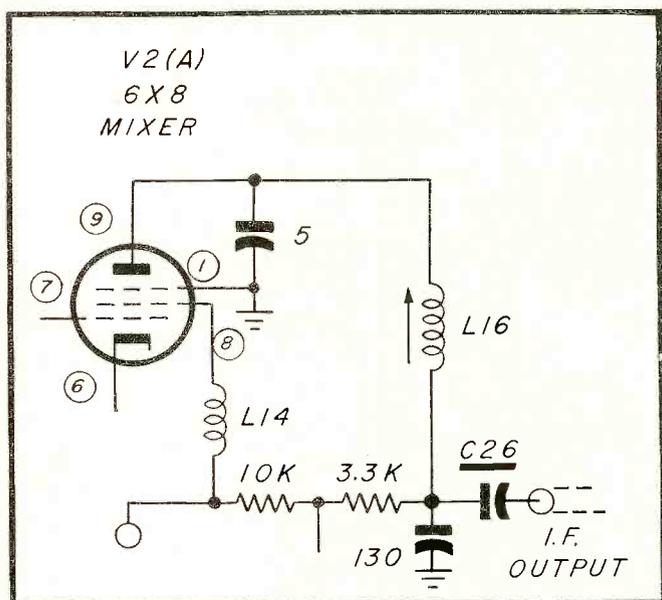
Section Affected: Raster

Symptoms: Picture blooming.

Reason for change: To increase the filament voltage to the high voltage rectifier tube.

What to do:

Add: R275 (15 ohms) across 4.3 ohm filament dropping resistor.



Mfr: Sylvania

Chassis No. 1-521 series

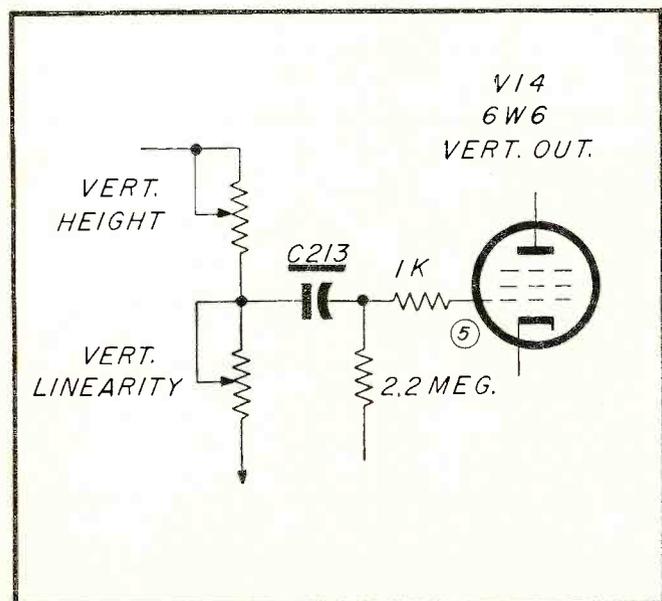
Card No. Syl 521-11

Section Affected: Pix and sound

Symptoms: Over-driven picture and slight buzz in sound.

Cause: Coupling condenser in tuner has developed leakage reducing the negative *agc* bias.

What to do:

Replace: C26 (1000 μ f).

Mfr: Sylvania

Chassis No. 1-521 series

Card No. Syl 521-12

Section Affected: Pix.

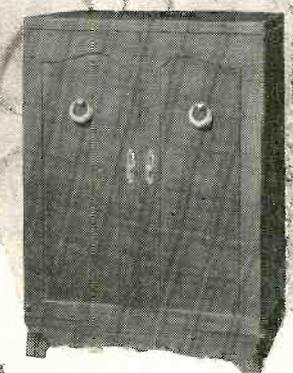
Symptoms: Vertical linearity cannot be made satisfactory.

Reason for Change: Coupling condenser to the vertical output stage has become leaky decreasing the grid bias.

What to do:

Replace: C213 (.47 μ f) with a .22 μ f.

Note: The use of the smaller capacitance will also improve vertical linearity.

AMERICAN TELEVISION &
RADIO CO. ST. PAUL, MINN.For those who
want the finest!Full Door Console
Receiving SetsUNSURPASSED
IN BEAUTYUNEQUALLED
IN PERFORMANCEUNMATCHED IN
QUALITY
CONSTRUCTIONexclusive
profitable
dealer
franchises
now availabledesigned
with the
Serviceman
in mind
... easy to
get atWRITE TODAY FOR COLORFUL
BROCHURE SHOWING THE
NEW LINE OF ATR TV SETSALSO MANUFACTURERS OF DC-AC INVERTERS,
"A" BATTERY ELIMINATORS, AUTO RADIO VIBRATORS

AMERICAN TELEVISION & RADIO Co.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA-U.S.A.

MARINE ELECTRONICS

[from page 32]

that your connection cannot be safely made to it. In this case, a simple rearrangement will give room, not only for the radiotelephone, but also for other equipment which may be installed later. A piece of heavy brass strip should be drilled to accommodate a number of terminal screws. Then, remove all of the cluster of wires on the "hot" terminal, and in their place install your terminal strip, or "bus." The myriad of wires can then be connected to individual screws on the new "hot bus."

Because of the size of high-current fuses and their voltage drop, fuses are not ordinarily used in radiotelephone wiring. However, it does make sense to use either a suitably heavy fuse block or circuit breaker in the "hot" lead of the radiotelephone power circuit. The fuse block should be at the battery end of the circuit and enclosed in a protective box, and the fuse itself should, of course, be large enough to pass full load current without overheating or bringing the voltage drop above the tolerable amount. *Never fuse the ground circuit.* The diagram (see Fig. 1) shows the reason why. In a radiotelephone circuit any discontinuity in the ground circuit, whether it be from a corroded connection, broken wire, or a blown fuse, will place the full battery voltage between the radiotelephone ground and the engine's underwater apertences. Rapid electrolytic deterioration of underwater metal will result, and this is a danger which could lead to actual sinking of the boat. If you are ever called upon to service equipment in which the ground circuit has been fused, it is your duty to point out this danger to the boat's owner, and to strap the fuse out of the circuit.

In connecting the equipment, first attach the bat-

tery-ground power lead at both ends. Then attach the "hot" wire at the equipment end (with the equipment turned "off"). At the power-source end of the "hot" wire, first touch the cable end to the power terminal and see if there is any indication of current. If not, connect an ammeter between the power (battery) connection and the radiotelephone cable, and make sure there is no current flow, stepping the meter down into the 10-milliamp range. Indication of any current flow at this point means trouble, either cable leakage or a fault in the set, and should be traced out and the current flow reduced to zero. After it is certain there is no leakage current, permanent connection may be made.

Then, at the equipment, measure the power-feed voltage, and make sure polarity is proper. Some equipment has floating input so that no other check is necessary. However, other sets, particularly small ones using vibrator power supplies, may have the input circuit grounded internally. In this event, make sure that the internal ground polarity conforms to the grounded polarity of the battery-power source. If it happens to be opposite, as might be the case one-half of the time, the equipment ground polarity can be reversed, either by reversing the power-supply vibrator in its socket or taking other steps which will be specified in the equipment instruction book.

Lastly, the telephone should be turned on with the voltmeter still attached to the input terminals. If the voltage is up to the specified level, you have done the job properly.

The next stages in installing a marine radiotelephone will be covered in subsequent parts of this series. ■■

THE JFD NCB COLORTENNA SERIES

[from page 24]

This antenna is fairly complex in view of the many interactions that take place between its elements. On the low band, it is inherently a double driven five element broad-band yagi. The driven elements, 600 ohm dipoles, are cut for Channel 2 video and Channel 5 sound. The use of 600 ohm dipoles makes possible a close 300 ohm impedance match despite the loading effects of the parasitic elements. A Channel 2 reflector and a Channel 5-6 director bring up the ends of the range. A diflector (director-reflector) between the two dipoles gives us the increased gain in the center of the band.

The addition of a 5-turn helix was the major critical design factor. To prevent side-lobe pickup and maintain sharp high-band directivity, it was necessary to add phasing elements to each of the dipoles as in Fig. 7. The length of the helix phasing harness was

chosen in such a manner as to compensate for the reactance present at the terminals of the forward dipole. A shorted stub was added to the rear dipole for much the same reason. Effectively, then, the helix is in combination with a director and two reflectors.

At this point, it became evident that the helix portion looked back into a reactance formed by its harness and the forward 600 ohm dipole. This reactance did not match the characteristics of the helix. For this reason, the effective high frequency stub length of the front dipole was varied by means of a shorting bar placed across the dipole at both ends and positioned for the best match.

Because of the locations of the parasitic elements, this antenna has a comparatively high average front-to-back ratio. Its application is in far-fringe areas.

[Continued on page 42]

PHILCO

The World's Largest
Field Service Organization

WANTS

Electronic Engineers, Radar
and Communications Men at
All Levels and In All
Fields of Electronics

YOU FOR IMMEDIATE OPENINGS!



● As the Pioneer in the servicing of electronic equipment, PHILCO has an interesting variety of BOTH Commercial and Government operations to be serviced on a long range basis. To men who possess the ability and/or educational background necessary to Design, Maintain and/or Instruct others in the fields of Communication, Radar and Sonar equipment this combination provides BOTH challenging opportunities and employment security.

What's more . . . in addition to TOP PAY commensurate with your ability to do a better than average job, PHILCO has many valuable company benefits which are acclaimed as "THE BEST IN THE INDUSTRY." But, why not find out for yourself . . . TODAY!

WRITE NOW FOR OUR
NEW 22 PAGE, FULL COLOR BOOKLET
"FIRST In Employment Opportunities..."

Dept. 17

PHILCO TECHREP DIV.
22nd & Lehigh Ave.
Philadelphia 32, Pa.

Please send me your booklet, "Philco TechRep Division, FIRST In Employment Opportunities The World Over."

NAME _____

ADDRESS _____

CITY _____

FIELD OF INTEREST _____

PHILCO TECHREP DIV.
22nd & Lehigh Avenue • Phila. 32, Pa.

A single closed stub with a "Wing" director provides high gain and a flat response without bulk in the Zephyr-Mite.

Flat Frequency Response in Single Dipole Antenna

by JOHN F. GUERNSEY
Trio Manufacturing Co.

Shown above is the New Zephyr-Mite model ZM-1 antenna incorporating the "Wing" dipole and "Wing" director.

THE old problem of securing broad band operation in a single dipole antenna has long plagued television engineers. This problem has been satisfactorily solved in the Trio Zephyr-Mite through the combining of a well-established antenna principle with a new engineering development. The Zephyr-Mite obtains its flat frequency response through the use of the well-known principle of stub matching in combination with a "Wing" director—a composite director specifically designed to function efficiently with the "Wing" dipole.

In the design of all-channel antennas great effort has been made to obtain a flat frequency response over the *vhf* spectrum with a minimum of compromise on any one channel within this spectrum. The advent of color has made the necessity of flat response more important than ever.

Previously, the problem of broad-banding has been accomplished by multiple dipoles with great success. This procedure is normally used in the higher gain or larger type of arrays. This problem cannot be so readily

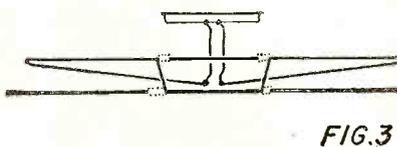
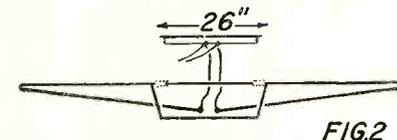
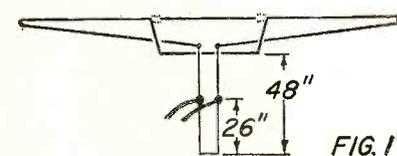
met in the smaller or lesser gain antenna where both size and price dictate the use of single driven elements. In the past, antenna of this class, with regards to the low band channels, find good gain on one channel but then have a tendency to fall off on the adjacent channels by as much as 2 to 3 db. The problem of broad-banding, when using a single resonant dipole, arises because of the decreasing resistance and increasing reactance as one deviates to one side or another of the self-resonant point of the dipole.

In the design of Trio's new Zephyr-Mite, which is in the class of single dipole antenna, a solution of this problem is obtained by the use of closed, single stub matching. It must be kept in mind that some compromising is necessary in the same manner that is anticipated in the lowering of the Q in a tuned circuit for greater band pass. Through experimentation it was found that a closed stub 48" in length with the feed line take off point being 26" from the closed end, as shown in Fig. 1, gave excellent results with regards to Channels 2 and 3, which normally is

the weakest end of most single dipole antenna. This procedure gave a minimum of compromise on Channels 4, 5, and 6.

