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# CTRONICS

WORLD

RADIO  
& TV NEWS

- THE THIRD CHANNEL FOR STEREO
- A 1-KW. FINAL FOR THE HAM
- HOW BASS REFLEX ENCLOSURES WORK
- TV CIRCUIT IMPROVEMENTS

JUNE, 1959

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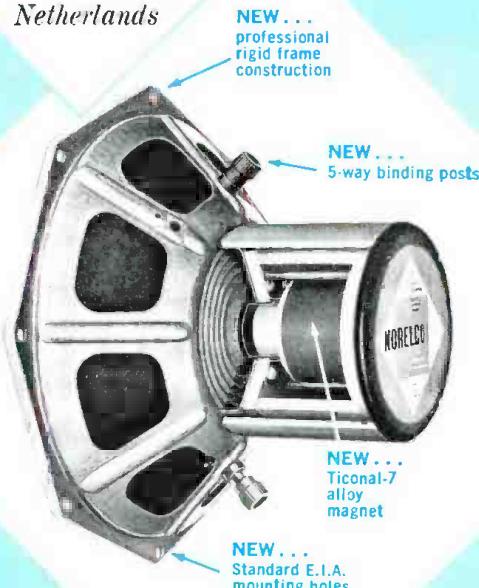
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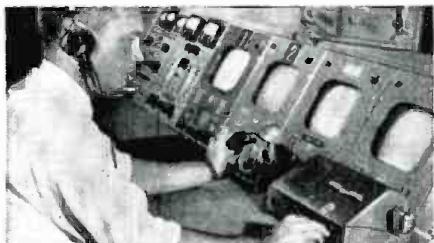


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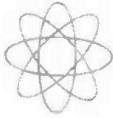
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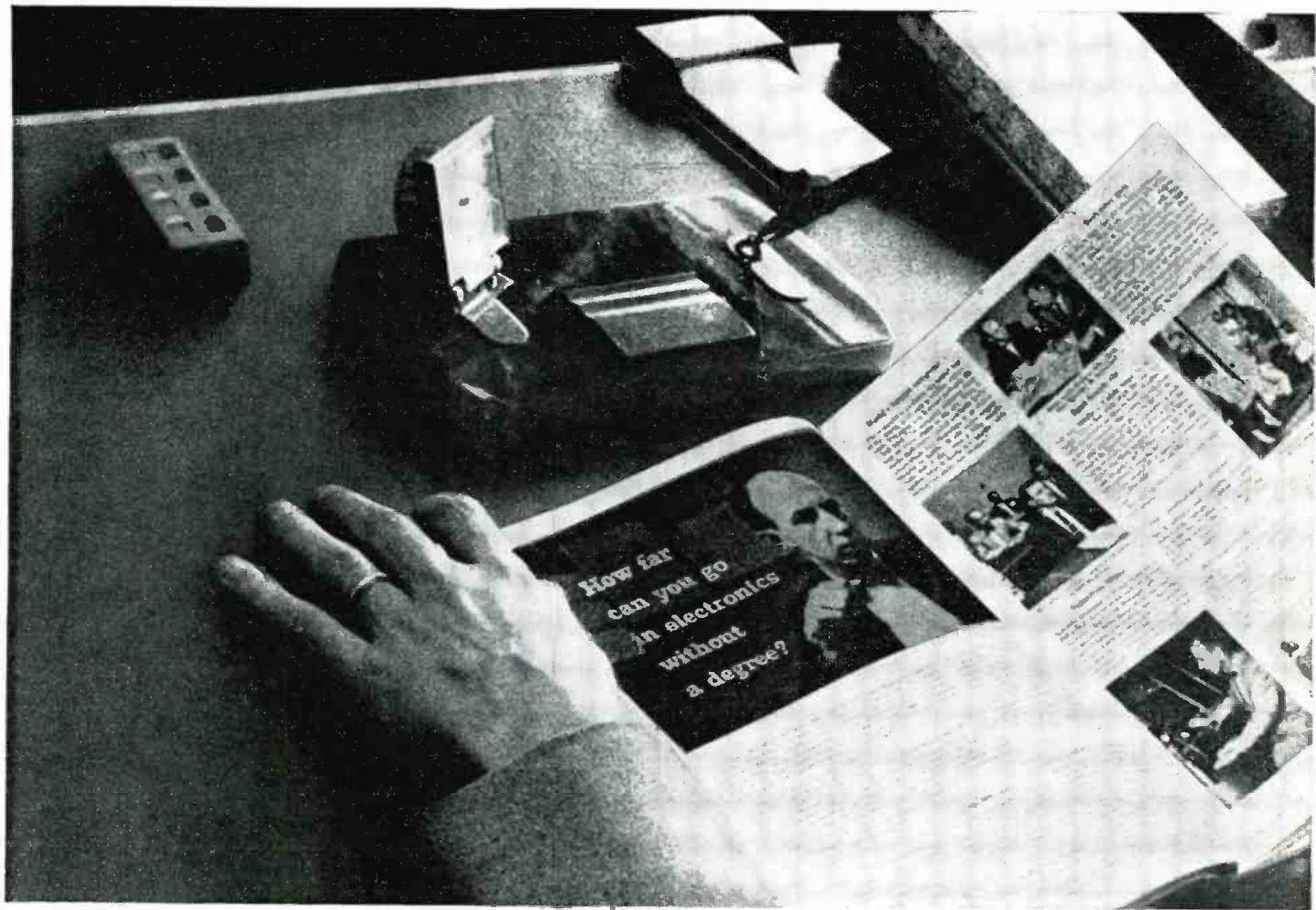
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## How far can you go in electronics . . .

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**HURDLING THE DEGREE BARRIER.** "A few years ago," recalls Bill Miles, "I felt that I'd gone about as far as a technician could without a degree. I just couldn't hurdle that education barrier. Now, thanks to IBM, I have a solid electronics education. I'm a Group Manager on Project SAGE, responsible for 20 field engineers. My future looks brighter than it ever did. I don't know of another company where a technician can go farther or receive more recognition, without a degree, than at IBM."

**UTILIZING HIS NAVAL TRAINING.** Bill Miles became interested in electronics in high school and spent three years as a Naval Aviation Radar Technician. After discharge from service, he worked as a TV serviceman, at the same time pursuing an engineering education at night. "I knew there were good career opportunities around somewhere, but I couldn't find them," Bill Miles says. "I investigated several big companies. They were impressed with my ability, but my lack of a degree kept me from the kind of a career I wanted. Then I answered an ad similar to this."

**EXTENSIVE ELECTRONICS SCHOOLING.** In May 1955, Bill Miles joined IBM and began an extended training course in electronic computers. "The teaching was adult and as technically advanced as I could ask for," he says. "Each day, I gained a deeper knowl-

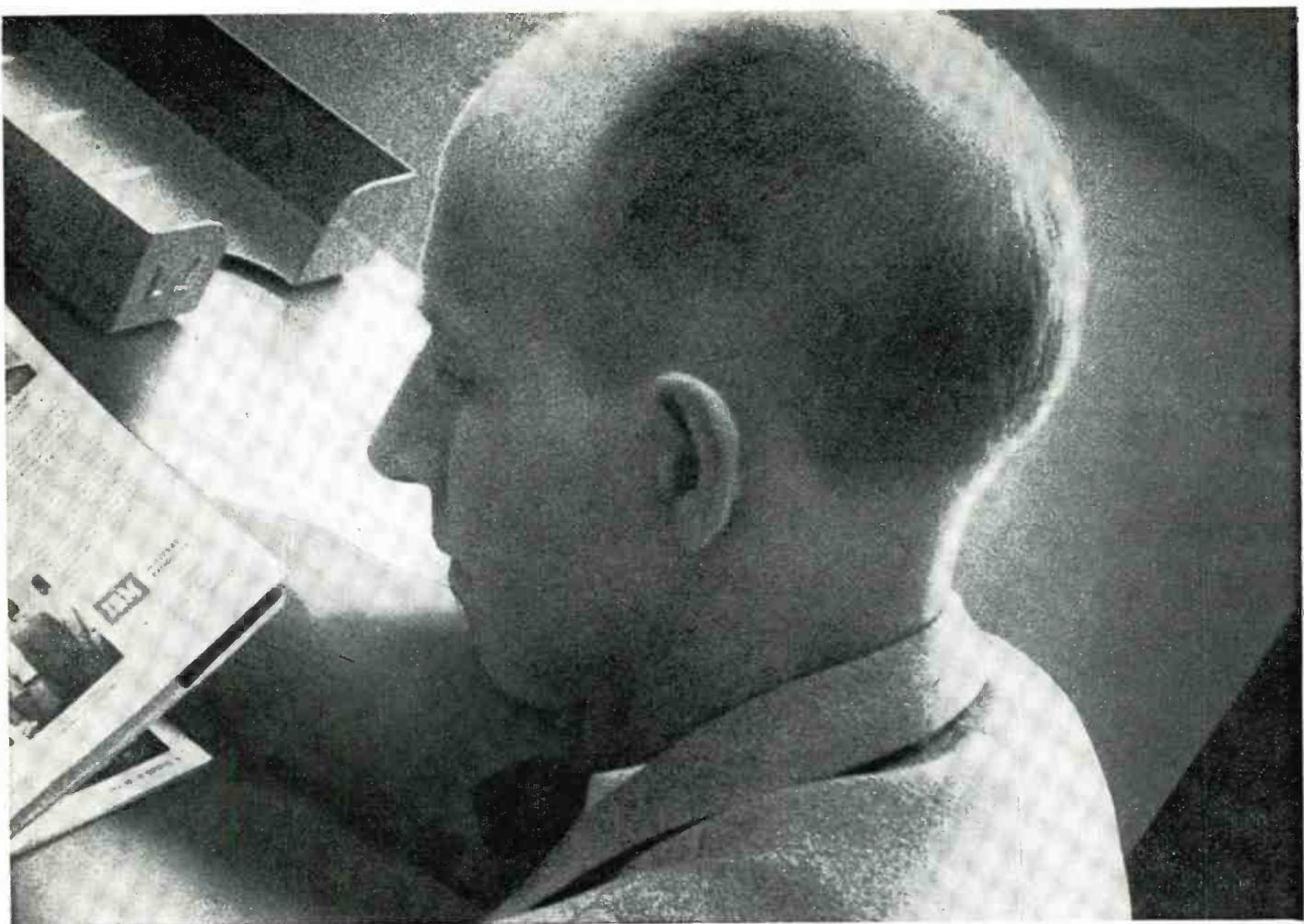
edge of electronics and added to my professional stature. IBM shows real interest in you as an individual: what your goals are, what plans you've made to reach your goals, how the company can help speed you toward them or even higher goals."

**ASSIGNED TO SAGE SITE.** After his training, Bill Miles was assigned to a SAGE site. SAGE is an important link in America's air defense, and the heart of SAGE is a real-time computer which is probably the world's largest and most reliable.

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**UPGRADING TECHNICIANS.** "The job of IBM field engineers is to keep SAGE computers running," explains Bill Miles. "This involves maintaining, testing, and checking computer units. It means anticipating trouble before it occurs. The work turned out to be exactly what I was looking for. I had a chance to do work ordinarily done by graduate engineers . . . work usually denied to men without a degree. Of all the companies I know, IBM appears to be one of the few which upgrades technicians to levels of engineering responsibility . . . levels dictated not by your formal education but by your native talents."

**MANY EDUCATIONAL OPPORTUNITIES.** "SAGE field engineers have many opportunities for education, above and beyond the 'basic' training, which lasts 20 weeks," says Bill Miles. "After a year or two in the field, they may be selected for further training to learn how the complete SAGE electronic computer system



Bill Miles reviews two-year-old article about his IBM career.

## without a degree?

works. To keep up with the most advanced electronic developments, they may also attend classes during working hours."

**RAPID ADVANCE TO GROUP MANAGER.** In his four years with IBM, Bill Miles has received several promotions. He is now Group Manager at a SAGE site. "My advancement is an example of IBM's policy of promoting from within," he says. "The company is quick to recognize a man's contributions and quick to reward him. To some degree, the growth of the SAGE system was a factor in my advancement, and SAGE is due for additional growth in the next few years. This means lots of opportunities for new men and rapid progress along a clearly defined advancement route. There are no limits set on your future. Everything IBM has ever promised about advancement in field engineering, I've seen happen—either to me or to someone I know."

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## ...for the Record

By **W. STOCKLIN**  
Editor



### SERVICE UNITY AT LAST?

WHAT you are reading now was not originally scheduled for this space. Late developments of unusual significance to the service industry have pushed other matters aside, for the moment. We have just received a report from Karl Heinzman, president of the Television Service Association (TSA) of Michigan, to the effect that his group has applied for membership in the National Alliance of Television & Electronic Service Associations (NATESA). As we went to press, the formalities were in progress with no serious snags foreseen by Heinzman. If that is true, affiliation may be a fact by the time you read this.

We simultaneously learned that elements in the state-wide Texas Electronics Association are also negotiating for membership in NATESA. These two reports follow by only a few weeks the decision of the Indianapolis Television Technicians Association to formalize affiliation in the national group. If these actions are all consummated, their significance to the industry as a whole cannot be overstated.

Queried about progress toward the possible affiliation, Executive Director Frank J. Moch of NATESA was cautiously optimistic. He called attention to certain formal, constitutional problems that would have to be resolved. However, he did not feel that these were at all insurmountable. With all parties working toward conciliation, these points could be worked out. Much of his caution should be viewed against a backdrop of past events. He does not wish to inject himself into current dealings to the extent that divisive charges of excessive control from the top or of arbitrary handling can be leveled. He also hopes to avoid reviving personal differences that have, in the past, hindered real issues. However, he reports that the welcome mat is out and adds his own fervent hope that the current moves toward affiliation are indeed realized.

If they are, the service industry will have reached a turning point. TSA, headed by able and intelligent Karl Heinzman, is a strong, active group with an outstanding record of achievement. TEA and its affiliates have set leads for other groups throughout the nation to follow with many of their programs. ITTA, another distinguished group with a propensity to lead, is a key component in the state-wide Indiana Electronic Service Association. Should NATESA indeed be strengthened by the addition of these three important organizations over so short a period, the service industry will hurdle one of its most formidable barriers:

despite the continued abstention of remaining groups (some of them quite noteworthy), there will at last be, in effect, a united, strong vehicle through which the industry may resolve the pressing problems now besetting it.

Significantly, each of the three groups mentioned here, ITTA, TEA, and TSA, has been identified as "anti-NATESA" at one time or another. With a fervent hope that the urgent and indispensable unity might be achieved as soon as possible, we have preferred to believe that, in truth, there were "non-NATESA" rather than "anti-NATESA" groups. The developing situation makes it difficult to dismiss that notion as a childish one any longer.

We are not trying to say that NATESA is the perfected and ideal instrument for national unity, or that those remaining outside of it will be wrong or evil. What we do say is that, whatever differences must still await conciliation, essential unity accomplished NOW to cope with problems that will not wait, and on which there is no disagreement, must come first, whether the resulting instrument is called NATESA, The National Fellowship Society, or anything else. The principals involved in the affiliation moves appear to feel that it is wisest to choose *the most suitable instrument* now available rather than to wait a decade or a century for one that is hypothetically *ideal*. Perhaps the continuing process of perfection and reconciliation can actually be accelerated by joining hands now.

Characterizing this sentiment, Frank Teskey of ITTA has said to some dissenting colleagues, "It is not compulsory to renew affiliation if the experience is unsatisfactory . . . how could we tell if we liked swimming, if we never tried the water?" Karl Heinzman feels that further wasteful division and duplication of energies is hopeless and intolerable, that the times call for the most efficient possible concentration of effort.

For our part, we earnestly hope that, at last, the service industry will now be able to speak with one strong voice, as retail dealers have been doing through NARDA and electronic distributors through NEDA. Only in this way can service assume its just position in relation to the electronics industry as a whole. The broader industry and the set-owning public can only benefit, in the long run. Our best wishes go with the principals in current negotiations to the end that they may at last achieve the long-delayed singleness of effort in an equitable way. —30—



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Send for your complete, money-saving guide to the world's largest selection of hi-fi systems and components. See everything in thrilling stereo; all the new KNIGHT components and systems; all leading make lines. For everything in hi-fi, for everything in Electronics, get the ALLIED Catalog. FREE—write for it today.

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Ship me the following:  KN-734.  KN-120.  
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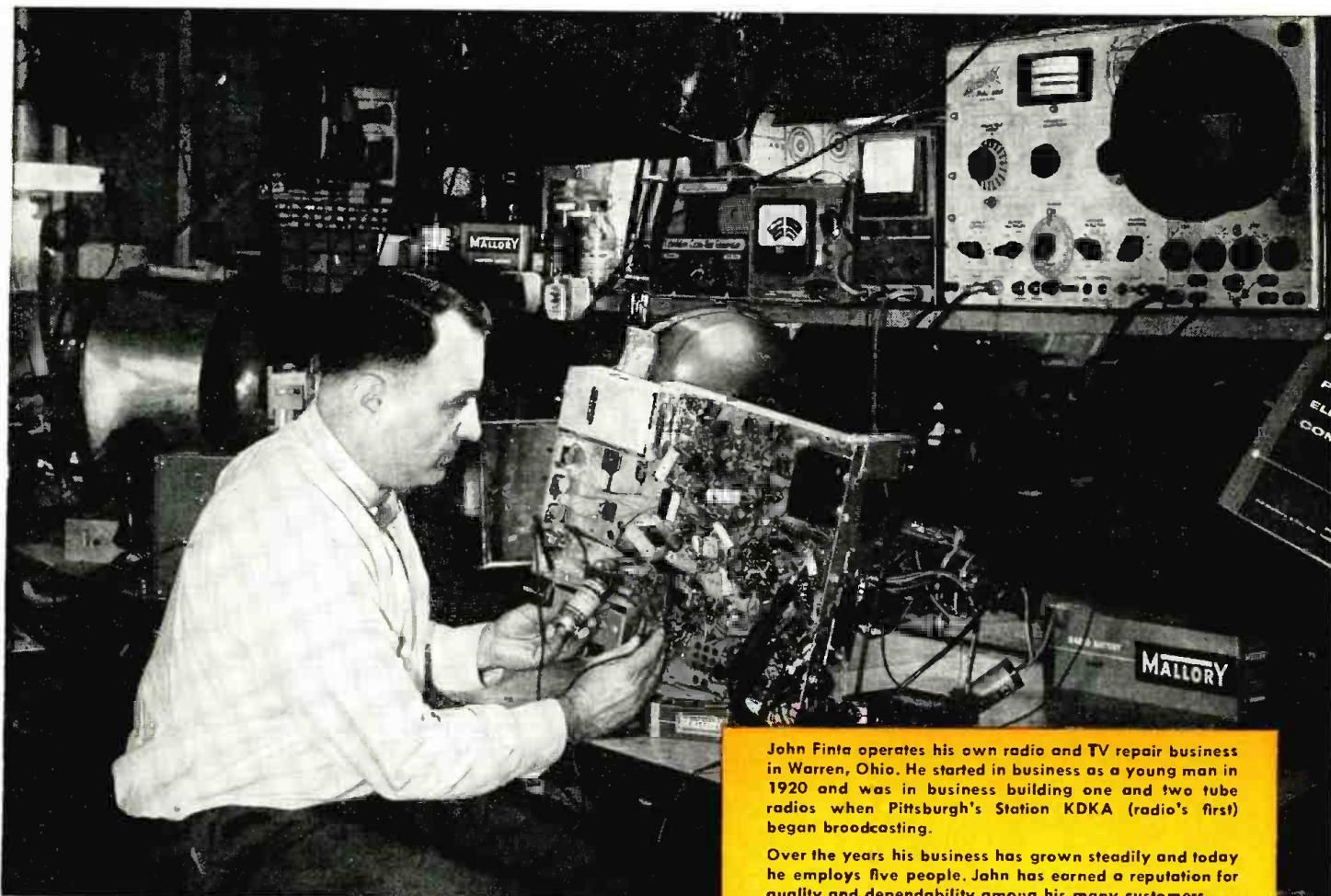
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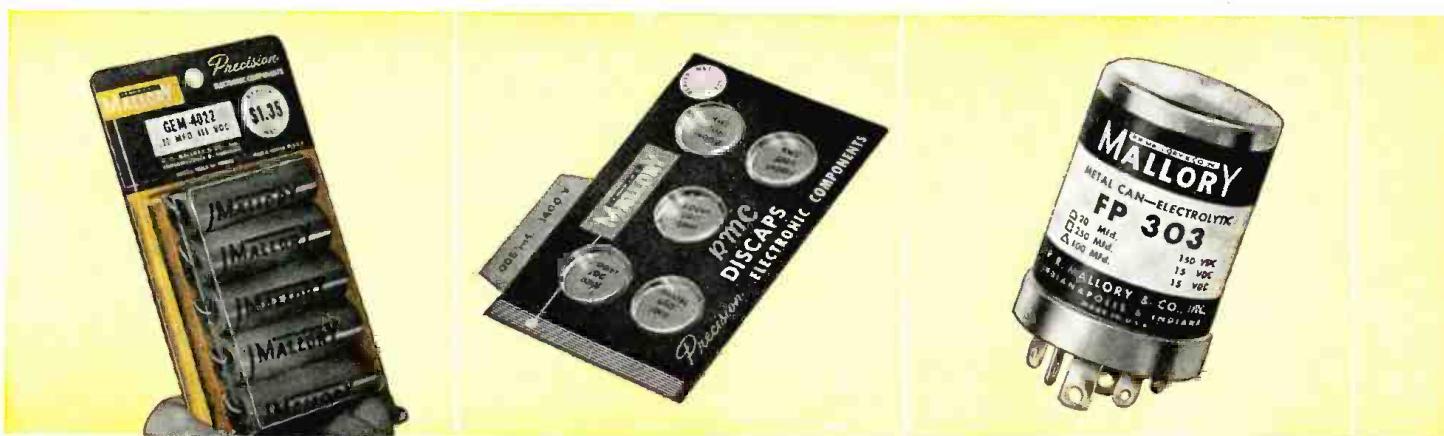
# Service Technician John Finta Says...



John Finta operates his own radio and TV repair business in Warren, Ohio. He started in business as a young man in 1920 and was in business building one and two tube radios when Pittsburgh's Station KDKA (radio's first) began broadcasting.

Over the years his business has grown steadily and today he employs five people. John has earned a reputation for quality and dependability among his many customers . . . a reputation that is bringing him new customers as well as making fast friends of the old.

## Cut Call-Backs with These Quality Mallory



**Gems**—5 rugged, moistureproof, Mallory "Gem" tubular capacitors in an easy-to-use dispenser that keeps your stock fresh and clean—easy to find—no more kinks in lead wires. They're your best bet for outstanding service in buffer, bypass or coupling applications.

**RMC Discaps®**—are a product of the world's largest producer of ceramic disc capacitors. Long the original equipment standard, Mallory RMC Discaps are now available for replacement. They come in a handy 3" x 5" file card package . . . easy to stock, simple to use.

**FP Electrolytics**—The Mallory FP—the original 85°C capacitor—now has improved shock-resistant construction and leakproof seal. Its etched cathode construction—standard in all FP's—assures hum-free performance. High ripple current ratings fit the toughest filter circuits.

# ....“Mallory Components Make Every Job a ‘Sure Thing’”

“Nothing gets under your skin more—or eats into your profits deeper—than time consuming, expensive call-backs. But, there's one sure way to stop them: use only quality replacements.

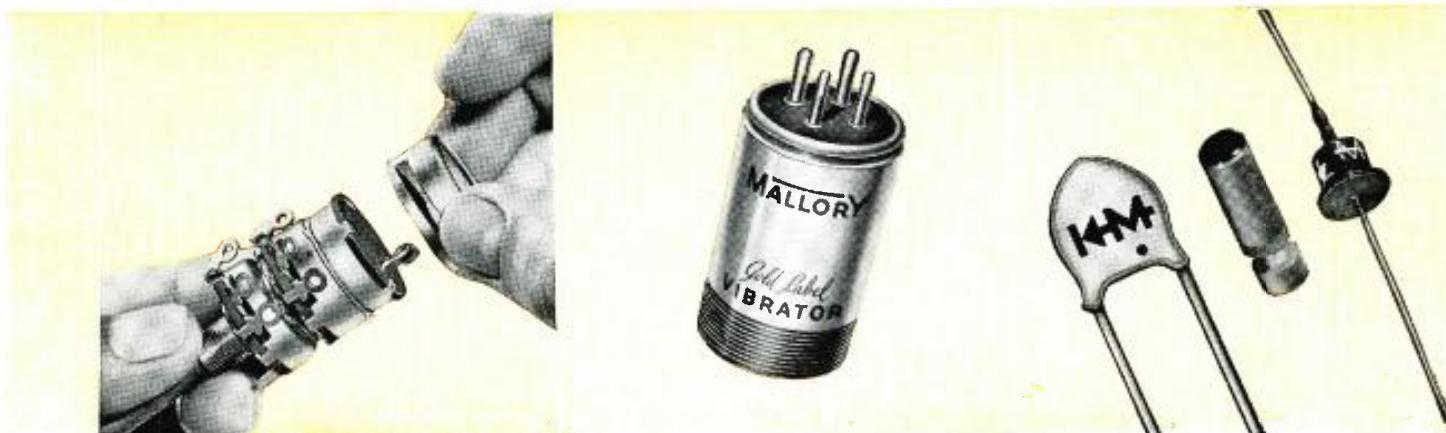
“You know you're getting the best when you ask for Mallory . . . and you don't pay premium prices, either. You see, Mallory components are service-

engineered to give long, trouble-free life. They've been thoroughly tested and ‘punished’ in the Mallory lab, far beyond any beating they'll ever get in actual service.

“This is the kind of quality you get across the entire line of Mallory components . . . capacitors, controls, resistors, vibrators, rectifiers and batteries.”



## Products...



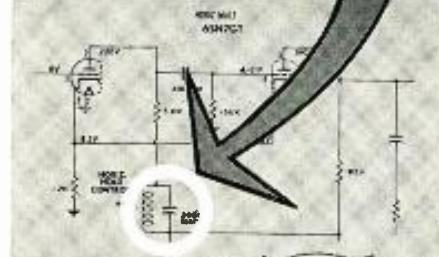
**Sta-Loc\*** Controls—New Sta-Loc design enables your distributor to custom build, in just 30 seconds, over 38,000 combinations—eliminates waiting for out-of-stock controls. You can replace the line switch by itself, without unsoldering control connections.

**Gold Label\* Vibrators**—On critical auto radio servicing, use the Mallory Gold Label Vibrator. It gives longer, trouble-free service life. Mallory Gold Label Vibrators feature Mallory exclusive button-less contact design.

\*Trade Mark

**Silicon Rectifiers**—New Mallory design gives far longer life, lower forward voltage drop, and reverse leakage current than conventional types . . . exceed the requirements of military humidity tests. In convenient kits for replacement of selenium rectifiers in radio and TV.

can your present  
test equipment  
check this  
capacitor  
in circuit?



## Aerovox Model 97 LC-CHECKER

*will do this and much more!*

Yes, the Aerovox LC-Checker will check the above and similar capacitors *regardless of the parallel circuitry and without disconnecting them from the circuit*. You can quickly and accurately locate defective units without performing the time consuming task of unsoldering and resoldering components. If your present test equipment cannot match this performance, then you *need* an Aerovox LC-Checker.

This versatile instrument also tests for capacitor leakage, determines resonant frequency of tuned circuits, checks inductance and performs many other service-important functions all for the low price of \$69.95.

### SEE IT...TRY IT...BUY IT TODAY...

at your local Aerovox Parts Distributor. Write for free literature and address of your nearest distributor.

**AEROVox CORPORATION**  
DISTRIBUTOR DIVISION  
NEW BEDFORD • MASSACHUSETTS

# Within the Industry

**FRANK B. POWERS** has joined the *Aerovox Corporation* as executive vice-president. He has also become a director of the firm.

From 1952 until the present time Mr. Powers had been vice-president of manufacturing of the *P. R. Mallory Company*. He was associated with *Westinghouse Electric Corporation* for twenty years—his last post being head of all manufacturing engineering. He was then vice-president of manufacturing and engineering and a director of *Federal Telephone and Radio Corporation* until 1952.

Mr. Powers graduated as an electrical engineer from the University of Illinois.



**ELECTRONIC INDUSTRIES ASSOCIATION** has announced the admission of sixteen new members, bringing the total to 341. In addition, the Technical Products Division voted to change its name to the Industrial Electronics Division.

Other items from EIA include the news that the Consumer Products Division has decided to broaden its TV public relations program while the Parts Division has approved a sweeping reorganization plan.

\* \* \*

**NEIL UPTEGROVE** has been appointed manager of advertising and sales promotion of *Tung-Sol Electric Inc.* . . . **JOHN D. GOODELL** is now manager of the production development group of *CBS Laboratories*, a division of the *Columbia Broadcasting System, Inc.* In addition, **GEORGE SIOLES** has been named group leader for transducer research in the acoustics and magnetics department . . . *Acoustica Associates, Inc.* has appointed **KURT F. VOGT** general sales manager and **STANLEY E. JACK** chief engineer . . . *General Electric Company's* television receiver department has announced that **I. L. GRIFFIN** is now marketing manager . . . **OLIVER J. GREENWAY** has been named general manager of *Communication Accessories Company*, a subsidiary of *Collins Radio Company* . . . **RALPH C. ROUTSONG, JR.** is now a member of the

consumer product sales division of *Vocaline Company of America, Inc.* . . . *Electro-Voice, Inc.* has made known the following appointments: **JAMES M. PRICE**, general manager of the *RME* division and **HENRY MANDLER** to specialize in high-fidelity products.

\* \* \*

**INSTITUTE OF HIGH FIDELITY MANUFACTURERS** will assemble an exhibition to be shown in Moscow this summer. It will demonstrate stereophonic high-fidelity sound equipment.

*Allied Radio Corp.* has also accepted an invitation from the Office of American National Exhibition in Moscow to display five of its kits at the show. The kits selected are an FM-AM tuner, a four-band radio, a clock radio, a transistor portable radio, and a tube checker.

*Radio Corporation of America* will be represented by a color TV demonstration. The exhibit will feature a fully-equipped color TV studio which will originate eight hours of live and filmed programming daily. The programs will be carried to sixteen 21-inch color TV sets situated throughout the grounds.

\* \* \*

**RICHARD E. KRAFVE** has been elected to the newly created position of group vice-president—commercial for *Raytheon Manufacturing Company*.

Mr. Krafve had been an executive of the *Ford Motor Company* since 1947 and an officer of the company since 1956. Prior to his new appointment, he was a vice-president of the motor company.

In his new post, Mr. Krafve will direct and coordinate the activities of those divisions engaged in the manufacture and distribution of commercial and industrial products. He will also be responsible for acquisition and expansion activities.

\* \* \*

**GC-TEXTRON, INC.**, Rockford, Ill. has announced the formation of **AUDIOTEX MFG. CO.** Walter L. Schott is general manager with headquarters at 3225 Exposition Place, Los Angeles, Calif. The firm plans to market a line of



### JULIUS FINKEL

founder and president of the *I.F.D. Manufacturing Company*, recently passed away at the age of 72. He came to the United States from Russia when he was in his early 20's and founded the company in 1929. Some of his developments include the television antenna kit, the "Remote-O-Cable" replacer, and the "Repairack". He is survived by his widow and seven sons. Albert, Edward, Harvey, Paul, Stanley, Jack, and Harold.



# LET RCA TRAIN YOU IN ELECTRONICS

RCA Institutes celebrates Fifty Years of Electronic Training by introducing its newest Home Study Course...  
**ELECTRONICS FOR AUTOMATION**

... Now you have *four* comprehensive courses for your electronic training... from basic electronic theory to the more advanced principles of color TV and Automation.

Electronic Fundamentals

Electronics for Automation

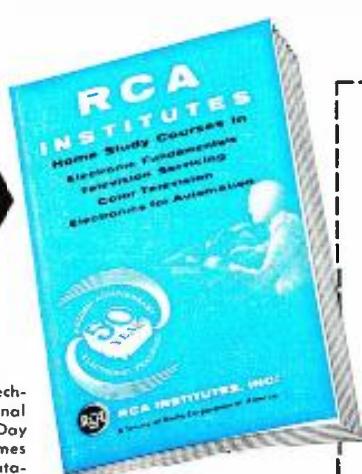
Television Servicing

Color Television

Send for our  
64 page Home  
Study Catalog

**FREE!**

RESIDENT SCHOOL offers Technical Institute and Vocational School Courses in Electronics. Day and Evening classes start 4 times each year. Resident School Catalog sent free on request.



Practical work with the very first lesson. Pay-as-you-learn.  
You need pay for only one study group at a time.

**RCA INSTITUTES, Inc. Home Study School, Dept. RN-69**

A Service of Radio Corporation of America

350 West Fourth Street, New York 14, N. Y.

Without obligation, send me the FREE catalog of Home Study Courses. No salesman will call.

Name \_\_\_\_\_ Please print \_\_\_\_\_

Address \_\_\_\_\_

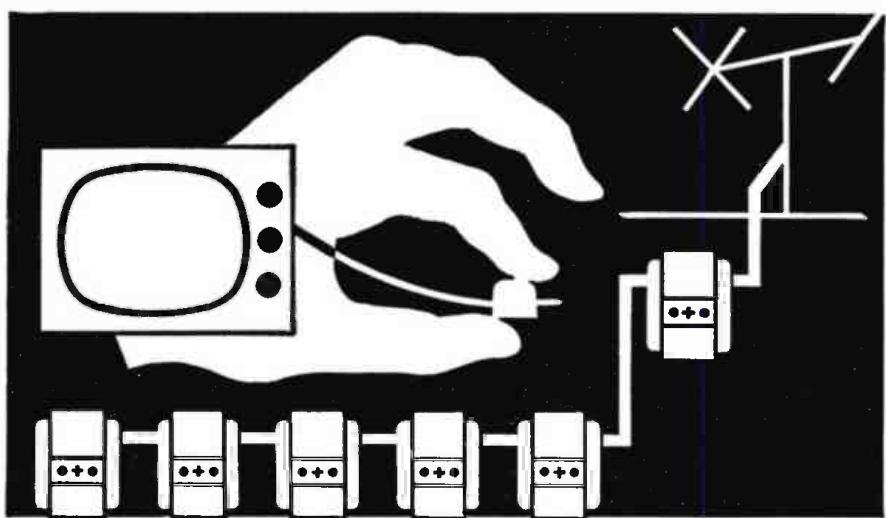
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Korean Vets! Enter Discharge Date \_\_\_\_\_

**CANADIANS** — Take advantage of these same RCA courses at no additional cost. No postage, no customs, no delay. Send coupon to:  
RCA Victor Company, Ltd., 5001 Cote de Liesse Rd., Montreal 9, Quebec  
To save time, paste coupon on postcard.