When classifying antennas as all-channel, it is normally assumed that they function satisfactorily on all *vhf* Channels 2 to 13, exhibiting good gain, impedance, and pattern. This is usually accomplished by means of various designs of composite dipoles which have been designed to function effectively on both bands, Channels 2 thru 6 and Channels 7 thru 13. Trio obtains this dual operation with their composite dipole referred to as the "Wing" dipole. Through past use of the dipole in Trio's Zephyr and Zephyr Royal, it has been found most effective as a composite dipole on Channels 2 thru 13. Since gain is an important factor in the design of antenna, the engineer must take every opportunity to improve the gain without increasing the bulk or size of the antenna. In mentioning how improved impedance match of the "Wing" dipole was obtained when used singly in an antenna, it will be recalled that the distance between lead-in take off, and the closed or shorted end of the stub was 26". This 26" is also the proper length for a dipole tuned to Channel 13. To increase the gain of the antenna on Channels

7 to 13 it seemed feasible that, since the stub was the same length, it could easily be converted into a Channel 13 dipole, and with the proper selection of spacing between the "Wing" dipole
[Continued on page 46]



Figs. 1 to 4 show the use of stub matching and a "Wing" director to achieve the wide band response and high gain of the Zephyr-Mite.

prices never before
slashed so **LOW!**



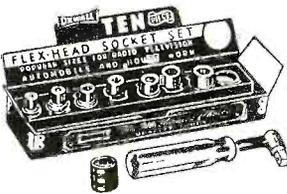
STANLEY
ELECTRONICS CORP.

WRITE FOR NEW FREE
TUBE and PARTS LIST!

935 MAIN AVE., PASSAIC, N. J.
Dept. SD-1, Gregory 1-2498

Your order will include one or more of these
famous brands

- Westinghouse • National Union • Motorola
- SE • Tung-Sol • Admiral • Zenith
- Sylvania • And many more



FREE!

with each \$25.
order or more!

10 Pc. Flex-Head Socket Set with Extension Bar

Unbreakable, shock-proof, non-inflammable amber-plastic handle with flex-head,
8 extra-strong sockets to withstand heavy loads. Flexhead for hard-to-reach and
angular positions. 3 1/2" extension bar.

Brand Name TUBES

UNCONDITIONALLY GUARANTEED FOR ONE YEAR
PRETESTED TUBES—INDIVIDUALLY BOXED

Tube	Price	Tube	Price	Tube	Price	Tube	Price	Tube	Price	Tube	Price	Tube	Price
OA2	70	1P5GT	50	5A05	60	6B5	90	6L6GA	70	7B6	42	12SK7	48
OA3	60	1O5GT	59	5A18	60	6B6G	55	6L7	42	7B7	43	12SK7GT	50
OA4G	60	1R4	46	5A7B	60	6B7C	80	6L7C	44	7B8	47	12SK7GT	60
OB2	70	1R5	51	5J6	60	6B8	69	6N7	60	7C4	39	12SN7GT	57
OB3	90	1S4	54	5T4	69	6B8G	69	6P5GT	60	7C5	42	12SQ7GT	40
OC3	90	1S5	51	5T8	90	6BA6	47	6Q7G	45	7C6	43	12SR7	43
OD3	90	1T4	51	5U8	80	6BA7	49	6Q7GT	45	7C7	45	12Z3	25
OZ4	43	1T5GT	58	5U4G	49	6B8C	50	6R7	49	7E5	25	14A5	59
1A3	60	1U4	47	5V4G	58	6B8D	53	6S4	40	7E6	30	14A7	47
1A5GT	45	1U5	50	5X4G	44	6B8E	46	6S7G	47	7E7	49	14B6	40
1A6	35	1U6	53	5X8	90	6B8F	40	6S8GT	55	7F7	59	14B8	1.04
1A7GT	43	1V	57	5Y3G	39	6B8G	118	6S7	48	7F8	70	14Q7	52
1A85	90	1V2	50	5Y3GT	39	6B8H	51	6S7GT	50	7G7	75	19B6G	1.18
1A5	66	1V5	66	5Y4G	43	6B8J	47	6S7C	48	7H7	50	19J6	66
1A4	58	1W4	63	3Z3	45	6B8K	68	6S7DGT	57	7J7	75	19T8	70
1A5	55	1W5	66	5Z4	54	6B8L	70	6S7E	41	7K7	75	24A	39
1AX2	79	1X2A	68	6A3	91	6B8M	75	6S7GT	43	7L7	59	25A7GT	1.50
1B3GT	68	2A3	50	6A5G	1.11	6B8N	58	6S7J	43	7N7	50	25AV5GT	78
1B4P	35	2A5	57	6A7	57	6B8O	80	6S7GT	45	7Q7	59	25BK5	78
1B5	91	2A6	71	6A8	59	6B8Q	80	6S7K	50	7R7	60	25B6GT	.85
1B7GT	89	2A7	43	6A8GT	59	6B8Y	58	6S7LGT	50	7S7	69	25C6	1.05
1C3	58	2A8	1.00	6A84	45	6B8Z	88	6S7MGT	57	7V7	82	25L6GT	.47
1C5GT	41	2B7	89	6A87	80	6C4	37	6S7N	41	7X6	49	25Y5	45
1C6	91	2D21	1.00	6A85GT	59	6C5GT	35	6S7Q	41	7Y4	35	25Z6GT	.37
1C7G	91	2V3G	80	6A7	67	6C6	80	6S7GT	44	7Z4	40	27	23
1C8	66	2X2A	1.00	6AD7G	1.00	6C6	47	6S7R	42	7Y4	40	27	23
1D5GT	43	3A4	51	6AF4	79	6C8	51	6S7RT	43	12A6	40	32L7GT	60
1D7C	93	3A7	1.00	6AG5	50	6C16	71	6S57	41	12AL5	43	35A5	46
1E5GP	1.13	3AF4	1.35	6AG7	69	6C4G	1.18	6T7G	63	12AT6	41	35B5	48
1E7GT	41	3AL5	57	6AH4	80	6C5A	51	6T8	63	12AT7	66	35C5	48
1E8	66	3AU6	57	6AH6	70	6C6U	1.09	6U8	80	12AU6	43	50A5	48
1F4	43	3AV6	57	6AK5	54	6D6	48	6V3	1.17	12AU7	58	35W4	39
1F5G	43	3B7	57	6AL5	42	6D6E	60	6V6GT	46	12AV6	42	35Y4	40
1F7G	43	3B8A	60	6AL7GT	70	6E5	44	6W4GT	40	12AV7	67	35Z3	41
1G4GT	67	3B8C	67	6AG6GT	67	6F5GT	37	6W6GT	53	12AX4	64	35Z5GT	39
1G6GT	41	3B8E	60	6A26	42	6F6	38	6X4	39	12AX7	66	45Z5GT	40
1H4G	43	3B8N	60	6A27GT	70	6F6GT	38	6X5GT	39	12AY7	90	50B5	48
1H5GT	47	3C86	60	6AM8	80	6F7	89	6X8	75	12BA6	46	50B5	48
1H6GT	91	3C56	60	6AN8	80	6G6G	40	6Y6G	60	12BA7	60	50C5	48
1J6GT	47	3D6	45	6AS5	48	6H6GT	38	7A4-XXL	47	12B4	68	50L6GT	45
1L4	56	3E5	43	6AS6	2.00	6J4	2.00	7A5	53	12BE6	46	75	44
1L6	51	3E4	75	6AS7G	2.25	6J5	3.9	7A6	45	12BH7	60	77	39
1L44	57	3IF4	80	6AS8	80	6J6	49	7A7	45	12BH7A	83	78	39
1L6A	47	3Q4	55	6AT6	39	6J7	43	7A8	45	12BK5	80	80	35
1L8A	59	3Q5GT	57	6AU4	65	6J7GT	45	7AD7	79	12BY7	64	83V	60
1L5	49	3S4	47	6AU5GT	60	6J8G	80	7AF7	53	12CY6	1.05	117L7GT	2.00
1L6	66	3V4	58	6AU6	43	6K5GT	47	7AG7	55	12J5GT	40	117N7GT	2.00
1L5D	59	4A1	1.00	6AV5GT	85	6K6GT	39	7AH7	55	12K8	49	117P7GT	2.00
1L3	59	4BQ7A	1.00	6AV6	39	6K7	39	7AJ7	60	12SA7	48	117Z3	37
1L5G	59	4BZ7	1.00	6AW8	90	6K7GT	39	7AK7	75	12SA7GT	48	117Z6GT	62
1LH4	64	5AM8	90	6AX4	67	6K8G	65	7AU7	89	12SG7	55		
1LH5	47	5AN8	90	6AX5GT	57	6K8GT	65	7B4	44	12SH7	47		
1N5GT	50	5AS8	90	6B4G	90	6L6G	68	7B5	41	12SJ7GT	45		

TRANSMITTER AND SPECIAL PURPOSE TUBES

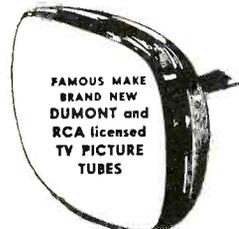
NEVER BEFORE PRICED SO LOW!

No.	Type	Price	No.	Type	Price	No.	Type	Price
3AP1	11.00	.....	IN21B	2.59	.....	841	1.65	.....
3BP1	5.75	.....	IN23	1.70	.....	843	1.05	.....
3EP1	5.30	.....	IN23B	3.40	.....	845	5.75	.....
3FP7	2.49	.....	IN34	.65	.....	864	.29	.....
4AP10	4.40	.....	IN38	1.50	.....	866A	1.00	.....
5BP1	5.00	.....	IN60	.57	.....	872A	2.00	.....
5BP4	4.65	.....	IN68	2.05	.....	874	1.48	.....
5CP1	5.00	.....	304TH	14.00	.....	876	.90	.....
1B32	3.20	.....	304TL	12.00	.....	878	1.95	.....
1P40	1.85	.....	307A	4.90	.....	884	1.60	.....
2C22	.45	.....	371B	1.30	.....	885	1.80	.....
2C26A	.60	.....	388A	4.25	.....	930	1.42	.....
2C34	1.00	.....	393A	6.00	.....	931A	6.00	.....
2C39A	24.00	.....	394A	4.00	.....	954	.36	.....
2C40	10.00	.....	407A	5.90	.....	955	.47	.....
2C43	19.00	.....	417A	14.90	.....	956	.49	.....
2C46	24.00	.....	446A	2.65	.....	957	.49	.....
2C51	4.75	.....	450TL	59.00	.....	958A	.69	.....
2C53	12.75	.....	450TH	59.00	.....	1612	2.50	.....
2D21	1.00	.....	615	6.00	.....	1616	2.09	.....
2E22	1.90	.....	701A	3.00	.....	1619	.36	.....
2E24	3.40	.....	703A	5.98	.....	1620	4.50	.....
2E26	3.40	.....	704A	1.80	.....	1625	.40	.....
2E30	2.00	.....	705A	2.25	.....	1626	.35	.....
2K25	25.00	.....	707B	19.00	.....	1634A	.80	.....
2K28	32.00	.....	708A	3.00	.....	1629	.40	.....
2V3G	.80	.....	713A	1.90	.....	1630	.85	.....
2X2A	1.00	.....	714AY	25.00	.....	2050	1.50	.....
3A5	.90	.....	715C	23.00	.....	2051	1.25	.....
3B4	1.75	.....	717A	1.90	.....	5651	2.50	.....
3B22	2.95	.....	717A/B	20.00	.....	5654	2.00	.....
3B24	5.75	.....	800	2.65	.....	5675	17.00	.....
3B24W	6.75	.....	801A	.50	.....	5702	2.00	.....
3B28	4.00	.....	802	4.00	.....	5703	1.75	.....
3C23	11.00	.....	803	2.75	.....	5726	1.75	.....
3C24	1.85	.....	804	13.50	.....	5750	4.20	.....
3C45	17.50	.....	805	3.00	.....	5751	3.00	.....
3D21A	8.35	.....	806	17.00	.....	5763	1.50	.....
3E29	12.00	.....	807	1.50	.....	5814	2.00	.....
4B32	8.00	.....	811A	4.00	.....	5829	3.20	.....
4C35	26.00	.....	813	11.00	.....	5879	1.65	.....
4D32	20.00	.....	814	3.50	.....	5881	2.95	.....
5D21	19.00	.....	815	3.00	.....	8005	7.00	.....
5R4GY	1.75	.....	816	1.30	.....	8008	8.00	.....
5R4WGY	2.55	.....	826	.99	.....	8012	2.55	.....
6A15	2.43	.....	828	11.50	.....	8913	4.80	.....
6AK5W	2.18	.....	829B	12.50	.....	8013A	6.00	.....
6AN5	2.69	.....	830B	2.40	.....	8020	2.20	.....
6AR6	2.59	.....	832	8.50	.....	8025	6.00	.....
6AS6	2.00	.....	832A	9.25	.....	9001	1.50	.....
6CJ	9.05	.....	833A	39.00	.....	9002	1.75	.....
12A6	.48	.....	834	7.50	.....	9003	1.50	.....
100TH	4.75	.....	836	5.35	.....	9004	.38	.....
250TH	21.00	.....	837	2.15	.....	9005	2.00	.....
250TL	17.00	.....	838	5.00	.....	9006	.35	.....

Coupon

Mail this coupon with your order and get this Deluxe
4-in-1 interchangeable screwdriver set absolutely free!

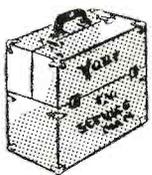
**FREE! 4 In 1 Screw Driver Set
WITH EVERY ORDER**
regardless of size!



DELUXE TUBE AND TOOL CADDY

Expertly made — size 20" x 14" x 8".
14 separate compartments. Carries tubes
and tools to the job.
Metal protectors on corners.
Reg. \$18.95

\$12.95



SCOTCH MAGNETIC TAPES

Stock No.	Description	Stanley Price	1-11	12 or more
111A-6	600' Plastic Reel	\$1.50 ea.	\$1.35 ea.	
111A-12	1200' Plastic Reel	\$2.34 ea.	\$2.10 ea.	
120A12	1200' Plastic Reel	\$3.67 ea.	\$3.30 ea.	
190A18	1800' Plastic Reel	\$3.67 ea.	\$3.30 ea.	

SCOPE TUBES

Brand New — Gov't. surplus. Values to \$25.
Types: 3FP7 5BP1 3AP1 5FP7 **99¢ ea.**

TERMS: FREE POSTAGE on all prepaid continental U.S.A. orders on receiving tubes only. 50¢ handling charge on all orders under \$5. 25% deposit on all COD's. Picture tubes F.O.B. Passaic, N. J. via

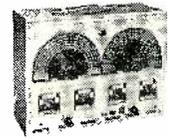
STANLEY'S EXTRA VALUES EMC TEST EQUIPMENT

STANLEY PAYS ALL FREIGHT CHARGES ON PRE-PAID EMC ORDERS



*** VOLOMETER — EMC Model 102**
Durable molded bakelite case, pocket size. Features 800 micro amperes D'Arsonval-type meter, 3 1/2 inch plastic meter, accurate to within 2%. Three AC current ranges — and the same zero adjustment for both resistance ranges.
\$14.90 wired & tested \$12.50 kit form
**Reg. trade mark for volt-ohm millimeter.*

VOLOMETER — EMC Model 104
This precision-engineered instrument features a 4 1/2 inch, 50 microampere meter, with alnico magnet . . . with 3 AC current ranges to 3 amps and three resistance ranges to 20 megohms.
\$26.95 wired & tested \$19.25 kit form



**RF-AF
CRYSTAL MAKER
TV Bar-Generator —
EMC Model 700**

The popular 700 has three extra features — bar generator for TV adjustment with a variable number of bars available for horizontal or vertical alignment. Complete coverage from 18 cycles to 108 megacycles on fundamentals.

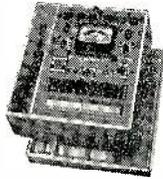
\$55.90

wired and tested

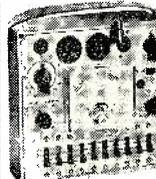
**MUTUAL CONDUCTANCE
TUBE TESTER — EMC Model 206 P**

One of the finest pieces of tube testing equipment at a price comparing favorably with emission-type testers. This completely flexible model using lever-type switches offers extremely accurate results with ease of operation.

\$83.50 (hand rubbed carrying case)



**TUBE TESTER
EMC Model 209**



Miniaturized instrument gives fast, absolutely accurate checks for tube quality, shorts, leakages, continuity, and opens on all modern and future tubes . . . uses standard emission test for quick readings on modern, 3 1/2" plastic meter. \$38.50 in hand rubbed carrying case.

\$35.90 (hammerstone metal case)
\$25.90 kit form



**VACUUM TUBE VOLTMETER —
EMC Model 106**

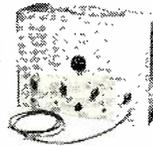
Specially designed for field alignment of TV and radio sets. Uses 1% precision resistors for voltage multipliers. 5 db ranges. Full scale deflection of 1 1/2 volts for both AC-DC volts. Housed in compact portable bakelite case. Size 4 1/4" x 5 1/4" x 2 7/8". Net weight 3 lbs.

\$35.00 wired and tested \$23.90 kit form

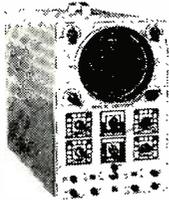
**NEW RF SIGNAL GENERATOR —
EMC Model 501**

A professional, 6 band (115 kc to 220 mc) generator produces dependable signals for precision alignment tuning and adjustment of all types of circuits including TV. Electrostatically shielded transformer for 115 v 60 cycle operation.

\$37.90 wired & tested \$24.90 kit form



OSCILLOSCOPE



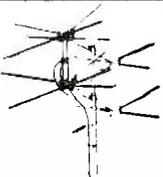
EMC MODEL 600 SCOPE features the use of a 5UP1 new 5 inch scope tube. The 2-stage, push pull, vertical amplifier has a sensitivity of .02 volts per inch and can be used up to 5 megacycles.

A two step attenuator input is available. Synchronization is available on either positive or negative phase of input voltage through the vertical amplifier or from an external source. A multi-

vibrator type of sweep from 15 cycles to 75 kilocycles is incorporated. Direct connections to scope plate available.

MODEL 600. . . . (completely wired and tested) \$99.50

STANLEY'S quality parts dept. biggest dollars worth ever!



10 ELEMENT CONICAL

Single \$3.69
Stacked \$6.89

An economy conical antenna unsurpassed for general all channel use and signal getting. High front to back ratio reduces noise and interference. All corrosion resistant aluminum construction. Stacked antennas give better results in fringe areas. Stack No. SE-167



12" COAXIAL

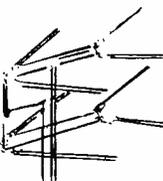
12 watt output. Response 35 to 15,000 cps plus or minus 6 db. 8 ohm impedance. Crossover 2000 cps. Alnico 5 magnet in woofer section, 3" built-in tweeter. Both cones have aluminum voice coils for better heat dissipation and resistance to moisture.
\$10.95

FAMOUS UTAH 15" G SERIES SPEAKER

8 ohms, huge 21 1/2 oz. magnet
List price \$44.95
Sale price \$24.95

TWO SET TV COUPLER

Now use one antenna with 2 TV sets! Also reduces interference. Usable with 300 or 72 ohm leads. Stock No. SE-181 \$1.99 ea



DOUBLE "V" ANTENNA

Single \$3.19 Stacked \$6.45

Best buy anywhere! Broad band principle for all channel coverage with maximum signal strength. High frequency stubs boost hard to get channels in higher frequencies. Easily assembled. Sfk. No. SE-166.

6" PM

Stack No. SE-74. \$1.89 ea.

OVAL PM

SE-79, 6" x 9" Each \$2.29



6 x 9 Custom Deluxe REAR SEAT SPEAKER KIT
CHROME GRILLE AND MESH

Complete with speaker and all hardware — chrome finish mounts.
6" x 9" \$5.25

25 Paper

BY-PASS CONDENSERS

Kit of 25 assorted by-pass condensers by famous makers. The most popular sizes, voltages — all top quality. Values .002 to .2 MFD 200 to 1000 VDC. Stock No. SE-163 Kit of 25 \$9.9c
Lots of 5 Kits 89c ea



UHF-VHF INDOOR ANTENNA

Has 6 position phasing switch to electrically adjust antenna for maximum efficiency on channel being received. Spade lug terminals for quick attachment to TV set. Sfk. No. SE-167-A. \$2.89

CHEATER CORD

UL approved . . . standard Holes. For Every Make Set. A must for every serviceman!
Lots of 10 \$27c ea. \$33c ea.



Picture Tube BRIGHTENER

Series or Parallel
Lots of 3 \$1.00 ea.
\$1.09 ea.

4" PM SPEAKER

Fits most small radios and intercoms.
Each \$1.19

VERTICAL OUTPUT TRANSFORMER

Equivalent to Stan-Cor A-8112
Ratio 10:1. Size 3 x 2 1/2 x 2
Stock No. SE-121 List price \$5.88c ea.
\$8c ea.

ORDER NOW!

ALL PARTS F.O.B. PASSAIC, N. J. 50¢ handling charges on all orders under \$5. 25% deposit required on all C.O.D.s. Subject to prior sale.

RIDER SPEAKS



by JOHN F. RIDER

"Dean of America's Radio Servicemen"

HAVING described the conditions which surround factory service in the previous installment, let's look at what the servicing industry can do to maintain its position, if not increase its stature.

Let's take a case in point, the city of San Antonio, Texas. Factory service hits the town. After a great deal of thinking and discussion, the owners of five independent TV service shops decide that it makes sense to discontinue individual operations and get together to function as a single large unit. Resources are pooled; a new corporation is formed, and a new building leased to house the effort. It is equipped with the testing devices originally in the possession of the five separate concerns. Operations are not limited to TV servicing. All kinds of electronic equipment are serviced—home radios, auto radios, portable radios, hi-fi systems, tape recorders, record players, intercommunication devices and everything else which falls in the realm of electronic servicing—even industrial electronics wherever possible.

Service is rendered on a basis of two shifts—from 9 in the morning until 11 o'clock at night and it is available six days a week. To serve a widespread area the service trucks are radio dispatched, using the 450-470 mc citizens radio band.

The officers of this firm expressed no fear whatsoever of factory service. They found that they could sell all-around-competent service on all kinds of equipment. Service at hours during which the usual factory branch could not or would not operate was important to the public. Results achieved in a relatively short time of operation are gratifying, and the operation is gathering business

which otherwise would have gone to factory service organizations.

Lest you get the wrong impression, this activity is not a cooperative. It is an enlarged operation which functions more effectively than five individuals competing with each other. Their sources of supply for components and everything else used in servicing are still the distributors in San Antonio.

Let's consider another town, Phoenix, Arizona. Factory service exists in that town, too, but the independent servicing dealers in that rapidly growing community are selling themselves to the public. All kinds of electronic devices are being serviced. Service business is plentiful—the problem is to get enough competent technicians. Although the factory service exists, it has in no way limited the capabilities of the servicing operators in expanding their activities. It is interesting to note that in one city in the United States a factory service branch ceased operation because its major competition were part-time technicians who worked in the local electronic equipment factory. The established service shops did enough business to make the factory service branch a loss operation, and it closed. In other words, factory service operation is not something which is so strongly entrenched that only the curtailment of independent activity can be the outcome.

In our travels throughout the country we have spoken to many operators of service facilities who now do all kinds of electronic equipment servicing. Naturally, they don't like factory service, but they have not allowed it to frighten them. Some of them said that it took a little while for the public to be cognizant of their expansion in terms of the kinds

of equipment they service, but little by little their roster of customers grew, and the presence of factory service was taken in stride.

We don't kid ourselves about a service call taken by a factory not being a service call lost to a service shop. However, factory service can't get all the business. Moreover, competition with factory service is not an impossible task. A factory service operation must be profitable, therefore the charges made for service by these organizations is not cut-throat. Independent shops can do

similar work, if not better work, and make a profit while charging less than the factory service operation. But the independent must work with equally effective tools—test equipment and service information. The phrase "factory service" carries a lot of weight. What is it that the independent can offer the public which would be of equal interest?

Technical competency is not an exclusive property of factory service facilities. It is possessed by a great many independent servicing shops and servicing
[Continued on page 43]

Everyone Admires Versatility,

IF...



Performance is Profitable!

Don't misunderstand us, we really sympathize with poor Fothergill here. He is doing his level best to offer the same results as that of a full symphony orchestra, but though he claims to be a virtuoso on 90% of all known instruments, he receives only a meager profit for his efforts.

No matter how hard he blows his own horn, the fact remains that his offerings have not been very successful... because... results from the full symphony orchestra will always assure richer rewards.

So, for highest performance, for complete customer satisfaction, for full mark-up, don't rely on "one man band" substitutes. The pickup cartridge in a phonograph is designed specifically to do the finest job in that particular unit... NO LOW PROFIT SUBSTITUTE IS ever EXACTLY the same. Always replace with ASTATIC ORIGINAL and DIRECT REPLACEMENT cartridges.

ASTATIC IS THE WORLD'S ONLY COMPLETE LINE OF PICKUP CARTRIDGES!

Leader with Originals, First with Replacements.

THE **Astatic** CORPORATION, CONNEAUT, OHIO 

KNOWN THE WORLD OVER

IN CANADA: CANADIAN ASTATIC LIMITED, TORONTO ONTARIO

Export Sales Representative: 401 Broadway, N.Y. 13, N.Y. • Cable — ASTATIC, N.Y.

RIDER SPEAKS

[from page 41]

dealers and it must be demonstrated on a repair job. It is of the utmost importance to make the customer aware that a good job has been done. It must be a complete job. Close attention to so-called "small" details is vital. Politeness on the telephone, prompt service, keeping a promise, courtesy, respect, the absence of arrogance, the display of patience and understanding and treating the customer's equipment with care.

Solicitation of business on a personal basis while in the home is something which the independent can do and the factory service branch personnel cannot. Inasmuch as each factory handles only its own products, it cannot very well solicit additional business and then turn it down because it is some other manufacturer's product. The independent knows no such restriction.

The type of service desired by the public has long been a subject for discussion. Now that factory service is becoming more prevalent, the discussion stage has come to an end. Now the fulfillment becomes the important thing. The vast majority of set dealers are interested in having their customers served, and if they don't conduct their own servicing business, they are interested in getting the best service for their customers.