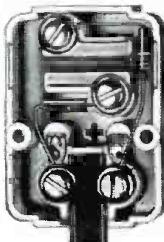
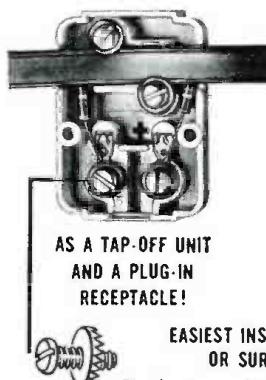
**JERROLD**

# PLUG-INTELLA OUTLETS



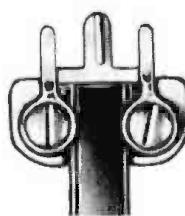
## The New Plug-In TV and FM Outlet With a Built-In "Isolation Network"

JERROLD'S new PLUG-INTELLA Outlet is the only TV-FM outlet that combines a "tap-off" ... and a plug-in receptacle ... in a single unit! Each PLUG-INTELLA Outlet has a built-in isolation network that provides 20 db isolation between receivers . . . allows outlets to be used with 1 or many TV or FM receivers!



### EASIEST INSTALLATION FOR FLUSH OR SURFACE MOUNTING!

Quick-connecting JERROLD PLUG-INTELLA Outlets with Serrated Washers require no wire stripping . . . no soldering . . . prevent connection breakage!



THE PERMA-GRIP PLUG attaches to lead without stripping or soldering . . . cannot be plugged into AC outlets!

SURFACE MOUNTING  
OUTLET HS-135  
complete with plug  
**\$1.95** and hard-  
ware.  
LIST

FLUSH MOUNTING  
OUTLET HS-140  
complete with plug  
**\$2.45** and hard-  
ware.  
LIST

For PLUG-INTELLA Applications, Write for Jerrold Technical Reporter  
**ELECTRONICS CORPORATION**

Distributor Sales Division

Dept. PD 159, The Jerrold Building • Philadelphia 32, Pa.  
Jerrold Electronics Corp., Ltd., Toronto, Canada

Export Representative, CBS International, N.Y. 22, N.Y.

**LOOK TO JERROLD FOR AIDS TO BETTER TELEVIEWSING**

audio and hi-fi accessories . . . NATIONAL COMPANY, INC. has acquired all of the stock of MUTUAL ELECTRONIC INDUSTRIES CORPORATION. The latter firm will operate as a wholly owned subsidiary of the parent organization . . . Directors of RAYTHEON MANUFACTURING COMPANY of Waltham, Mass. and MACHLETT LABORATORIES, INC. of Springdale, Conn. have approved an agreement providing for the merger of the two companies, subject to the approval of the stockholders of both firms. Under the agreement, the Springdale firm would continue to operate under the same name and present management but as a division unit of the parent company.

\* \* \*

**STEWART EDGERTON** has been appointed vice-president and controller of Shure Brothers, Inc.

Mr. Edgerton formerly was controller of the Chicago Parts Depot of the Ford Motor Company. He is a graduate of the University of Wisconsin and received his master's degree in business administration from the University of Chicago.

He is a member of the American Institute of Certified Public Accountants and the National Association of Accountants.

\* \* \*

**DAVID R. HULL**, vice-president of Raytheon Manufacturing Company and currently serving as president of the Electronic Industries Association, has been elected to the board of directors of the Mycalex Corporation of America . . . The Schober Organ Corporation has elected LOUIS H. EXSTEIN vice-president and general manager . . . Telecros Industries Corp. has announced the appointments of EDWARD WALDMAN as general manager and GEORGE BROWN, SR. as chief engineer . . . KENNETH M. STEINKE is now assistant sales manager, jobber division, of Pyramid Electric Company . . . The appointment of GEORGE H. GAGE as manager of product planning for CBS-Hytron has been announced by the company . . . Raytheon Manufacturing Company has announced the following appointments: RAY V. McCADAM, manager of equipment tube sales for the industrial tube division; WILLIAM T. WELSH, sales manager of the equipment and systems division; and GEORGE LOOMIS, manager of the receiving tube division . . . JONAS SHAPIRO, credit manager of EICO, has been elected first chairman of the newly formed High Fidelity Manufacturers' Credit Interchange . . . American Microphone Mfg. Co. of Rockford, Illinois is now celebrating completion of its thirtieth year in business.

\* \* \*

**MAGNETIC RECORDING INDUSTRY ASSOCIATION** has announced the approval of four organizations for membership in the group. Executive headquarters are at 274 Madison Ave., N.Y. 16, N.Y.

**WE'RE MAKING IT EASIER THAN EVER TO BECOME A WELL PAID  
RADIO-TELEVISION SERVICE TECHNICIAN**

**NOW - Just \$6 Starts You Training in**

# **RADIO-TELEVISION**

**the SPRAYBERRY "Learn-by-Doing" Way . . .**

## **25 BIG, COMPLETE KITS of PARTS & EQUIPMENT**

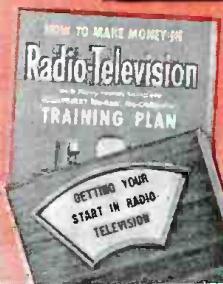
To help you learn fast the practical side of Radio-Television, we send you expertly engineered training kits to test and assemble for interesting, valuable shop-bench practice!

**17" to 24"  
PICTURE TUBE**

- The new Sprayberry Training Television Receiver, built and tested in 5 sections.
- Now offered . . . this fine modern oscilloscope.
- You build this powerful two-band superheterodyne radio receiver.

**Big New  
CATALOG  
AND  
Sample Lesson  
FREE!**

You build the new Sprayberry tester—a complete 18-range Volt-Ohm-Milliammeter test meter.



\* \* \* \* This great industry is begging for trained men . . . to step into good paying jobs or a profitable business of their own! Our new plan opens the doors of Radio-Television wide to every ambitious man who is ready to act at once!

Men by the thousands... trained Radio-Television Service Technicians... are needed at once! Perhaps you've thought about entering this interesting, top paying field, but lack of ready money held you back. Now—just \$6 enrolls you for America's finest, most up to date home study training in Radio-Television! Unbelievable? No, the explanation is simple! We believe Radio-Television must have the additional men it needs as quickly as possible. We are willing to do our part by making Sprayberry Training available for less money down and on easier terms than ever before. This is your big opportunity to get the training you need... to step into a fine job or your own Radio-Television Service Business.

### **Complete Facts Free—Act Now; Offer Limited**

Only a limited number of students may be accepted on this liberal and unusual basis. We urge you to act at once... mail the coupon below and get complete details plus our big new catalog and an actual sample lesson—all free. No obligation... no salesman will bother you.

### **HOME STUDY TRAINING IN SPARE TIME**

Under world-famous 27-year old Sprayberry Plan, you learn entirely at home in spare time. You keep on with your present job and income. You train as fast or as slowly as you wish. You get valuable kits of parts and equipment for priceless shop-bench practice. And everything you receive, lessons and equipment alike, is all yours to keep.

### **LET US PROVE HOW EASILY YOU CAN LEARN!**

Radio-Television needs YOU! And Sprayberry is ready to train you on better, easier terms, that any ambitious man can afford. Just \$6 starts you! Mail coupon today... let the facts speak for themselves. You have everything to gain. Let us prove the kind of opportunity that's in store for you!

**SPRAYBERRY Academy of Radio-Television**  
1512 Jarvis Avenue, Dept. 25-W, Chicago 26, Illinois

**Mail This Coupon Now—No Salesman Will Call**

**Sprayberry Academy of Radio-Television  
Dept. 25-W, 1512 W. Jarvis Ave., Chicago 26, Ill.**

Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Include New Catalog and Sample Lesson FREE.

NAME..... Age.....

ADDRESS.....

CITY..... ZONE .... STATE .....

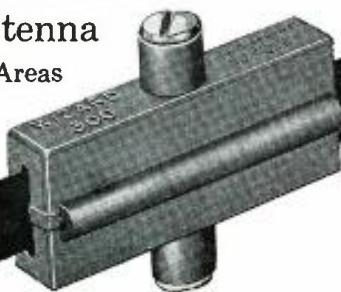


**Multiple Set Installations are  
Fast...Simple...Profitable...**

## **NOW OPERATE 2 to 20 or More TV/FM Sets**

**Without Amplification  
From One Antenna  
In Normal Signal Areas**

**ACTUAL SIZE**



**\$1.95**  
LIST PRICE

## **WIZARD 300\***

**Electro-Magnetic Coupler For  
300 ohm TV Flat Line  
Multiple Set Installations**

\*Pat. Pend.

### **PROVEN EFFICIENCY**

The high electrical efficiency of the Wizard is proven in many installations where more than thirty sets are being operated from a single antenna without amplification.

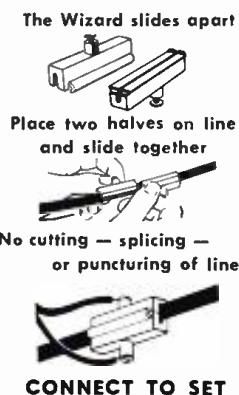


Mr. Wendell Niles, Veteran TV Personality: "I use the Wizard set couplers and have seven TV/FM outlets in my home...all operated from one antenna without amplification."



Partners Ray Kirkhart and Joe Kopin of Picture Tube Center: "We are operating 38 sets from one antenna without amplification and have the finest reception we've ever seen."

### **EASY TO INSTALL**



Mr. J. A. Morris, Owner of the De Ville Motel: "We operate 31 TV sets from one Antenna without amplification...and reception is excellent."



THE NEW WIZARD 300 TECHNICAL BROCHURE EXPLAINS EXACTLY HOW THE WIZARD MAY BE USED FOR ALL MULTIPLE SET INSTALLATIONS, AND IT EXPLAINS WHERE AND HOW TO DEVELOP THIS VERY PROFITABLE BUSINESS.

WRITE TODAY AND ASK FOR: BROCHURE EW69.

**CHARLES ENGINEERING, INC.**  
6053 Melrose Avenue • Los Angeles, California

The firms elected are: *American Recording Tape Corporation*, Los Angeles, California; *Electro-Voice*, Buchanan, Michigan; *North American Phillips*, Hicksville, New York; and *Sonotone Corporation*, Elmsford, New York.

\* \* \*

**ROBERT E. SVOBODA**, general manager of the *Amphenol Distributor Division* of *Amphenol-Borg*, has been elected president of the Association of Electronic Parts & Equipment Manufacturers, Inc.



**Irving Rossman**, president of *Pentron, Inc.*, is first vice-president and Warren Stuart, *Belden Mfg. Co.*, has been chosen second vice-president. Kenneth Hathaway of *Ward Leonard* and Kenneth C. Prince were re-elected treasurer and executive secretary, respectively. New members of the board of directors, elected for three-year terms, include Jay Greengard, president of *Waldom Electronics, Inc.*, Helen Staniland Quam, *Quam-Nichols*, and Roy Laird, *Ohmite, Inc.*

\* \* \*

**ELECTRONICS INDUSTRIES ASSOCIATION** has announced the following new appointments:

Dr. Louis N. Ridenour, vice-president and general manager of *Lockheed Aircraft Corporation's* newly-formed electronics and avionics division, has been elected a member of the Association's board of directors.

Major General W. Preston Corderman (USA-Ret), vice-president of *Littton Industries*, has been named to the organization's military products division executive committee.

Norman A. Triplett, vice-president of *Triplett Electrical Instrument Company*, has been appointed one of EIA's two representatives to the Electronic Industry Show Corporation. He succeeds William S. Parsons of *Centralab*, a division of *Globe-Union, Inc.*

\* \* \*

**INTERNATIONAL RESISTANCE COMPANY**, Philadelphia, Pennsylvania, has been appointed sales agent for the *Chicago Telephone Supply Corp.* of Elkart, Indiana. The company will handle the line of distributor military and industrial controls plus replacement controls marketed through distributors. In addition, *IRC's* foreign licensees will be adding the manufacture of *CTS* variable resistors to their product lines.

To assist in carrying out these agreements, the Indiana firm has purchased and will operate *IRC's* variable resistor manufacturing plant in North Carolina. Service from this plant to all customers will continue without interruption. All variable resistor products of both companies will continue to be manufactured.

It is anticipated that sales and employment will increase for both firms, producing more job opportunities and greater job security.

-30-

**6 months  
from today**



**WHICH WILL YOU HOLD ...**

**OR**



**add technical training to your practical experience. Get your FCC license quickly!**

**then use our effective**

**Job Finding Service!**

**Get your FCC Commercial License**

**or your money back**

The Master Course in Electronics will provide you with the mental tools of the electronics technician and prepare you for a First Class FCC License (Commercial) with a radar endorsement. When you successfully complete the Master Course, if you fail to pass the FCC examination, you will receive a full refund of all tuition payments.

**Employers Make Offers Like These**

**to Our Graduates Every Month**

Broadcast Station in Illinois: "We are in need of an engineer with a first class phone license, preferably a student of Cleveland Institute of Radio Electronics; 40 hour week plus 8 hours overtime."

West Coast Manufacturer: "We are currently in need of men with electronics training or experience in radar maintenance. We would appreciate your referral of interested persons to us."

**Our Trainees Get Jobs Like These Every Month**

**CHIEF ENGINEER**

"Since enrolling with Cleveland Institute I have received my 1st class license, served as a transmitter engineer and am now Chief Engineer of Station WAIN. I also have a Motorola 2-Way Service Station. Thanks to the Institute for making this possible."

Lewis M. Owen, Columbia, Ky.

**TEST ENGINEER**

"I am pleased to inform you that I recently secured a position as Test Engineer with Melpar, Inc. (Subsidiary of Westinghouse). A substantial salary increase was involved. My Cleveland Institute training played a major role in qualifying me for this position."

Boyd Daugherty, Falls Church, Va.

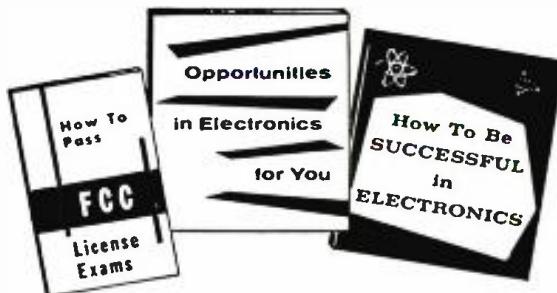
**Names of Trainees in Your Area  
Provided on Request**

**Carl E. Smith, E.E., President**

**CLEVELAND INSTITUTE OF RADIO ELECTRONICS**  
Dept. RN-30, 4900 Euclid Bldg., Cleveland 3, Ohio

**Get these valuable  
Booklets**

**FREE!**



**Accredited by National Home Study Council**

**Cleveland Institute of Radio Electronics**

**Dept. RN-30, 4900 Euclid Bldg., Cleveland, Ohio**

Please send Free Booklets prepared to help me get ahead in Electronics. I have had training or experience in Electronics as indicated below:

- |   |   |
|---|---|
| <input type="checkbox"/> Military           | <input type="checkbox"/> Broadcasting       |
| <input type="checkbox"/> Radio-TV Servicing | <input type="checkbox"/> Home Experimenting |
| <input type="checkbox"/> Manufacturing      | <input type="checkbox"/> Telephone Company  |
| <input type="checkbox"/> Amateur Radio      | <input type="checkbox"/> Other _____        |

In what kind of work are you  
now engaged? \_\_\_\_\_

In what branch of Electronics  
are you interested? \_\_\_\_\_

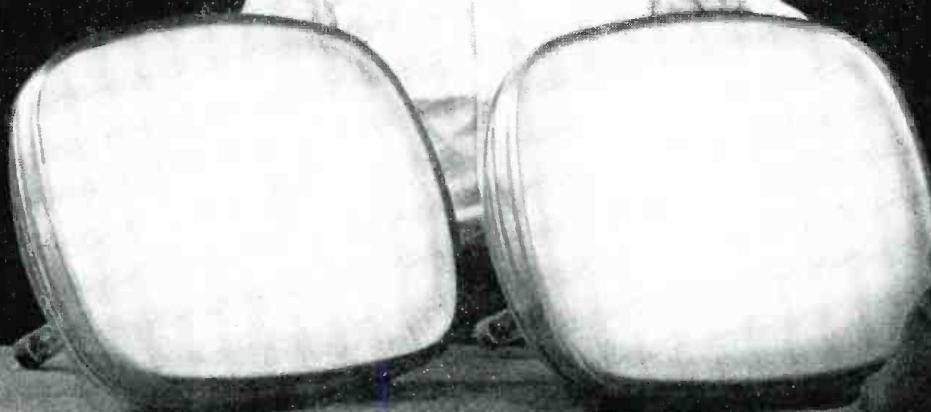
Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

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

# SELL WITH CONFIDENCE

Premium-Performance  
or Budget-Priced  
**NATIONAL BRAND**  
**PICTURE**  
**TUBES**



## PREMIUM-PERFORMANCE



## Silver Vision

- Brighter silver-activated AG-905 screen
- Sharper pin-point focus electron gun
- Nationally advertised brand
- Meets performance specifications of all leading TV set manufacturers

## BUDGET-PRICED



## PALOMAR

- All-new electron gun
- All-new phosphor screen
- Full 12 months warranty
- Backed by CBS Electronics, a Division of Columbia Broadcasting System, Inc.

For over a year, the combined sales appeal of CBS Silver Vision and CBS Palomar picture tubes has been field-tested on the West Coast. Now this proven sales approach originated by an independent tube manufacturer is available to all independent service-dealers.

Does your customer demand the finest in performance, or is he budget-minded? You can make the sale with CBS

Silver Vision . . . or with CBS Palomar. Either is easy to sell because of top brand prestige. Either stays sold because of top performance in its field.

And their dependable CBS national brand assures you of profit without callbacks. Play safe. Sell premium-performance CBS Silver Vision or budget-priced CBS Palomar with confidence.

THE CBS FAMILY • CBS ELECTRONICS • CBS INTERNATIONAL • CBS TELEVISION NETWORK • CBS LABORATORIES • CBS NEWS • CBS RADIO • CBS TELEVISION STATIONS • COLUMBIA RECORDS • LEADERS IN ELECTRONIC COMMUNICATIONS



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

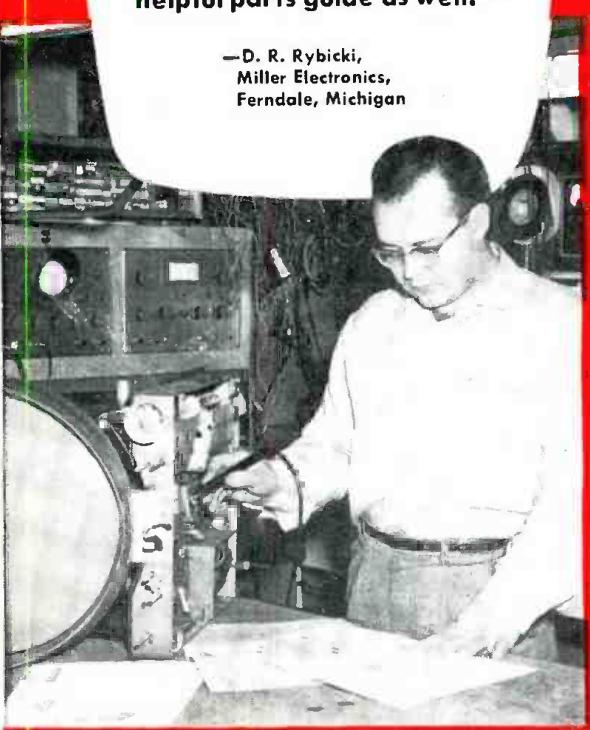
ELECTRONICS WORLD

# ownership of a **PHOTOFACt SERVICE DATA LIBRARY** **SPELLS SUCCESS FOR SERVICE TECHNICIANS**

*here's actual proof from the men who know*

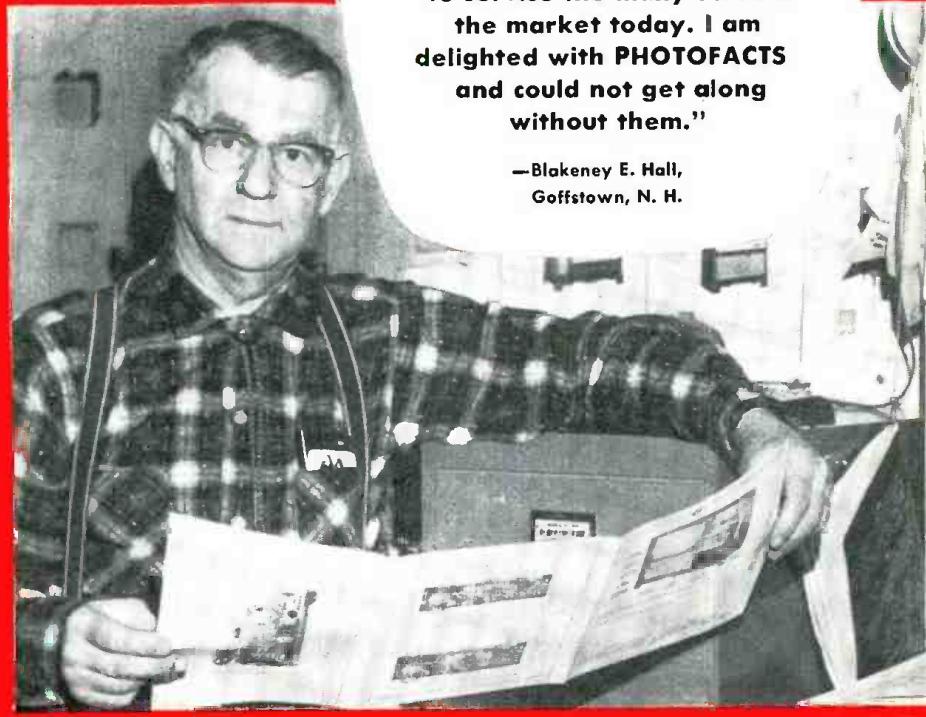
"**PHOTOFACtS** are a valuable time-saver and a helpful parts guide as well."

—D. R. Rybicki,  
Miller Electronics,  
Ferndale, Michigan



"Without SAMS PHOTOFACtS, it would be almost impossible to service the many sets on the market today. I am delighted with PHOTOFACtS and could not get along without them."

—Blakeney E. Hall,  
Goffstown, N. H.



## HERE'S MORE PROOF...FROM COAST-TO-COAST

"...Sams PHOTOFACt Folders are a time-saver, and have been a great help in making the proper diagnosis of various television troubles."

—Mervin E. Bruce  
Jacksonville, Fla.

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from our Readers

### 2-WAY MOBILE SQUELCH

To the Editors:

I read R. Eldridge's article in the February issue entitled "2-Way Mobile Squelch Problems." This is an excellent presentation on a subject that is not sufficiently understood by the average serviceman.

STUART F. MEYER, Manager  
Mobile Engineering Dept.  
Allen B. DuMont Labs., Inc.  
Clifton, New Jersey

Thanks to Reader Meyer for his comments and also for sending us additional material on special compensated squelch circuits as used in some DuMont equipment.—Editors.

\* \* \*

### "RADIO AMATEUR NEWS"

To the Editors:

Regarding the announcement in "For the Record" in the February, 1959 issue of RADIO & TV News in which you advise of the impending name change, I regret the need to make the full and complete break, but I see the merit of your reasoning.

You state that my favorite publication was started in 1919 as RADIO NEWS. As I recall it, the magazine started as RADIO AMATEUR NEWS, and later under Ed T. Jones (now with RCA), the word "Amateur" was dropped following a reader vote. I could never pin Ed down on the point of who counted what votes.

I don't suppose you have the old subscription lists back that far, but if you have, I think you will find that I was a charter subscriber. I know that I got the first copy and just about every one that followed. Maybe I got it from the news dealer, but seems to me I subscribed.

I wrote the lead article in the November, 1935 issue covering the Key Brothers' endurance flight record giving all the details except where the event occurred. Before the friendly name of RADIO NEWS becomes just a memory, I should like to correct that omission from the account. The Key Brothers made their now historic flight at Meridian, Mississippi, the field being renamed during the flight from the Municipal Airport to "Key Field." I had the privilege of so advising Al and Fred on Amateur Radio W5UE. Their plane, the "Ole Miss" (from the University of Mississippi) is now in the Smithsonian.

BEN WOODRUFF, W9UJE, exW5UE  
Chicago, Illinois

Reader Woodruff is certainly right about the original name of this magazine. Although it was changed fairly

soon, our original name was RADIO AMATEUR NEWS.—Editors.

\* \* \*

### OUR "BIASED" FEBRUARY ISSUE

To the Editors:

I have just finished reading your biased February, 1959 issue. I say biased because in it you show nothing but contempt and disdain for the average man and woman who has trouble with his TV set and doesn't like to pay top dollars to have it repaired.

Your articles are all for the so-called "legitimate shops." You picture the owners of these as poor, misunderstood, honest family men trying to earn a decent living, but woefully underpaid and abused. Anyone with a knowledge of electronics that attempts to supplement his family income with part-time servicing for friends and relatives is called a "night crawler" and "fast-buck artist."

GEORGE POWELL  
St. Clair Shores, Michigan

We are sorry that Reader Powell has misunderstood our stand. We are aware that unethical operators do exist, and we feel that the set owner should be protected. (See the April editorial "When Your Set Needs Servicing.")

Insofar as being in favor of so-called "legitimate shops," indeed we are as we are in favor of legitimate businessmen in any field.

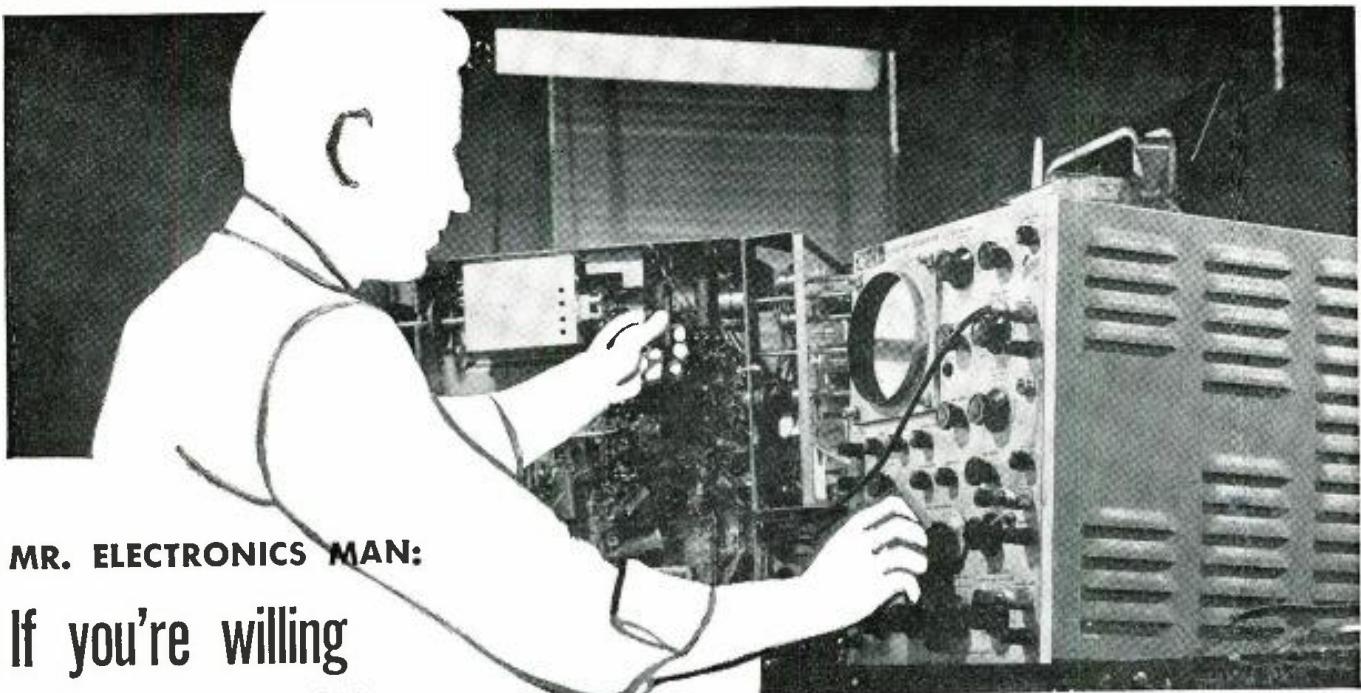
If the "night crawler" is unethical or incompetent, we are against him. However, we have nothing against part-time operators who are qualified and fair minded. The best of these frequently develop into full-time service dealers or enter other areas of electronics.—Editors.

\* \* \*

### IGNITION ANALYZER

To the Editors:

I have had much correspondence from readers who have built the electronic ignition analyzer, which I described in the July, 1958 issue. Only one of them has pointed out that the output from  $V_2$  is actually a positive saw-tooth rather than negative as is shown in Fig. 5. Since there is no phase inversion in  $V_{1B}$ , the output from the unit is also a positive saw-tooth. This means that the uncorrected waveform of Fig. 6A slopes up to the right rather than down as shown. Of course, a positive output from the adapter will require a negative saw-tooth to be taken from the scope to correct the slant of the display. The original circuit actually was of the hard-tube variety, which would give a negative output. At the last minute, I changed



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to a 2D21 because the circuit was simpler and less troublesome for the average constructor.

Perhaps I should also point out that the plug to which the sync lead is attached is the one which will appear as the bottom line of the display. The order in which the displays appear is not the numerical order of the plugs but of the firing order.

As shown in the article, it is necessary to feed the output of the coil to the external sync terminals of the scope as well as the adapter. Due to the form of the composite waveform coming out of the adapter, many scopes will not reliably synchronize when used in the internal sync connection. Therefore, external synchronization is necessary. With some scopes it may be necessary to wrap a short length of tin foil around the coil lead, instead of just a few turns of wire, in order to get enough voltage for reliable synchronization when the ignition analyzer is used.

DAN PETERS  
171 Reservoir Drive  
Boonton, New Jersey

The circuit certainly evoked quite a bit of interest from our readers. We are glad to pass along the additional comments of Author Peters about it. We would also like to extend our special thanks to Reader Don Girard of Oakland, California for having brought this error to our attention.—Editors.

\* \* \*

## VERSATILE LC METER

To the Editors:

Many readers have written concerning some problems they are having with the versatile LC meter, which I described in the December, 1958 issue. Two errors crept into the article, and these were probably responsible for much of the trouble.

First, resistor  $R_2$  should be 2000 ohms at 10 watts rather than 750 ohms. Second,  $RFC_1$  should be connected to the other side of the a.c. line from that shown in the diagram, that is, to the side of the line in which switch  $S_2$  is located. Otherwise, there will be no potential across the tube, and the unit will not operate.

The Bud coil forms specified should be widely available and are listed in the catalogues of various electronics supply houses. If these cannot be located, the following equivalents are satisfactory: National XR51, Millen 69048, and CTC Type LS5.

The cabinet is a Bud "Handy Box," measuring 8 inches x 4½ inches x 6 inches. The dial is 5 inches in diameter and is handmade of sheet aluminum.

GENE BRIZENDINE  
1001 Merritt St.  
Old Hickory, Tennessee

We apologize for having allowed the above errors to go unnoticed, but we trust that the information given by Author Brizendine will put those readers right who are interested in building this very useful and versatile piece of test equipment.—Editors.

-30-

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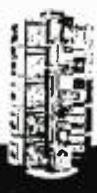
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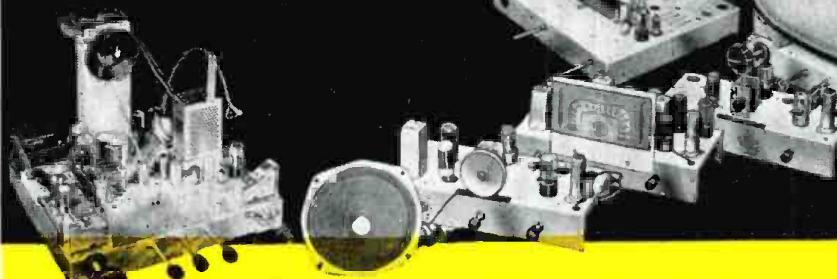
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such positive distinctions.

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Since well-informed customers become better customers, RCA believes that all TV technicians will welcome this opportunity to promote new tubes as "all-new" and rebuilt tubes as "rebuilt." Toward this end, RCA is engaged in a comprehensive, national advertising program. The public is being told the difference between "new" and "rebuilt"—in quality and in optional list prices. And the public is being directed to *you*, the local TV technician, for the final choice of product.



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Harrison, N. J.



Latest Information

on the Electronic Industry

Spot News

By ELECTRONICS WORLD'S  
WASHINGTON EDITOR

THREE-YEAR TOLL-TV PROGRAM SET UP—After years of wrangling, Congress and the FCC have evolved a subscription-television formula providing for a tightly controlled study over a 3-year period. Effective immediately, the Commission said that it will consider applications by TV stations to test pay-TV on a one-market-per subscription-system and a one-subscription-system-per-market basis, provided the subscription programs are not broadcast simultaneously over more than one station and listeners will not be called upon to purchase any special receiving equipment required for pickup. In addition, the rules specify that although applicants may propose the use of any technical method of encoding and decoding video or audio signals or establishing a means of setting up a charge for the intelligible reception of programs, they will have to develop safeguards against not only interference within or without the frequency used but against any perceptible degradation in video-audio signal quality on any receiver during either a subscription or a non-subscription program.

SPACE-COMMUNICATION SATELLITES TIME-TABLES BY MILITARY—Orbiting stations in space for military communication systems are now being developed, according to a House Science and Astronautics Committee report. In the laboratories is a delayed repeater, low-orbit active relay which has been tagged "Courier" satellite and is expected to provide 20 continuously available 100 wpm teletype channels to ground stations around the world; also a high-orbit 24-hour, wide-band simultaneous relay. Commenting on these startling advances in a Washington address before the Electronic Industries Association, T. Keith Glennan, Administrator of the National Aeronautics and Space Administration, said that if the satellite can be placed in orbit at an altitude of about 22,000 miles, its speed will be such as to cause it to appear to be stationary in space with respect to a point on the earth's surface. Such a system, it was noted, would permit use of very large fixed antennas and high signal-strength transmissions. To insure controlled performance, Glennan said that engineers and scientists are now devising means which will provide not only precise positioning of the satellite in orbit, but a power supply for the receiver-transmitter to operate over a long period of time.