It is reasonable for service technicians to solicit the aid and guidance of the parts distributor in the effort to protect the interest of the servicing field. It is to the interest of the parts distributor that the servicing industry grow in size and financial stability. There has been talk about this in the past, but today action is necessary. It is not beyond the realm of possibility for the servicing dealers in a community to pool their efforts in direct mail solicitation; cooperative advertising, newspaper promotion and association effort.

Summarizing the entire issue, it is our considered opinion that factory service will not jeopardize the future of the servicing industry if the servicing industry makes up its mind to go out and get all the kinds of electronic equipment servicing business available. ■ ■

ORDER NOW FOR CHRISTMAS SELLING!

Fine Profits Are Yours When You Sell These Fine Sets

FIVE STARS

Compact, light-weight 4-tube battery-powered, super-het circuit 540-1600 KC radios. Cases are high impact Styrene; chip-proof, crack-proof. These sets, made abroad, use RCA Licensed Circuits. All tubes and components are replaceable with American-made equivalents. Uses one standard 45 v "B" and one 1½ v "A" batteries. Tubes are 1R5—1T4—1S5 and 3S4. Tuck-away plastic handle. Sensitive Ferrite antenna. Schematics pasted in back of each set.

Color choices: Forest Green and Ivory, Maroon and Ivory, Ebony and Ivory.



6¾" wide, 3¾" high, 1¾" deep.

Suggested Selling Price **\$19.95***
Your dealer net cost (In lots of 5 or less) **15.35***
Your dealer net cost (In lots of 6 or more) **15.00***
*Less Batteries, F.O.B. New York City.



8½" wide, 5" high, 2¼" deep.

Suggested Selling Price **\$18.95***
Your dealer net cost (In lots of 5 or less) **\$14.35***
Your dealer net cost (In lots of 6 or more) **\$14.10***
*Less Batteries, F.O.B. New York City.

GLOBAL

4-tube portable battery super-het circuit radio covering standard AM 540-1600 KC bands in rugged plastic case. Features side tuning and volume controls. These sets, made abroad, use RCA Licensed Circuits. Tubes and components replaceable with American-made equivalents. Uses one standard 67½ v "B" and one 1½ v "A" batteries. Tubes are 1R5—1T4—1S5 and 3S4. Tuck-away plastic handle. Schematics pasted in back of each set. Sensitive Ferrite antenna.

Color choices: Ivory, Slate Gray, Smoke Blue, Chinese Red.

Sold with 100% unconditional Warranty for 90 days on the receiver, tubes and components.

Novel Products Corp.

19 W. 44th St., New York 36, N. Y.

Here is our check or money order. RUSH the following:

NAME.....

ADDRESS.....

CITY & STATE.....

New York City buyers — add 3% City Sales Tax

Five Stars	
No.	Color
	Green & Ivory
	Maroon & Ivory
	Ebony & Ivory

Global Radio	
No.	Color
	Ivory
	Gray
	Blue
	Red

Reprinted from SERVICE DEALER and ELECTRONIC SERVICING, November 1956

ASSOCIATION NEWS

[from page 17]

Radio Television Technicians Association, Pasadena

At the regular dinner meeting of the Radio-Television Technicians Association of Pasadena (R.T.A.-Pasadena) preliminary arrangements were made to provide for an R.T.A. booth at the Pasadena Home Show, Nov. 16, 17, 18, 1956. Tentative plans call for an operating television chassis, surrounded by scopes and meters connected to major

test points. R.T.A. code of ethics and folders listing R.T.A. members will be handed out.

Associated Radio & Television Servicemen, Illinois

The Associated Radio & Television Servicemen, Illinois, held their semi-annual business meeting and election of Officers.

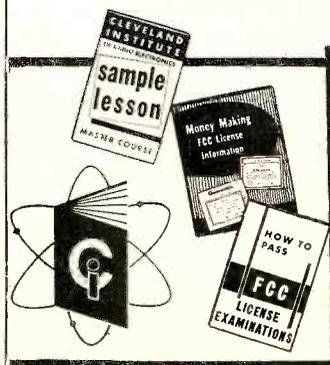
How to increase your income

- ▶ Two-way radio
- ▶ Microwave relay
- ▶ Home electronics
- ▶ Industrial electronics
- ▶ Radar

Find out how you can increase your monthly income by installing and maintaining the types of electronic devices listed above.

Anyone now in the radio-television servicing field can qualify. A Commercial FCC license will open the door to new profit areas . . . and the work is interesting.

Don't limit yourself to receiver servicing. Prepare yourself to handle the more profitable jobs in electronics. Fill out the coupon below and mail it TODAY. The information is free!



CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk 5D-11, 4900 Euclid Bldg., Cleveland 3, Ohio
Please rush the Free booklets to

Name _____
Address _____
City _____

Member National Home Study Council

The following have been elected to office for the fiscal year of 1956-1957: Chairman, Howard Wolfson; Vice Chairman, Joe Ehlinger; Secretary-Treasurer, Delmar Kotrba; and Sergeant at Arms, George Neize.

Radio & Television Servicemen's Association of Pittsburgh

Beginning with next month's issue, the Video Scope will take a militant stand on vital issues concerning the electronic service profession.

AGC IN COLOR TV

[from page 21]

agc voltage, thereby protecting the *rf* and *if* circuits against overload.

In order to prevent the *agc* voltage developed on weak signals in strong signal areas from reducing the signal gain too much, the setting of the control on a strong station should be made judiciously. Thus, the control should be adjusted so that the setting is as much below point (B) as possible without overloading the receiver. Doing this, the developed *agc* bias will be high enough for the most powerful station, yet will not develop too much bias, that is enough to cause the gain of the *rf* and *if* stages to be reduced to a point where weak station reception is impaired. Care, therefore, should be exercised when adjusting the *agc* control to make sure that the control is not

advanced beyond the required setting. Referring again to Fig. 2, notice that the cathode of the *agc* amplifier is connected to B plus 145 volts, the source of which is the cathode of the audio output tube. For this reason, failure in the audio circuit will affect the *agc* action. This is an important point to keep in mind when servicing receivers using this circuit.

Another point to watch for in this circuit is the values of *R214*, *R212*, *R211*, *R213* and *R224*. Unless these values are maintained as rated, the relative applied *rf* and *if* *agc* voltages will be incorrect, thereby resulting in symptoms associated with defective *agc* action, that is snow, tearing, etc.

In order to minimize noise in a weak picture it is desirable to delay the *agc*

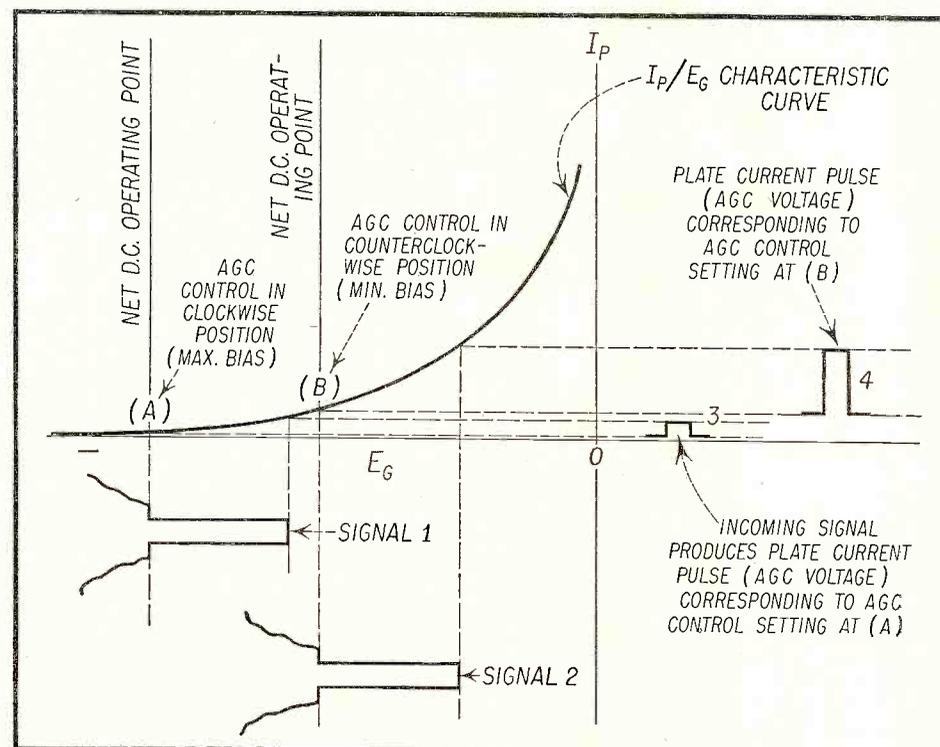


Fig. 3—Curve showing how different adjustments of AGC threshold control provides varying plate current output (AGC voltage) for same signal.

DIPOLE ANTENNAS

[from page 38]

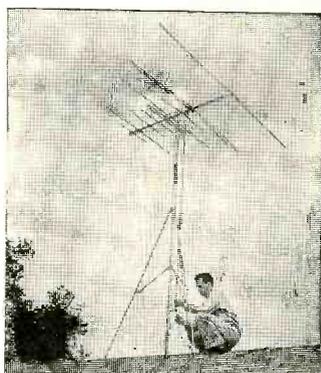
and Channel 13 dipole as shown in Fig. 2, an increase in gain could be accomplished on the high band channels. Upon experimentation it was found that proper spacing gave an increased gain of from 1.5 db on Channel 7 to 3 db gain on Channel 13.

Keeping in mind the desire to attain as flat a response as possible it was necessary to include or add to the an-

tenna, components that would favor the low end of the high band and overcome the variation in gain between Channels 7 thru 13 caused by the addition of the Channel 13 dipole and the directors normally added for high band operation. The equalization of the response curve was accomplished by the addition of two reflectors which operate on the outer half wave sections of the "Wing" dipole, shown in Fig. 3, which gave a 3 to 4 db gain on the low channels of the high band. These reflectors become an integral part of

the dipole and are so called integrated reflectors in the same manner as the integrated director which acts upon the center half-wave section of the "Wing" dipole on the high bands. By converting the stub into a Channel 13 dipole in connection with the "Wing" dipole and integrated reflector, the Zephyr-Mite showed a gain of 10 db on Channels 7 thru 13 with only a variation of .5 db from Channel 7 to 13.

For the same reason that a low channel dipole is ineffective on the high band channels, a director tuned for low channel operation is also ineffective. Therefore, to obtain maximum results from a composite dipole such as the "Wing" dipole, it is necessary to design a composite director—that is, one which will function on the high channels as a high channel director as well as operate on the low channels as a low channel director. Trio's solution to this problem was the designing of the "Wing" director shown in Fig. 4. The basic idea was to make use of the bent antenna effect often used by amateurs to eliminate the extreme lengths encountered in amateur work. This was carried still further by folding the ends so that a cancelling effect was encountered on the outermost sections which left the center section of the "Wing" director to act effectively as a director for the high band channels, yet when properly tuned and spaced to operate as efficiently on the low band channels as a low channel director. Due to the contour of the "Wing" director it was necessary, for mechanical reasons, to support it at more than one point on the boom. This was done effectively by the use of an element tuned to act as a director on the high channels and insulated from the folded ends, allowing the "Wing" director to take on the same form as the "Wing" dipole. This construction and design enabled Trio engineers to obtain excellent gain and pattern characteristics in the Zephyr-Mite, which shows a gain of 5½ db on Channel 2 to 6.5 db on Channel 6 with only 1 db variation on the low bands. On the highs, with the construction explained in the article, the antenna shows a gain of 10 db on Channels 7 thru 13 and only .5 db variation.



cut your roof time
90%
with
Winegard

one-man, one-call TV Antennas!

ONE MAN—Save hours you now spend on antenna installation. *One man* can install a WINEGARD TV Antenna in a matter of minutes. Only WINEGARD features "Umbrella-Ease" construction for ONE-MAN installation. Comes from the factory as a completely assembled *installation!* Just open like an umbrella! Most models anodized *after assembly* so *all surfaces* are corrosion and rust resistant. Gleaming gold color (exclusive with Winegard) complements the finest home... adds extra sales appeal.

ONE CALL—Don't spend valuable hours on return calls! Install a WINEGARD antenna—and be sure your customer's happy, the *first time!* "In-the-studio" clarity is assured with all these exclusive WINEGARD features: *ALL-12-CHANNEL high gain performance—especially designed for COLOR! *Optional POWER-PACK for signal-building boost on all channels! *Patented ELECTRO LENS intensifies signal, increases gain.

and...

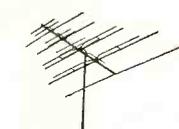
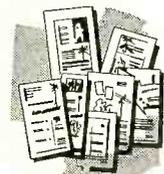
ONE STANDARD OF WINEGARD QUALITY!

The unmatched quality story of WINEGARD antennas is hitting hard at *your customers* in the pages of SATURDAY EVENING POST, FARM JOURNAL, BETTER HOMES AND GARDENS, HOUSE BEAUTIFUL, TOWN JOURNAL, SUNSET, TV GUIDE and other national magazines. And quality strengthens the selling story all across WINEGARD'S complete line of television antennas.