AUDIO SYSTEM DESIGNED TO REPLACE AIRCRAFT-WARNING LIGHT SYSTEM—A calm yet urgent instructor's voice may soon replace blinking lights and annoying horns to warn Air Force pilots of emergencies in flight, the Air Research and Development Command has revealed. Present warning signals alert the pilot to an unsafe condition, such as a combination of low air speed with landing gear in the up position, or warn the pilot of a dangerous condition, such as an engine fire. The new voice warning approach features a multi-audio system with as many as 12 channels with separate tape-recorded messages, pre-recorded to suit a particular mission and type of aircraft. Each tape allows 15 seconds of recorded voice; ample time for warning and additional instructions. The voice-warning system is contained in a six-pound 6" x 4" x 3" box with two reproducers and two sets of tape-recorded messages. When triggered by an unsafe or emergency condition, the correct tape is selected automatically and played to transmit a warning message to the pilot through his headset.

ELECTRONIC COMPUTER TO CHART WORLD-WIDE MAGNETIC MAP—An electronic computer at the headquarters of the Coast and Geodetic Survey, U.S. Department of Commerce, will soon digest 150,000 observations so that one visual chart can be made—the 1960 magnetic chart of the world—a chart that will tell a navigator anywhere how much to allow for the variation of his compass from true north. The computer will do the calculating job in four weeks.

COMMENTS ON FM STEREOPHONIC MULTIPLEXING INVITED BY COMMISSION—The FCC has enlarged the scope of its proceedings looking into possible wider uses for FM to include specific data on FM stereophonic broadcasting. The decision to expand the inquiry was prompted by a growing interest in stereophonic multiplexing by FM broadcasters, as well as a number of manufacturers, trade associations, and listener groups.

-30-

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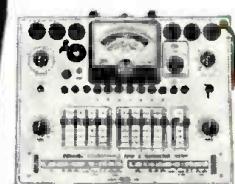
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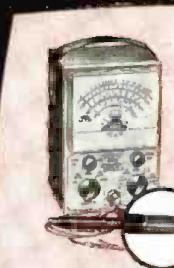
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# Direction Finders for the Boatsman

**Basic information on uses, operation, and limitations of this vital safety device that tells "where you are."**

By FRED M. LINK

OUR AUTHOR is often referred to as "Mr. Mobile Radio." He founded and was president of Link Radio Corporation. He now serves as a consultant to the Communications Division, Industrial Electronic Products, Radio Corporation of America. Fred has also been mayor of Westwood, New Jersey.

A RADIO direction finder can be a source of pleasure as well as a font of important information for the boatsman. It is a vital safety device which will provide information on "where you are," "where you are headed," and "how far you have gone." In addition, the DF can be used for reception of radio programs on the AM broadcast band and weather information on the beacon band, as well as ship-to-ship and ship-to-shore communications if it is designed to tune the 2-3 mc. marine band.

On the well-equipped boat outfitted with a marine radiotelephone, the DF performs an additional function. Ordinarily, the radiotelephone is left on, tuned to 2182 kc.—the calling and distress frequency. When expecting a telephone call afloat, it would be a convenience to be able to monitor the regional marine telephone channel. This can be done with a DF which is equipped for marine-band reception. When the radiotelephone is switched to the telephone channel, the DF can be used for monitoring the calling and distress channel. Boat battery life can be conserved by monitoring with the DF which generally consumes less current than the radiotelephone.

There are dozens of DF units on the market ranging from \$55.00 "do-it-yourself" kits to "pro" devices that cost several hundred dollars. The choice depends upon where you do your sailing, how far from shore you cruise, and how much you can afford to invest in such gear.

## How It Works

A radio direction finder is basically a radio receiver equipped with a rotatable loop antenna. Any radio set equipped with a loop antenna can be used as a direction finder. Almost all table and portable model radios, made within the past 20 years, employ loop antennas.

To demonstrate the DF principle

(Fig. 1), simply pick up a loop-equipped radio receiver and rotate it until the program to which it is tuned is weakest or even disappears. If tuned in to a strong signal from a nearby, powerful broadcasting station, the weakest point may be determined only by an increase in background noise. This is because a.v.c. action automatically fights any change in volume. When the signal is strong, the a.v.c. reduces the sensitivity of the receiver to keep the sound from getting any louder. When the signal becomes weaker, the a.v.c. increases sensitivity in an attempt to keep the volume at the same level. With a weaker signal and more sensitivity, background noise becomes more noticeable.

The signal is weakest when the plane of the loop antenna is at right angles to the direction of signal of the station to which the receiver is tuned. This point is quite sharp. The signal becomes much stronger when the loop is in any other position and strongest when either end of the loop is pointed at the station. There are two weak-signal positions, 180-degrees apart, and two rather broad maximum signal points.

The loop antenna is bi-directional, picking up the strongest signal when either end is pointed toward the station tuned in. The points of maximum signal are very broad compared to the two minimum signal points. The reason for this should be very easy to understand. When the plane of the loop is at right angles to the incoming signal, equal voltages are induced in both sides of the loop which tend to cancel each other out. At all other positions there is a difference in signal voltage between the two sides and the signal which remains is fed to the receiver.

## Errors

To be accurate, the two null points should be exactly 180-degrees apart and should be obtained only when the

plane of the loop is precisely at right angles to the station on which a bearing is being taken. In a conventional radio receiver, not designed to serve as a DF, this "loop error" may be quite large, but is of no significance when the set is used only for radio reception. In a DF, however, loop error is important and the equipment should be designed so as to minimize it.

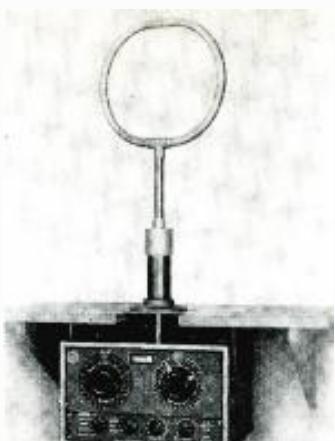
This is done by balancing the loop electrically so that its capacity with respect to ground is symmetrical. The loop is generally fed into a balanced input circuit or to a single-ended circuit through a transformer in order to preserve the desired electrical balance.

Loop error is also caused by pickup of unwanted signals. Instead of just the desired signal which one hears, there are myriad tiny signals which may not be audible but which are added to the desired signal, masking or altering the position at which the nulls should be found. At night particularly, unwanted signals from far away stations which arrive via the skywave route are also picked up and added to the signal voltages induced in the loop.

Error from these causes is reduced in some DF units by shielding the loop. Several turns of wire, which form the loop coil, are encased in a metal hoop, not unlike the spin hoops in appearance, which acts as an electrostatic shield. The shield does not form a complete circle, however, although it may look as if it does. The metal sheath is broken at one point in the circle where an insulated joint is installed. If the circle were not broken electrically, the shield would act as a shorted turn which would nullify the effectiveness of the loop.

Because of the presence of metallic objects in the vicinity of the loop, whose locations and characteristics differ among vessels, a DF should be calibrated for use on a specific boat. This is done by preparing a "bearing deviation" correction chart, as shown in Fig. 2. While the DF may give a correct reading when taking a bearing on a station dead ahead or directly astern, there may be an error in readings taken at various angles with respect to the ship's lubber line. These errors are taken into account when the bearing deviation correction chart is prepared.

The simplest way to make such a chart is to position the vessel so that



Kaar Model R-238



National RDF 66

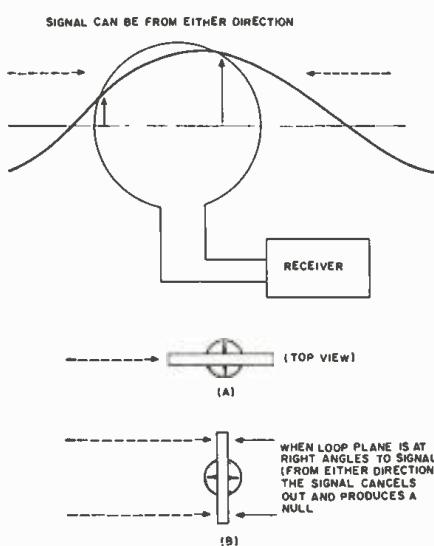


Fig. 1. Basic principle of loop operation. When plane of the loop winding is parallel to direction of signal (A), maximum loudness is heard. With loop at right angles to direction of signal (B), cancellation occurs and a null is produced.

a zero-degree relative bearing is obtained on a transmitting station. The vessel is then turned through 360 degrees, comparing the DF bearing indications with changes in the ship's heading, which can be checked with a pelorus or against corrected ship's compass readings, noting the amount of correction required.

Since the DF is generally most accurate when the null is dead ahead or directly astern, a correction chart is seldom necessary when the DF is used for homing but is generally required when taking bearings other than dead ahead or astern.

In addition to errors caused by environment as well as the loop itself, error is caused by what is known as coastline refraction. This sometimes occurs because radio waves travel somewhat faster over water than over land. When a bearing is taken on a station and the signal travels close to the shoreline for a considerable distance, it appears to bend toward the coastline. The DF bearing may indicate that the vessel is closer to the shoreline than it actually is. This error is avoided by taking bearings on nearby stations, selected after a study of charts, avoiding those which would require the signal to travel close to the shoreline.

*Night effect* causes DF errors. Night effect is caused by changes in the way radio signals travel at night. It can cause the nulls to broaden or even change position. Sometimes the nulls cannot be found. During daylight, the groundwave predominates, that is, the signal picked up by the DF loop travels along the earth's surface. At night, however, in addition to the groundwave, there may be a *skywave* which adds to or cancels out the groundwave signal, depending on its phasing with respect to the groundwave. DF errors due to night effect can be avoided by taking bearings only on nearby stations, not more than 25 to 50 miles distant, and preferably those operating on the lower frequencies. Night effect is generally more troublesome during summer months.

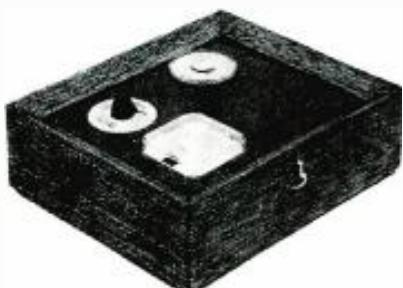
#### Loops and Scales

For the sake of convenience the loop is generally installed on top of its associated receiver. However, where space permits, the loop is sometimes installed at a distance from the re-

Bendix "Navigator" 440



C.A.S. Marine 100a



Radiomarine "PortaGuide" CRM-D1A

Parametrics "Port-A-Finder"

ceiver so that the loop can be up in the clear, away from most metallic objects which can introduce error. The loop may be rotated from the receiver location directly below through a long shaft (see Fig. 3) or the loop may have a separate drive knob and output indicator, remote from the receiver to which it is connected by means of a shielded cable.

However, the trend in moderately priced DF units is to use a much smaller loop directly on top of the receiver. These small loops are wound on a ferrite rod or slab which gives them a high "Q" and, as a result, high sensitivity.

Irrespective of the type of loop used, an azimuth scale (compass rose) is provided which is calibrated in degrees and gives the user an indication of the orientation of the loop antenna. The azimuth scale can be set so that its zero-degree position coincides with the position of the loop when at right angles to the prow. This means that when the DF is set for a null reading on the signal being received from a station either dead ahead of the vessel or directly astern, the pointer of the azimuth scale will read zero degree. When set in this manner, bearings taken will be relative to the ship's heading. The DF measures relative bearing, the angle, or number of degrees with respect to the ship's lubber line.

The compass rose can also be set to indicate *true* bearing in degrees with respect to north. The azimuth scale is preset so that it corresponds to the ship's course. A *true* bearing may also be obtained by taking a *relative* bearing and adding the ship's magnetic compass reading, taking both at approximately the same time. For example, if the relative bearing indicated by the DF is 315 degrees and the ship's corrected compass reading is 35 degrees, the true bearing is 350 degrees. If the sum of the readings is greater than 360 degrees, 360 is subtracted from the figure obtained.

#### Operation

To determine one's location, a bearing is taken on two or more stations and the measured angles are noted on a navigation chart, drawing lines from each station. The vessel is at the intersection of these lines (Fig. 5). The distance traveled can be determined by

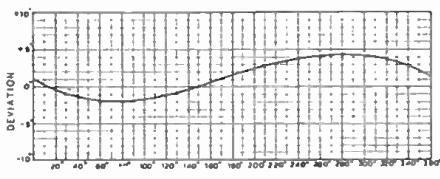


Fig. 2. Typical bearing deviation chart.

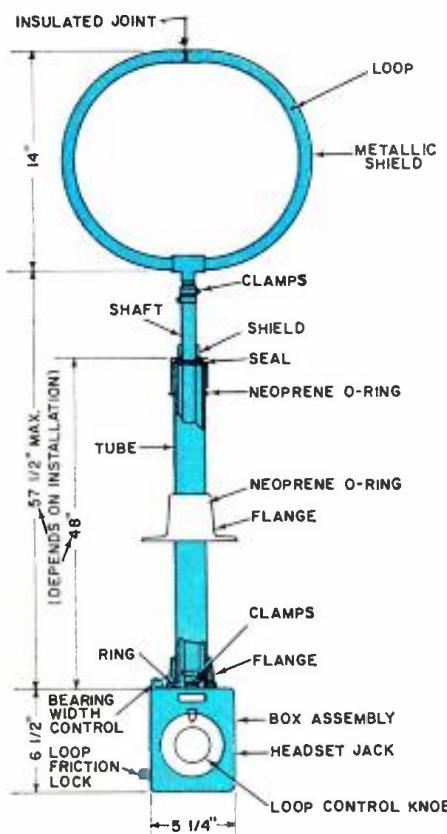


Fig. 3. Construction of typical direction finder that uses an outside loop assembly.

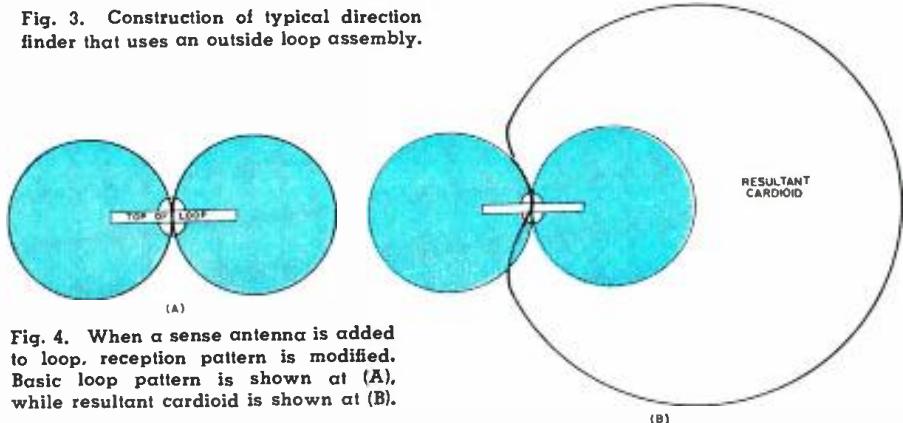


Fig. 4. When a sense antenna is added to loop, reception pattern is modified. Basic loop pattern is shown at (A), while resultant cardioid is shown at (B).

taking new bearings at different time intervals and plotting the new "fixes" on the chart, measuring the distance from one fix to another with a scale.

*Homing* is a real aid to the boatman. He can adjust his DF for a null with respect to a station in the direction he is headed. He steers his vessel to maintain the null indication. When he wants to change his course, he can head the vessel in the null direction of another station of known location.

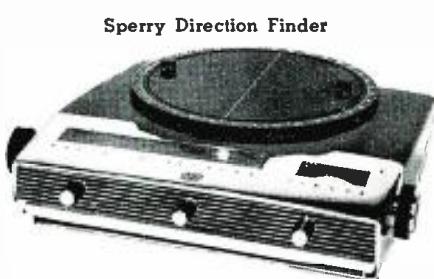
However, a loop has two null points 180-degrees apart. Thus, the user gets two directional indications, one of which is apparently correct and the other obviously false. It is therefore necessary to guess from which of two directly opposite directions the radio signal is coming. Often, the position of the sun, magnetic compass, or other factors help the user to make the decision as to which is correct. The correct direction can be determined by taking additional bearings on the same station after sailing farther and noting the change in angle.

Some direction finders employ a "sense" antenna in addition to a loop to avoid this 180-degree ambiguity. The sense antenna enables positive determination as to which of the two nulls is the correct one. After the null points have been determined, the sense antenna, which is normally disconnected, is switched into the circuit. Now, the loop is adjusted for maximum signal. Ordinarily, there are two maximum signal points. But, with a sense antenna connected, one maximum signal point is produced as shown in Fig. 4 below.

A loop is considered to have a figure-



June, 1959



Ray Jefferson Model 483



Robinson 303-NML

# COVER STORY



THIS month's cover symbolizes the importance of the radio direction finder for the small boatsman. Four typical DF's are shown against a background of the U.S. Coast and Geodetic Survey's nautical chart 1108, "Approaches to New York."

Two of the DF's shown are tube models employing air-core loops, while the other two are transistor types with small ferrite-core loops. The unit nearest the top of the cover is the Bludworth Marine "Port Pilot," Model DF-30A, covering frequencies between 200 and 410 kc., which includes the marine beacon band. Directly below this

unit is the Raytheon transistor DF "Ranger," Model 354, covering the same band plus the standard broadcast band and the additional frequencies between 1.8 and 3.4 mc. (which includes the marine radiotelephone band). Beneath this unit is the Heathkit transistor "Radio Navigator," Model DF-2, covering the beacon band and the broadcast band. At the left is the Sonar "Sonar-finder," Model DF-4X, with built-in sense antenna and covering the beacon, broadcast, and marine radiotelephone bands.

-30-

(Cover photo by Bob Loeb)

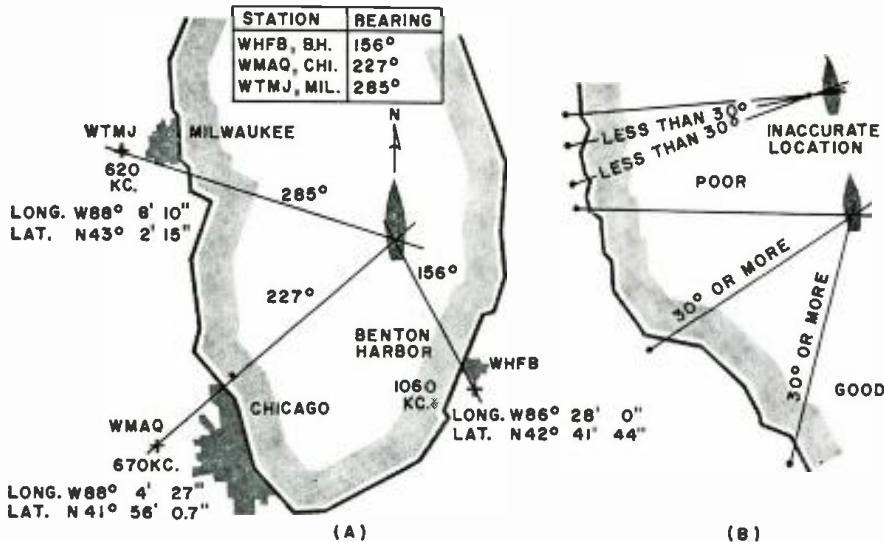


Fig. 5. Bearing taken on three stations are more reliable than those taken on only two stations. Angle between various bearings should be at least 30 degrees.

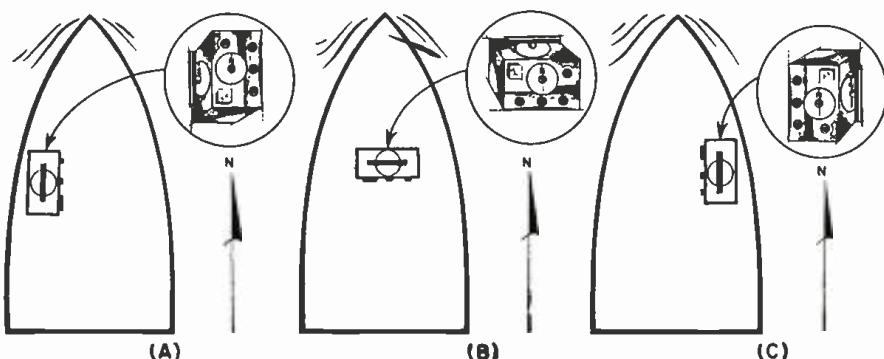
8 directional pattern (Fig. 4A). With the sense antenna connected, the directional pattern becomes a cardioid (Fig. 4B). The signal picked up by the sense antenna adds to the signal picked up by the loop when it is in one of the maximum positions. When the loop is pointed in the opposite direction, the signals picked up by the loop and the sense antenna are out-of-phase and tend to cancel out.

Thus, with a sense-antenna-equipped DF, the pin-point nulls are still used for bearing indication and the one broad maximum signal indication identifies which of the two nulls is correct.

Table 1. Manufacturers producing direction finders for the boatsman.

ALLEN & BRADFORD, INC., 3181 N. Elston Ave., Chicago 18, Ill.
APPLIED ELECTRONICS CO., 213 E. Grand Ave., South San Francisco, Calif.
BENDIX AVIATION CORP., 11600 Sherman Way, N. Hollywood, Calif.
BLUDWORTH MARINE DIVISION, 1500 Main Ave., Clinton, N. J.
CAS MANUFACTURING CO., 413 Hubbard St., Mineral Wells, Texas
G & M EQUIPMENT CO., INC., 7315 Varna Ave., Hollywood, Calif.
HEATH COMPANY, 305 Territorial Road, Benton Harbor, Mich.
KAAR ENGINEERING CORP., 2995 Middlefield Road, Palo Alto, Calif.
MACKAY RADIO & TELEGRAPH CO., 132 Terminal Ave., Clark, N. J.
MOTOROLA INC., 4501 W. Augusta Blvd., Chicago 51, Ill.
MICRO-LAB INDUSTRIES, INC., 10 E. Clair St., Anderson, Ind.
MUNSTON MANUFACTURING & SERVICE, INC., Beech St., Islip, N. Y.
NATIONAL COMPANY, INC., 61 Sherman St., Malden, Mass.
PARAMETRICS, P.O. Box 629, Costa Mesa, Calif.
RADIO CORPORATION OF AMERICA, Camden 2, N. J.
RAYTHEON MANUFACTURING CO., 100 River Street, Waltham, Mass.
RAY JEFFERSON, INC., 40 E. Merrick Road, Freeport, N. Y.
ROBINSON & CO., 731 W. 129th Street, Gardena, Calif.
SONAR RADIO CORP., 3050 W. 21st St., Brooklyn 24, N. Y.
SPERRY GYROSCOPE, PIEDMONT DIV., Charlottesville, Va.
ZENITH RADIO CORP., 6001 Dickens Ave., Chicago 39, Ill.

Fig. 6. Three typical locations for installation of a portable direction finder.



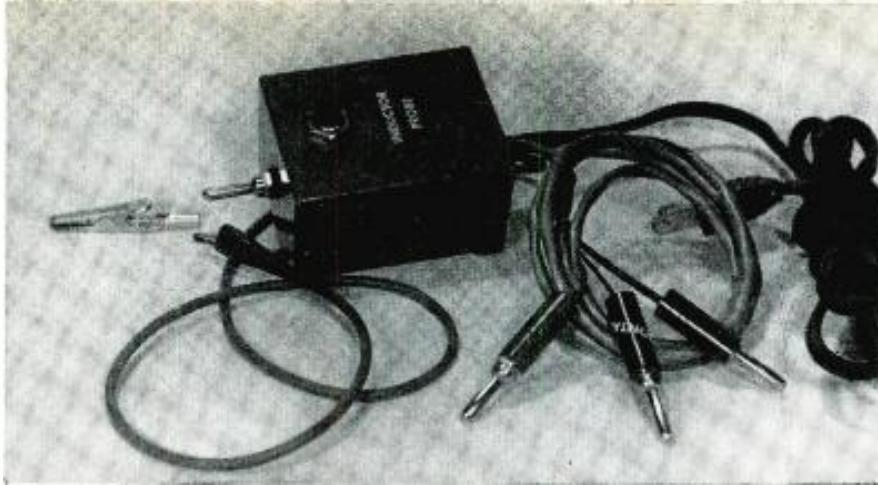
When homing, the "yes-no" sense antenna answer can be determined first, the loop can be set to the correct null, and the vessel can be headed in that direction.

The most accurate bearings are taken on nearby stations and at the lowest frequencies. Since the signal may be very strong, the null points may be difficult to locate by ear, but easily noted on an electronic indicator. Or, when the signal is weak but static and noise are strong, it may be hard to distinguish nulls. Many DF units are equipped with visual null indicators, either a meter or an electron-eye tube. The meter, or eye tube, depending on the make of DF, indicates the strength of the received radio signal or the level of the audio signal. Some DF units are provided with a sensitivity control to make it easier to obtain a null on a strong signal.

As the loop is turned to the null

points, the receiver's a.v.c. circuit tends to offset the drop in received signal and sometimes makes it difficult to accurately locate the nulls. Thus, some DF units provide a switch for cutting off a.v.c. action when desired. Some are also provided with b.f.o. which is turned on when taking a bearing on a weak station. When the b.f.o. is turned on, a beat whistle is heard whose intensity changes with signal strength. The variation in the loudness of the whistle is more readily discernible than subtle changes in level

(Continued on page 90)



The completed probe: banana plug and lead at left connect across inductor.

By R. L. WINKLEPLECK

# Check Inductors with a Test Probe

**Use this easily built accessory with your scope to test yokes, flybacks, and other windings.**

QUIET often in radio and TV service work there is occasion to be suspicious of a transformer, coil, or yoke, but, unless it is definitely open or obviously shorted, the only way to pinpoint the difficulty is by painstaking substitution. Here is a simple probe, for use with the scope, with which you can easily and quickly locate the trouble—even though it is only a few shorted turns that would be difficult or impossible to detect with an ohmmeter.

It is a fundamental principle of a.c. theory that a closed reactive circuit containing an inductor and a capacitor will oscillate for an interval of time when triggered momentarily by a d.c. voltage. The number of cycles of oscillation and their frequency will depend on such factors as inductance, capacitance, and "Q," including resistance. Any leakage, any break in the circuit, any partial or complete short, will kill the oscillations before they have an opportunity to develop to any appreciable extent. This is the principle be-

C<sub>2</sub> and the inductor being tested is connected to the ground terminal of the scope. The vertical input of the scope connects to the opposite side of capacitor C<sub>3</sub> through C<sub>2</sub> to provide the correct phase relationship. The opposite side of the inductor connects to the scope's horizontal input through isolating resistor R<sub>2</sub> (which keeps the scope from loading the inductor). R<sub>1</sub> serves only to complete the closed reactive circuit without shorting the applied d.c. pulse.

The scope pattern produced by a good inductor, connected as indicated, is a spiral. The number of turns of the spiral is determined by the reactance and other values of the circuit. The size and shape of the trace, however, is determined by the adjustment of the scope's horizontal and vertical gain controls.

A partially shorted inductor winding may produce a vertical deflection of the spot or the beginning of a spiral, but the first full circle will not be completed (Figs. 2B and 2C). An open circuit will produce only a straight vertical line and horizontal line in the shape of an inverted "L" (Fig. 2A).

Construction of the probe is simplicity itself. A 2 1/4" x 2 1/8" x 1 1/8" Bud "Minibox" CU-3000 makes a good housing. For the probe shown in the photographs, a banana plug was mounted on one end of the box and insulated from it with composition shoulder washers.

This is one of the test points. It may be simply touched to one of the transformer leads being tested or an alligator clip may be slipped over the plug so the lead may be clipped in place. The trigger switch is mounted on one side of the box and the leads all emerge from the opposite end through an insulating grommet.

The second test point may be a short length of the "lump" wire so often used for all kinds of test leads. It terminates in an alligator clip. The lead to the scope should be a two-conductor, shielded, insulated, microphone cable. The shield is used as the scope's ground lead. This cable is terminated with connections chosen to fit the scope's input. The box is completely insulated from the circuit, electrically.

Assembly can be considerably simplified by slightly modifying a 4-point tie-strip so that it may be slipped over the collar of the switch and held in place with a collar nut. Before the switch is installed in the box, all the components may be attached to the switch terminals and to the tie-strip. Then, after installing the switch, it is only necessary to attach the external leads and the job is completed.

To use the probe, plug it into an a.c. receptacle and connect the scope leads. Set the scope for external horizontal sweep and adjust the spot to relatively high intensity. Be careful, however, to

(Continued on page 117)

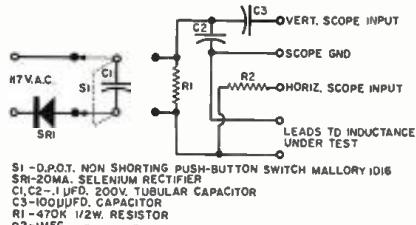


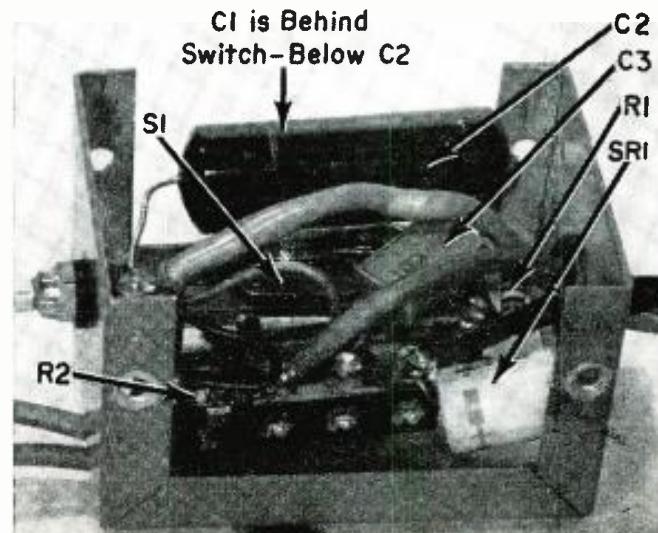
Fig. 1. Schematic of the probe shows that only 7 electrical parts are needed.

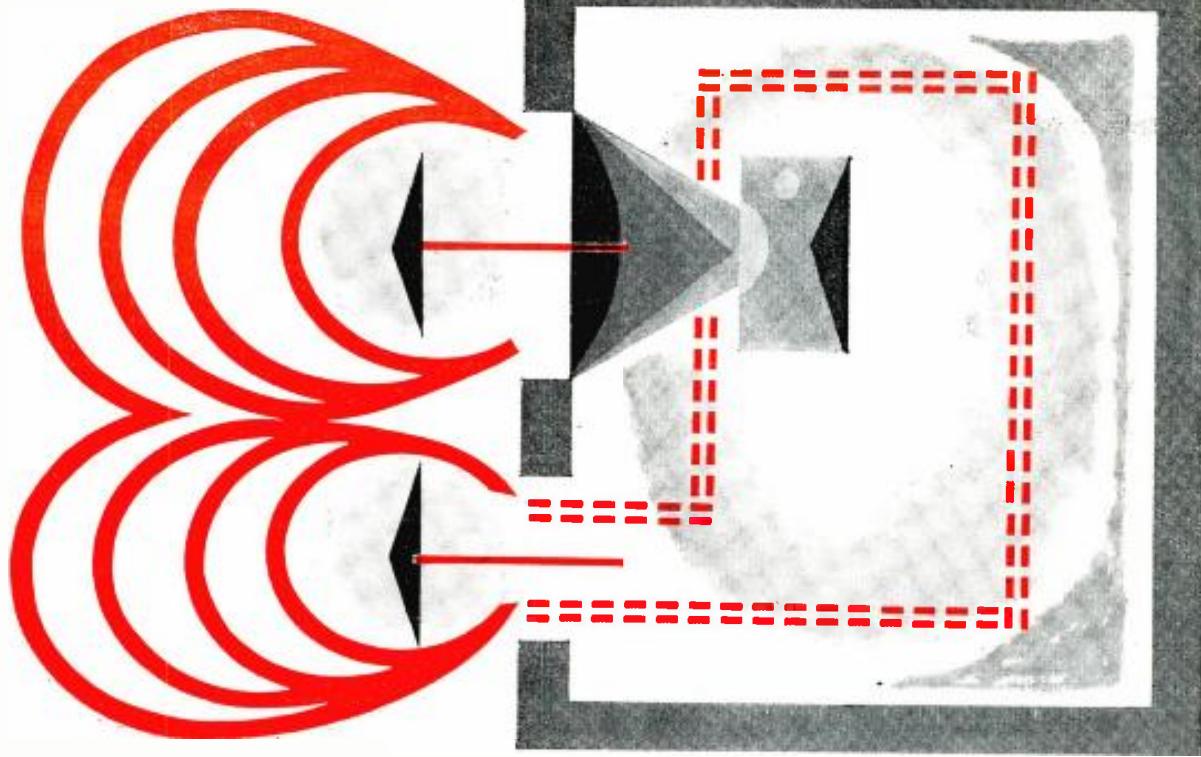
hind the operation of the inductor probe.

Referring to Fig. 1, note that the required source of d.c. for excitation is supplied by the house current, which is rectified and stored in C<sub>1</sub>. When the d.p.d.t. switch, S<sub>1</sub>, is operated, the d.c. charge in C<sub>1</sub> is transferred, as a pulse, to the closed reactive circuit consisting of R<sub>1</sub>, C<sub>2</sub>, and the inductor being tested. Since the switch is non-shorting, its action also isolates the line voltage from the test circuit, eliminating any possibility of shock. When the d.c. pulse is supplied to the test circuit, oscillations occur if the coil attached to the test leads is good.

The common point between capacitor

This inside view will give some idea as to how parts may be laid out in the compact probe housing. The position of the housing is upside-down as compared to the view shown above in the left-hand corner.





MOST loudspeaker enclosures are designed to do three things: (1) achieve full bass response from a given speaker; (2) increase the acoustic efficiency of the speaker; and (3) provide a suitable piece of furniture.

The bass-reflex cabinet is generally claimed to extend the useful range of its cone speaker a half-octave, reduce distortion, and improve transient response. Before investigating these claims, let's briefly examine the fundamental concepts involved in this type of loudspeaker system.

#### The Helmholtz Resonator

A simple Helmholtz resonator consists of a spherical chamber having a cylindrical spout attached (Fig. 1). The "lump" of air in the spout bounces against the springiness of air in the chamber and the resonator behaves in the same way as a toy whistle or musical jug.

Now, suppose that instead of blowing across the mouth of the jug, we install a piston driven at some audio frequency (Fig. 2). If the frequency of the piston oscillation coincides with the resonant frequency of the original chamber, very small piston movement will produce a considerable amount of sound intensity.

So far, this is all quite simple and easy to visualize. The tricky point is this: at resonance, the piston and the lump of air in the spout are moving in opposite directions—they are out-of-phase. This is not contrary to what we should expect if we remember that the compression and expansion of air in the chamber is an essential factor. If the piston and the air in the spout moved in-phase, there would be no expansion-compression cycle within the chamber . . . the air inside would simply move back and forth.

# Reflex Enclosures

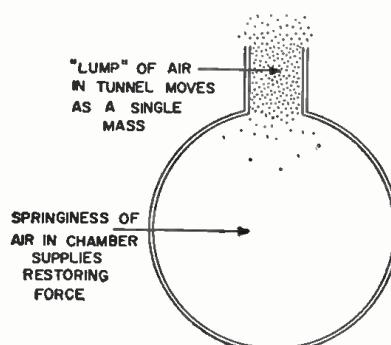
## How They Work

By

**GEORGE L. AUGSPURGER**

**Here is a good review  
of what you should  
know about an  
enclosure that's  
still a favorite for  
the hi-fi loudspeaker.**

Fig. 1. The basic Helmholtz resonator.



If this is still confusing, the behavior of such a piston-driven resonator can be verified by experimenting with a simple analogous resonant system. Try hanging a weight from a spring (rubber bands and a table knife work well) and noting the frequency at which the combination oscillates. If you now sustain oscillation by moving your hand up and down, as in Fig. 3, you will find that your hand moves *up* at the same time the weight moves *down*. The driving element (you) and the driven element (the weight) are 180° out-of-phase.

Going back to the acoustic resonator, the elements can be re-arranged as in Fig. 4 without affecting the operation of the system. The piston has been replaced by a cone loudspeaker, the spherical chamber is now cubical, and the speaker and the port are located together on the same side of the chamber. At resonance, the piston and the air in the port move together to alternately expand and compress the air in the chamber. From the standpoint of anyone listening outside the resonator, the port and the speaker are operating *in-phase* to produce sound.

It may seem odd that two elements which were described as being out-of-phase should suddenly turn out to be in-phase after all. The answer is that it all depends on which side of the piston you consider as the source of sound. Since, in practice, both sides act as sound sources, we can reverse the radiation from the rear of the cone and use it to re-inforce front radiation.

#### The Practical Reflex System

The arrangement of Fig. 4 is duplicated in many commercial bass-reflex systems. In practice, the reflex port adds usable radiation in a range extending about an octave on each side

of system resonance. One way to get an idea of how such a system operates is to study its impedance curve. Since, in the region below 500 cps, speaker impedance is related to cone movement, an impedance curve gives information concerning the acoustic load which a given enclosure imposes on its speaker. Fig. 6 shows three impedance curves for the same 8-inch speaker. The first is that of the cone speaker in free air, the second is the same speaker mounted in a 2.5-cubic-foot reflex enclosure, and the third curve is of the same combination with the reflex port closed to make a sealed enclosure. Notice that the impedance variation of the reflex system does not exceed a 7:1 ratio, while that of either the free-air speaker or the totally enclosed system exceeds 10:1. Notice also that the minimum impedance of the reflex system occurs at 60 cps—the same frequency as the speaker's free-air resonance. At this frequency the cone is heavily loaded acoustically by the Helmholtz resonance of the system. It is being forced to do work and the increased electrical drain is indicated by a drop in impedance. But since a drop in impedance also means smaller cone excursions, distortion due to magnetic and suspension non-linearity is reduced at the same time.

The sealed enclosure, on the other hand, instead of loading the speaker in the bass region, shifts the impedance peak upwards in frequency. The cone moves farther and farther at progressively lower frequencies and will overload quite easily unless a special long-throw (and relatively inefficient) speaker is used.

This is not to say that the reflex system is inherently superior to a total enclosure. It does explain why speakers designed for reflex loading will not operate as satisfactorily in sealed enclosures or infinite baffles.

#### Performance

The impedance curves we have just examined bear no direct relationship to frequency response. Unfortunately, the response curves normally published for loudspeakers do not, in themselves, bear much more relation to listening evaluation. Frequency response is merely one element in a highly complicated series which determines how closely a speaker system reproduces the real thing.

However, a comparison of the frequency response curves of the same speaker in a reflex enclosure and a sealed enclosure is valuable in further understanding the characteristics of reflex loading. Fig. 5 shows the bass response of the speaker whose impedance is plotted in Fig. 6. These curves were run with the speaker system along the wall of a reasonably large room. Constant voltage was fed to the speaker and a calibrated microphone located three feet from the speaker, on-axis.

Although these graphs clearly show the increase in bass response when a matched reflex enclosure is used, they do not give any information concern-

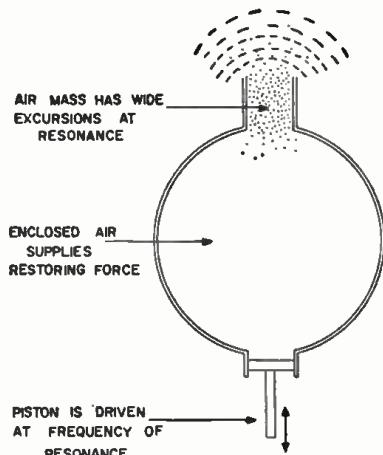


Fig. 2. Resonator driven by a piston.

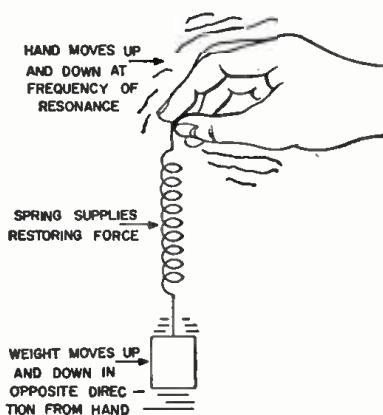


Fig. 3. Resonant system analogous to Helmholtz resonator discussed in text.

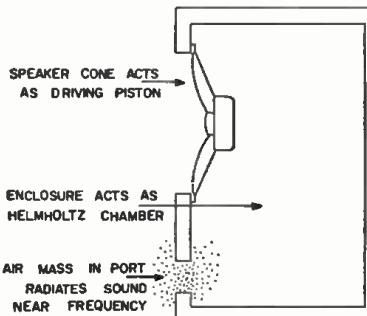
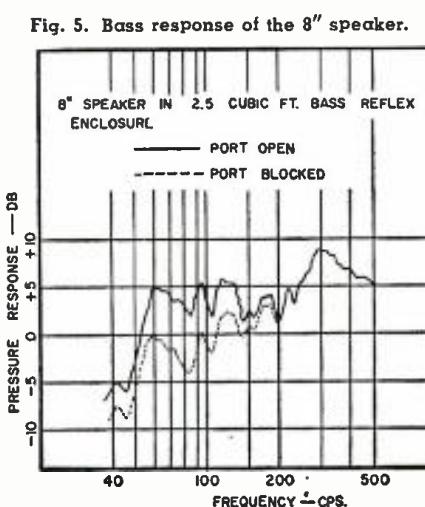


Fig. 4. Standard bass-reflex enclosure.



ing the alleged improvement in transient response. Attempts to measure transient characteristics of loudspeaker systems have been made by various engineers with varying degrees of success. Part of the difficulty is caused by the fact that what the average listener often interprets as "good transient response" may be the exact opposite.

A full explanation of the factors involved in what is called "transient response" would require several issues of this publication. Generally speaking, if there is any tendency toward "ringing" in the system, this will be audible as a blurring of sharp transient sounds. Moreover, any high-*Q* resonance in the speaker system will be excited by the normal transients in program material. Some speakers tend to make tape hiss sound like turntable rumble.

A totally enclosed loudspeaker has a single resonant peak. This resonance is directly related to impedance and can be controlled to some extent by the electrical damping of the power amplifier. A reflex system, on the other hand, damps the speaker cone acoustically at system resonance.

This feature of high acoustical damping is often cited as a reason why the reflex system should have excellent transient characteristics. Some critics have pointed out, however, that while the reflex enclosure damps the loudspeaker, the loudspeaker does not damp the enclosure. And, since the whole thing is basically a Helmholtz resonator, it will take just as long for the signal to decay as if the speaker were replaced with a solid board.

This disturbing state of affairs has prompted numerous methods for "critically" damping reflex systems. Most of these involve the use of acoustic resistance elements in the port. In practice, some efforts along this line result in questionable improvement. The reason is that the Helmholtz resonance is usually tuned to a frequency between 35 and 55 cps and slight ringing in this low range is hardly ever objectionable. The "boomy" quality often attributed to bass-reflex systems is actually not a property of the reflex principle at all, as can be readily demonstrated by blocking the port and noting that the boom is still there.

To get the answer to this puzzle, we must take a look at our impedance curves once again. The upper impedance peak of the characteristic double-humped curve is due to the mass of the cone resonating with a combination of its suspension and the air trapped in the enclosure. This frequency is relatively unaffected if the port is made larger or smaller or sealed up altogether. Fortunately, electrical damping, provided by the power amplifier, helps swamp out this resonance if an efficient speaker is used. It can also be damped by introducing acoustic resistance at the point where air particle velocity is greatest: immediately behind the speaker cone. A partition (as in Fig. 7) made of one-inch acoustical glass fiber is practically a general-purpose cure for bass-reflex systems.

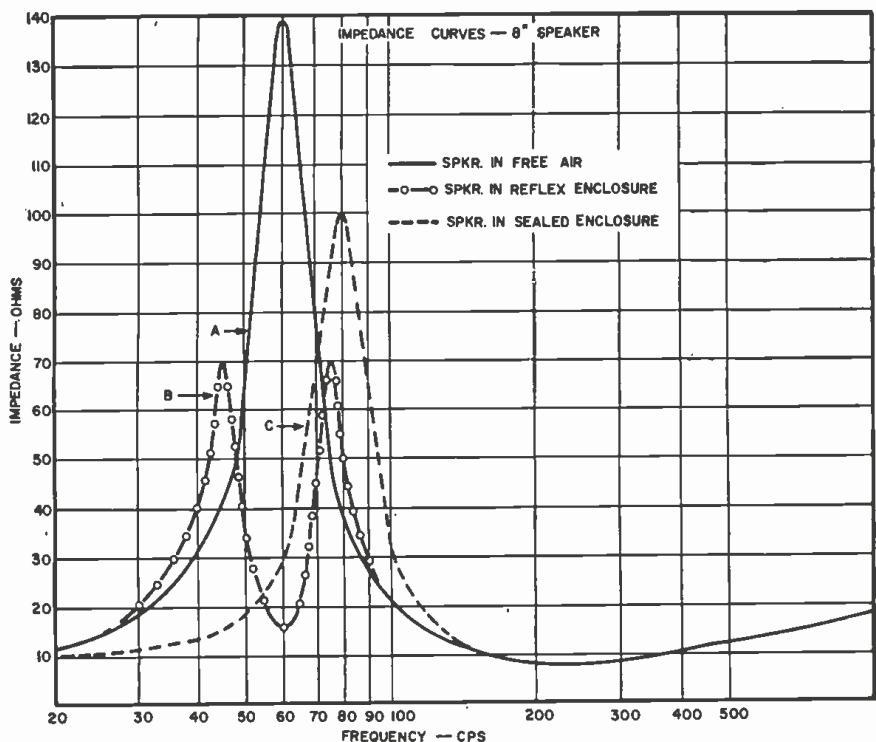


Fig. 6. Impedance curves for 8" speaker whose bass response is shown in Fig. 5.

in which the upper resonance is pronounced.

Excessive ringing at system resonance, on the other hand, is generally a fault only in very large reflex enclosures. If present, it can be controlled by stretching a screen of light material across the port. Particle velocity is very high in this area at resonance and one thickness of burlap stretched tightly across the opening will usually be sufficient.

To sum up the question of transient reproduction: a bass-reflex system in which the upper impedance peak is controlled and in which system resonance is lower than 55 cps, usually has quite satisfactory transient response. Transient characteristics are further improved if an efficient speaker with high electrical damping is employed.

#### Designing a Reflex System

Since the bass-reflex cabinet is a Helmholtz resonator, it would seem simple enough to take the basic formula for determining resonant frequency and apply it to the speaker enclosure. Unfortunately, as many ex-

perimenters and numerous magazine articles will testify, it doesn't always work.

There are at least four reasons why a practical bass-reflex enclosure deviates considerably from predictions based on the Helmholtz formula:

(1) Interior standing waves introduce peaks and dips which interfere with simple Helmholtz resonance.

(2) Mutual coupling between the port and the speaker cone is a factor not considered in the standard resonance formula.

(3) The walls of any cabinet flex to some degree, introducing still another variable.

(4) It is impossible to guess just which portion of the enclosed air is acting as capacitance and which is behaving as inductance, thus, the shape, position of speaker mounting, and port configuration all influence the final frequency of resonance.

The safest bet is either to use specific recommendations from the manufacturer of a particular speaker or else provide some means of varying the port area and juggle things around until

Table 1. Dimensions for building reflex enclosures to house 8", 12", 15" speakers.

8-INCH SPEAKERS (50-60 cps free-air resonance)		8- & 12-INCH SPEAKERS (40-50 cps free-air resonance)		12- & 15-INCH SPEAKERS (30-40 cps free-air resonance)	
CUBIC FEET	PORT AREA	CUBIC FEET	PORT AREA	CUBIC FEET	PORT AREA
2.5	14 sq. in. plus 3" duct	4	16 sq. in. plus 3" duct	6	30 sq. in. plus 3" duct
3	14 sq. in. plus 2" duct	5	20 sq. in. plus 3" duct	8	50 sq. in. plus 3" duct
3.5	16 sq. in.	6	30 sq. in. plus 2" duct	10	75 sq. in. plus 2" duct
4	20 sq. in.	7	40 sq. in.	12	85 sq. in.
4.5	25 sq. in.	8	50 sq. in.	14	100 sq. in.

an impedance curve having two equal peaks is achieved.

Rough impedance curves can be run quite easily if a sine-wave generator and v.t.v.m. are available. The circuit of Fig. 8 is usually used. Providing the series resistor is large compared to the speaker's maximum impedance, the voltage measured will be proportional to the impedance of the speaker. However, it is usually not important to be able to calibrate the meter directly in ohms and for the purpose of tuning a reflex enclosure any value of resistance greater than 20 ohms will work.

Merely determining the resonant frequency of the system doesn't even require a meter. A candle held in front of the port while a sine-wave tone is fed to the speaker will indicate quite dramatically the frequency of resonance. But since the exact determination of frequency is not as important as balancing the two impedance peaks on either side to approximately equal values, it is best to use a meter when making any adjustment of a reflex system.

For the home builder who wishes to construct a reflex enclosure without making costly mistakes, the following rules are generally accepted as reliable.

#### Cabinet Size

Assuming that the enclosure is to be

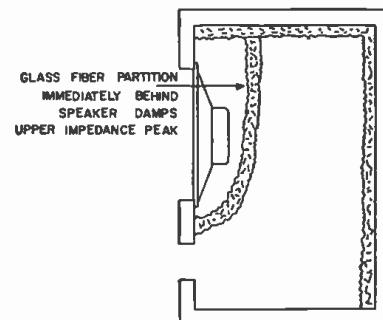
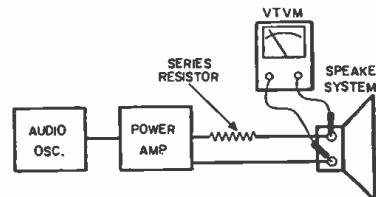


Fig. 7. Reflex system shown with added glass fiber screen to control boominess.

Fig. 8. The hookup for measuring impedance.



tuned to a frequency in the 40-60 cps range, the cabinet is usually made large enough so that the port area will not be less than one-third the cone area of the speaker used. In general, an eight-inch speaker requires an enclosure of 3 to 5 cubic feet, a twelve-inch speaker from 4 to 7 cubic feet, and a fifteen-inch speaker from 5½ to 12 cubic feet.

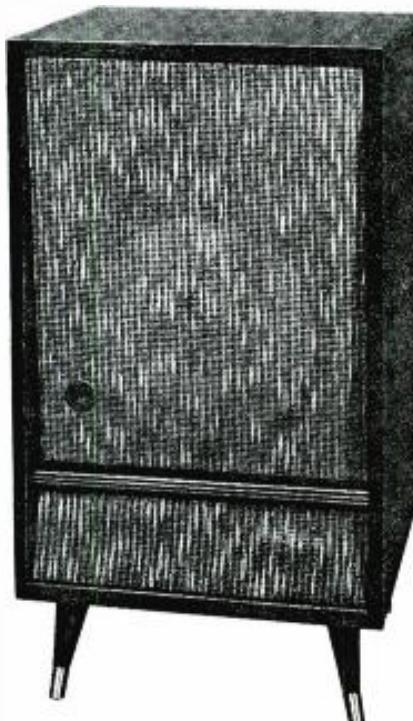
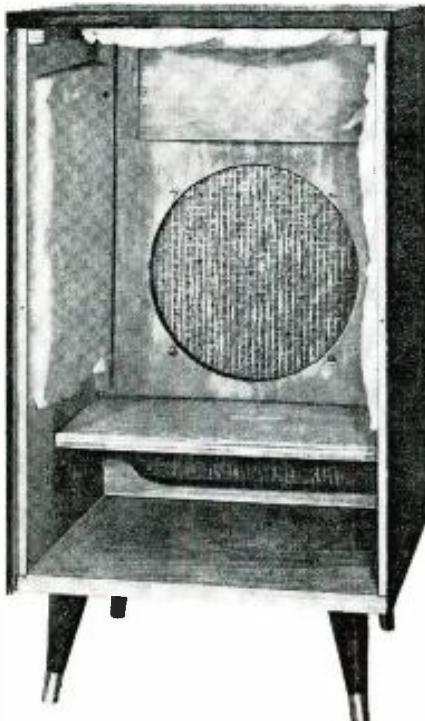
The shape of the cabinet must not be more than a reasonable departure from (Continued on page 86)

# Ducted-Port Bass-Reflex Enclosure for 12" Speaker

**ELECTRONICS** WORLD

LAB TESTED

A professionally designed hi-fi enclosure that provides quality reproduction at reasonable price.

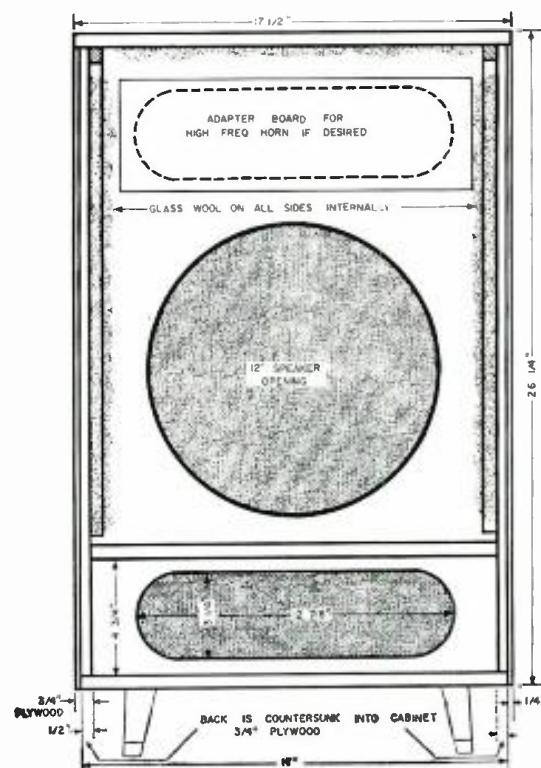
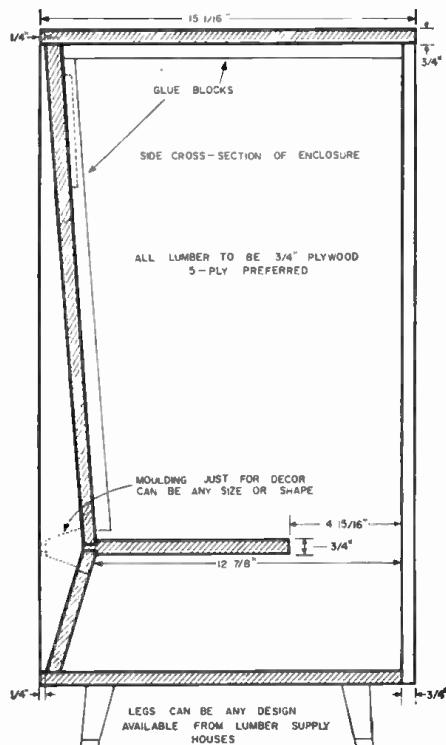


ANOTHER addition to *Allied Radio Corporation's* hi-fi line is its Model KN-1260K loudspeaker enclosure, which is available from the firm in kit form at the reasonable cost of \$36.50. The design is such that it can be readily assembled in the home by those who are so inclined. Since it is an economically priced item we thought it interesting to check its performance using the *Electro-Voice "Wolverine"* Model LS-12 speaker, which itself is a fairly inexpensive speaker. According to the manufacturer, this speaker has a free-air cone resonance of 40 cps. With this combination we found that the speaker is adequately loaded by the cabinet at about 42 cps and its output extends to 12,000 cps, then drops off rather rapidly beyond 13,000 cps. As is usual with some ducted-port speaker enclosures, we found two resonant peaks; these occurred at approximately 95 and 205 cps.

These two peaks were discernible when using an audio oscillator to sweep the audio range. Listening tests showed that these peaks were not objectionable and the low-frequency peak helped to extend the bass response. Considering the price, the unit provides good hi-fi performance.

-30-

Complete construction details on the ducted-port speaker enclosure. The entire assembly is made up of  $\frac{3}{4}$ -inch plywood and all corners should be solidly secured with glue blocks and screws if possible. Glass-wool is to be used on two sides, top, and back. The adapter board shows the position of a tweeter if it is found desirable. For those who are interested in the kit from Allied, it is available in mahogany, limed oak, or walnut and all sections of the assembly are pre-finished. We found that all parts are properly pre-cut to size and one should have no difficulty in assembling the enclosure described.



By PAUL H. WENDEL

# SERVICE

## Keyed to the Community

### This dealer found success in individually tailoring his shop to local preferences.

AGE OF regimentation though ours may be, there is still room for the man with an original, sound idea who also has the enterprise to carry it out. About two and a half years ago, TV technician Michael J. Chattinger took over a do-it-yourself service center located in a suburb of Detroit, Michigan. He immediately replaced the conventional shop layout with a functional arrangement of benches and parts supply bins that is rather distinctive.

*Do-It-Yourself T.V. Service*, located at 345 East 8 Mile Rd., Hazel Park, Mich., now keeps five bench men busy on staggered shifts from 9 a.m. to 9 p.m. every day except Sunday. Two technicians are on duty until noon; all five are on hand from noon to 6 p.m.; and three men fill out the rest of the day until 9 p.m. The full time of each is devoted to troubleshooting, since most handling and moving of the chassis is performed by the set owners.

Basis of the operation is to provide immediate service to set owners willing to bring their receivers to the shop. It also lets them save part of the home-call charge and gives them a chance to see their sets repaired. Many customers are suspicious about parts for which they are charged when they cannot see the physical evidence of replacement. This technique overcomes their distrust.

Originally the shop was laid out in conventional fashion. Long work benches lined the walls. Tubes and components were kept in a stock room toward the rear. On a busy day, the place was jammed with customers. Children became tangled in cords. Technicians had to leave their benches to go to the stock room for parts. The confusion was nerve-wracking and time-consuming.

Immediately on taking over, Chattinger launched a

Fig. 1. A large sign, clearly visible from the adjacent highway, tersely conveys the owner's service message.

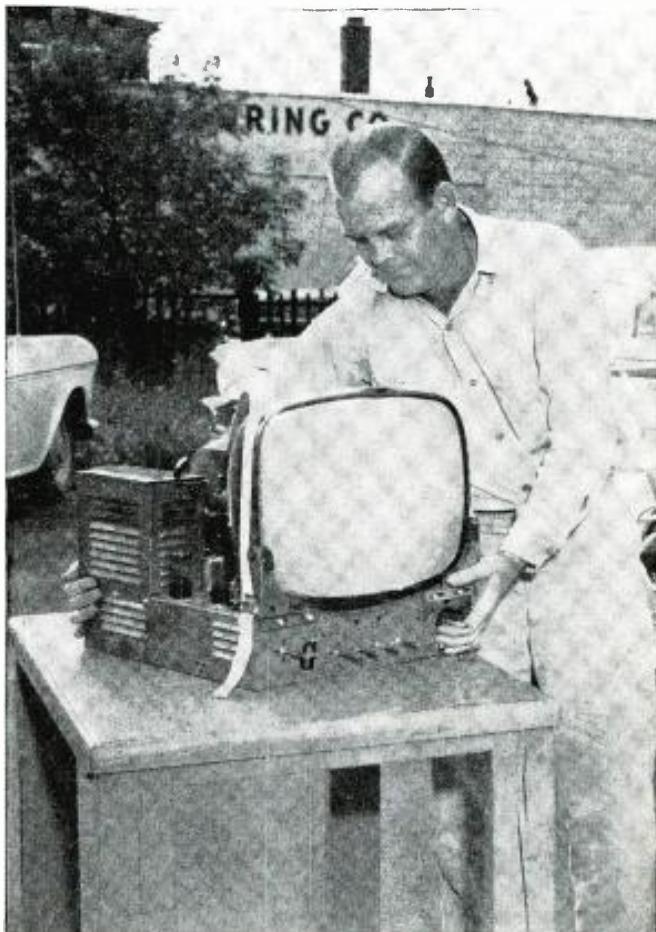


Fig. 2. The set owner moves his chassis from car to this bench-high dolly, then rolls both into the service center.

search for a more sensible arrangement. The functional design now in use was the result. Two circular turntables, each eight feet in diameter, are the heart of the system. One of these, located overhead, is a tube and parts rack. The other is the major rotary service shuttle. The system works like this:

The customer parks his car on the ramp in front of the shop (Fig. 1). He wheels a bench-high dolly from the front of the shop to his car and transfers his TV chassis or table model in its cabinet to the dolly (Fig. 2). He then trundles the latter into the shop and waits his turn at any of the two to five service positions.

If the set is a table model in its cabinet, the customer is told how to remove the chassis. The dolly is then wheeled in place at one of the minor-service positions and the chas-



Fig. 3. Owner slides set from dolly to minor-service bench, then gets a quick fill-in from the technician.

sis is slid onto the work bench by the customer (Fig. 3).

After a brief description of the trouble by the customer, the technician begins to check the set. Only minor service—replacement of defective tubes and simple adjustments—is handled at these initial positions. To get the tubes, the technician simply turns around and revolves the circular, eight-foot rack behind and above him, shown at the top of Fig. 4. He picks up the tubes he needs as they move by.

If work is completed at this point, the customer slides the chassis back to the dolly, pays a \$2.50 service charge plus the price of tubes and other parts used, and wheels his set back to the car. If it is a table model he brought in with the cabinet, he is instructed in proper re-assembly.

Should a set need more extensive work, the technician moves it to the major-service, bench-height rotary shuttle directly in back of him, as is being done by the bench man in the center of Fig. 5. This shuttle is the lower section of the double-deck revolving wheel. From here, the chassis can be rotated to either of two major-service bench positions, at which any type of equipment that may be needed for extensive troubleshooting is available.

As a rule, this last step is not undertaken immediately. For such work, the customer must generally leave the set, which may remain on the shuttle until that part of the day when shop traffic is at a minimum. Then it is repaired and moved to a run-off table. It can be slid from the latter to a dolly when the customer calls for it. For this type of service, the customer pays a higher service fee plus the price of all parts required. A run-off table is to the extreme right in Fig. 5. Note here how the barriers keep customers out of the service area but permit them to watch work on their equipment.

For customers who insist on checking their own tubes, three testers (Fig. 6) are located at the opposite end of the shop from the service benches, to minimize confusion. There is still one type of set owner whom Chattinger has not yet been able to attract with his novel system. These are the deep-dyed do-it-yourself addicts that have some knowledge of electronics and like to attempt more than simple tube replacement on their own. Many are not fully equipped for such work, and others don't have quite enough competence or confidence to proceed without supervision. Chattinger is considering the conversion of one room in his building to accommodate these people, at a fee, under guidance.

Hazel Park *Do-It-Yourself T.V. Service* revolves—literally—about the unique revolving shelves and the unique placement of service positions in relation to them. The upper and lower racks, of course, revolve independently of each other. During a busy afternoon, the upper tube rack will be in constant, slow rotation: Often all the technician

has to do is pluck off the tubes he needs as they pass him by!

Success of the system is proven by the fact that its present high volume is almost exclusively the result of word-of-mouth advertising. Although a weekly ad runs in the local paper, the most effective piece of advertising is a simple business card with the shop name and address on one side and instructions for removing a chassis from its cabinet on the other. Kept near the cash register, these cards disappear at the rate of about one box a week.

Before Chattinger took over, the center was open seven days a week. His first step was to eliminate Sunday work. He also hopes to cut down on the Saturday hours, possibly even to institute a five-day week. Because of the importance of reliability, the owner uses only brand-name tubes and parts of proven quality.

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Fig. 4. Overhead rotary shuttle carries stock of tubes, lower shuttle carries sets to advanced-service benches.

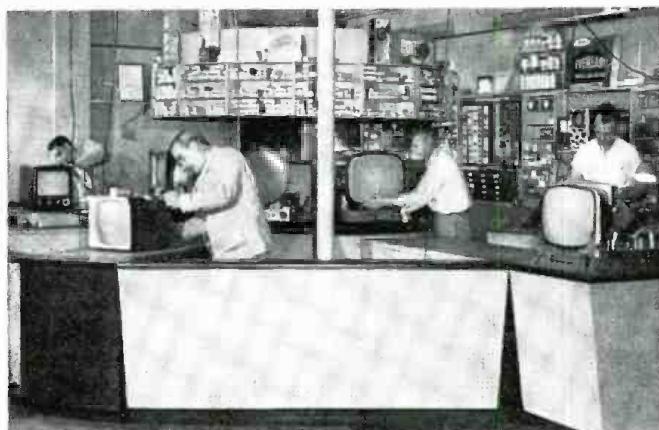


Fig. 5. Barriers avoid confusion by keeping customers out of service area, yet permit them to watch work on sets.

Fig. 6. For the man who will trust no one else to test his tubes: three checkers are out of the way, off to one side.

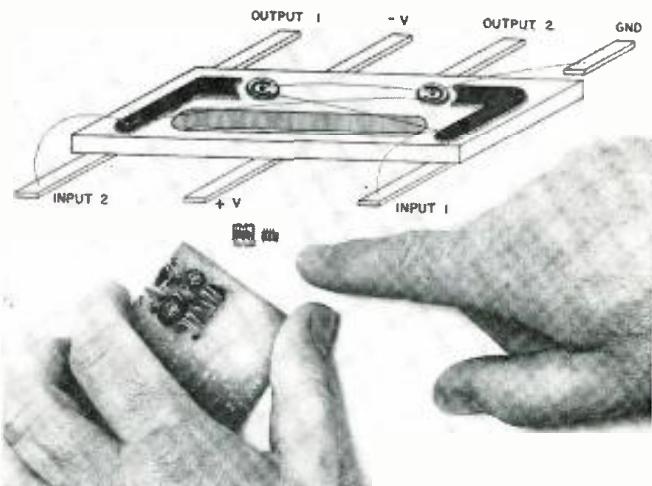




#### ▲ Radar for Cars

An experimental radar warning device for automobiles has been developed by the Delco Radio Div. of General Motors. Part of the device is housed in the two black nose cones pictured above on the experimental Cadillac shown. The unit sends out signals in front of the car which are reflected by solid objects in the car's path. Visual or audible warning signals are set off by an object within 1000 feet of the car.

## Recent Developments in Electronics



#### ▲ Semiconductor Solid Circuitry

Finger points to Texas Instruments' new solid circuit multivibrator assembly (left) and hermetically sealed unit (right). The unit is less than  $\frac{1}{4}$ -inch long,  $\frac{1}{8}$ -inch wide, and  $\frac{1}{32}$ -inch thick. It is compared in size with a multivibrator made with ordinary printed circuit (held in hand). Solid circuit is shown, greatly enlarged, in drawing at top.



#### ◀ Tracking Antenna for Space Probes

This is the tracking antenna which received signals from the first successful space probe missile. Technicians at the Goldstone Tracking Station in Camp Irwin, Calif., relayed data from space to the computing center at the California Institute of Technology Jet Propulsion Laboratory in Pasadena. Shown here under construction, the antenna is 110 feet high and 85 feet in diameter.

### Satellite Transmitter

This all-transistor 20-mc. telemetering transmitter, designed for possible use in space satellites, has been built by Philco Corp. for the U. S. Army. The transmitter weighs less than 10 ounces and has more power output than the transistorized transmitters used in present U. S. satellites.



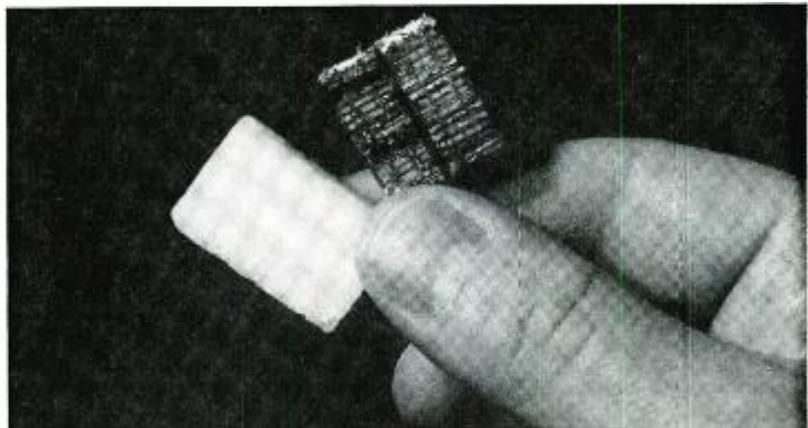
### World's Largest Klystron Tube

Varian Associates' newest and largest klystron tube, the 12-foot, 900-pound VA-842, especially designed for use in high-power radar and missile tracking, gets a final inspection before shipment. Developed under U. S. Air Force sponsorship, the VA-842 is the world's largest klystron producing tremendous high average power for long-pulse radar.