WINEGARD Complete Antenna Installations start as low as \$17.95. Ask your Parts Distributor for complete information or write:

 **Winegard**
company

3000 Scotten Blvd., Burlington, Iowa



Colorceptor
\$29.95 list

*Pat. No. 2700105



ADJUST- ABLE 3rd ARM

FOR HOLDING
CHASSIS IN
POSITION ON
WORK BENCH

\$5.50
each

Send checks or money orders only

TELE-SCOPIC PRODUCTS, INC.
215 W. 33rd St. • New York 1, N.Y.

AUTOMATION

[from page 10]

means is a cost savings, since the initial cost can be written off over a large group of finished products.

Modularization

The very use of printed circuits implies a further step. Since a circuit such as audio amplifier, or a cathode follower, or a pulse-generator can be built on a single board the question arises as to the final use of these circuits. In any given line of electronic equipment, a circuit can be found more than once. Some, as the examples above, will occur many times. If the proper evaluation is made, a standard circuit will be found which will answer the needs for many equipments. Thus, the basic module is born; a standard circuit which may be used in many equipments. Modular construction has a two-fold advantage. First, the production techniques may take advantage of it by producing the standard modules, as end-items, and then storing them until the final assembly operations. Secondly, standard circuits allow engineering effort to be directed toward the best possible circuits, rather than a number of circuits which differ only in details.

Packaging of these standard modules is also a fertile field because many interconnected modules make up the electronic equipment. The packaging techniques and the modular construction complement each other. One cannot very well be changed without considering the other.

The modules, as above, can be considered as the starting point from which smaller units may be developed. For

MECHANIZE

WITH

Mall
TOOLS

Speed Control Clutch \$15.95

Reciprocating Saw \$14.95

Metal Nibbler \$17.95

MODEL 143T DRILL \$42.00

POWERS ALL OF THESE ATTACHMENTS

Screwdriver \$10.95

Auger Set \$5.50

Mechanic's Drill Set \$7.25

Tool Balancer \$23.95

Equip your shop for **MECHANIZED SERVICE** for as little as **\$138.50.**

Mechanization of your radio and television shop with MALL Tools can save you time and money. And, the lightweight, powerful and flexible MALL 143T (1/4") drill is the answer. This perfectly balanced drill, with the trigger switch lock, is equally perfect in wood or metal. It is a virtual powerhouse around which many useful attachments can be driven. Mechanize your shop and increase productivity now with MALL Tools.

MAIL THIS COUPON TODAY

MALLTOOLCO, Division of Remington Arms Company, Inc.
7749 South Chicago Ave., Chicago 19, Illinois
O. K! tell me about MALL Tools for the Radio and Television field.

Name _____
Address _____
City _____ State _____

example, several resistors and capacitors can make up a package which is used very often in modular circuits—indeed in almost all circuits. If a package is made up of these several components, it can be applied to different circuits in different ways. This is the concept of the "super-component"—the group of individual components mounted as a unit and treated as a unit in purchasing, manufacturing, and servicing the completed equipment. The printed circuit module could contain several super-components.

Modularization is not confined to the approach outlined above. Another approach is the *Tinkertoy* project. Here the basic module is a stack of notched ceramic wafers, each 7/8 of an inch square and 1/16th of an inch thick. These may be clearly seen in *Figs. 2* and *3*. Components are not mounted but are actually constructed on each wafer. For example, by producing a metal film on each face of a wafer, a capacitor is made; or by placing a layer of resistive material on one face of the wafer, a resistor is produced. By connecting the wafers with vertical wires, a complete modular circuit is produced.

This approach to Automation was developed by the National Bureau of Standards and sponsored by the Navy Bureau of Aeronautics. Starting from the raw materials, machines produce modular wafers, which when used in groups, make up the modules of an electronic circuit. The basic wafer is 7/8 inches square, and it can contain almost all of the components of the circuit—resistors, capacitors, coils, or tube sockets. When these wafers are stacked vertically, and inter-connected, the result is a complete circuit.

A complete circuit has the component wafers and a final wafer with a tube inserted in the tube-socket. In *Figs. 2* and *3*, counting down from the top, the individual wafers each have different parts. One is the tube socket; two is a coil; three represents the three capacitors—as indicated on the schematic—with a common connection; four has the resistors of the circuit—there are four resistors; and five is the capacitor without any common connection to the other capacitors. Connecting wires, which fit into the notches in the wafers,

[Continued on page 49]

TWO-WAY RADIO

communications equipment

VHF-FM FOB: MOBILE AIRCRAFT MARINE MOTORCYCLE PORTABLE BASE

VHF-FM FOB: AIRPORT VEHICLES GROUND STATIONS POINT-TO-POINT

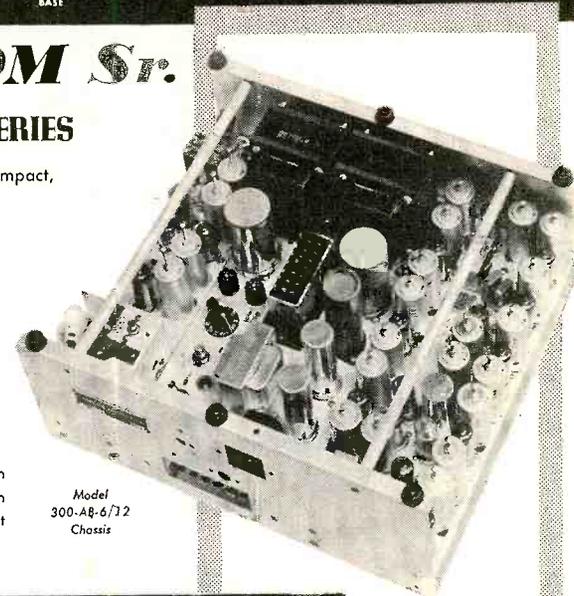
VHF ANTENNAS REMOTE CONTROLS ACCESSORIES

FLEETCOM Sr.

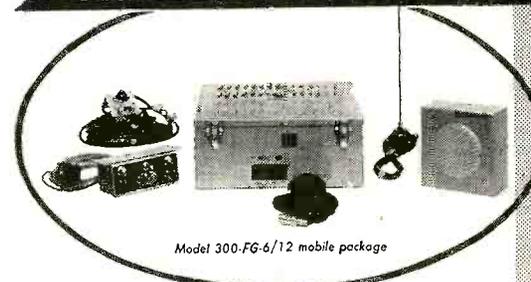
MODEL 500-612 SERIES

The FLEETCOM Sr. is rugged, compact, universal 6/12, VHF-FM two-way mobile communications equipment for the Public Safety, Industrial, Land Transportation and other radio services.

COMCO'S 17 years experience in design leadership and production "know-how" is engineered and built into every FLEETCOM Sr. unit.



POWERFUL! COMPACT! EFFICIENT!



Features:

55 Watts output in low band
Front or rear mounts
Case size 14"x13 1/2"x6";
Maximum output with minimum battery drain.

UNIVERSAL! Instantly convertible for 6 or 12 volt operation.
COMPLETE! Ready for installation and operation.
QUALITY! Exceptional value/price ratio.



DESIGNERS AND MANUFACTURERS OF RADIO COMMUNICATIONS EQUIPMENT
COMMUNICATIONS COMPANY, Inc.

FOUNDED 1938 CORAL GABLES, MIAMI 34, FLORIDA

1ST DC POWER SUPPLY
to service
transistor auto radios
and standard sets

0-8, 0-16 Volts Model D-612T

Send for free illustrated bulletin

Electro
ELECTRONIC EQUIPMENT

ELECTRO PRODUCTS LABORATORIES
4501 N. Ravenswood Ave.,
Chicago 40, Ill. LOngbeach 1-1707
Canada: Atlas Radio Ltd., Toronto



CONTACT



This section of SERVICE DEALER AND ELECTRONIC SERVICING serves as liaison office between 1) Manufacturers of Electronic devices who seek qualified service firms capable of acting as their branch service depots, and 2) Technically qualified, financially sound Service Firms or Independent Radio-TV Servicemen who seek to be appointed as Factory-Trained Branch Service Agencies for Electronic Equipments Manufacturers in the areas where they are situated. Advertising run in this section costs \$15.00 per column inch.

TECHNICIANS BELL TELEPHONE LABORATORIES

... world communications research and development center now has openings for qualified technical aides in the fields of:

- Communications
- Radar
- Computing Systems
- Data Systems
- Fire Control
- Apparatus Development
- Guided Missiles
- Specification Wiring and many others

If you have had a good basic science training at high school; applicable schooling in a technical institute, armed services school, or equivalent; and preferably 2 or more years of applicable industrial or military experience

Please send resume, phone or wire to

**Bell Telephone Laboratories
General Employment, Dept. R
Mountain Ave.-Murray Hill, N.J.**

You will be considered for openings at all of our laboratory locations including Whippany, N. J., New York, N. Y., Massachusetts, Pennsylvania, Maryland, Indiana and North Carolina.

**Please State
Locational Preference**

**BELL
TELEPHONE
LABORATORIES**

ST. PETERSBURG, FLORIDA ELECTRONIC SERVICE FIRM SEEKS ADDITIONAL CLIENTS

We are fully licensed, experienced and qualified to install and service the following:

- Mobile and Marine Radio
- Broadcast and TV Station Equipment
- Aircraft receivers and transmitters
- Garage Door electronic openers
- Radiation electronics devices
- Inter-com, P.A., and Sound installations
- Closed circuit TV.

College graduate, hold 1st Telephone (since 1917). 1st Telegraph with Radar rider and sea service licenses. Bank references furnished. Manufacturers or users of above mentioned types of electronics equipment, write to:

**Box 1104, SERVICE DEALER &
ELECTRONIC SERVICING**

BRANCH FACTORY SERVICE DESIGNATION WANTED IN ERIE, Penna. area

Hold First Class FCC radio-telephone license. For 4 years was radio station engineer. Since 1948 have serviced radio, TV, audio, mobile, marine, aircraft radios, closed circuit TV and industrial electronics equipment. Competence proven. Write for further details.

**Box 1101 — SERVICE DEALER &
ELECTRONIC SERVICING**

INDUSTRIAL ELECTRONIC DEVICE AND TEST EQUIPMENT MANUFACTURERS

For years we have devoted our efforts exclusively to the maintenance* and calibration of electronic devices such as: Counters, PH Meters, Metal Locators, Geiger Counters, PEC units, Scopes, VTVM's, Generators, Power supplies, etc. *(We sell no devices or equipment).

Our facilities are available to manufacturers and users of electronic devices and electronic test equipment. We invite inspection of our facilities and abilities. Write:

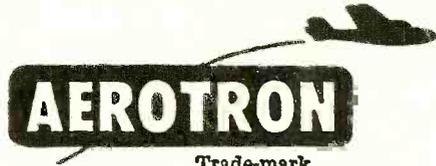
**Cleveland, Ohio Firm, c/o Box 1103,
Service Dealer & Electronic Servicing**

TECHNICIAN WANTED

Radio-television service organization situated at Salina, Kansas has opening, on contract basis, for a thoroughly competent technician. Give details in first letter.

**BOX 1102, SERVICE DEALER &
ELECTRONIC SERVICING**

Branch Service Agencies are now being appointed by



AEROTRON

Trade-mark

We manufacture two-way VHF RADIO for private airport unicom, ground control, civil defense, air-sea rescue, civil air patrol, student flight training, airline standby, etc. We also produce two-way Mobile Radio Communication Equipment—receivers and transmitters—for all types of industrial application.

Financially responsible technically competent independent service dealers and service firms who qualify will be designated to act as our official Factory Branch Service Agencies in their territory. Full cooperation and technical assistance will be afforded.

Interested parties communicate with:
MR. CHARLES BROWNING

AERONAUTICAL ELECTRONICS, INC.

P.O. Box 6527

RALEIGH, N.C.

LABORATORY TECHNICIANS

Join Expanding Kearfott!

Kearfott's rapid growth in the development of advanced aircraft navigational systems and components has created permanent positions for qualified men. These openings are for trade school graduates with at least 1 year experience, to wire and assemble special electro-mechanical test equipment from schematics and wire diagrams.

Kearfott's decentralization into several small plants in suburban northern New Jersey provide a friendly atmosphere with plenty of encouragement to advance for ambitious young men.

For interview, write or phone Mr. Paul Kull.

KEARFOTT COMPANY, INC.

Subsidiary of General
Precision Equipment Corporation
1150 McBride Ave., Little Falls, New Jersey
Little Falls 4-1600, Ext. 340

ENGINEERS

**Advance Now,
Broaden Your
Career in this**

RCA ELECTRONIC SYSTEMS and MISSILES POSITION

DUTIES . . . analysis, modification, re-design, maintenance engineering of advanced naval operational airborne electronic systems and missiles.

BACKGROUND . . . college degree or equivalent experience, plus minimum of four years' industrial and/or military electronics experience.

LOCATION . . . east of west coast U.S.; overseas in Hawaii, Japan, Alaska or Mediterranean area.

SALARY . . . start at \$7000 and up yearly. Travel allowance, relocation reimbursement for you and family in U.S. Travel expenses and living allowance overseas.

BENEFITS . . . enjoy the complete, modern RCA program.

FOR CONFIDENTIAL DISCUSSION OF THIS PROMISING RCA OPPORTUNITY

Write:
MR. ROBERT MAHON
Employment Manager, Dept. Y-000
RCA SERVICE CO., INC.
Cherry Hill, Camden 8, N. J.

RCA SERVICE CO., Inc.

AUTOMATION

[from page 47]

form the circuit from the individual components.

From the raw materials, all of the individual items, with the exception of the tube, are manufactured by machine. Tubes are purchased rather than made on the production line. Automatic inspection is used to examine every module for the proper electrical and mechanical characteristics. The final result is a rugged, standard package which is interchangeable with all others of the same type.

Project Tinkertoy has two parts. MDE, or Modular Design of Electronics and MPE, Mechanized Production of Electronics. MDE establishes a series of standards, both electrical and mechanical, to provide a group of electrical circuits which will cover a wide range of characteristics. There are many single-circuit functions which have a high degree of repeatability. Amplifiers, i-f, a-f, and r-f, to name only a few, are in very wide use. Other circuits quite often used, are cathode-followers, clippers, and phase-inverters. Each of these can be designed as a module, and from the appropriate selection of modules, many complete electronic devices may be made through proper interconnections.

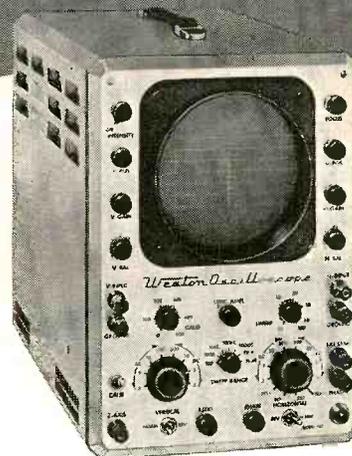
There are four to six wafers to each module; just as an equipment can be made up of a group of modules so a module can be made from a group of individual wafers. For the MPE line these individual parts are made automatically and inspected automatically. Quite clearly, this technique is suited for large-scale production; this is its intended purpose.

Digital Computer Control Techniques

The third leg of the three-sided program for Automation is the use of digital-computers for control. In many areas, large-scale computers are now being used for machine control. Drilling machines, lathes, and drill-presses have all successfully been regulated by this means. Numerical data is fed into the system, whose output controls the action of the machine. There are other systems where punched-cards are used

THE ALL-PURPOSE OSCILLOSCOPE

(MODEL 983)



A high gain, wide band scope which accurately reproduces waveforms comprising a wide band of frequencies.

No scope offers equal versatility and profit-making possibilities. High sensitivity of 15 millivolts per inch RMS makes it ideal for setting resonant traps, signal tracing in low level stages, as a general null indicator, phase characteristic measurements, sweep frequency visual analysis. At your distributor, or write for bulletin-R-36-A. WESTON Electrical Instrument Corporation, Newark 5, N. J. A subsidiary of Daystrom, Inc.

WESTON test equipment
The Quality Line

SPECIAL OFFER TO OUR READERS!

By special arrangement with John F. Rider Publisher, Inc. SERVICE DEALER and ELECTRONIC SERVICING now brings you a COMPLETE diagram service to help you do a faster, easier servicing job!

ALL FACTORY PREPARED! ALL FACTORY AUTHORIZED

Just 50¢ for DETAILED SERVICING INFORMATION on Admiral, Crosley, Emerson, G.E., Motorola, Philco, RCA and Zenith TV receivers from 1952 on!

Just \$1.25 for DETAILED SERVICING INFORMATION on all other TV receivers—any make—any model from 1946 on!

Just 75¢ for COMPLETE SERVICING INFORMATION on any radio . . . any year, any make, any model . . . from 1941 on!

TAKE ADVANTAGE OF THIS SPECIAL OFFER . . .
MAIL THE COUPON TODAY!

COWAN PUBLISHING CORP.
67 W. 44 Street, New York 36, N.Y.
Please RUSH me the following diagrams:

	TV Diagrams at 50¢ and \$1.25 Each	Radio Diagrams at 75¢ Each
Chassis #		
Make		
Model #		

MAKE CHECKS & MONEY ORDERS PAYABLE TO COWAN PUBLISHING CORP.
(For all New York City orders, please submit additional 3% sales tax)

Name _____
Address _____
City _____ State _____

EICO 84 Withers St., Brooklyn 11, N. Y. D-11

SAVE ME 30% on precision instruments—
send **FREE CATALOG** on EICO's 46 models
in factory-wired and kit form.

My Name.....

Address.....

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



NEW! COLOR
and Black-&White
DC to 5 MC LAB & TV
5" OSCILLOSCOPE

#460
Factory-wired
and tested..... \$129.50

Also available as kit \$79.95

• Features DC Amplifiers!

Flat from DC-4.5 mc, usable to 10 mc. **VERT. AMPL.:** sens. 25 rms mv/in; Z 3 meg; direct-coupled & push-pull thruout; K-follower coupling bet. stages; 4-sweep freq-compensated attenuator up to 1000:1. **SWEEP:** perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); pre-set TV V & H positions (30 & 7875 cps); auto. sync. ampl. & lim. **PLUS:** direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equip. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. calib. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.

BEFORE you buy ANY instruments—get the **FACTS** on the money-saving, high-precision EICO line. Fill in coupon for **FREE** catalog & name of your nearby distributor.

EICO 84 Withers St., Brooklyn 11, N. Y.
Prices 5% higher on West Coast

AMATEUR RADIO is a fascinating hobby!

Many thousands of professional technicians and engineers are amateur radio operators in their hobby time. The experience derived from this interesting pastime is invaluable both in industry and in civil defense.

Keep up to date on all the latest doings on the "Ham" bands. You can do this by reading the magazine devoted exclusively to amateur radio—CQ—The Radio Amateur's Journal.

For only \$4.00 you can receive 12 big issues of CQ, or 24 issues for \$7.00. This is a terrific saving over the newsstand price of six dollars per year. Don't miss out on another copy. Send in your subscription today!

CQ MAGAZINE D-11
67 W. 44 St., New York 36, N.Y.

Enclosed is \$..... for a..... year
 new renewal subscription to CQ, to be sent to:

Name..... Call.....

Address.....

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

to generate control signals which operate many types of machines for production.

For inventory records, as would be required in an automatic factory, these computers are becoming increasingly important. As they are used now, operators punch information into the machine, which then records the data, and also provides a printed-output of the actual inventory at any time. In other inventory applications, these computers can consider past usage, fluctuations in the business cycle, and the cost of ordering parts—as well as the quantity discount—before ordering parts to replenish the inventory.

Even from this short sketch, the application of digital computers to the control of automatic-production of electronics, through the control of not only individual machines but the flow of material between these machines, ap-

UNDERSTANDING TONE CONTROLS

[from page 12]

bass response, because of room acoustics, a loudspeaker which is perhaps a bit more efficient at certain low frequencies, or other peculiarities of individual components of the total system. As a result, it would seem desirable to incorporate a means for attenuating the bass response. Such combination tone control circuits will be discussed below.

There are also several valid reasons for the incorporation of treble or high-frequency tone controls in high fidelity systems. For one thing, AM broadcasting still constitutes the most important means of communication in this country, and this form of transmission is notorious for its static content. This is especially true in remote areas during electrical storms. Most of the static we hear is of a high frequency or "hissing" nature. Furthermore, AM broadcasting is generally limited to a maximum tonal spectrum of only 5000 cycles or so. It is therefore pointless to run a high-fidelity system "wide-open" only to allow this annoying static to get through and with no particular improvement in the program sound itself. A moderate amount of treble attenuation would seem desirable in this case, for this cut serves to reduce the static

appears quite feasible. The computer could control the production rates, production machines, the inventory level in the stockroom, or even the progress reports for management. These are all possible and they all apply to the Automation system for tomorrow.

The Automation System of Tomorrow

The basic parts of the present trend toward Automation, as discussed in the preceding section can form the background for the Automation system of tomorrow. Mechanization, Modularization and computer control are used today as separate parts in the overall technology. As each expands, it can be brought into a unified system. This requires further refinement of present methods, the development of new methods, and the system thinking and planning needed to tie all of the elements into an integrated whole. ■ ■

amplitude without biting into the program content materially. Room acoustics are also a big factor in determining whether or not to deviate from flat response by means of treble controls. A heavily carpeted room containing draperies on one or more walls absorbs an appreciable portion of the high frequencies and gives the listener the impression that the electronic system is deficient in "highs." On the other hand, hard, bare walls and floor have the reverse effect and tend to render the overall sound too shrill and harsh. Proper use of tone controls in these instances is simpler than complete refurbishing of the home.

How to Check the Action of Tone Controls

The typical tone control set-up in high fidelity components consists of two individually and continuously variable knobs marked "TREBLE" and "BASS." These controls may be located on the amplifier itself, on a separate audio control chassis, or on the tuner, if it is the type of tuner which is serving as the center of operations for the entire system. In rare cases, you may find a customer who has had the misfortune of assembling a system in

for all your
**Exact Replacement
TV TRANSFORMERS**

Specify Stancor

FREE

STANCOR TV Transformer Replacement Guide listing over 8000 models and chassis of 117 manufacturers... also STANCOR Auto Radio Replacement Guide with replacement data on over 540 auto radios of 40 manufacturers. Available from your distributor or by writing Chicago Standard.



**CHICAGO STANDARD
TRANSFORMER CORPORATION**
3511 Elston Avenue • Chicago 18, Illinois



Priced to Sell!

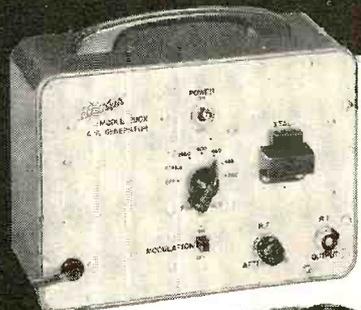


At
All
Distributors

manufactured by
Perma-Power COMPANY
4727 N. Damen Ave., Chicago 25, Ill.
manufacturers of electronic equipment since 1928
Export: SCHEEL INT., Chicago

HICKOK

Model 290X



\$44²⁵ Net

HIGHLY ACCURATE AM GENERATOR

Specifically designed to meet the accuracy and high speed requirements of today's radio servicing. All output frequencies easily obtained by dialing the front panel selector switch. Crystal accuracy through addition of crystal in holder provided.

THE HICKOK ELECTRICAL INSTRUMENT CO.

10533 Dupont Ave. • Cleveland 8, Ohio

HE MADE THE GRADE!



Just as he promised, the man who claimed we couldn't spend months designing the smallest electric test clip in the world, couldn't invent a fool-proof insulator, tool up, get production going, keep the cost under a dime, and have the biggest hit in our history (since 1908)...that man just made the grade as a Monkey's Uncle!

At jobbers everywhere:
MUELLER

"MINI-GATOR"

FREE SAMPLE "MINI-GATOR" AND CATALOG...WRITE

Mueller Electric Co.

1568Y East 31st Street, Cleveland 14, Ohio

which *two* of the components have duplicate sets of tone controls. In such instances, it should be emphasized to the customer that only *one* set should ever be used. Better still, if it is possible to by-pass one set of controls completely (as in the case of a tuner, which may have a separate output at the detector ahead of any tone controls) this should be done to avoid confusion and duplication of functions.

Determine the required specification with regard to the tone controls of the particular system directly from the manufacturer's specifications or instruction sheet. If this information is not available, it may be stated generally that most universal tone controls have a maximum range of about 15 decibels of boost or attenuation at the two check points of 50 cycles and 10,000 cycles. Set both the treble control and the bass control for flat response. (This point is usually indicated by means of a dot on the knob lining up with a corresponding dot or symbol on the control panel.)

Apply a 1000 cycle signal to any one of the high level inputs of the system (*not* to the phonograph or other low level, equalized inputs). Replace the speaker with a "dummy load" of 4, 8 or 16 ohms, depending upon the output impedance of the power amplifier. Connect an *ac* VTVM across the dummy load and increase the input signal until a reading of one volt or so is obtained. Check the frequency response at 50 cycles with the tone controls still in the flat or uniform response position. The reading should still be one volt, within the tolerance permitted by the manufacturer (usually plus or minus 1 decibel or so).

Very often, the real trouble will show up at this point. That is, the customer may be complaining that his treble control does not afford enough boost, when actually his system has lost its uniform response even at flat response settings. Obviously, if a point other than the tone control circuit causes a drop of 10 db at 10,000 cycles, then the best the treble control can do is a boost maximum of only 5 db, even though the control circuit itself is contributing a total boost of fully 15 db (and is conforming to its specifica-

tions), the two effects are additive and might cause the customer to falsely suspect that his treble control is not operating properly. In such cases, point by point signal tracing is required, in accordance with methods outlined in an earlier article of this series.