### Sugar-Lump-Sized Radio Set

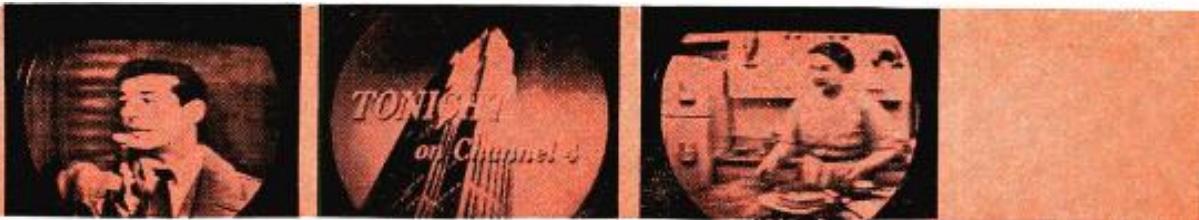
The electronics of a radio unveiled by the Army and *RCA* actually are slightly smaller than a lump of sugar. The receiver is made of micro-modules, building blocks which measure a third of an inch on each side and promise a size reduction of 10:1 or better in electronic gear. Although the program began less than a year ago, tests show micro-modules promise to be highly reliable, long-lived, use little power, deliver high performance, and simplify repairs. For complete details on the technique see "Micro-Modules—the Ultimate in Miniaturization" in our September 1958 issue.



### Battlefield Radio Station

Two U. S. Army Signal Corps soldiers erecting the modified yagi type antenna for the v.h.f. multichannel tactical communications radio set, the AN/GRC-53, designed and developed for the Army Signal Corps by *Westinghouse Electric Corp.* for use in forward combat areas. At a recent official demonstration of the equipment at the Pentagon, the two soldiers set the equipment up and had it operational in 24 minutes.





## Those Marginal TV Defects



By WALTER H. BUCHSBAUM  
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"THE PICTURE looks fuzzy—it just isn't as clear as it was." How often is this or some similar complaint heard by the service technician? A picture that looks "unclear," slightly distorted, or a little too pale; sound that is slightly garbled, has a little hum, or just does not sound as good as it used to, these are what we mean by marginal defects, and they can be as much of a headache as intermittents. The main problem with these symptoms is to decide whether they really are defects or whether they are just due to the limitations of the receiver and the antenna.

Often the service technician will be called in to work on some other equipment and then, as an afterthought, he will be asked what he thinks should be done about the marginal performance of the TV set. In other instances, these troubles become apparent only after the main defect has been repaired: the customer then feels that the set does not work as well as it did before it became defective. It requires a lot of tact and patience to explain that the repaired portion of the set is not the one responsible for the marginal trouble or, in many cases, that the set never worked any better.

One way or another, we must deal with these borderline defects, their causes and cures, and also learn how to distinguish between real defects and tolerable imperfections. Some suggestions on how to explain these marginal troubles to the customer are offered at the end of this article.

### Should they be tolerated or corrected? Where does "acceptable deviation" end and "true fault" begin?

tions on how to explain these marginal troubles to the customer are offered at the end of this article.

#### How Bad Is Bad?

The first decision to be made about any type of doubtful defect is probably the hardest. We must decide whether the picture or sound is really defective. Here several factors must be considered, the first of which is the customer's opinion. Is he really convinced that picture or sound is bad? Can he point to something more specific than "the picture should be clearer?" The experienced technician will know pretty well how clear a picture can be expected from a certain set and how much sound distortion must be tolerated, but the set owner has no basis of comparison by which to judge. In some cases it may be wiser to compare pictures on a neighbor's set as proof that ghosts or interference are due to local reception conditions not the fault of the set.

To help decide whether a defect exists, the various controls should be manipulated first to make sure that the trouble is not simply due to misadjustment or misalignment. Some marginal cases can be quickly classified as genuine defects in this way. If, for example, the focus control has to be set completely to one side in order to get any focus at all, a definite defect exists. For that matter, if the contrast, brightness, or any other control has to be operated at an extreme position, or its adjustment has no effect, the technician knows that there is a real trouble.

When all controls seem to function correctly, the next step will be to inspect the antenna lead-in, multiple-set coupler, channel traps, remote control device, or any other external accessories. Grasping the transmission line and moving the hand up and down on it will give an indication of mismatch at the receiver antenna terminals or at the antenna itself.

Most technicians will explain to the set owner at this point that any further tests must be charged for and the decision must be made whether the set is defective or not. If all controls function and the complaint is only that the picture should be "clearer," without any specific condition such as poor focus, interference, fine tuning on edge, ghosts, etc., then the customer should be told diplomatically that perfection is not possible and any improvement in picture clarity might cost much more than is warranted. In many cases, it can be pointed out that reception from a more distant station is always poorer than from a local one, or that weather and terrain affect reception. The disadvantages of viewing a TV picture from too close up should be explained and a minimum viewing distance recommended. Most customers are will-





Fig. 1 (left). "Weaving" pattern superimposed on the picture. Fig. 2 (center). Definite, displaced ghost. Fig. 3 (right). Poor resolution may be caused by misalignment, antenna-system mismatch, or a "close" ghost.

ing to accept a less-than-perfect picture if they can be shown reasons for it.

Audio defects such as garbling, hum, or serious unbalance are usually distinct enough to make the decision easy. However, when it comes to subjective evaluation of tone and fidelity, the limitations of an inexpensive TV sound system must be explained carefully. Often such a discussion will prompt the set owner to have the TV sound connected to an existing high-fidelity system.

When the technician decides that the set is defective because one of the controls does not work properly, this fact should be pointed out to the customer together with the probability that the defect will become more pronounced as time goes by and may even result in more serious trouble later. When it is not a problem of controls but misalignment, component aging, outside interference, or some undetermined reason, then it may be more difficult to convince the set owner of the need for repair. This is a particular problem in the case of alignment, where the labor charge may be considerable while the visible improvement is not so pronounced. But before the technician can even begin to quote prices he has to try to estimate just what repairs will be required. Listed below are the most common types of marginal defects and the troubleshooting and repair work usually associated with them.

#### "Unclear" Picture

The description "unclear" is applied by the set owner to a great variety of defects. Before considering repair, the technician will want to be sure just which component or receiver section causes the trouble. Here are some of the wide variety of problems that fall into this loosely descriptive category:

**Dirty screen.** Surprising as it may seem, a large number of dim, unclear, or fuzzy pictures are due to an accumulation of dust on the inside of the safety glass and on the faceplate of the picture tube. The electrostatic charge on the inside of the picture tube attracts dust particles and holds them on to the glass. While many sets have detachable safety glass to facilitate cleaning the screen, many others require removal of the chassis and picture tube. In either event, the average set owner will not be qualified to do the job himself. Most technicians clean the

screen thoroughly whenever they do any service work on a set.

**Weak high voltage.** Poor focus and dim pictures are often due to low high voltage and this, in turn, is most often caused by a weak horizontal-output tube or a defective h.v. rectifier. The damper tube or some other component in the flyback and h.v. section can also cause this trouble. A quick measurement with the h.v. probe and meter will definitely determine the trouble. Weak low-voltage output may also first make itself evident indirectly in this way.

**Defective picture tube.** If the second-anode voltage is the correct value and all other picture-tube voltages are proper, the CRT itself may be going bad. Most technicians are familiar with the symptoms of a weak picture tube and many set owners are also quick to recognize this trouble.

**Defective CRT circuits.** Occasionally resistors in series or parallel with the focus control go bad and cause poor focus. Component defects in the brightness control and the video amplifier circuits can also give weak or fuzzy pictures. In each case, the respective control will indicate whether its receiver section works correctly or not. If, for example, the contrast cannot be reduced sufficiently, a defect in the video amplifier stages is the most likely cause. If the screen cannot be darkened sufficiently by adjusting the brightness control, some component in that circuit has probably become defective.

**Reflections.** When ghosts appear sufficiently delayed, as in the photograph of Fig. 2, the customer will realize that this is not the fault of the set. But if the ghost is only displaced slightly, its presence may appear as smeared outlines and the viewer may complain of an unclear picture. Careful observation by the technician as to the exact nature of the smearing usually will show the cause. Grasping the transmission line and squeezing it at different points near the receiver terminals often shows a change in the reflection and thereby confirms the presence of a ghost. Much has been written about various methods of eliminating ghosts. For this discussion it is only necessary that we establish the source of the trouble.

**Misalignment.** A badly misaligned i.f. strip may result in poor resolution, as in the photograph of Fig. 3. Less severe misalignment is often difficult

to recognize, especially on weak signals or when kinescope recordings or old movies are transmitted. If the lack of detail is sufficiently pronounced, the set will have to be taken into the shop and a complete r.f. and i.f. alignment performed. Other indications that point to misalignment include sound interference in the picture, buzz in the sound, and interference due to the 3.58-mc. color subcarrier during color telecasts. Before deciding on a complete alignment, the tuner oscillator adjustment, which is usually accessible through an opening in the front of the set, should be tried. A simple touch-up of the oscillator often improves picture quality and removes any sign of interference.

**Interference.** Although the set owner may complain of "unclear" pictures, the presence of external interference is not difficult to determine. Weaving patterns superimposed on the picture, as shown in Fig. 1, are invariably due either to misalignment or outside interference. By comparing the audible sound variations with the interference pattern to see whether they vary in step with each other, quick determination can be made as to which symptom is involved. If the interference is present only when color transmissions are received, its source is obvious. The elimination of external interference is often a difficult job depending on local conditions.

#### Deformed Pictures

Under this heading fall all types of picture distortions and, in general, these are simpler to diagnose as definite defects than the "unclear" picture complaint. Adjustment of the vertical and horizontal controls are part of the preliminary check-up: some distortions can be eliminated with no effort beyond this.

Occasionally, however, some deformity remains. Typical of this is the case of vertical distortion where no combination of settings of the vertical linearity and height control seems to eliminate a definite stretching in the center of the screen. This may be due to a defective tube or other component in the vertical-sweep section and may require considerable bench testing.

The tendency to horizontal pulling or bending at the upper portion of the picture is another frequent marginal defect. In many cases, the distortion occurs only when the picture back-

(Continued on page 98)

# TV Service—and the Ladies

By  
**HAL ROSEN**



*Most technician dealings—confusing, amusing, or both—are with members of the fair sex.*

**EDITOR'S NOTE:** *The TV set owner can be more of a service problem than the receiver itself. More often than not, the set owner to be dealt with is that strange and wonderful creature, the American Housewife, with her unsophisticated view of electronics. However, as these amusing and instructive histories show, dealing with her can be more rewarding than vexing. All you need is the right attitude.*

**I**T MAY be trite to say so, but the TV technician's lot is not always a happy one. His work is the out-growth of trouble. People no more enjoy calling him than they enjoy calling the doctor. With television now regarded as a necessity rather than a luxury, the man who services the sets has become a sort of evil that must be accepted—graciously or not.

Aware of this virtually automatic hostility, technicians could easily degenerate into a group of neurotics with persecution complexes, if they let themselves. Luckily, most are sensible enough to find comic relief instead of anguish in some of their encounters with the public. The public, of course, generally means the lady of the house. With this happy breed, our shop has had its share of dealings worth cherishing and repeating.

Recently our service manager got an urgent call from a customer who reported that her TV set had "just exploded." Could someone come over as quickly as possible? Until his arrival, she and her children were taking refuge in a neighbor's house. The service manager assured her that, if the picture tube had indeed let go, nothing more would happen, but he sent a man over quickly anyhow.

When Les (the lucky man in question) arrived, he found a group of curious women and children in front of the place. The lady of the house

greeted him with, "Thank goodness you've come; we were afraid to go back in."

Saying, "Just relax, Mrs. Armstrong; we'll take care of it," he picked up his caddy and bravely threaded his way through the cluster of onlookers and into the house.

A 17-inch *Admiral* table model stood quietly in one corner, with a basin placed under it to catch the stuff that had dripped from the cabinet. Les removed the back and turned the set on. The low-voltage rectifier (Fig. 1) didn't light, so he tried a new 5U4 and turned the set on again. Its plates began to glow cherry red quickly, so he turned the set off right away.

Measuring from pin No. 8, the cathode, to ground with his ohmmeter, he read zero ohms. With the meter still connected, he pulled out the plug from the speaker field coil. The pointer swung up to an infinite reading. This might have suggested a short somewhere in the set beyond the first filter capacitor. In that case, however, he would certainly have read the resistance of the field coil, instead of zero, when the speaker plug was in. The likeliest culprit, then, was  $C_{m1}$ , the 80- $\mu$ fd. filter capacitor—and he was right on the nose this time.

Events now fell into place. When an electrolytic shorts, there is often a loud noise like that of a firecracker going off. The dripping from the bottom of the set wasn't hard to understand either. Les put in a replacement, got the set working, and then called a very upset Mrs. Armstrong back into her house: "It's all right now, ma'am; and I must say that you're a very brave woman. In spite of the crisis, you had enough presence of mind to pull the

plug out of the wall and shove the basin under the set to protect your carpeting. Not many ladies could do that."

She blushed prettily and paid without a whimper.

On another occasion Eddie, the "comedian" of our service department, answered an unusual phone call. The woman claimed that "something seems to be sucking the power from the set." After noting a few seconds of silence from the other end, she inquired, "Hello, are you still there?" Eddie took the phone from his ear, glanced at it curiously for a second, shrugged his shoulders, and replied, "Yes, I'm still here, we'll send a man over shortly."

He turned to the service manager. "Hey, Fred; ever hear of an electronic leech?" "Can't say I have," Fred replied, "Why?" "Lady here says something is sucking the power from her set. What else could it be?" "Well suppose you just go over and find out what else it could be," Fred laughed, "and none of your sarcasm in front of the customer either." Eddie winked as he walked out to the truck.

When he arrived at the lady's house, she repeated her interpretation of the symptoms and added that "it took a while for them to show up, so you better sit down and have a cup of coffee while you wait for it to happen." Eddie was about to decline but, since she had spoken more in the tone of command than suggestion, he turned the set on and meekly sat down. Ten minutes and three-quarters of a cup later, the picture began to bloom, slowly growing larger and dimmer. As he turned up the brightness control, the picture disappeared completely.

He opened the high-voltage cage and

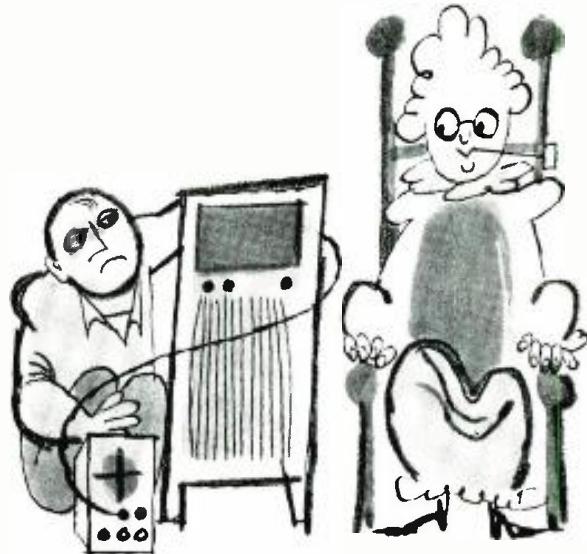
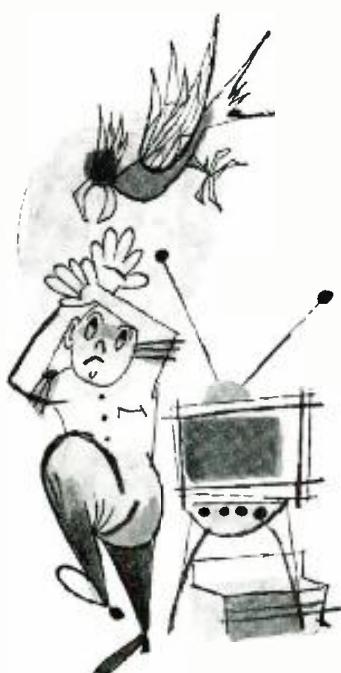
replaced the 1B3 rectifier (Fig. 2). In a few moments the picture bloomed again. Eddie re-inserted the old rectifier and darkened the room to check for possible arcing. He discovered a slight, bluish light in the center of the 2-megohm resistor,  $R_{105}$ , and knew he'd found the trouble. Eddie explained what had happened as clearly as he could and recommended that  $R_{105}$  be changed as well. The lady agreed and he replaced both resistors.

After waiting a reasonable amount of time, the set having held up, he prepared to leave. "Well, here they are," Eddie said, handing the resistors to the customer, "They won't trouble you any more." "Hmph," she snorted, "you wouldn't think a little thing like that could just suck all the power out of a television set." "No you wouldn't," Eddie wisely agreed. Chuckling to himself, he walked out to his truck.

Then there was the case of the "Rock-and-Roll Parakeet." Les, who ran the call, was quite shaken by the experience.

The lady of the house greeted him at the door. "You'll have to hurry. Pete is watching his favorite program and every so often the picture goes off and he becomes very upset." "Pete?" Les inquired. "Yes; my parakeet," she replied, "He loves to watch that program where the teen-agers dance to rock-and-roll records; it's his favorite show."

Les glanced around the room and caught sight of Pete standing in the middle of a plastic tablecloth, which was spread out on the floor directly in front of the TV set. The bird had its attention focused on the wildly gyrating boys and girls pictured on the screen and didn't notice Les until he gingerly swung the set away from the wall. At once Pete set up a series of piercing chirps, fixing Les with a beady eye. The technician, never having been a bird fancier, grinned apologetically



and removed the back. As the sound from the set disappeared, the chirping increased in frequency and volume and Pete began stalking angrily up and down the tablecloth. Les quickly jammed his cheater cord in and swung the set around until it was once more in line with the bird's vision. As the sound and picture returned, the noise and the pacing ceased and Pete settled down to watching his program, glancing at Les suspiciously out of the corner of his eye.

Beginning to perspire, Les took a deep breath and began tapping tubes to see if he could cause the picture to disappear. A few seconds later he discovered the filament in the neck of the picture tube was growing dimmer. As it went out completely—and the picture with it—the awful din started again in front of the set. With a groan, Les quickly twisted the cap at the base of the CRT until the filaments lit up again. He stood there holding it until the bird quieted down. Then, muttering to himself, "Well; it's gotta be done," he took a deep breath, removed the interlock and pulled the cap off the neck of the picture tube.

This was too much for Pete, who took to the air and, as he flew in great circles around the room, pecked at Les' hair and ears each time he went by. The bewildered technician slumped down in back of the TV set, waving his arms to ward off the attacks.

The lady of the house, hearing the commotion, came running in from the kitchen. Taking the situation in at a glance, she cooed, "Ah, has that mean old man taken away baby's picture again?" She then held up one finger, on which Pete quickly perched. With a look of disdain at the cowering technician, she placed Pete in his cage and set it in front of the receiver.

Les slowly crawled out from in back of the set and took out his soldering gun. Studiously ignoring Pete, he proceeded to apply heat to pins 1 and 12, the filament connections of the picture tube. When he turned the set on again, the picture stayed on. He explained to

the customer what he had done and informed her that, if the same thing happened again, he'd probably have to install a new picture tube. Then he packed up his gear and prepared to leave. As he passed Pete's cage (Les insists) the bird scooped up a beakful of birdseed and, with a Bronx cheer, blew it in the technician's direction. "Same to you, you little monster," Les muttered under his breath as he hastened out the door.

Eddie once got a complaint that a set was "giving off gas." "I could have toppled over when she told me that," Eddie informed the service manager. "I was tempted to tell her to toss it over her shoulder and try burping it. Well, I guess I better go over and see if I can stop the leak."

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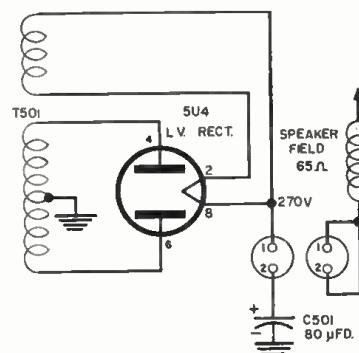
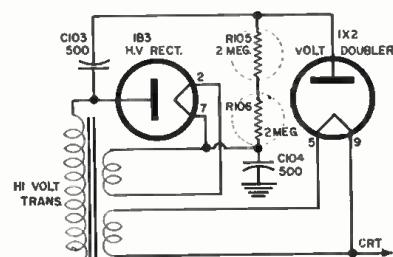


Fig. 1. Cause of this 5U4's demise was easier to understand than the set owner.

Fig. 2. Arcing, not an electron leech, "sucked power" from this h.v. circuit.





# Phantom Channel for Stereo

By HERMAN BURSTEIN

**Simple methods that may be used to obtain a third or center channel to eliminate that "hole-in-the-middle."**

ONE of the major problems of two-channel stereo is the apparent absence of sound in the space between the two speakers. The more widely separated the speakers, which augments the sense of spaciousness, the more severe is the "hole-in-the-center" effect. Therefore an increasing measure of attention has been directed toward filling this seeming void. One way of doing this is to use three-channel stereo. However, since three-channel program sources are not available to the public, the "fill" must be derived from two-channel material.

A simple way of filling in the center is to move the left and right speakers closer together. If corner speakers are employed, this is difficult or impossible to do. Even if wall-type speaker systems are involved, problems of furniture arrangement may interfere with bringing them together.

Another expedient used on occasion is that of a dummy speaker, connected to nothing at all, which is situated between the left and right speaker systems. Sight and sound go together much as taste and smell do and the visual presence of a speaker system in the center can lead the mind to conclude that it hears sound from this region. A third technique is to conceal the two stereo speakers behind a cur-

tain, so that one is not conscious of speaker separation, enabling the two sounds to blend together in the mind.

What is apt to be a more satisfying approach is the "phantom-channel" technique, where signals from the left and right channels are combined and fed to a central speaker. The phantom-channel signal can be derived either before or after the power amplifier. If after, one saves the cost of a third power amplifier.

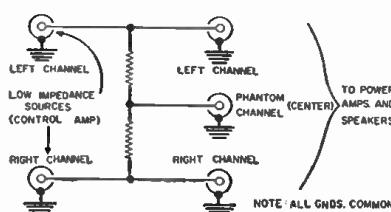
One early proponent of the phantom channel as a solution to the problem of hole-in-the-center was Paul W. Klipsch of Klipsch speaker fame. His method combines the left and right signals prior to the power amplifier, so that a third power amplifier as well as a third (central) speaker is required.

Fig. 1 shows the essence of Klipsch's method while Fig. 2 shows the refined

circuit, including values of the resistive network, chosen to provide adequate isolation (minimization of crosstalk) between channels and the proper level of the middle channel relative to the other two. In Fig. 2 the mixing function is performed by the 33,000-ohm resistors, while the 82,000- and 220,000-ohm units attenuate the signals to the left and right channels. Klipsch in his experiments used a 5000-ohm source in the left and right channels, so that the 33,000-ohm resistors provide slightly better than 20 db attenuation of cross-talk between channels. If a cathode-follower source were employed, typically with an output impedance of about 500 to 700 ohms or less, crosstalk attenuation would be about 40 db. Generally, 20 db attenuation is considered adequate for stereo.

A vital feature of Klipsch's network is that the level of the central channel is *higher* than that of each of the end channels. To be specific, the middle channel is designed to be 3 db higher than each of the others or, in other words, equal to the *combined* level of the left and right channels. Of course it is assumed that the power amplifiers and speakers for each channel are identical, resulting in an acoustic output which is greater for the center speaker than for the flanking ones.

Fig. 1. The basic phantom channel circuit.



Klipsch states in this matter: "Some guessing was done as to the level to be fed the center channel and the guesses were all wrong. Experiment led to better thinking and a theoretical basis was arrived at and corroborated. . . . My experiments resulted in a workable system with the center channel a half-and-half mixture of the two sound tracks (from a tape) and the flanking channels using corner speakers fed from the two sound tracks with 3 db attenuation relative to the center channel. . . . When success finally was achieved in balance, a surprise occurred: the center channel was perfectly real, and not just a simulated effect to fill up a hole in space. Sounds remembered as arising in the center of the stage occurred there; one ceased to hear sounds from the three speakers, and actually sensed a spread across the curtain of sound."<sup>1</sup>

Contrary to Klipsch's findings, others have recommended that the center channel be substantially lower than the end channels. Thus it has been advised that "the gain of the center channel amplifier should be adjusted so that the sound from the center speaker is just audible."<sup>2</sup> Another has recommended that the center channel should be below the end channels.<sup>3</sup>

Possibly the discrepancy in views as to the proper level for the center channel relative to the left and right speakers may be explained by variations in speaker location or by the nature of the stereo material used for the pertinent experiments. For example, if very wide microphone spacing were employed in the original recording, it might be desirable—in the sense of greatest listening satisfaction—to compensate for the abnormal stereo effect by elevating the volume of the center channel. Or if the left and right speakers are spaced a relatively great distance apart, so as to form an angle of more than about 50° with the listener, it may be desirable to accentuate the center channel. On the other hand, the narrower the microphone and/or speaker spacing, the lower may be the level of the center channel for optimum listening results.

All-in-all, it appears that the stereophile should not commit himself to a fixed relationship between the center channel and the other two but should leave the situation open to experimentation. He should have a handy means of varying the relative level of the center channel, for example by a readily accessible potentiometer in the control amplifier or power amplifier, or by a pad in the leads to the speaker system. (The last approach may raise problems because a pad intervening between the power amplifier and speaker system may deteriorate speaker damping to the point where hangover and/or ringing become apparent.)

As shown in Fig. 3, Klipsch has suggested a means for eliminating the third power amplifier. Here, however, the level of the middle speaker would be 6 db down with respect to each of the flanking speakers instead of 3 db

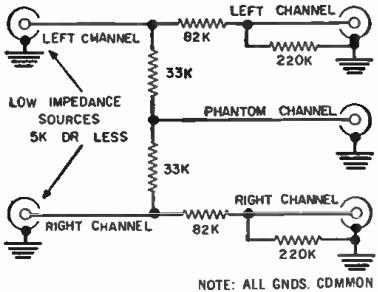


Fig. 2. More elaborate version of Fig. 1.

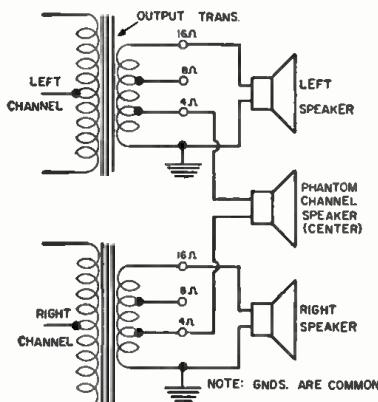


Fig. 3. Obtaining a third channel at the outputs of the power amplifiers employed.

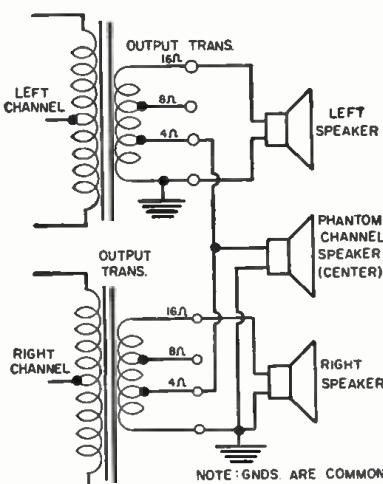
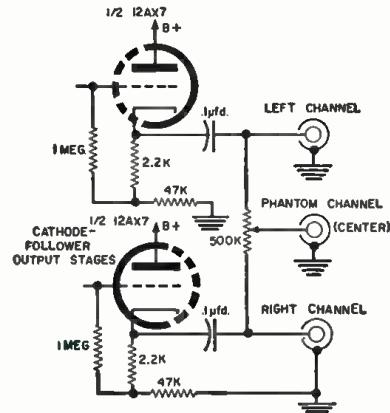


Fig. 4. Alternate method of obtaining a third channel at power amplifier outputs.

Fig. 5. Circuit used in Madison Fielding Series 340 stereophonic control amplifier.



higher in level. This assumes speakers of equal efficiency on each channel. One could change the situation by using a center speaker of greater or lower efficiency than the others.

The method of Fig. 3 introduces a question of crosstalk. But this seems to be not at all serious. The writer, pursuing Klipsch's method, introduced an 8-ohm resistor, in lieu of a speaker, between the 4-ohm terminals on a typical stereo amplifier. He found that crosstalk attenuation was 28 db.

Another question raised by Fig. 3 is that of signal cancellation. Assume there are equal signals in the left and right channels, as can happen, depending upon microphone techniques. In such a case, there would be no electrical potential between the 4-ohm terminals (or any other pair of like terminals) and hence no signal. However, in actual stereo source material there are generally differences in amplitude and phase between like signals, so that signal potentials will exist between like terminals.

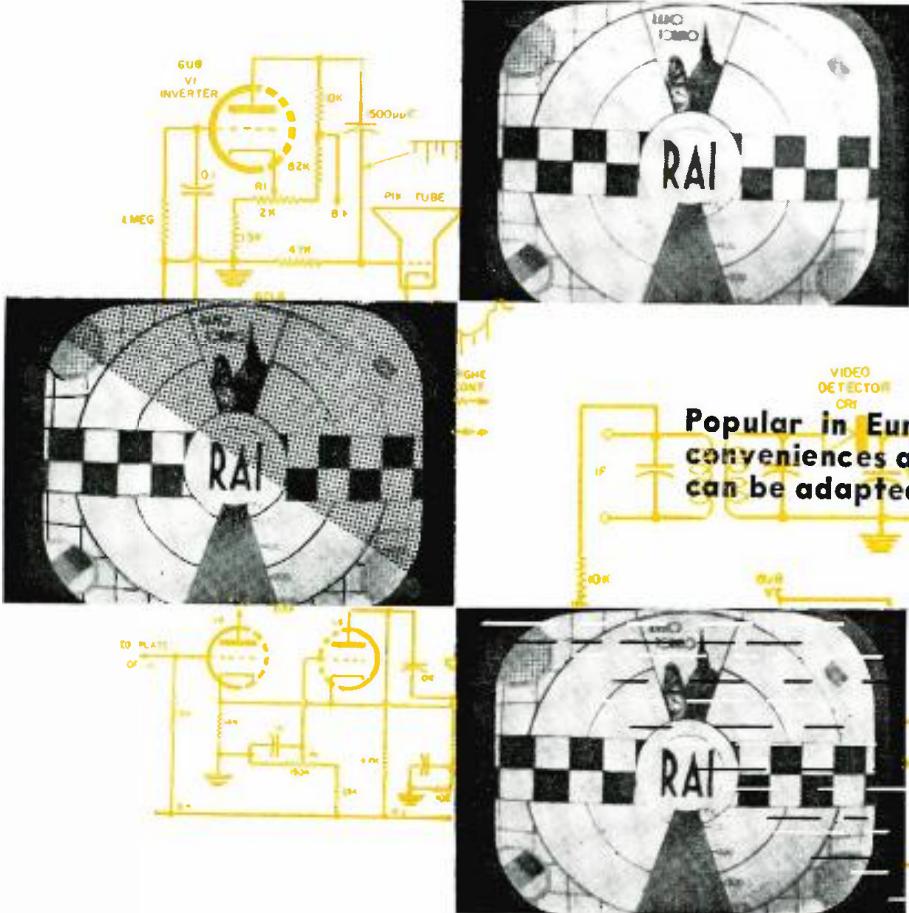
To the extent that signal cancellation does exist, an alternative technique to prevent such cancellation would be to connect the middle speaker to the outputs in parallel as in Fig. 4. However, this results in considerably greater crosstalk. It was found that crosstalk attenuation dropped from 28 db to 16 db when the hookup of Fig. 4 was employed. When crosstalk attenuation drops much below 20 db, it is apt to interfere with the stereo effect.

At least 3 stereo control amplifiers now on the market incorporate a phantom-channel output. These are the *Madison Fielding 340*, the *H. H. Scott 130*, and the *Lafayette KT-600*.

Fig. 5 reveals the method employed by *Madison Fielding* to derive the phantom channel. The left and right signals are combined by a 500,000-ohm pot connected to the high side of the left and right output jacks. The arm of the pot goes to the phantom channel output jack. The left and right channels have cathode-follower output, with an impedance of about 700 ohms and the linking 500,000-ohm resistance introduces negligible crosstalk, i.e., channel separation is nearly 60 db.

Use of a potentiometer as a combining device, instead of fixed resistors, allows one to balance the relative levels of the left and right signals for purpose of combining them into a center channel. Such balancing may be desirable for a number of reasons. For example, the balance control in the Series 340 might be set to produce different signal levels in each channel due to variations in power amplifier gain or variations in speaker efficiency. A potentiometer enables the user to again obtain equal signals for center channel purposes. To take another example, the listener may wish to obtain unequal signals in the center channel, say a dominantly left signal, because the center speaker cannot be located exactly midway between the other two but is situated closer to the left one because of prob-

(Continued on page 80)



By A. V. J. MARTIN

## Novel TV Circuit Improvements

WITH TV a well-established medium in this country, set manufacturers are no longer content to market basic, straightforward receivers. There is a constant search for novelties and refinements, apart from the primary receiver function, that will in some way improve performance or viewer convenience. Some ensuing ideas have only fad value and die out quickly. Others take hold.

Interestingly enough, there has been a parallel trend toward circuit innovation in European TV sets. Many of the designs that have become quite popular on the other side of the water have no counterparts in this hemisphere. Several will interest American readers strictly because of their novelty. Some provide an additional element of interest: they can be incorporated in existing sets by the experimentally inclined without undue difficulty.

### Noise Cancellation

In connection with domestic TV receivers, the term "noise cancellation" is not unheard of. Here, however, we immediately think of its application to sync circuits. In Europe, it can mean actual neutralization of noise pulses that interfere with picture content! Oddly enough, the relatively simple

circuit used bears resemblance to some of our own sync noise cancellers (those using an added triode to invert signal). The big difference is that someone has thought of applying the action to another part of the receiver. It is done directly in the picture tube.