If the system checks out at 50 and 10,000 cycles in the flat response position, set the audio generator to 50 cycles and rotate the bass control clockwise, noting the increase in reading on any VTVM. If your VTVM is not equipped with a decibel scale, you may use the table in Fig. 2, which indicates

Table 2. Decibel relationship to voltage, using a reference of 1 volt equal to 0 db

VOLTS	DB	VOLTS	DB
.10	20	1.00	0
.12	19	1.12	1
.13	18	1.26	2
.14	17	1.41	3
.16	16	1.58	4
.18	15	1.78	5
.20	14	2.00	6
.22	13	2.24	7
.25	12	2.51	8
.28	11	2.82	9
.32	10	3.16	10
.36	9	3.55	11
.40	8	3.98	12
.45	7	4.47	13
.50	6	5.01	14
.56	5	5.62	15
.63	4	6.31	16
.71	3	7.08	17
.79	2	7.94	18
.90	1	8.91	19
		10.00	20

the relationship between voltage and decibels, starting with a reference of 0 db equal to 1 volt. Note whether the total increase is equal (within reasonable tolerance) to the value specified by the manufacturer and repeat this procedure by rotating the control fully counterclockwise, noting the decrease in reading below the fixed reference of 1 volt. Next, switch the audio oscillator frequency to 10,000 cycles and repeat the boost and attenuation readings varying the treble control fully counterclockwise and clockwise. If all checks out as expected, illustrate this fact to the customer graphically (by showing meter readings) and aurally (by replacing the dummy load with the loudspeaker and feeding appropriate frequencies through the system while varying both the bass and treble controls.)

[Continued on next page]

SHOOT TV TROUBLE FAST!

With H. G. Cisin's Copyrighted RAPID "TV TROUBLE SHOOTING METHOD"

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to DIAGNOSE TV troubles as rapidly as an expert. **NO THEORY—NO MATH**—you can locate all faults in record-breaking time, regardless of make or model. "TV TROUBLE SHOOTING METHOD" is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings. Open your own Profitable Business or get a high-paying skilled job.

It's all in this book . . .

Nothing more to Pay—Nothing else to Buy
Alphabetically listed there are 83 picture troubles, over 58 raster and 17 sound troubles and by this unique copyrighted method you know EXACTLY WHERE the trouble is; plus step-by-step instructions, including 69 RAPID CHECKS, enabling you to find the faulty part.

13 IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS! Of the 69 Rapid Checks, **OVER 65 ALSO REQUIRE NO INSTRUMENTS!** Rapid checks include emergency checks for distorted pictures, defective tubes including PIN tube, plus 57 others. **ALL EXPLAINED IN SIMPLE LANGUAGE, PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.**

H. G. Cisin, the author, is the inventor of the AC/DC midge radio. He licenses RCA, AT&T, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new TV TROUBLE SHOOTING METHOD. **Guaranteed. Money Back in 5 Days if Not Satisfied!**

ABSOLUTELY FREE with each order: H. G. Cisin's newest book "TV & RADIO TUBE SUBSTITUTION GUIDE." Gives direct replacements of set and picture tubes. Most valuable servicing aid! **ACT NOW**—get both books postpaid at cost of only one! **\$1 Post-paid**

RUSH COUPON NOW!

H. G. CISIN, CONSULTING ENGINEER

Amagansett, N. Y. (Dept. D-4)

Enclosed find \$1. Rush both books.

Name _____

Address _____

City _____

Zone _____

State _____

NEW folding platform attachment fits all YEATS dollies



carries TV models & chassis ends back breaking lifting & lugging!

Folds up when not in use!

Attached instantly, this ingenious new aid to TV and radio repairmen ends second story service problems when removing TV table models or chassis. With this new attachment, YEATS dolly users can use the dolly for chassis and table models as well as consoles . . . enjoy all the famous YEATS handling conveniences: 30 second strap ratchet fastening, caterpillar step glide and on-a-dime turning. Folding Platform is 13½" x 24", priced at \$9.95. Call your YEATS dealer today!

SEND postcard for full information on our complete line TODAY!

YEATS appliance sales co.

2133 N. 12th St.

Milwaukee 5, Wis.

Only the 5 TOP-QUALITY brands of

STANDARD BRAND TUBES

AT SENSIBLE PRICES

• 90 Day RETMA Guarantee • Brand New
• 1st quality only • Individually boxed

FREE! Newest handy air-mail order form for your ordering convenience.—Free!
• Lists ALL popular TV & radio types.
• Makes mail-ordering a real pleasure.
• Orders over \$25.00 (with remittance) postpaid

0Z4	\$.60	6AS6	2.25	7F8	1.20
1AX2	1.15	6AS8	1.20	7G7	1.15
1B3GT	.95	6AT6	.60	7H7	.85
1H3GT	.90	6AT8	1.10	7L7	1.20
1L4	.85	6AU4GT	1.10	7K7	1.20
1L6	1.10	6AU5GT	1.25	7L7	1.15
1LA4	1.00	6AU6	.75	7N7	.95
1LA6	1.00	6AU7	.90	7Q7	1.00
1LB4	1.00	6AV5GT	1.20	7R7	1.30
1LC5	1.00	6AV6	.60	7V7	1.30
1LC6	1.00	6AW8	1.20	7W7	1.30
1LD5	1.00	6AX4GT	.90	7X7	1.00
1LE3	1.00	6AX5GT	.90	7Y4	.70
1LG5	1.00	6BA6	.70	7Z4	.70
1LH4	1.00	6BA7	.90	12A4	.85
1LN5	1.00	6BC4	1.60	12AL5	.70
1NSGT	.95	6BC5	.75	12AV7	.75
1QS6T	1.25	6C7	1.25	12AT6	.65
1R4	1.00	6BD5	1.40	12AT7	1.00
1R5	.85	6BD6	.75	12AU6	.70
1S4	.90	6BE6	.75	12AU7	.85
1S5	.75	6BF5	.90	12AV6	.65
1T4	.85	6BF6	.70	12AV7	1.05
1T5GT	1.65	6BG6GT	1.85	12AW6	1.00
1U4	.75	6BH6	.90	12AX4GT	1.00
1U5	.75	6BJ6	.85	12AX7	.90
1V	.95	6BK5	1.15	12AY7	1.75
1V2	.70	6BK7A	1.15	12AZ7	.95
1X2B	1.00	6BL7GT	1.25	12B4A	.90
2AF4A	1.40	6BN6	1.15	12BA9	.70
2D21	1.00	6BQ6GT	1.45	12BA7	.95
2X2	.50	6BQ7A	1.30	12BD6	.75
3A3	1.10	6BX7GT	1.25	12BE6	.75
3A4	.55	6BY5G	1.30	12BF6	.70
3A5	.75	6BZ6	.80	12BH7A	1.00
3A15	.70	6BZ7	1.35	12BK5	1.10
3A16	.75	6C4	.60	12BQ6GT	1.45
3A18	.85	6C5	.80	12BX7	.90
3BA6	.75	6CB5	4.50	12BY7A	1.05
3BC5	.80	6CB6	.75	12BZ7	1.10
3BE6	.75	6CD6G	1.90	12CA5	.80
3BN6	1.05	6CF6	.90	12CU6	1.45
3BV6	.90	6CG7	.90	12L6	.80
3BZ6	.80	6CL6	1.20	12SA7GT	1.00
3CB6	.85	6CM6	.85	12SC7	.80
3CF6	.85	6CS6	.75	12SJ7	.75
3CS6	.80	6CU6	1.45	12SK7GT	.80
3LF4	1.20	6DC6	.95	12SL7GT	1.00
3Q4	.85	6DE6	.80	12SN7GT	.85
3QS6T	1.00	6E5	.85	12SQ6GT	.75
3S4	.80	6FF6G	.80	12V6GT	.80
3V4	.85	6H6	.75	12W6GT	.95
4BQ7A	1.30	6J4	3.95	14A4	1.00
4BZ7	1.35	6J5	.75	14A5	1.50
5AM8	1.05	6J6	.70	14A7	.85
5AN8	1.10	6K6GT	.75	14A77	.80
5AQ5	.75	6K7	.90	14B6	.85
5AS8	1.10	6K8	1.25	14C7	1.00
5AT8	1.10	6L6GA	1.30	14E6	1.20
5AY8	1.15	6L6M	1.75	14E7	1.30
5AW4	1.15	6N7	1.20	14F7	1.00
5AZ4	.60	6Q7	1.00	14F8	1.30
5BK7	1.10	6S4	.70	14H7	1.00
5J6	.95	6S8GT	1.10	14N7	1.00
5T4	1.75	6SA7GT	.90	14Q7	.85
5T8	1.10	6SC7	1.00	14R7	1.30
5U4G	.70	6SF5	.75	14S7	1.25
5U4GB	.75	6SF7	.95	14W7	1.35
5U8	1.10	6SG7	1.00	19T8	1.20
5V4G	1.00	6S7	.95	25A V5GT	1.30
5V6GT	.70	6SJ7M	.85	25A X4GT	1.10
5W4GT	.70	6SK7GT	.85	25BK5	1.10
5X4G	.80	6SL7GT	1.00	25BQ6GT	1.45
5X8	1.05	6SN7GT A/B	.90	25CD6GA	1.85
5Y3GT	.60	6SQ7GT	.75	25CU6	1.45
5Y4G	.65	6SR7	.75	15L6GT	.75
5Z4	.90	6T4	1.30	25L4GT	.80
6A8GT	1.10	6U8	1.10	25Z6GT	.85
6AB4	.70	6V3A	1.50	35A5	.75
6AC5GT	1.15	6V6GT	.75	35B5	.70
6AC7	1.15	6V6M	1.35	35C5	.70
6AD7G	1.55	6W4GT	.80	35L6GT	.65
6AF4	.95	6W6GT	.85	35W4	.55
6AF6G	1.20	6X4	.55	35Y4	.75
6AG5	.80	6X5GT	.55	35Z5	.60
6AG7	1.35	6X8	1.20	41	.85
6AH4GT	1.00	6Y6G	.95	42	.75
6AH6V	1.05	7A5	.95	43	.85
6AJ5	1.75	7A6	.80	50A5	.75
6AK5	.80	7A7	.85	50B5	.75
6AK6	.80	7A8	.80	50C5	.75
6AL5	.65	7AG7	1.00	50L6GT	.75
6AL7GT	1.65	7AH7	1.00	50X6GT	.90
6AM4	1.55	7B4	.80	50Y6GT	1.00
6AM8	1.15	7B5	.70	50Y7GT	.90
6AN4	1.50	7B6	1.00	70L7GT	1.55
6AN5	3.50	7B7	.80	.90	.65
6AN8	1.20	7B8	.90	117L7GT	2.50
6AQ5	.75	7C5	.80	117N/P7	2.00
6AQ6	.60	7C6	1.00	117Z3	.80
6AQ7GT	1.25	7C7	.85	1274GT	1.15
6AR5	.75	7E7	1.20	117Z6GT	1.15
6AS5	.80	7F7	.90	5642	1.00

We stock over 1000 types including Diodes, Transistors, transmitting and Special Purpose types.

TERMS: 25% with order, balance C.O.D. All merchandise guaranteed. F.O.B., N.Y.C.

BARRY ELECTRONICS CORP.
Dept. 5D

512 Broadway, N. Y. 12, N. Y.

Call us day or night
24-hour telephone service
WALKER 5-7000

If the results of these tests indicate that insufficient boost is available, the cause, once again, may not be the tone controls themselves. To check this point, set the tone control in question back to the flat response position and increase the signal input (at the audio generator) to raise the output level by the total number of decibels expected if the tone control were to be rotated fully clockwise. If the rise in output falls short of the expected amount (that is, further increase in signal input results in no further increase in output) then it is the signal handling capability of the amplifier itself which should be questioned, rather than the tone control system. In such cases, either the output tube or tubes or the associated circuitry is usually at fault. In order to evaluate other forms of trouble with tone controls, it is now necessary to consider in detail how these typical circuits actually work.

A Simple Bass-Boost Circuit

The action of the circuit of Fig. 1 has been explained briefly above. It has been pointed out that the most boost action is obtained at lower settings of the volume control. Suppose the arm of the volume control is at the tap point and suppose that the 250K bass control is shorted out by its arm being in the uppermost position. Under these conditions, the impedance from the arm of the volume control to ground will be

very nearly 10K (actually 10K in parallel with 125K) or 1/50th of the total resistance of the volume control (500K). Thus, 1/50th of the signal applied to the volume control will be fed to the next grid by voltage divider action. This will be true at all frequencies and no boost action occurs.

Now, suppose the arm of the bass control is moved downward toward the ground connection. At frequencies above 1000 cycles or so, the impedance of the .02 μ f capacitor becomes smaller and smaller and finally approaches a negligible value with respect to the 10K resistor in series with this capacitor. As a result, the effective impedance from the arm of the volume control to ground is about 10K, or 1/50th of the total impedance. At lower frequencies, the capacitor begins to look like a higher impedance until finally, at about 50 cycles, for example, it looks like an open circuit. Under these conditions, the impedance from the arm of the volume control to ground is about 80K or about 1/6th of the total 500K. Thus, at 50 cycles, 1/6th of the total signal will be sent along to the next grid, or about 8 times as much as at 1000 cycles and above. This corresponds to a boost of about 17 db at 50 cycles (maximum). It can be seen from the foregoing that intermediate settings of the bass boost control will provide intermediate amounts of bass boost.

[To be continued]

SAVE TIME! MONEY! CUSTOMERS! **INCREASE SALES! PROFITS! GOOD WILL!**

DECREASE LOSSES... ERRORS... COMPLAINTS... with

OELRICH Business Forms & Sales Aids



DESIGNED SPECIFICALLY FOR RADIO-TV SERVICE

Twenty-Eight items that can earn extra profits, organize business FOR YOU while at the same time favorably impressing your customers and eliminating misunderstandings. You can't afford to be without them. Buy in small quantities at low cost. Ask your jobber about them today!

OVER 800 JOBBERS TO SERVE YOU!...

Our products are distributed coast to coast... look for our big red display unit on your jobber's sales floor. Solve many of your business problems by including our forms and sales aids in your business plans.

SEND FOR FREE CATALOG

• OELRICH PUBLICATIONS
• 4308 N. MILWAUKEE AVE. • CHICAGO 41, ILL.
• PLEASE SEND FREE CATALOG

Name _____
Address _____
City _____ Zone _____ State _____



KEEP AHEAD

by keeping informed. CORNELL-DUBILIER'S pocket-size monthly magazine is loaded with technical articles that KEEP you ahead. PLUS a "Sell-Swap and Buy" section for your ad. Mailed FREE to your home every month for the asking.

CORNELL-DUBILIER ELECTRIC CORP.

DEPT. ST116, SOUTH PLAINFIELD, N. J.

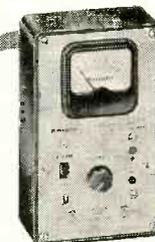
OK! Send me "The Capacitor"—Free

Name _____
Please Print!

Address _____

City _____ Zone _____ State _____

My occupation or job title is _____



NEW

Build-Your-Own Knight-Kit TRANSISTOR & DIODE CHECKER KIT

only \$850

Save on this valuable new instrument! Checks leakage-to-gain ratio and noise level of all junction, point contact and barrier transistors. Can also check germanium and silicone diodes, and forward and reverse conduction of selenium rectifiers. Useful for continuity and short tests, as well as for noise level tests. Features: spring-return leakage gain switch, calibration control, full-vision meter, separate sockets for PNP and NPN type transistors. Complete kit with bakelite case, all parts, 2 1/2 v. battery and instructions. Shpg. wt., 2 1/2 lbs. Model 83 Y 149. Net only... \$8.50

Net F.O.B. Chicago

FREE



356-PAGE ALLIED CATALOG

Lists dozens of other low-cost quality Knight-Kit test instruments, plus the world's largest selection of parts and equipment for service work. Write for FREE copy.

ALLIED RADIO

ALLIED RADIO, Dept. 26-L-6
100 N. Western Ave., Chicago 80, Ill.

Send Kit described above. \$_____ enclosed

Send FREE 356-Page ALLIED Catalog

Name _____

Address _____

City _____ Zone _____ State _____

Advertisers Index

Aeronautical Electronics, Inc.	48
Alliance Manufacturing Co.	13
Allied Radio Corp.	52
American Television & Radio Co.	34
Astatic Corporation	41
Barry Electronics Corp.	52
Belden Manufacturing Co.	23
Bell Laboratories	48
Bussmann Manufacturing Co.	4
CBS-Hytron	11
Channel Master Corp.	2, 3
Chicago Standard Transformer Corp.	50
Cisin, H. G.	51
Cleveland Institute of Radio Electronics	44
Communications Company, Inc.	47
Cornell-Dubilier Elec. Corp.	6, 52
Eico	50
Electro Products Labs, Inc.	47
Heath Company	45
Hickok Electrical Instrument Co.	51
Hi Lo TV Antenna Corporation	16
Hotpoint Co., Div. of General Electric	29
Jackson Elec. Instrument Co.	36
Kearfott Company, Inc.	48
Mall Tool Company	47
Merit Coil & Transformer Corp.	35
Mueller Electric Co.	51
North American Phillips Co., Inc.	33
Novel Products Corp.	14, 43
Oelrich Publications	52
Perma-Power Company	50
Philco	37
Pyramid Electric Company	18
RCA Batteries	19
RCA Service Co.	49
RCA Tubes	Cover 4
Radiart Corporation	6
Raytheon Manufacturing Co.	7
Rohn Manufacturing Co.	Cover 3
Sams, Howard W. & Co. Inc.	5
Shure Brothers, Inc.	1
Simpson Electric Co.	31
Standard Coil Products Co., Inc.	17
Stanley Electronics	39, 40
Trio Manufacturing Co.	21
Triplett Elec. Instrument Co.	Cover 2
Wall Manufacturing Co.	45
Weston Elec. Instrument Corp.	49
Winegard Company	46
Yeats Appliance Dolly Sales Company	51

Rohn

only complete line of
TV and COMMUNICATION TOWERS

proven in Profits and Customer Satisfaction

look at these
ROHN exclusives

• HOT DIPPED GALVANIZED

The finest, most durable finish is available for ROHN Towers and accessories... all done entirely on the ROHN premises under careful ROHN supervision.

• UNEQUALLED DESIGN AND ENGINEERING

ROHN is the only design that has stood up over the years. ROHN has been first and foremost... and always the leader in new products to meet the changing demands.

• MASS PRODUCTION FOR LOW COSTS

ROHN was the first to utilize mass production techniques to build a superior tower at the most competitive prices. This means no sacrifice in quality yet far greater profits for you.

• UNIVERSAL CUSTOMER ACCEPTANCE

Thousands and thousands of installations prove the ROHN line first in customer satisfaction.

• PIONEER MANUFACTURERS

Pioneers in tower manufacturing—and today one of the world's largest manufacturers of this type equipment. The ROHN Company was built on satisfaction on the part of distributor, dealer and customer alike.

• COMPLETE LINE

Only ROHN offers a full line—one dependable one-stop source for all TV installation equipment. Save headaches, save shipping costs, save time... use ROHN unequalled service exclusively.

ALSO a full line of ROHN ACCESSORIES

Rotor posts, house brackets, eave brackets, peak and flat roof mounts, instant drive-in bases, hinged base sections, telescoping mast bases, guying brackets, UHF antenna mounts, erection fixtures, variety of mounts and supports for masts or tubing,

tower installation accessories, TV service tables, mast and TV hot-dipped galvanized tubing, guy rings, "twister-anchors", rubber tower grommets, insulator sections, hinged rotor platform, accessory shelf and platform and dozens of other items. Get the complete catalog TODAY!

ROHN Manufacturing Company

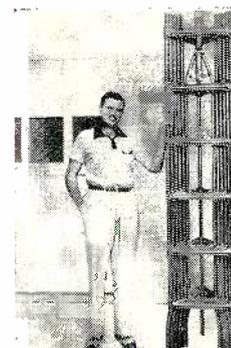
116 LIMESTONE, BELLEVUE
PEORIA, ILLINOIS

• • • HIGHLIGHTS OF THE ROHN LINE • • •

no. 6 tower

"All-Purpose" tower.

Fulfills 75% of your general tower needs—is structurally as sturdy—yet costs less than the well-known Rohn No. 10 Tower. Ideal for home and industrial installations, communication requirements... eliminates stocking many different tower models. *Self-supporting to 50 ft. or guyed to 120 ft.!* Easy to climb for fast, efficient servicing. Utilizes "Magic Triangle" which insures far greater strength and stability. Permanent hot-dipped galvanized coating. Dependability—a feature customers demand—is assured with the Rohn No. 6 Tower... designed to "stand up" for years to the rigors of weather and climatic conditions.

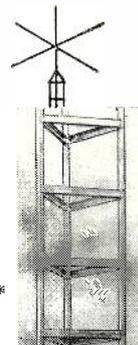


Package Tower*

"Space Saver"—cuts storage space 300% or more!

Popular PT-48 has almost 50' of sturdy tower within a compact 8' x 20" package! "Magic Triangle" design is adapted to a pyramid shape using a wide 19" base with progressively decreasing size upward. Decreases your overhead... easy to transport and assemble—cuts shipping costs. Galvanized throughout. Available in heights of 24, 32, 40, 48, 56 and 64 feet!

COMMUNICATIONS TOWER



For extreme heights and communication purposes of all kinds, the Rohn No. 40 gives you strength and durability on which you can depend. The time tested and proven

equilateral triangle design using extra heavy duty tubing and corrugated steel cross-bracing is utilized. The No. 40 is structurally sound so you can install it for heights up to 300'; or at lesser heights when considerably greater strength is required because of excessive wind or antenna loading. Use for radio telephone, broadcasting, microwave relay and all other such communication purposes. If a particular job calls for this type tower, save real money by using ROHN towers.

Note: For lesser heights, use the Rohn No. 20 or No. 30 Tower.

Both Towers Feature THE ROHN MAGIC TRIANGLE*

For structural superiority, famed wrap-around "magic triangle" design is featured in these all-steel towers. Towers have full 2 1/2" wide corrugated cross-bracing welded to tubular steel legs. The exclusive design assures dependable strength and permanence.

* pat. pending

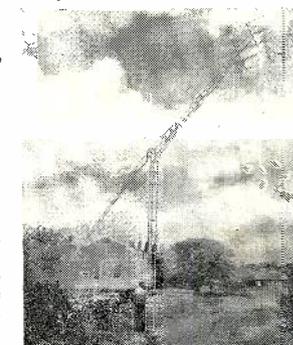
Telescoping Masts



Heavy-duty hot-dipped galvanized steel tubing and rigid joints give extraordinary strength. *Quick installation*... mast attached to base—antenna fixed, then mast hoisted quickly to desired height. Utilizes special clamp and guy ring arrangement. Flanged interior section; crimped exterior section gives mast stability that can't be beat. Complete with guy rings and necessary erection parts. In 20, 30, 40 and 50 ft. sizes. Bases and ground mounts available.

ROHN FOLD-OVER TOWERS

These unique fold-over towers are perfect for experimentation, TV service departments, amateur use, and special purposes. Uses regular ROHN tower sections with kit. Now available in standard No. 10 tower to 50', and in ROHN No. 30 & No. 40 towers for heavy-duty use.



MAIL THIS COUPON FOR FREE LITERATURE!

Rohn Manufacturing Company
116 Limestone, Bellevue
Peoria, Illinois

Gentlemen: Please rush me complete details on the full line of Rohn Towers and Accessories.

Firm _____

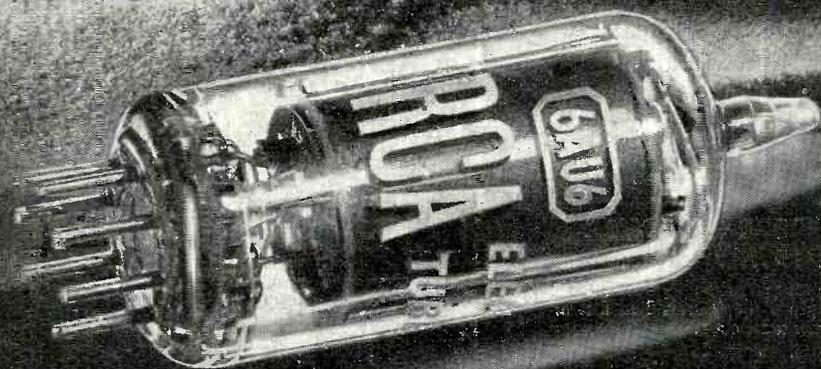
Name _____ Title _____

Address _____

City _____ State _____

Advanced
engineering
and precision-
manufacture
build

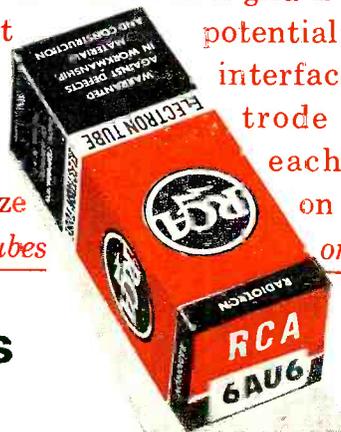
LONG LIFE
into RCA RECEIVING TUBES



A receiving tube that delivers, and keeps on delivering at maximum performance levels doesn't just happen—it *has to be made to happen!* Stringent quality control checks govern each part and each process in the manufacture of all RCA Receiving Tubes. Take the RCA-6AU6, for instance: The control grid is silver-plated to minimize grid emission and to give low contact potential; care-fully processed cathode materials minimize leakage and mica support is specially treated to insure low inter-electrode leakage; result—Long Life! To insure noise-free performance—each tube is “receiver-tested.” Avoid costly callbacks—standardize on RCA. Tell your distributor to fill your tube order with RCA Tubes only.



RECEIVING TUBES
RADIO CORPORATION OF AMERICA



COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.



SERVICE DEALER
and ELECTRONIC SERVICING

IAP 6E 1718 16 SEP 57A
M J HINKO
15827 TRAFALGAR
CLEVELAND 10 OHIO