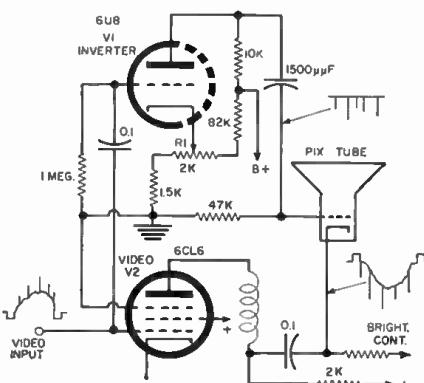
A simple way of getting the desired result is to apply the noise-riddled video signal directly to one electrode of the picture tube (for example, the cathode) and to apply the noise alone,

in the same phase, to another element of the CRT, where its effect on tube conduction will be opposite (the grid, for example). This is done in the French-made *Opera* receivers, as shown in Fig. 1.

In this circuit, the video signal is fed to a conventional video amplifier,  $V_2$ , but also applied in the same way to an added triode ( $V_1$ , one half of a 6U8). However, the cathode of  $V_1$  has a positive voltage applied to it, through potentiometer  $R_1$ . The latter is adjusted so that the tube is kept cut off except when grid voltage exceeds a certain level. This level is set just above the maximum amplitude of normal video signal, so that  $V_1$  amplifies only the large noise spikes that exceed this level. The noise pulses alone then appear at the  $V_1$  plate, amplified and negative-going, and are thence applied to the control grid of the picture tube.

Simultaneously the complete signal voltage—video plus noise—is amplified by the normal video stage,  $V_2$ , and applied to the picture tube in the same phase. However, it is injected at the cathode. The effective signal voltage thus activating the CRT is then the cathode voltage minus the grid voltage. The cancellation of noise pulses then results without disturbance to desired

Fig. 1. Using the CRT itself as the mixer, this circuit eliminates visible noise pulses without disturbing video.



portions of the video-signal content.

A British variation of this circuit, shown in Fig. 2, is adapted from a *Murphy* receiver. The European 20L1, a double triode, is used. Output from video amplifier  $V_1$  is applied to the cathode of the picture tube through a cathode follower, triode  $V_2$ . The latter also feeds the cathode of triode  $V_3$ , a grounded-grid amplifier in which there is no phase reversal of signal from input to output. The grid bias, set by  $R_1$ , determines the level at which  $V_3$  starts to conduct. As is the case with

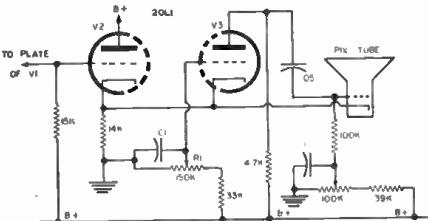


Fig. 2. Another circuit for canceling visible noise in the picture tube.

the preceding circuit,  $R_1$  is adjusted so that  $V_3$  will amplify only noise pulses. These pulses are then applied to the grid of the CRT to produce the desired cancellation.

Note that the circuits of Figs. 1 and 2 are used in countries (like France and Great Britain) where positive modulation of the TV carrier is the standard. Noise is thus more likely to appear as white specks on the screen, rather than black. High-amplitude white peaks can cause defocusing of the CRT electron beam, producing white blotches or smeared streaks that mar the picture considerably more than do black spikes. This fact, the main drawback to positive modulation, explains the special pains taken to minimize noise in the picture.

Nevertheless, even with negative modulation, particularly noisy reception can destroy viewing pleasure and the circuits noted can be used to gain considerable improvement. Sometimes a simple re-adjustment of the operating point of a video amplifier tube will cause it to limit on large noise peaks, thus providing some relief.

### Sync Instability

Many European countries have adopted the CCIR television standard for the signal, which is similar to that used in the United States. In these, noise is considered a greater factor in upsetting sync circuits than it is in marring the picture. Therefore cancellation circuits, many similar to those embodied in American receivers, are applied to the sync stages rather than the video section.

A rather interesting circuit of this kind, sufficiently different from those used in domestic receivers to merit attention, appears in German *Siemens* receivers. Shown in Fig. 3, it could be adapted to American sets simply by tuning  $T_1$  to some frequency other than the one used in the original design.

As shown, all of the video i.f. signal is fed from the last i.f. transformer to video detector  $CR_1$ , whence it goes to the grid of the video amplifier  $V_1$  in the conventional way and is then applied to the picture tube. Some of the video i.f. is also taken off from the last i.f. transformer and fed to  $T_1$ , a bandpass transformer tuned 4.5 mc. below the i.f. carrier. (In Germany, the intercarrier sound i.f. is 5.5 mc. below the video i.f., rather than 4.5 mc. below. The bandpass transformer therefore samples a small part of the video-modulated signal below the intercarrier frequency.)

Sampling only that noise which occurs over a restricted bandwidth is feasible for the following reason: these undesired pulses are random in frequency, occurring over a wide bandwidth when they are present. Thus only those that fall into the limited

is desirable. At night, this level is easy to control with artificial illumination. In daylight, however, the ambient lighting is almost certain to be at a higher level and different settings of the brilliance and contrast controls are necessary to compensate for this fact.

To minimize this need for re-setting, deluxe models of the German *Metz* receivers incorporate a "Day-Night" switch, whose circuit is shown in Fig. 4.  $R_7$  is the normal brilliance or brightness control. The contrast control, not shown here, is a potentiometer in the grids of the i.f. stages that controls the gain of this section, rather than a cathode control in the video amplifier. This location in the i.f. system was used on early domestic TV receivers. With the switch in the "Night" position,  $R_7$  controls brilliance normally and the full negative contrast-control voltage is applied to the video i.f.

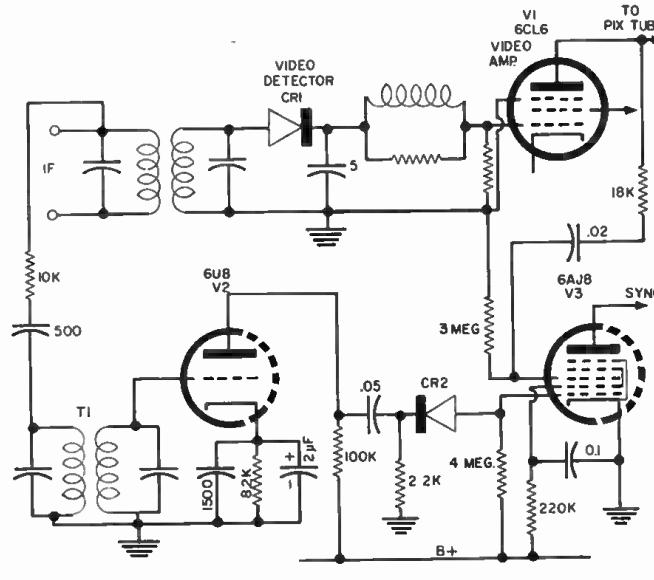


Fig. 3. While many American receivers use pentagrid sync separators to cancel noise that might upset stability, this Siemens circuit adds an interesting feature. A separate, narrow-band transformer ( $T_1$ ) is used to take off some i.f. signal, from which the separately detected and amplified pulses for cancellation are extracted.

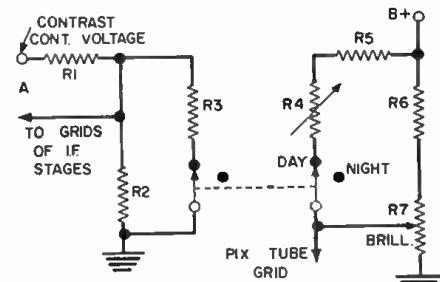
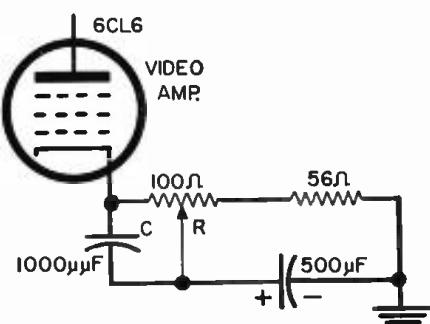


Fig. 4. Switched circuit automatically compensates for day or night lighting.

Fig. 5. A continuously variable compensator for "quality" or definition.



### Day-Night Switch

To view TV under the best conditions, a certain level of ambient light

# Novel TV Circuit Improvements

stages, subject to manual variation.

When the switch is thrown to the "Day" position, potentiometer  $R_1$  and  $R_2$  shunt the normal brightness-control circuit. This increases the positive voltage on the grid of the CRT, thus increasing over-all brightness for daylight viewing. The extent to which brightness will be thus increased is controlled by  $R_1$ . This increase will depend on the specific difference between daytime and nighttime ambient light in each case. Once set for a given installation, therefore,  $R_1$  should not have to be re-adjusted.  $R_1$  now continues to function as a normal brightness control without regard to differences in ambient light.

Along with this brightness change, the switch, in the "Day" position, also shunts  $R_2$  with  $R_3$ . This lowers the negative voltage at point A, enabling the i.f. stages to operate at higher gain and thus produce greater contrast, also necessary in daylight.  $R_3$  can also be made variable to produce a selectable difference in contrast between the two

conditions, but experience has shown that this is not necessary. In either position the normal contrast control, not shown, is as fully operative as the normal brilliance control.

Circuits of this kind are not out of the question on more familiar TV sets, where the contrast control is in the video-amplifier cathode. A shunt resistance that can be switched in and out across the control can also be made to provide some difference in contrast.

## Picture Quality Control

A very popular refinement in European receivers is "PQC," or picture quality control. Roughly it consists in modifying over-all receiver response to best suit the type of picture being received. The differences in transmission standards on either side of the Atlantic may account for its greater importance in Europe, since differences among various types of program materials may be more obvious. The modification can be applied anywhere in the signal system, but the simplest circuits appear in the video amplifier.

An example of continuous PQC, shown in Fig. 5, is used in French *Opera* receivers. Adjustment of potentiometer  $R$  varies the time-constant of the  $RC$  network to alter high-frequency peaking of the video amplifier. With this network, high-frequency peaking can be increased for filmed shows to compensate for the reduced definition that generally prevails on such broadcasts. A similar circuit could be added to domestic receivers where a stage of video amplification is available with a fixed resistance in the cathode. The value of  $C$  would probably have to be increased if this is done. Where the contrast control is in the cathode, it may be possible to insert an adjustable compensating circuit between the cathode and the contrast control. It is interesting to note that, in some deluxe 24-inch American receivers, a type of peaking control intended to accomplish the same thing is used.

A switched PQC with three positions is very common. This is due to the fact that studio broadcasts in Europe are likely to offer the best definition, with less clarity available on film, and still less on outside pickups. Accordingly the circuit of Fig. 6, used in *Pathé-Marconi* sets, has three positions marked "Studio," "Film," and "Outside".

In the "Studio" position, the normal cathode circuit of the video amplifier —  $R_1$  shunted with  $C_1$  — is used. In the "Film" position,  $R_2$  and  $C_2$  are inserted for some high-frequency peaking. In the "Outside" position,  $R_3$  and  $C_3$  provide still more accentuation. Fig. 7 shows the effects of the control on the trailing edge of a high-frequency square wave, as observed on a wide-band scope. A is the applied wave. In the "Studio" position (B) slight peak-

ing due to compensation in the plate circuit of the video amplifier is evident. In the "Film" position (C) peaking is increased and the rise time is shortened. These effects are heightened in D.

In the final position, a certain amount of overshoot becomes evident in the picture as an engraved or plastic effect. While too much of this would be objectionable, especially on pictures that are already well defined, the average viewer feels that apparent sharpness has been improved on program material of poorer inherent quality.

Some German receivers use a more elaborate version of the switched PQC feature, involving a coil, a capacitor, and assorted resistors that may be switched in various combinations. While details are not given here, the arrangement is interesting because, as is the case with most domestic receivers, the contrast control remains in the cathode of the video amplifier, although the compensating circuit is also applied there. Thus, such circuits are adaptable to conventional receivers made in this country.

Where a two-stage video amplifier exists, of course, the problem is simplified because PQC can be added to the cathode of the stage that does not have the contrast control. A circuit like that of Fig. 8 is simple to add whether the control is involved or not.  $R$  represents total resistance already in the cathode circuit, including the control if it is present. If there is a cathode bypass capacitor, it is connected to position 3 of the switch, as shown by the broken line. Otherwise, no connection is made to this point.

In position 3, the original cathode circuit is used. In positions 2 and 1 respectively, increased amounts of peaking are applied. The values recommended for  $C_1$  and  $C_2$  are those most likely to produce the desired action with domestic receivers. However, some experimentation may be necessary to produce the exact degree of peaking that is individually desired. An added feature of this arrangement in conjunction with an existing contrast control is that the latter will have a desirable effect on the compensating action. At low-contrast settings peaking action is greater than at high-contrast settings. Since low-contrast settings are generally used when signals of greater strength are being received, the lower noise content present will make higher peaking more tolerable. On weaker, noisier signals, where excessive peaking would accentuate the noise, the increased setting of the contrast control tends to apply the compensation more gently.

The PQC switch can be mounted at the rear of the receiver. Since one position generally is best suited to the viewer's taste and local conditions, the control is not likely to be used often, once set.

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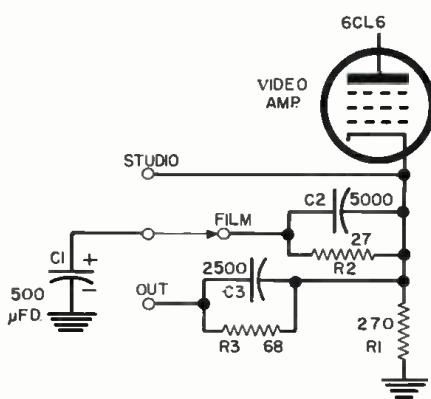
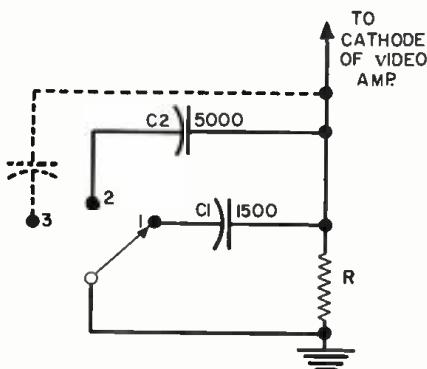


Fig. 6. A 3-position quality control.



Fig. 7. Trailing edge of square wave (A) before effect of compensation and after alteration (B, C, and D) by various positions of circuit in Fig. 6.

Fig. 8. A simple quality control that can be added to most domestic TV sets.



# Service Business Progress

By helping to bring individual goals into focus, association programs are often the key to

By WILLIAM LEONARD

**R**ECENTLY a couple of men were discussing the unusual success a mutual friend had achieved in a retail business. This man had started on a shoestring in a highly competitive field. In a period of less than ten years, he had built up a substantial establishment with an excellent credit rating.

"The main reason for his success," said one of his friends, "is the fact that he is an excellent navigator. He has a definite plan for progress. He has a knack for taking advantage of every event and every circumstance that can be used to focus attention on his business. He pilots his business like a good navigator, using every favorable wind or current that will help to speed it forward toward its predetermined objectives."

During the past five years, a remarkable change has occurred in the electronic service industry. Over that period, when most small businesses were feeling the pressures of economic attrition, the financial condition of thousands of electronic service dealers has shown a substantial improvement.

In analyzing the progress made during this period by electronic service dealers as business men, it is apparent that the dispersion of business management experience and knowledge through association contacts made an important contribution to the steady advance of the industry. For one thing, these association contacts crystallized the need for definite objectives. Out of the confusion in thinking that existed ten years ago, definite principles of service-business management and objectives for service as an industry are now clearly established and widely accepted.

The first problem any association must meet is that of educating and indoctrinating service dealers in its area in the basics of good service-business management. The most important of these basics is that no business can survive indefinitely if it cannot pay its bills and pay its owner a decent, living wage. Associations have proven that the key to survival in a service business is an adequate level of charges for time, knowledge, and overhead.

When a dealer joins an association and starts to take part in its activities, he immediately expands his own horizons of thought. He acquires new and broader perspectives. He is exposed to



new viewpoints on his own problems.

The influence of association participation on a new member is usually first reflected in a new appraisal of service pricing. Most dealers, working alone and out of touch with their competitors, fall prey to pricing fears. They are afraid they will lose business if they charge on the basis of their costs of doing business. They underprice their time and try to capture the needed income in other ways. The contacts a dealer makes in a service association prove to him that set owners do not buy price. They buy service—*reliable* service—and good customer relations.

In those areas where effective associations have been operating for a period of time, there has been a noticeable improvement in the financial status of the members who are active participants in the association's programs. The interchange of business operating information among members has served to establish the standards that are essential for profitable operation in the association's area. As one dealer puts it:

"I didn't realize how deep the rut was that I was in until I got acquainted with some of my competitors at our association meetings. I found that my thinking was about five years behind the times. Business wise, I was creeping along at a Model-T pace in a jet-propelled age."

There are forces constantly at work in our economy that will undermine any large and important activity, if these forces are permitted to continue

without opposition. The huge market for electronic service and the products involved have made it a prime field for erosive forces that will leach out the foundation necessary for stability. The only force that can stop this erosion is the combined efforts of all independent service dealers who are sincere in their desire to build stable, profitable businesses in handling electronic service work.

It took quite a few years for the association idea to click with a substantial number of independent electronic service dealers. The spirit of rugged individualism that was deep-rooted in the activity impelled many dealers to feel they were quite capable of running their own businesses without help from their competitors. As conditions steadily worsened in consumer TV service, however, there was a rapid acceptance of the idea that cooperation among dealers is the only way that conditions in the industry can be improved.

With associations now active in practically every state, service dealers are crystallizing the objectives that must be attained at local, state, and national levels. They realize that, if consumer service is to continue to provide opportunities for small establishments, changes must be made to bring about a cleaner and healthier economic atmosphere for established, legitimate, service businesses.

The well-organized, determined drives now being made in a number of states for laws to license electronic technicians and dealers represent one phase of the over-all program to put a firm foundation under the business of electronic servicing. One important objective of many of these proposed licensing laws is to get on record the names and addresses of everyone who does TV service work. Established dealers know that many people who do consumer TV service work do not pay the local, state, and federal taxes that are a part of the overhead burden of *bona fide* businesses. Association members feel that, if part-time technicians are forced to carry their share of the multiple tax load, they will have to price their time on a reasonable, competitive basis.

Many local associations, working closely with their Better Business Bureaus and municipal legal authorities, have been able to curb the activities of "gyps" and "fast-buck" operators in their communities. Many BBB's report that incompetence and indolence on the part of some part-time service technicians now are the major cause for consumer complaints about TV

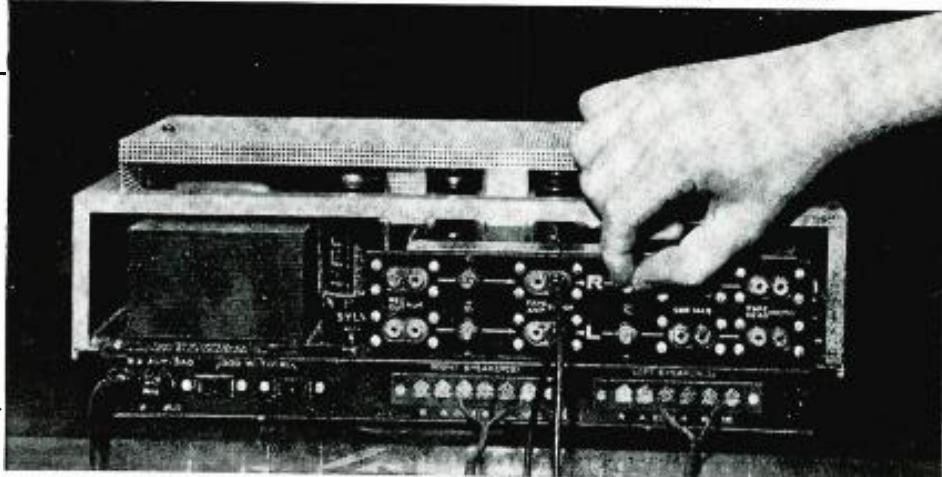
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Over-all view of the "Carillon"—a new dual 30-watt integrated stereo amplifier.

**ELECTRONICS WORLD**  
LAB TESTED

Rear view shows the arrangement of all input and output terminals.



**Attractive design and top quality performance are keynotes of Bell's new stereo amplifier.**

## "Carillon" Stereo Amplifier

ONE of the most recent additions to Bell's\* "Carillon" hi-fi line is the Model 6060 stereo amplifier. It is a dual 30-watt stereo amplifier combining preamplifiers and power amplifiers on a single chassis. There are several features in this unit that put it high on the list as a quality hi-fi component for sound reproduction.

One of its features is that it is possible to hook up two different stereo speaker systems which can be used either independently or together. A flip of the switch on the front panel provides any choice one might desire. This is of particular interest to those who would like to set up a stereo system in the living room, for example, and another in the den.

Like any other dual power amplifier this unit can be used with both channels in parallel providing 60 watts of power for single speaker system operation.

Another unusual feature that is incorporated in this design and one which we have not run across with other similar units, is that the power transformer includes an additional primary tap that permits compensating for differences in power-line voltage. This point is not covered in the operating instruction manual supplied by the company but details are shown on the schematic diagram. This shows two taps—one for 125 volts and the other

for a 117-volt power-line source. The units are apparently shipped with the higher voltage tap connected in the circuit and it is advisable that the unit be used this way unless line voltage is low. There is a loss of power output when this is done but it is negligible and it does permit the tubes to coast at a lower "B+" voltage. This should mean fewer servicing problems over a longer period. If the power line is consistently below 117 volts, the tap should be changed.

For those who plan to use it in an open-faced cabinet, bookshelf, or even on a cocktail table, this unit rates well as far as attractiveness is concerned. It is obvious that much effort went into the mechanical design of the unit. The lever-type switches add considerably to the convenience of operation.

As to flexibility of operation, this stereo unit incorporates all the basic functions that are required. It does not include such features as individual volume control operation permitting mixing of different inputs, phase reverse, level indicators, special pilot lights, third channel output, or equalization for 3 1/2 ips tape. These are usually not found on an integrated unit but are sometimes available on systems that are made up of separate pre-amplifiers and power amplifiers.

The front panel has four lever-type switches for low filter, high filter, function, and choice of speaker. In addition, five rotary-type controls are in-

corporated for choice of inputs (selector), balance and loudness, volume level, and both bass and treble controls for each channel.

The over-all performance of the unit was exceptionally good. For test purposes we received the twelfth model off the production line. We could find no flaws in performance even though the unit was one of the very early units produced. In fact, the performance was really outstanding in the sense that all specifications that we measured were better than those published by the manufacturer. Bell has always been extremely conservative in all its published specifications. This should be clearly evident when we review the following results that we obtained.

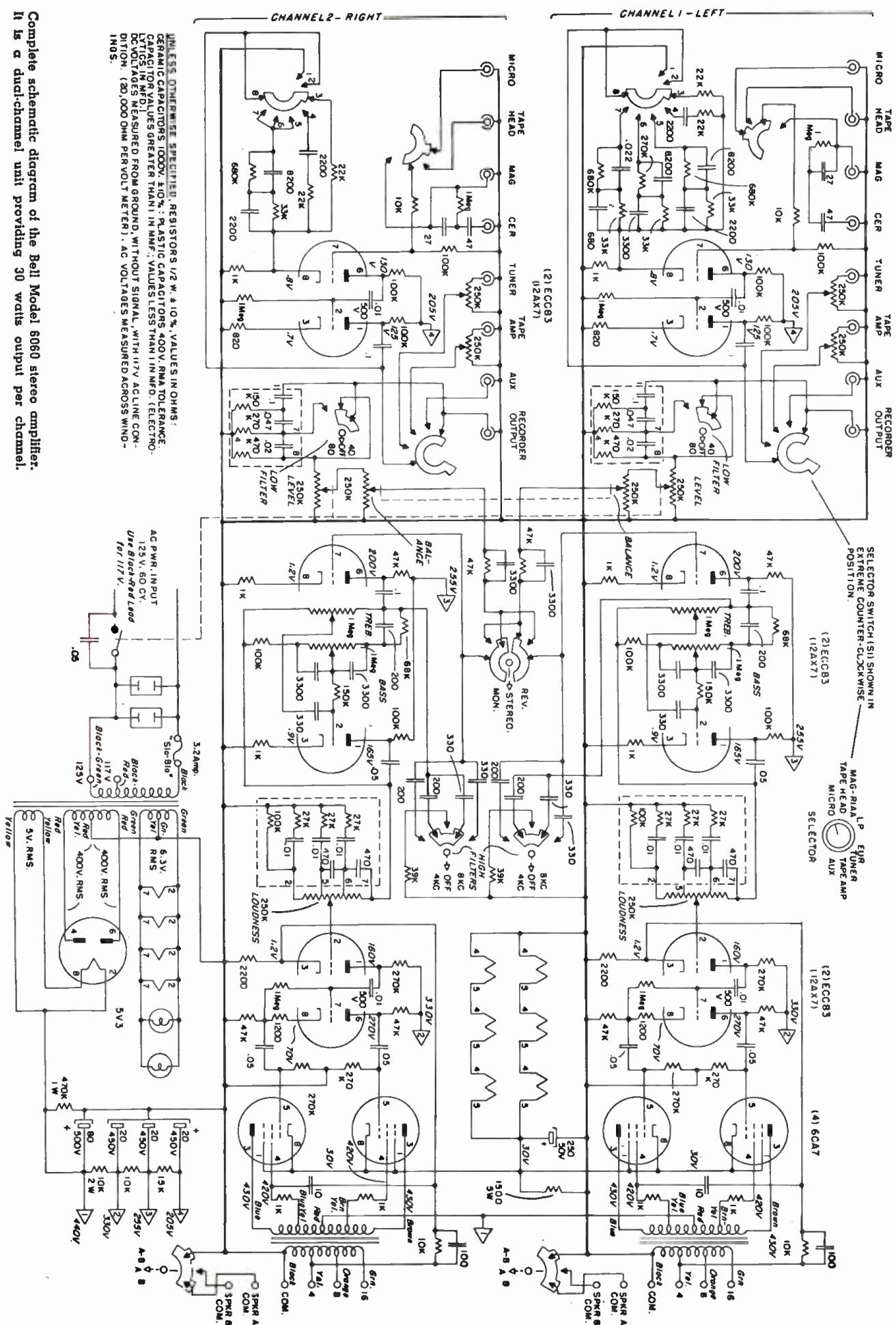
### Test Results

All of our tests, unless indicated to the contrary, were made using a 117-volt power source with the power transformer wired for 125 volts.

**Sensitivity:** All high level inputs, tuner, auxiliary, tape amplifier, and ceramic cartridge, .0425 volt; microphone input, .0023 volt; magnetic phono input, .0013 volt; and tape head input, .00088 volt. All of these figures are at 1000 cps and indicate the sensitivity for 2 watts output.

**Hum and Noise:** With .006 volt into the magnetic phono input and the level control set for 2 watts output, the hum and noise was -55.5 db, average for (Continued on page 114)

\* Bell Sound Division of Thompson Ramo Woolridge, Inc.



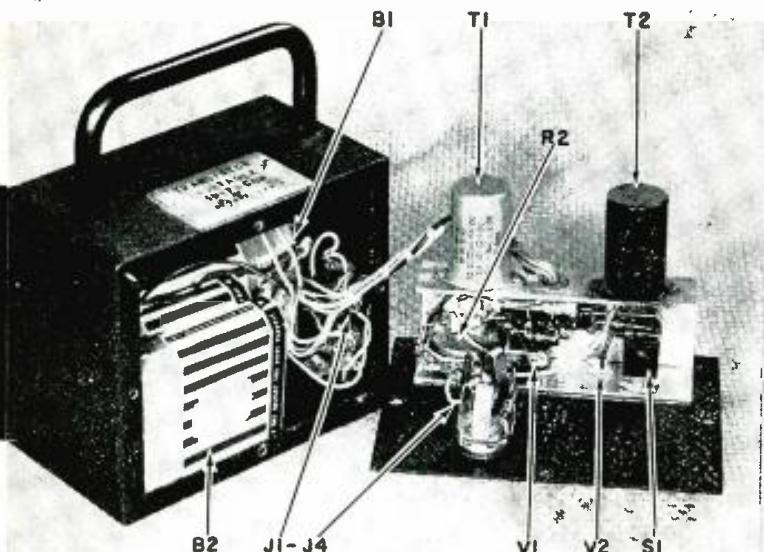
**Complete schematic diagram of the Bell Model 6060 stereo amplifier. It is a dual-channel unit providing 30 watts output per channel.**

UNLESS OTHERWISE SPECIFIED, RESISTORS 1/2 W. ± 10% VALUES IN OHMS;  
CERAMIC CAPACITORS 100PF. ± 10%; PLASTIC CAPACITORS 400V. RMS TOLERANCE  
CAPACITOR VALUES GREATER THAN 1 MM<sup>2</sup>. VALUES LESS THAN 1 MM<sup>2</sup>. (ELECTRICAL)  
DC VOLTAGES MEASURED FROM GROUND, WITHOUT SIGNAL, WITH 117V AC LINE CONNECTION;  
AC VOLTAGES MEASURED ACROSS WINDINGS.

# Portable Transistor Intercom

By WILLIAM F. KERNIN

Instrumentation Technician, Bell Aircraft Corporation



Inside view of the intercom unit with front panel removed.

**Simple, compact communications system for high-noise locations requires no switching.**

WITH the advent of transistors, life has become easier for those of us in the instrumentation field. The situations encountered in the aircraft industry where light, compact, and completely self-contained equipment is required are numerous—and increasing every day. It is only natural that transistorized equipment should be called upon to meet this need. The circuits to be described are of general interest since they represent the application of transistors to field equipment.

The circuit shown in Fig. 1 was designed to serve as the "heart" of a portable communications system for use in high-noise-level locations. Typical applications include use in vibration laboratories, rocket test cells, wind tunnels, acoustic test areas, jet warm-up areas, remote test locations—to name only a few. By using surplus T-30 carbon throat microphones and padded headphones with this amplifier, reliable and intelligible communication can be maintained in such areas. Furthermore, unlike typical intercoms, normal conversation may be carried on between any and all personnel patched into the amplifier without switching of

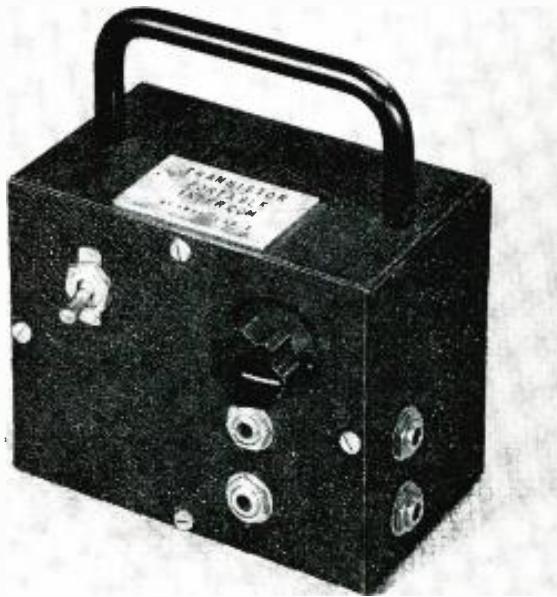
any kind. This means a man is free to work with both hands and little thought need be given the communications system.

Basically, the unit is a two-stage,  $RC$ -coupled transistor voltage amplifier. The signal from the throat microphone is fed to the volume control  $R_2$  through the impedance-matching transformer  $T_1$ . Voltage for the carbon microphone is obtained from the 3-volt battery,  $B_1$ , through the voltage adjust potentiometer  $R_1$ . It is adjusted to give the most intelligible output from the microphone. In most cases,  $R_1$  may be eliminated and the entire 3 volts used. From the wiper arm of volume control  $R_2$  the signal is fed to the base of  $V_1$  through the isolating capacitor  $C_1$ .  $R_3$  provides the proper base bias on the first stage CK722. The value of  $R_3$  may be varied for the lowest noise level; however, the resistance indicated proved to be suitable for all units constructed. The collector load for  $V_1$  is  $R_4$ . The output is coupled to the base of  $V_2$  by capacitor  $C_2$ . The base of  $V_2$  is biased by  $R_5$  and  $R_6$  to provide temperature stabilization and low internal noise level. In this case, it is

recommended that  $R_6$  be made temporarily variable, as shown in Fig. 3. Upon completion of the amplifier, adjust  $R_6$  for maximum amplification with minimum internal noise. A fixed resistor of proper value may then be mounted permanently in the unit.

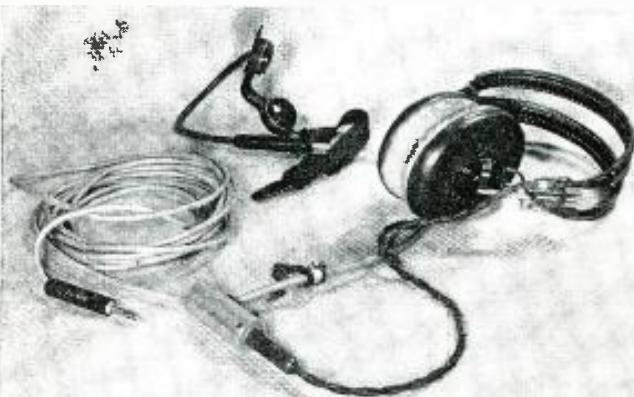
The output load of  $V_2$  is a UTC H-1 "Ouncer" transformer. This "Ouncer" has a primary d.c. resistance of approximately 3400 ohms and an audio impedance of 50,000 ohms. It has been used with very good results as the collector load for the CK722 or 2N107 type transistor in voltage amplifier service. The secondary winding provides the low impedance necessary to feed the headphones. (Note: The "H" series "Ouncers" are industrial units and if not stocked by your local parts jobber may be obtained on special order or equivalents used.)

Operating voltage for the amplifier is provided by two  $4\frac{1}{2}$ -volt batteries in series with the 3-volt microphone battery—giving a total of 12 volts. The first stage is decoupled from the second by means of  $R_7$  and  $C_3$ . The value of  $C_3$  shown is high, for it is a standard tantalum value. A lower value electro-



Over-all view of the transistorized portable intercom unit.

Harness worn by each man "patched" into portable intercom.



lytic may be used without any adverse effects.

500-ohm headphones are used in most installations but 2000-ohm units may be used with an increase in volume. Four T-30 mikes and four 500-ohm headphones have been used in parallel with no detrimental effects and little loss in volume. For remote locations, all that is required is a two-conductor, individually shielded cable of appropriate length. One conductor carries the microphone signal and the other the headphone signal while the shields are used as a common ground return. Runs up to 150 feet have been used with good results. The low impedance of the microphone and headset lines is beneficial since it insures freedom from electrical noise pickup.

The physical parts layout of the amplifier is not critical. The cabinet is a Bud CU 728-B black crackle finish steel box 3" x 4" x 5" with a good sized handle for ease and comfort in carrying.

There are a few things to watch in the wiring of the unit. The tantalum

used in the unit shown. These jacks are all connected in parallel and jacks may be added at the cost of reduced volume and shortened battery life for  $B_1$ . A typical harness for a throat microphone and headset is shown in one of the photos. Fig. 2 illustrates the wiring for such a harness. No specifications for construction are given since each installation may have to be "custom built." For many later harnesses, use was made of the coiled, kink-less cord similar to that used on telephone receivers. The feed cable of the harness is terminated in a PJ-068 telephone plug of the tip, ring, and sleeve variety to match the type JJ-033 jacks in the amplifier.

The total current drain on the two 4½-volt batteries is approximately 2 to 3 milliamperes depending on the value of the bias resistors. Their life therefore is long and little attention is required.  $B_1$  is the battery for the carbon microphones. The more microphones used, the more the current drain, thus, its life expectancy cannot be predicted accurately. However, with two harness

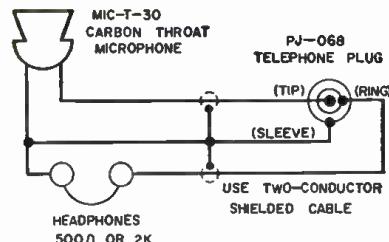


Fig. 2. Diagram of harness wiring used.

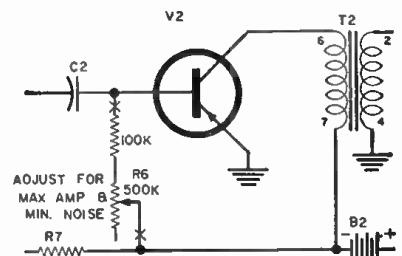


Fig. 3. Temporary bias-set network used.

sets in intermittent operation, battery  $B_1$  lasted approximately two months.

One last point. Notice that a person speaking through his throat microphone will hear himself in his own headset. At first thought, this may seem undesirable. However, in noisy locations—particularly high level noise areas—the ability to hear yourself talking provides a sort of human feedback system, that is, the speaker unconsciously maintains a level of speech that is agreeable to him and, incidentally, to his partner.

An interesting variation of the basic circuit is shown in Fig. 4. This circuit was developed for use with a crystal pickup and headphones as a "stethoscope" for instrument repair. Three major changes were made in the original circuit. A UTC H-10 "Ouncer" transformer is used for  $T_1$  to match the high-impedance crystal pickup to the low input impedance of  $V_1$ . Volume control  $R_2$  is now a 10,000-ohm unit. Finally, the output of  $V_1$  is coupled to the input of  $V_2$  by an H-1 transformer which increases the amplifier gain markedly. An  $RC$ -coupling network for

(Continued on page 81)

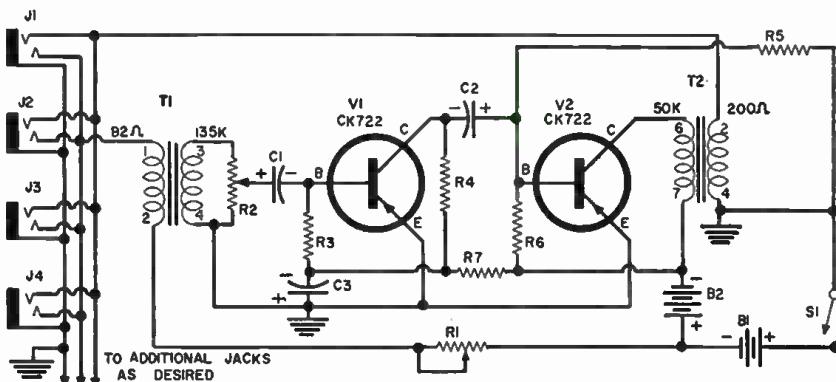


Fig. 1. Complete schematic diagram and parts listing for the portable intercom.

- $R_1$ —250 ohm, 2 w. pot
- $R_2$ —100,000 ohm audio taper pot
- $R_3$ ,  $R_5$ —220,000 ohm,  $\frac{1}{2}$  w. res. (see text)
- $R_4$ —10,000 ohm,  $\frac{1}{2}$  w. res.
- $R_6$ —3900 ohm,  $\frac{1}{2}$  w. res.
- $R_7$ —510 ohm,  $\frac{1}{2}$  w. res.
- $C_1$ ,  $C_2$ —20  $\mu$ fd., 10 v. tantalum capacitor or equiv. (see text)
- $C_3$ —70  $\mu$ fd., 15 v. tantalum capacitor or equiv. (see text)
- $S_1$ —S.p.s.t. toggle switch

- $J_1$ ,  $J_2$ ,  $J_3$ ,  $J_4$ —Type JJ-033 jack (see text)
- $T_1$ —Mike-to-grid trans. 82-ohm pri. to 135-000-ohm sec. (UTC H-2 or equiv.)
- $T_2$ —Line-to-grid trans. 200-ohm pri. to 50,000-ohm sec.—connected backwards in this circuit (UTC H-1, UTC O-1, or equiv.)
- $B_1$ —3-volt battery (Burgess #F2BP)
- $B_2$ —Two 4½-volt batteries in series (Burgess #5360)
- $V_1$ ,  $V_2$ —“p-n-p” transistor (CK722, 2N107, or equiv.)

capacitors  $C_1$  and  $C_2$  must be connected with the polarity shown otherwise very low volume and distortion will result. Tantalum capacitors were used because of their small size and large capacity, but the usual electrolytics may be substituted if desired. The transistors are soldered into the circuit, providing a more reliable and rugged piece of equipment. Holding the transistor leads with a long-nose plier between the transistor and the soldering iron while soldering them into the circuit will prevent heat damage. Most important of all, be sure to connect the batteries with the polarity indicated.

The input and output connections to the amplifier are provided by means of one jack per party. This is a three-terminal tip, ring, and sleeve jack to provide microphone input, headphone output, and common ground connections respectively. Four such jacks are

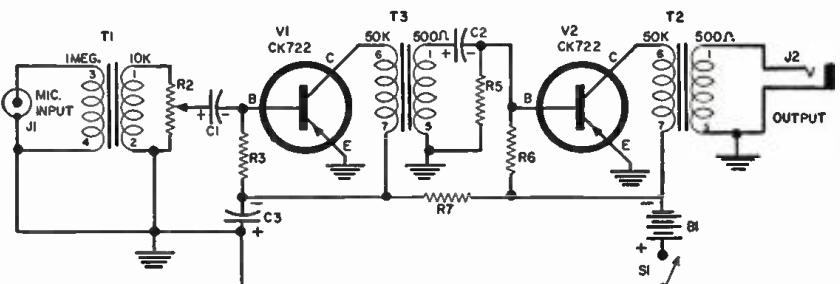
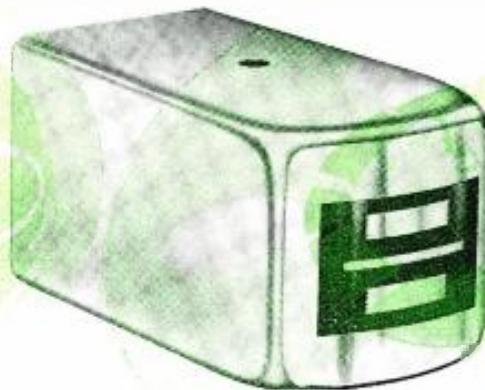


Fig. 4. Schematic diagram and parts for high-gain instrument amplifier discussed.

- $R_1$ —10,000 ohm audio taper pot
- $R_2$ —220,000 ohm,  $\frac{1}{2}$  w. res.
- $R_3$ —3900 ohm,  $\frac{1}{2}$  w. res.
- $R_4$ —220,000 ohm,  $\frac{1}{2}$  w. res. (see text)
- $R_5$ —510 ohm,  $\frac{1}{2}$  w. res.
- $C_1$ ,  $C_2$ —20  $\mu$ fd., 10 v. tantalum capacitor or equiv. (see text)
- $C_3$ —70  $\mu$ fd., 15 v. tantalum capacitor or equiv. (see text)
- $J_1$ —Input jack (Amphenol 75PC1M)
- $J_2$ —Output jack (Type JJ-034)

- $S_1$ —S.p.s.t. toggle switch
- $T_1$ —Mike-to-grid trans. 10,000-ohm pri. to 1-megohm sec.—connected backwards in this circuit (UTC H-10, UTC O-15, or equiv.)
- $T_2$ ,  $T_3$ —Line-to-grid trans. 500-ohm pri. to 50,000-ohm sec.—connected backwards in this circuit (UTC H-1, UTC O-1, or equiv.)
- $B_1$ —Two 4½-volt batteries in series (Burgess #5360)
- $V_1$ ,  $V_2$ —“p-n-p” transistor (CK722, 2N107 or low-noise equivalents)

**Here is what some of the very newest extra-small-gap heads can do with quarter-track tape when operated at speeds of only 3.75 inches/sec.**



Here are examples of new quarter-track record/playback (left) and erase (below) tape recorder heads.



# Slow-Speed Tape Recording

By JOHN W. HOGAN

Chief Engineer, The Nortronics Co., Inc.

**EDITOR'S NOTE:** From reports filtering in to our office it seems that the tape industry will direct its attention to the use of quarter-track tape at a speed of 7.5 ips. The 3.75 ips speed seems to be out of the picture at the present time as far as recorded stereo tape is concerned. It is certainly possible that with further improvements in techniques, equipment, and tape the 3.75 ips speed will make the grade. This may take one or two years. For further thoughts along these lines see "Sound on Tape" on page 110 of this issue.

In spite of this feeling, it is still interesting and important to know what the new extra-small-gap heads can do when used with the slow-speed (3.75 ips) tape. The following article gives this information.

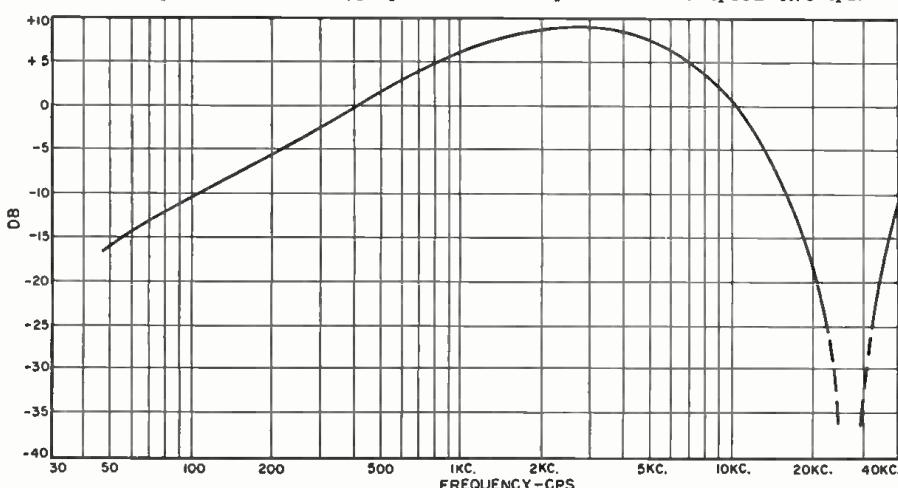
WHEN two large tape recorder manufacturers released specifications on a four-track, 3.75-ips system last year, the impact was sufficient to cause a complete re-appraisal of the medium by other members of the tape recording industry including equipment manufacturers, dealers, distributors, tape-music suppliers, and, of course, audiophiles and other ultimate users of tape recorders. As of this writing, several machine manufacturers are supplying reel-type machines that will operate at 3.75 ips and incorporate "quarter-track" heads for this type tape. In a few cases, recorder manufacturers have provided a vertical head mechanism that enables the quarter-track head to be shifted to a center

position for playback of the older half-track stereo tapes. As an alternate plan, other manufacturers are supplying both half-track and quarter-track heads on the same machine.

Performance evaluation of quarter-track, 3.75-ips operation is a difficult task. In direct comparison with stereo discs, the new tape system offers advantages common to any tape unit. These include: negligible quality deterioration with extensive playing, professional cross-talk rejection characteristics, excellent dynamic range, and good frequency response characteristics. Recent LP discs are capable of high-fidelity performance—particularly when new and in good condition. Unfortunately, the basic noise level and corresponding usable dynamic range may deteriorate so that some audiophiles "tape" their new stereo discs and preserve the original. Channel cross-talk rejection on the finest stereo disc systems is only 20 to 30 db while even the poorest tape system betters this figure by at least 10 db.

Compared with 7.5-ips, half-track tape, the new tape system requires careful analysis. In the first place, only a few manufacturers of 7.5-ips recorders have taken advantage of the full potential of the basic tape recording art. Most machines use single laminar heads which are characterized by excessive core losses and subsequent reduction in dynamic range. Amplifiers, in many cases, are not properly equalized and, generally, the inherent tape noise level—which should determine the noise in the basic system—is exceeded by amplifier hum and noise. In

Fig. 1. Constant-current-record, unequalized-playback characteristics for Model TLD-L laminated quarter-track record/playback head. Tape: 3M's 190; speed 3.75 ips.



the author's opinion, a well-designed, quarter-track, 3.75-ips machine using laminated heads, properly adjusted bias and equalization characteristics, and precision drive components is capable of providing equal or superior performance to many of the recently manufactured 7.5-ips machines.

The high retail prices of recorded music tapes have damped the enthui-

siasm of many audiophiles and music lovers. Adoption of the lower speed and the narrower track widths will provide one answer to this cost problem and, in all probability, open the tape recording field to the popular music market as well.

### Technical Considerations

Keeping in mind these factors, let's consider a few of the technical problems involved in the design and manufacture of components for tape recorders in the medium-priced field. We will discuss record/playback and erase heads, amplifiers, as well as integrated systems for quarter-track operation. Record/playback head design, production, and limitations will be covered in some detail since this component is of such basic importance in any system designed for high-fidelity performance. In other words, no amount of engineering ingenuity or production "gimmicks" can offset the liabilities of inadequate head performance in a tape recorder.

### The Heads

A basic description of a magnetic recording head is simple. It consists of a closed core assembly with a precisely lapped and spaced gap over which the tape passes during the recording and/or playback process. The head also includes a winding assembly consisting of multiple turns of copper wire to energize the head on recording and provide the induced voltage on playback.

When the head is used exclusively for playback, the effective gap should be small enough so that it doesn't approach the wavelength of the highest frequency on the tape. Fig. 1 shows a constant-current-record, unequalized-playback curve of a laminated quarter-track head at 3.75-ips. The effective gap coincides with the null reading at 28 kc. and is, therefore,  $3.75/28000$  or .000134 inch. The actual or mechanical gap on a head of this type, as checked under a microscope, measured .000090

frequency null, occurring when the wavelength on the tape equals the effective gap, will be twice the highest frequency desired. Thus, Fig. 2 represents a head well suited to 14 kc. playback performance with a quarter-track system at 3.75 ips.

In actual playback operation, the highly permeable structure of the head offers a relatively easy path for flux from the tape section that spans the gap. Tape motion across the gap causes the varying magnetic strength of the recorded flux signal to be transferred through the core and thereby generate a voltage in the associated winding as:

$$e = -N \frac{d\phi}{dt}$$

Since the induced voltage amplitude is proportional to frequency, a constant-flux recording will result in a uniformly rising output of 6 db or two times per octave. Two basic types of losses will completely alter the picture. The first of these, wavelength or gap losses, has already been briefly discussed. Here, as the physical wavelength of the recorded flux signal gradually approaches the effective gap, the induced voltage will approach a minimum or zero value, depending on the parallelism of the two gap surfaces.

The second group of losses are classified as electrical or frequency losses. They include core losses, such as eddy current and hysteresis losses, and copper losses in the winding. Other related factors that cannot be readily defined as losses and yet affect performance include capacitance, resonance effects, etc. Fig. 3 shows the composite effects of these various losses at 3.75-ips speeds.

Curve 1 in Fig. 3 shows a 6 db-per-octave curve. If there were no losses during recording or playback, a constant-current (flux) recording would produce this type of response from an open-circuit playback head into a voltmeter. Curve 2 includes nominal losses introduced during the recording proc-

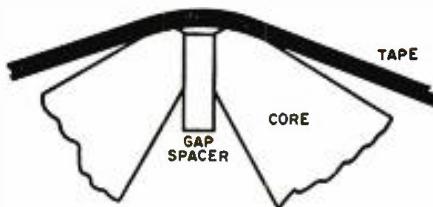


Fig. 2. Enlarged drawing showing how improper finishing will produce a large difference between mechanical and effective gap.

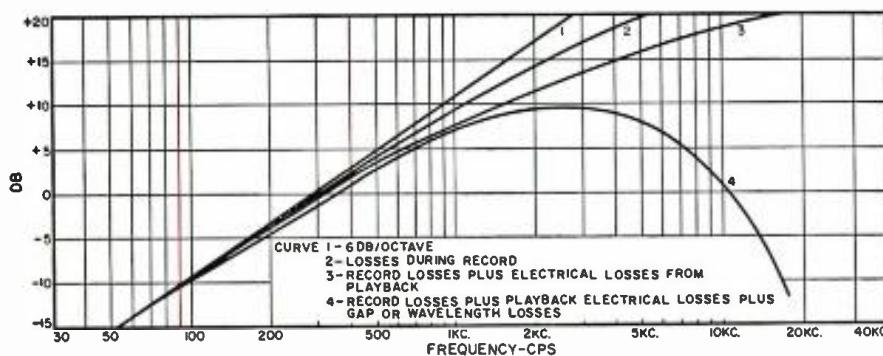


Fig. 3. Effect of losses during record and playback to show how resultant constant-current-record, unequalized-playback response differs from 6 db per octave rise.

Fig. 4. Curve showing how the signal current is combined with the bias current.

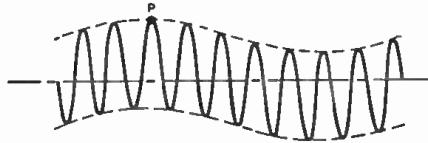


Fig. 5. Curve showing particles of the medium as they are carried through first an increasing field due to the tape entering the record head gap (points S, 2, 3, and 4) and then through a decreasing field when the tape leaves the record head gap (points 5, 6, and F). Point F represents the remaining magnetization.

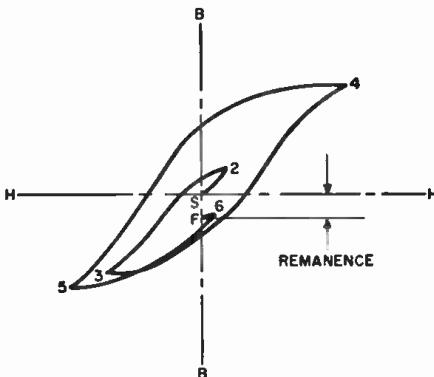
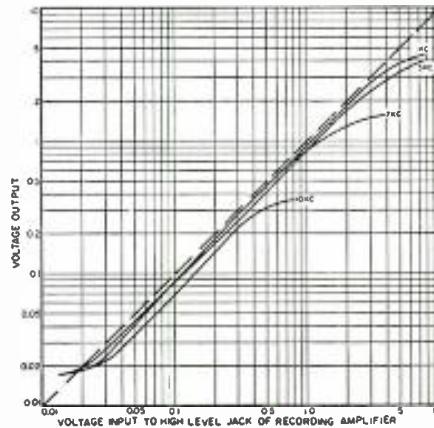


Fig. 6. Equalized input-output, record/playback curves for a quarter-track, 3.75 ips system at various frequencies. The record and playback equalization and bias settings are as shown in Fig. 8. Dashed curve is ideal. Each decade is 20 db.



ess. These will be described later in more detail. Curve 3 shows the effect of electrical or frequency losses on playback over and above those sustained in recording. Curve 4 shows the resultant of all these losses plus playback loss from gap or wavelength effects and is the same curve that was obtained experimentally in Fig. 1. Other factors which enter into playback performance include: tape-to-head contact, dirt, misalignment, etc.

A magnetic recording head designed specifically for recording applications would differ from a playback head in two respects. First, it would have a larger gap length to allow the medium to be subjected to several bias cycles. This eases the bias and record current drive requirements and further allows a relatively thick conductive spacer material to deflect the bias and signal fields toward the medium.<sup>1</sup> The second general design requirement of a head to be used exclusively for recording is that the relative number of turns or head electrical impedance be low enough to reduce winding capacity losses; this is especially true when the higher bias frequencies are used. Professional tape recorder manufacturers will often use a core material for a record head that has higher flux handling capabilities than the high-nickel alloys used for playback heads.

The a.c. bias-record operation is complicated and a thorough explanation of the principles involved would require more space than can be spared here. The basic point to remember is that the

bias and signal fields are added together in the recording operation. This is shown in Fig. 4. Considering a given point in time as *P* and remembering that several bias cycles occur as the tape passes across the gap, the action of entry and exit of tape coinciding with time point *P* would be to expose the tape particles to first an increasing intensity bias field (the signal may be considered as a d.c. component effectively deflecting the bias field upward at the point *P*) and then a decreasing field as the particles under consideration leave the gap area. As the particles are carried through this series of increasing and decreasing hysteresis loops, the ultimate remanence is represented by *F* in Fig. 5.

Any discussion of recording techniques requires consideration of bias frequency and amplitude. The bias frequency should be at least four or five times the highest audio frequency desired. Reducing the frequency below this figure will generate beat frequencies that will ultimately result in audible distortion when any amplifier-circuit non-linearity is encountered. The amplitude of the bias signal current is extremely important in critical tape recording applications. It assumes even greater importance at low speeds because demagnetization due to overbiasing will have a relatively greater effect on high-frequency performance. Using too little bias will improve the relative high-frequency response but at the expense of signal-to-noise ratio and distortion. At 3.75 ips the correct com-

promise for achieving good frequency response, low distortion, and wide dynamic range or good signal-to-noise characteristics is a bias slightly below that figure which will give maximum response at 1 kc. well below the 3 percent distortion level. This is somewhat different from the standards set for professional recording at the higher tape speeds. In the latter case, bias is generally adjusted to a level somewhat above the value that gives maximum response at 1 kc.

As previously mentioned, losses occur during recording which contribute to a non-uniform magnetization level on the tape if the head is energized with a uniform magnetizing current. These losses fall into two groups: tape losses which cannot be compensated when the tape is magnetized to its upper limit; and electrical or frequency

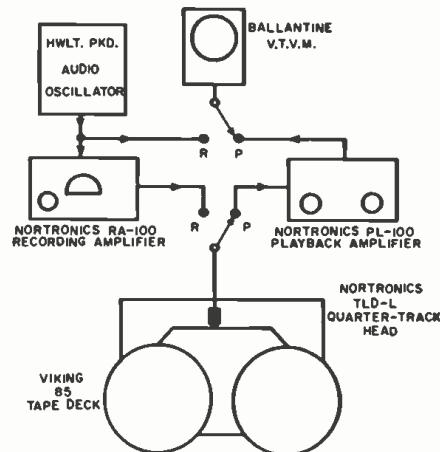


Fig. 7. Test setup employed for Fig. 6.

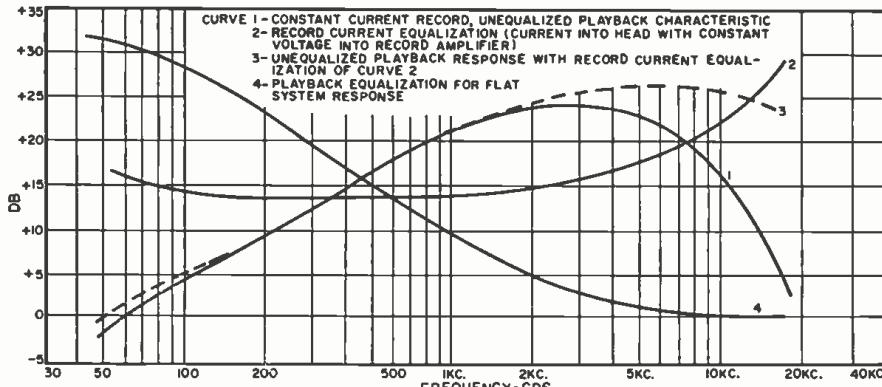
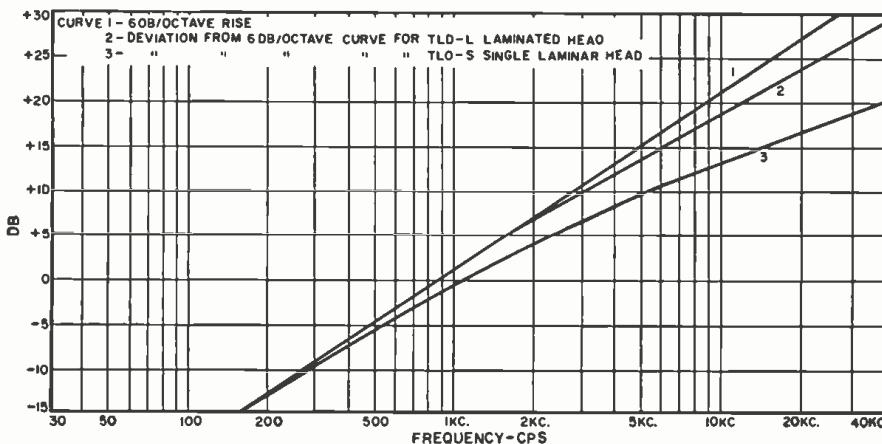


Fig. 8. Typical NAB-type equalization curves for laminated quarter-track head.

Fig. 9. Comparison between the new laminated head and the single laminar head.



losses and bias demagnetizing losses which can be counteracted irrespective of the recording level on the tape. The self-demagnetizing loss encountered when the tape leaves the recording head falls into the first category just mentioned.

The discussion thus far has been confined to the single-purpose, single recording or playback head. Far more common, even on some semi-professional recorders, are the combination record/playback heads. These heads are usually "weighted" toward the factors that make a good playback head. At 3.75 ips, however, even with effective gap lengths near .0001 inch, excellent recordings can be made. Bias voltage across the head must be maintained with low distortion. Correspondingly, uniformity of head design will be an important factor unless the manufacturer can adjust the bias and record currents individually so that they fall within the tolerances required by the performance specifications of the machine.

Several manufacturers have conducted extensive experiments to determine optimum equalization, dynamic range, distortion and frequency response characteristics for 3.75-ips operation. Their results have shown that precision in quarter-track record/

(Continued on page 119)

**B**ARNEY was trying to wrestle a tube from the radio he had just turned off. Suddenly it came loose from the tight grip of the socket, spun from between his scorching thumb and forefinger, and went flying across the service shop. It hit the wall, caromed off a TV cabinet, fell to the floor, and came to a spinning stop at Barney's feet.

"Didn't break!" he announced triumphantly as he stooped over and picked it up.

"Which is like gloating that your crystal isn't cracked after you've bounced your watch on a tile floor," Mac, Barney's employer, remarked sarcastically. "A transistor may take that kind of punishment but not a tube. Throw it away and put in a new one. Charge it off to the shop and to your butter-fingers."

"If it tests OK can't we still use it?" Barney asked.

"Nope," Mac demurred. "You know how often we get in a set with a cracked cabinet and a story that goes something like this: 'This set fell off the refrigerator a couple of weeks ago and cracked the cabinet, but it didn't hurt the radio a bit. It never stopped playing. However, yesterday it suddenly quit. While you're at it, you may as well get a new cabinet.'

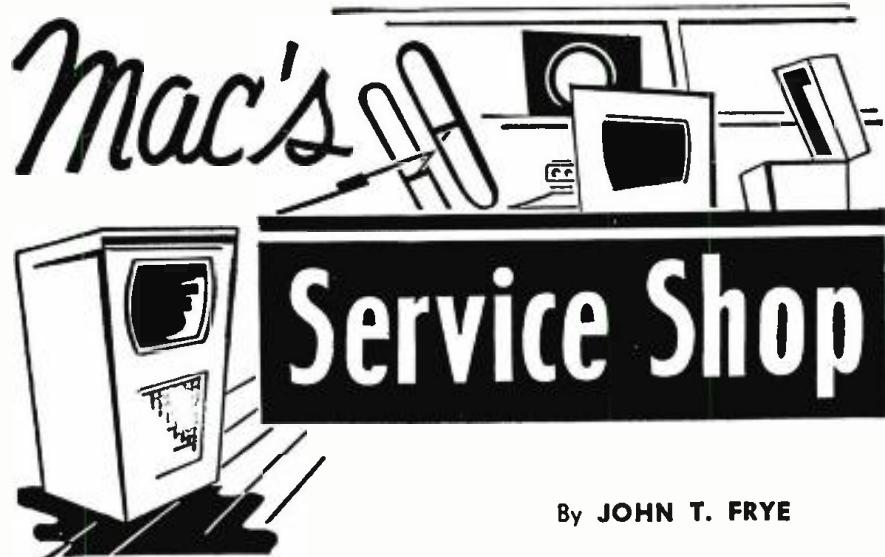
"We both know it was not coincidence that the tube failed shortly after the radio took a tumble. Even though the shock was cushioned by the tube's being in a socket, the jar was still sufficient to fracture or weaken the filament. It was only necessary to turn the set on and off a few times and expansion and contraction of the filament did the rest. You'll recall that when we replace a tube in such a set we always warn the customer other tube failures may show up soon as a delayed result of the radio's being dropped. If we're wrong, the customer is glad; if we're right, he has been prepared."

"You're the boss," Barney shrugged as he tossed the tube into the trash barrel and got a new one from stock.

"About now would be a good time for us to have a little heart-to-heart on the general subject of pulling tubes," Mac remarked as he leaned back against the edge of the bench. "You've displayed some distressing symptoms of becoming a bulb-snatcher lately."

"Who, me?" Barney exclaimed. "I don't go swiping light bulbs around here."

"I'm not talking about light bulbs; I'm talking about tubes," Mac explained. "As in everything else, there is one right way and about a dozen wrong ways of performing this simple, basic, service operation. A technician who deserves to be called such does it the right way. An untrained person who regards the tube as a 'bulb' because it lights up does it the wrong way. He isn't a tube puller; he's a bulb snatcher because he doesn't know any better. He doesn't appreciate the intricate, fragile nature of a tube nor its easily damaged socket. There is no such excuse for you."



By JOHN T. FRYE

## Bulb Snatching

"So what am I doing that's wrong?"

"Let's take what just happened. You had no business trying to pull that hot tube with your bare hand. It was too hot for you to hold on to it securely. That's why it flew out of your fingers. You were just too lazy to reach up for the tube-puller sitting within easy reach. Had you done so, you would not have burned your fingers, and the shop would not be out the cost of a new tube. How many times do I have to thump it into your pumpkin head that I want you *always* to use a tube-puller? Not only does it protect you against burns, but it also protects you from the ever-present possibility of having a tube break in your fingers and seriously injuring one of your most important servicing tools: your hand."

"OK; from now on I'll use your darned old tube-puller. Now are you happy?"

"No, because I don't believe you. You'll get in a hurry again and do the same thing over. But even when you do use the tube-puller you still manage to goof. You wrestle that tube around and around like a dentist trying to extract a stubborn molar. Remember there's one basic difference between you and the dentist: he doesn't have to put back what he is taking out of the socket; you do. If you yank the tube this way and that to get it out, the pins are not only bent out of shape but the socket itself takes a terrific beating."

"But look, Boss: some of those tubes are darned hard to get out. You don't just lift them out with your thumb and little pinkie like plucking an olive out of a big jar."

"Granted; but you still don't have to pry them sideways so far the pins are bent. Rock them back and forth through a *small* arc, first one way and then the other; but don't push them over until the pins are clearing the socket holes on one side and are being bent at a forty-five degree angle with the tube base on the other. That's a dandy way to crack the envelope of

miniature tubes. Even if that doesn't happen, you spread the jaws of the tube socket receptacles so far apart they can't grip the tube pins when the tube is replaced. If you will only use the tube puller so you can get a really good purchase on the tube, you can lift it nearly vertically out of the socket with the aid of just a little rocking."

"How about loctals?" Barney asked with a look of low cunning.

"Now you bring up one of my pet peeves. I have never liked loctal sockets because the tube *must* be pushed sideways to break the lock. The strain this puts on the socket negates any advantage of holding the tube firm mechanically—at least in my book. You know that time after time we get a radio in here with loctal tubes in which every socket is making poor contact with the pins. Wiggling a tube slightly with the finger will produce excessive noise or actually make the set cut in and out. This is the rule, not the exception, with loctal tube receivers."

"Yeah," Barney agreed; "and don't forget that sinking feeling a technician has when a stubborn loctal tube finally does break loose and comes up with some of the guts of a broken socket still clinging to the pins!"

"Give the devil his due, though," Mac suggested. "Loctal and octal sockets have one big advantage: they certainly make it easy to replace a tube in a hidden socket."

"You can say that again. I don't know of anything more maddening than having to fumble around like a coon fishing in a crawdad hole trying to replace a miniature tube in a blind socket."

"There are a few things that help there, too. You've doubtless noted that some of the service literature actually shows the pin positions of the sockets. Half the battle is knowing you're holding the tube in the right position for the pins to slip into place when you do get lucky. If this information isn't

(Continued on page 74)

# Transistor-Regulated Power Supply

By PETER J. VOGELGESANG

Well regulated supply for transistor experimenters features adjustable current limiting. Output is from 3 to 25 volts at 1/2 amp., with less than 20 mv. ripple.

TRANSISTORS have replaced vacuum tubes in scores of conventional circuits and they have made possible the application of electronics to many problems which were not suited to the characteristics of vacuum tubes. As a result, engineers, technicians, and fellows who simply like to tinker with electronic gadgets are finding hundreds of new applications for the transistor.

Although most transistor circuits are intended to be battery operated, it is highly desirable to use an a.c.-operated power supply during the design and development stages. A power supply which will pinch-hit for a battery must be adjustable to the terminal voltage of the battery which will ultimately be used to power the equipment and it must have regulation sufficient to simulate the comparatively low source impedance of the battery. But a low source impedance can be a dangerous advantage when working with transistors. One wrong connection or an inadvertent slip of a test probe and an expensive transistor can be ruined in the wink of an eye. Thus, a good utility power supply for use with transistors should have good regulation, but it also should have an adjustable current-limiting device which will prevent transistors from acting as fuses.

The power supply shown in the photos will provide load-regulated output voltages from 3 to 25 volts and will deliver up to 1/2 ampere of current with an output ripple of less than 20 millivolts. Regulation is better than  $\frac{1}{10}$ th of 1% from no load to full load of 1/2 ampere. Moreover, the supply features a current-limiting circuit which can be adjusted to drop out at any current from 10 to 500 milliamperes, thereby

providing short-circuit protection for the power supply and protection for the transistors in the circuit being powered.

With conventional voltage-regulating circuits, it is very difficult to achieve voltage control over a wide range and at the same time achieve good regulation at any point in this range. The diagram of Fig. 1A illustrates the reason for this characteristic of a conventional circuit. The control amplifier is supplied two voltages—one from a reference voltage which will not change with line or load variations and the other from the wiper of a potentiometer connected across the power-supply output terminals. The control amplifier adjusts the current through the series regulator and causes the voltage on the wiper of the potentiometer to balance the reference voltage. Any change in load current is immediately compensated to maintain this balance, thus accomplishing regulation. The output voltage of the supply is established by the position of the potentiometer wiper.

But if the power supply is adjusted for high output voltage, the wiper of

the potentiometer is near the positive end and a variation of the output voltage is divided by the potentiometer. As a result, a much greater output voltage variation is required to produce the same compensating current that would be produced if the supply were adjusted for a low output voltage. Thus, the conventional circuit displays good regulation at low voltages but poor regulation at high voltages. Also, the minimum output voltage of the supply is necessarily greater than the reference voltage and the operation of the control potentiometer is so nonlinear that accurate adjustment at high voltages is very difficult.

Output ripple of a power supply is greatly suppressed by the degenerative characteristic of the regulating amplifier and, in fact, this characteristic can provide as much equivalent filtering as can the actual filtering circuit. But with the conventional circuit, the amplitude of the ripple fed into the regulating amplifier is again divided by the voltage control potentiometer and the supply will have a low percentage of output ripple when adjusted for low output voltage but will have much greater ripple at a high output voltage.

It is apparent that these undesirable characteristics are the result of the way in which output-voltage changes (both d.c. and ripple) are applied to the control amplifier. The diagram of Fig. 1B illustrates a superior method of feeding the control amplifier.

The reference voltage is a floating supply which is connected to the controlled side of the output of the power supply. One input of the regulating amplifier is fed by the wiper of a potentiometer connected across this

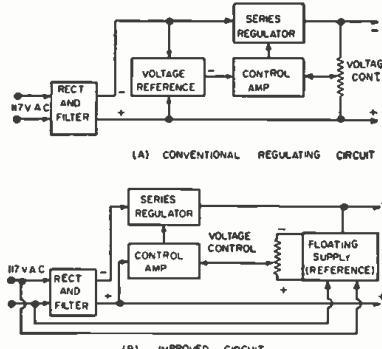
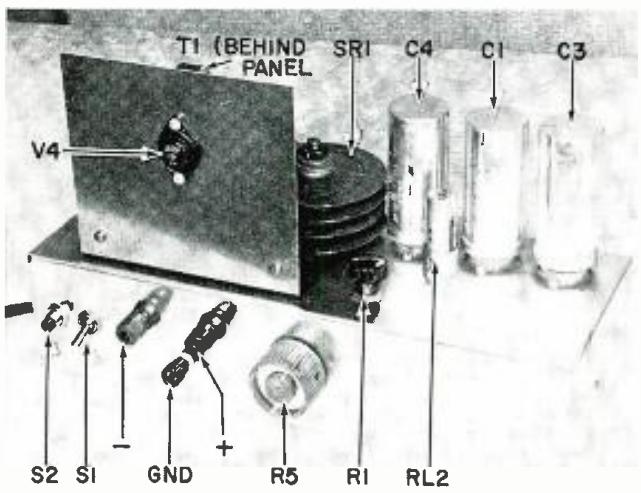


Fig. 1. Conventional and improved circuit.

Over-all views from front and rear show arrangement of parts. Note how transistor V<sub>4</sub> has been mounted.



floating supply and the other input of the amplifier is connected to ground. These inputs are balanced when the wiper of the potentiometer is set to a voltage which equals and opposes the output voltage of the power supply. With this circuit, the *entire* variation in output voltage and the *entire* value of output ripple is fed to the control amplifier because the whole reference supply "floats" with variations in output voltage.

A transformer with a 25-volt, 1-ampere secondary winding is used to develop the unregulated voltage for the supply. This voltage is rectified with a 1-ampere, full-wave, selenium bridge rectifier and is partially filtered by a 500- $\mu$ fd., 50-volt electrolytic capacitor,  $C_1$ . The rectified voltage is applied through the current-sensing resistor  $R_1$  to the collector of the output regulating transistor,  $V_1$ . The emitter of this transistor feeds the second filter capacitor,  $C_2$ , and provides the output of the power supply. The base of  $V_1$  is grounded through  $R_2$  to compensate for the leakage of the transistor.

Transistor  $V_3$  is connected as an emitter-follower to the input of  $V_4$ . The base of  $V_2$  is d.c.-coupled to the collector of  $V_3$ . These three transistors form an amplifier which has a current gain in excess of 10,000.

The base of  $V_3$  is connected through the floating supply to the output of the power supply. Variations in output voltage are thus applied to the base of  $V_3$ , and greatly amplified compensating currents are effected in  $V_1$ . Currents through the base of  $V_3$  are limited by  $R_a$  to prevent damage to the transistor, but capacitor  $C_2$  couples the full value of any instantaneous voltage change (including output ripple) into the control amplifier.

It is obvious that the output voltage of the floating supply (which is the reference voltage) varies with line voltage variations. Because line regulation was not considered an important feature in the applications for which this supply was intended, the floating supply was not regulated. This can be accomplished easily, however, by developing a slightly higher floating sup-

ply voltage and regulating it with a zener diode.

Because of the current-limiting circuit, the power supply is operated without a bleeder resistor. In spite of this, the output can be adjusted as low as 2 volts, although the supply does not regulate well below 3 volts.

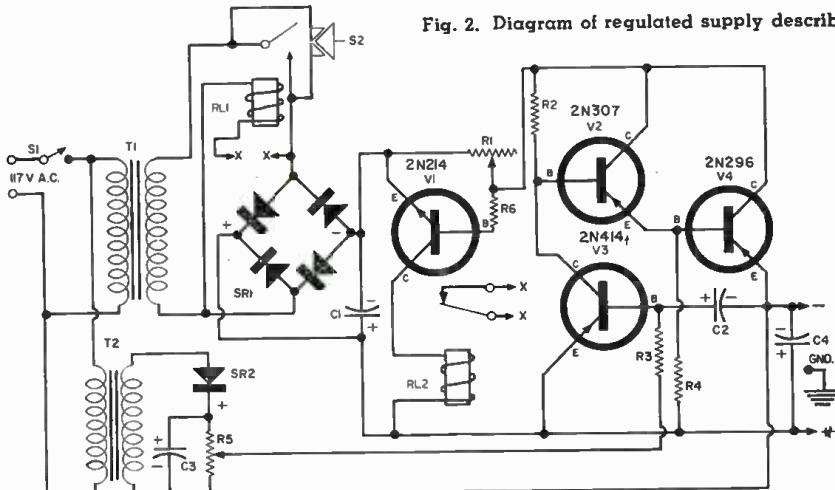
All current which is delivered by the power supply passes through resistor  $R_1$ , and the voltage drop across this resistor is proportional to the load current. An *n-p-n* transistor,  $V_1$ , is connected as a grounded-emitter amplifier to sense this voltage and to close relay  $RL_2$  when the output current reaches a predetermined value. With  $R_1$  adjusted for maximum resistance, a load current of 10 milliamperes will actuate the relay.

The normally closed contacts of  $RL_2$  are connected in the holding circuit of  $RL_1$ . If the contacts of  $RL_2$  are opened

by a current overload,  $RL_1$  opens and removes power from the rectifier and will remain open until it is reset by  $S_2$ . It is possible to reduce the resistance of  $R_1$  to such a low value that no reasonable load will actuate the circuit. A short-circuit, however, will load the power transformer instantaneously to such an extent that it will not continue to hold relay  $RL_1$  and the supply is thus protected from short-circuits even though  $R_1$  is adjusted for infinite current.

Because  $V_A$  is rated at 2 amperes, the current capabilities of the power supply at high voltage are limited by the current capabilities of the power transformer and rectifier. At low voltage, however, output current is limited by the dissipation of the transistor. Although the 2N296 is rated at a maximum of 25 watts dissipation, the temperature rise of the transistor degrades

Fig. 2. Diagram of regulated supply described.



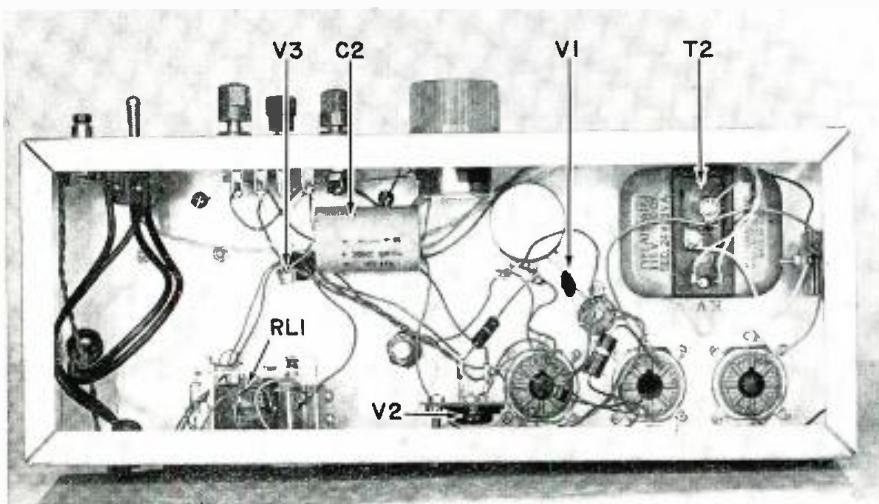
R<sub>1</sub>—20 ohm, 2 w. wirewound pot  
 R<sub>2</sub>—6800 ohm, 1 w. carbon res.  
 R<sub>3</sub>—2200 ohm, 1/2 w. carbon res.  
 R<sub>4</sub>—10,000 ohm, 1 w. carbon res.  
 R<sub>5</sub>—2500 ohm, 2 w. wirewound pot  
 R<sub>6</sub>—1200 ohm, 1/2 w. res.  
 C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>—500  $\mu$ fd., 50 v. elec. capacitor  
 C<sub>4</sub>—100  $\mu$ fd., 50 v. elec. capacitor  
 SR<sub>1</sub>—1 amp, 25 v. full-wave selenium rectifier bridge (an International Rectifier CR15DAGX can be used)  
 SR<sub>2</sub>—20 ma., 25 v. half-wave selenium rectifier bridge (an International Rectifier Q1H can be used)  
 RL<sub>1</sub>—S.p.s.t. relay, 25 v. a.c. coil, normally open

*RL2—S.p.s.t. relay, 5000 ohm (or more) coil, normally closed, plate-circuit type (author used s.p.d.t. unit, leaving second set of contacts unused)*

**S-1**=S.p.s.t. toggle switch  
**S2**=S.p.s.t. normally open push-button switch  
 $T_1$ ,  $T_2$ =Fil. trans. 117 v. pri., 25 v. sec. @  
 30 va. (Stancor P6469 or equiv. can be used.  
 Author used Minneapolis-Honeywell control  
 transformers)

$V_1$ —"n-p-n" transistor (*Sylvania 2N214*)  
 $V_2$ —"p-n-p" transistor (*Sylvania 2N307*)  
 $V_3$ —"p-n-p" transistor (*Raytheon 2N414*)  
 $V_4$ —"p-n-p" transistor (*Sylvania 2N296*)

This under-chassis view shows the simple, clean-cut wiring used in power supply.



this rating. With the 5" x 5" heat sink illustrated, it is not possible to dissipate more than 10 watts without exceeding the temperature rating of 85° C. Therefore, in determining whether or not the power supply will handle a particular load, the product of load current times the unused voltage of the supply should not exceed 10. It is possible to increase the low-voltage current capability of the supply by increasing the dimensions of the heat sink for  $V_4$ , but in any case, it is advantageous to mount the transistor near the front of the chassis where the temperature can be determined by touching it.

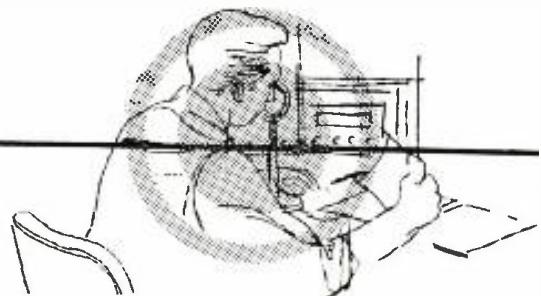
The power supply illustrated required a surprisingly small investment because of the availability of parts from surplus sources. Aside from the  
*(Continued on page 116)*

(Continued on page 116)

# A 1-kw. Final Power Amplifier

By HERBERT S. BRIER  
W9EGQ

This 10 to 80 meter r.f. amplifier will boost the output of a low-power ham rig to the legal limit.



LOW-POWER transmitters usually get out well when conditions are ideal but a bit more power is always helpful when conditions are unfavorable or when trying to raise those rare DX stations that always seem to answer the other fellow.

The r.f. amplifier described in this article will boost the output of a low-power transmitter to 1000 watts or any desired fraction of that amount. For inputs up to 1000 watts, two 813's in parallel are required while for inputs up to 500 watts, a single tube will do the trick. The 813's were selected because they perform well and are reasonably priced.

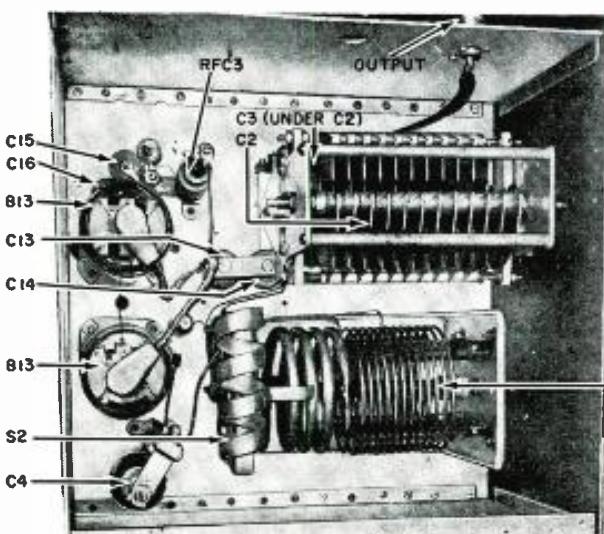
## The Circuit

As the schematic diagram shows, the amplifier is of the bandswitching type and covers the amateur bands between 3.5 and 29.7 mc. It performs equally well as a class C amplifier for c.w. and plate-modulated phone work and as a class AB<sub>1</sub> amplifier for boosting SSB and other low-level modulated signals.

Radio-frequency excitation is fed into the grids of the tubes via the bandswitched grid circuit. Table 1 gives specifications for grid-circuit coils.

A Barker & Williamson 850A inductor, with a built-in bandchange switch, is employed in the plate tank circuit. It is tuned with a 150- $\mu\text{fd}$ . 7000-volt variable capacitor and the output loading is controlled with a 1500- $\mu\text{fd}$ .

Top view of high-power final r.f. amplifier built by author.



variable capacitor,  $C_3$  on the schematic.

The 7000-volt rating of input capacitor  $C_2$  is sufficient for any mode of operation with up to 2500 volts on the plates of the 813's. A 4500-volt capacitor will be sufficient for c.w. and linear-amplifier operation; however, it will flash over in plate-modulated service at a plate voltage of 1500 volts.

The single 1500- $\mu\text{fd}$ . "loading" capacitor was found by test to be easier to adjust and more tolerant of mismatched loads than a smaller capacitor used in conjunction with additional fixed capacitors cut in and out of the circuit with a multi-contact switch. This capacitor is made by The Allen D. Cardwell Co. and may be ordered through most parts distributors.

The 813's are neutralized for stability in a capacitance bridge. To permit the screen voltage of the 813's to be self-modulated in plate-modulated operation, the voltage is fed to the screens through a 10.5-henry choke.

A built-in supply furnishes fixed bias for the 813's. This is the operating bias for AB<sub>1</sub> operation, but additional operating bias for class C operation is developed by the flow of the grid current through an additional resistor  $R_3$ . The filament transformer is also included on the chassis.

A switch,  $S_5$ , shorts out the screen choke and added grid resistor for class AB<sub>1</sub> operation.

Three milliammeters measure con-

trol grid, screen grid, and plate currents to the 813's. For safety, the plate meter is placed in the cathode circuit; consequently, it measures total cathode current. However, it is a simple matter to subtract the control grid and screen currents from the total to determine the actual plate current.

Precautions against television interference include complete shielding, making all d.c. and 60-cycle connections with shielded wire, and the generous use of bypass capacitors. In addition, all external connections are filtered before leaving the enclosure.

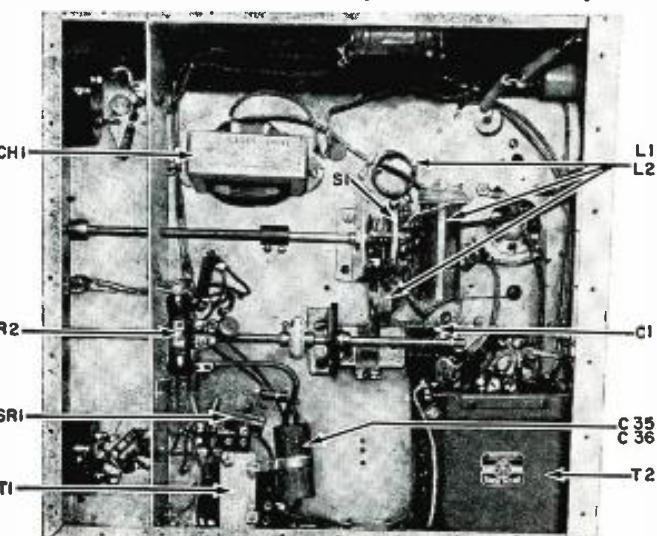
## Construction

The amplifier is constructed on a 14" x 13" x 4" aluminum chassis and a 19" x 12 1/4" x 1/8" aluminum panel. The chassis is formed by cutting three inches off one end of a standard 17" x 13" x 4" chassis and putting the open end against the panel. Actually, another inch could be shaved off the width and depth of the chassis without overcrowding the amplifier components.

The chassis is fastened to the panel with aluminum angle stock, 1" from the left edge of the panel and 1/16" from the bottom of the panel. When the bottom plate is in place, it is flush with the bottom of the panel.

The top of the chassis is enclosed in 1/16" aluminum. The two side pieces are 14" x 8" x 1/16" and the back is 13" x 8" x 1/16". They can be separate pieces or

Bottom view shows wiring and layout of the smaller components.



a single "U" bent from a single piece of sheet aluminum. The top and bottom plates are  $14'' \times 13'' \times \frac{1}{16}$ ". One-half inch flanges can be bent along the edges of the pieces of shielding to join them together or they may be joined with aluminum angle. The author used a combination of both methods.

Both the sheet aluminum and the  $\frac{3}{4}'' \times \frac{3}{4}'' \times \frac{1}{8}$ " or  $\frac{1}{2}'' \times \frac{1}{2}'' \times \frac{1}{8}$ " aluminum angle stock are available from the "do-it-yourself" racks of hobby shops and department or hardware stores.

The 6-32 x  $\frac{1}{4}$ " machine screws were used in preference to sheet-metal screws for joining the various pieces of metal together. They are spaced approximately  $1\frac{1}{2}$ " apart, with the angle stock and flanges drilled and tapped to accept the screws. The holes in the top and bottom plates are countersunk so that flat-head screws may be used with

five or thirty  $\frac{3}{16}$ " holes drilled above each tube.

The photographs show the positions of most of the amplifier components. However, a few measurements will be helpful. The plate inductor is mounted on the left of the chassis,  $1\frac{1}{2}$ " behind the panel with its shaft  $3\frac{3}{4}$ " from the left edge.

$C_3$  is mounted directly on the chassis about  $2\frac{1}{2}$ " behind the panel with its shaft  $3\frac{3}{4}$ " from the right edge.  $C_2$ , in turn, is mounted directly over  $C_3$  on brackets  $3\frac{1}{2}$ " above the chassis. The rear bracket is fastened to the rear of  $C_2$ , utilizing a pair of tapped holes already there, to provide a direct, low-resistance connection between the two capacitors, as well as supporting  $C_2$ .

The tube sockets are mounted on  $\frac{1}{2}$ " pillars above the chassis. Their centers are  $4\frac{3}{4}$ " in from each side of the chas-

sis and 2" from the bottom of the panel, while the screen meter is mounted with its center 2" from the right edge of the chassis and 3" from the top.  $S_3$  is positioned between the grid control,  $3\frac{1}{2}$ " from the bottom of the panel. The dial scales and other panel markings are from *Tekni-cal* decal sets.

### Wiring the Amplifier

As stated earlier, all connections carrying d.c. and 60-cycle a.c. are made with shielded wire. The conductors are bypassed (by .001- $\mu$ fd. disc ceramic capacitors) to the shielding where they enter and leave the chassis. The leads are strung along the chassis with the shielding grounded, wherever convenient, at soldering lugs under the various mounting screws.

The tube sockets are wired before

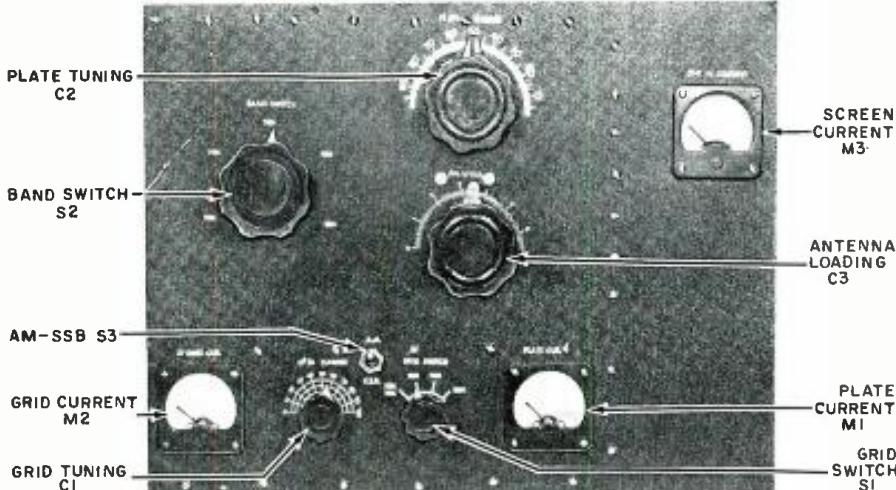
BAND	L <sub>1</sub>	L <sub>2</sub>
80 m.	46 t.	6 t.
40 m.	22 t.	3 t.
20 m.	8 t.	2 t.
10-15 m.	3 $\frac{1}{4}$ t.	1 t.
All L <sub>1</sub> coils are air wound of #18 tinned wire, 1" dia., 16 t. per inch (B & W "Miniductor" #3015). Two required.		
L <sub>2</sub> coils are wound of #20 plastic-insulated hookup wire, wound over L <sub>1</sub> coils at bypassed end and held in place with Duco cement. All coils supported by their leads.		

Table 1. Coil data for the amplifier.

	PLATE-MOD. PHONE	LINEAR (Class AB <sub>1</sub> )
Plate Voltage.....	.2250	2000
Screen Voltage.....	400	350
Plate Current (ma.).....	225	200
Grid Current (ma.).....	16	16
Screen Current (ma.).....	40	40

\*Adjust grid bias for 25 ma. zero-signal plate current.

Table 2. Voltage and currents obtained for three modes of operation.



Front panel view of the 1-kilowatt power amplifier, with parts identified.

them. The paint is removed from the panel at the points where the chassis and shielding touch it.

An aluminum partition inside the chassis, two inches from the front, separates the plate and grid meters and their r.f. filters from the rest of the amplifier components.

A surplus squirrel-cage blower, mounted on the side of the transmitter cabinet, cools the amplifier. It blows air into the chassis via a 3" diameter hole cut in the left side of the chassis. The hole is covered with metal screening to preserve the shielding.

The air flows up through 2" holes under each tube socket and  $\frac{3}{8}$ " holes drilled around the sockets, then around the tubes and out the top of the enclosure through a cluster of twenty-

six and  $1\frac{1}{2}$ " in from the back. Besides the 2" holes under the sockets and the  $\frac{3}{8}$ " ones around it, drill  $\frac{3}{16}$ " holes under the filament and screen terminals to accommodate the leads to them.

Under the chassis,  $S_1$  and  $C_1$  are mounted approximately eight inches behind the panel with their shafts five inches in from each side of the chassis and two inches from its top.  $S_1$  is mounted on a metal bracket and  $C_1$  is mounted on a piece of Bakelite for insulation.

One-quarter inch metal shafts extend the various controls to the front panel. All shaft couplings, except the one on  $C_1$ , are metal.

On the front panel, the grid and plate meters are mounted with their centers  $1\frac{1}{2}$ " in from the sides of the

being mounted. Insert 1" round-head screws through the socket mounting holes and place a  $\frac{1}{2}$ " bushing and a flat soldering lug on each screw, holding them in place with a nut on the screws. Solder terminal #5 of each socket to the nearest lug. Next, solder flexible shielded leads (about a foot long) to the filament and screen terminals (#1, #7, and #3), grounding the shield to the nearest solder lugs. Also, bypass these terminals with .001- $\mu$ fd., 2000-volt disc ceramic capacitors to the same solder lugs.

Turn the sockets so that the grid terminals (#4) face each other and determine how far apart they will be when the sockets are mounted, then connect them together with a length of heavy wire. Remove the nuts temporarily placed on the mounting screws and mount the sockets, threading the leads soldered to their terminals through the holes drilled in the chassis. Cut the leads to length and connect them to the appropriate points in the circuit.

Connect a #14 wire from the center of the wire joining terminal #4 of the sockets to the stator terminal of  $C_1$  and to the rotor terminal of  $S_{1A}$ . Next, connect a length of 52-ohm coaxial cable between the rotor terminal of  $S_{1A}$  and the r.f. input connector. Ground its shield at the switch end to a solder lug bolted to the switch assembly screw near the top of the chassis. Mount an insulated tie-point to this same screw.

Prepare the grid coils as indicated in Table 1 and connect them as shown in the diagram, positioning them as shown in the photograph of the bottom

view. The bypassed ends of the four  $L_1$  coils are terminated at the tie-point and the inner end of each link winding is grounded to the soldering lug. Connect the other ends of each winding to the appropriate terminals on  $S_1$ .

The tie-point and the bottom terminal of  $C_4$  are connected to the rotor terminal of  $C_1$ . This terminal is bypassed by a 500- $\mu\text{fd}$ . mica capacitor,  $C_5$ , and the negative grid bias for the 813's is fed into this point via  $RFC_1$ .

Other connections below the chassis can be determined from the circuit diagram. Use insulated tie-points where

necessary to support small components.

The connections in the plate circuit, indicated in heavy lines on the schematic, are made with  $\frac{1}{4}$ " wide copper straps cut from "flashing copper" obtainable at any sheet metal shop. A short length of copper strap connects  $C_{13}$  and  $C_{14}$  together and to the stator terminal of  $C_2$ . Short lengths of silvered copper braid, stripped from a length of RG-9/U coaxial cable, connect the other side of these capacitors to the 813 plate caps. As the tops of the tubes come fairly close to the

metal top of the box, insulated plate connectors should be used.

#### Adjustment and Operation

After the amplifier is wired, apply 117-volts a.c. and set the slider on  $R_2$  for -95 volts. Leave the "B+" and screen voltage leads disconnected. Turn the bandswitches to the 20-meter position and  $S_3$  to the AM/CW position. Feed 20-meter energy into the input connector. Tune  $C_1$  for maximum grid current, adjusting the exciter for about 20 ma. current.

Couple a sensitive r.f. indicator to the plate tank circuit and, with  $C_3$  set to maximum capacitance, tune  $C_2$  for maximum r.f. output. Using an insulated tool, adjust  $C_1$  for minimum output, peaking  $C_1$  and  $C_2$  from time to time to insure that they remain resonated. If an r.f. indicator is not available, after  $C_1$  is tuned for maximum grid current, adjust  $C_1$  for minimum flicker of grid current as  $C_2$  is tuned through resonance.

When the amplifier is neutralized, connect a load to the amplifier output terminal and tune the amplifier on the various bands with reduced plate and screen voltages applied.

Because of the relatively high output capacitance of two 813's in parallel, it is necessary to decrease the inductance of the 10-meter section of the plate tank inductor before it will resonate on 10 meters. To do this, remove the 4-turn coil from the circuit and twist it in your hands until it has five turns of reduced diameter. Straighten out the fifth turn and bend it to fit the original mounting screws. Drill a  $\frac{1}{4}$ " hole to mount it, cut off the excess material and remount the coil.

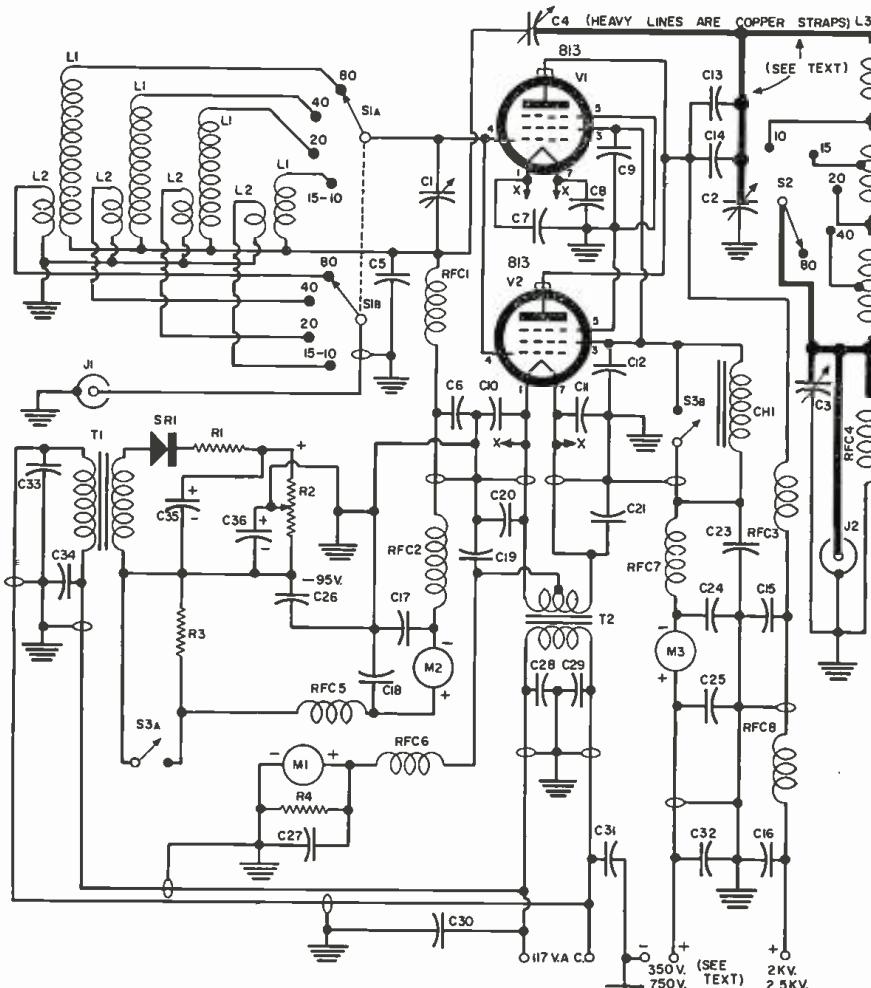
After pruning the coil and tuning the amplifier on 10 meters, still at reduced voltages, touch up the neutralization by carefully adjusting  $C_4$  until detuning  $C_2$  slightly to either side of resonance causes the grid current to decrease and plate current to increase. If neutralization is not exact, detuning  $C_2$  to the high-frequency side of resonance causes grid current to increase, indicating regenerative feedback.

After the amplifier has been tested at reduced voltages, they may be increased to normal values. Table 2 gives the maximum ratings for the 813 for different modes of operation.

The amplifier has been driven by a variety of low-power commercial and home-built excitors. Among them have been a modified Heathkit AT-1, a DX-20, and a Johnson "Adventurer." The power output of the excitors is controlled by varying the amplifier-tube screen voltage. At present, it is driven by a Johnson "Navigator" for c.w. and AM phone work and a Central Electronics "10A" for SSB work.

Used with a TVI-free exciter and with a good low-pass filter at the output connector, this amplifier causes no TVI to a television receiver sitting on top of the transmitter cabinet on any of the author's locally available channels (2, 5, 7, 9, and 11).

Fig. 1. Schematic of amplifier. A single 813 is used for input up to 500 watts.



$R_1$ —47 ohm, 1 w. res.

$R_2$ —2500 ohm, 25 w. res. with slider

$R_3$ —3000 ohm, 10 w. wirewound res.

$R_4$ —100 ohm, 2 w. res.

$C_1$ —150  $\mu\text{fd}$ . midget var. capacitor (Bud CE-2006)

$C_2$ —150  $\mu\text{fd}$ , 7000 v. var. capacitor (E. F. Johnson 150D70)

$C_3$ —1500  $\mu\text{fd}$ , 1000 v. var. capacitor (Cardwell #PL-8013)

$C_4$ —12.5  $\mu\text{fd}$ , 12.5 kv. neutralizing capacitor (E. F. Johnson N250)

$C_5$ —500  $\mu\text{fd}$ , 1250 v. mica capacitor

$C_6$ ,  $C_7$ ,  $C_8$ ,  $C_9$ ,  $C_{10}$ ,  $C_{11}$ ,  $C_{12}$ ,  $C_{13}$ ,  $C_{14}$ ,  $C_{15}$ ,  $C_{16}$ ,  $C_{17}$ ,  $C_{18}$ ,  $C_{19}$ ,  $C_{20}$ ,  $C_{21}$ ,  $C_{22}$ ,  $C_{23}$ ,  $C_{24}$ ,  $C_{25}$ ,  $C_{26}$ ,  $C_{27}$ ,  $C_{28}$ ,  $C_{29}$ ,  $C_{30}$ ,  $C_{31}$ ,  $C_{32}$ ,  $C_{33}$ ,  $C_{34}$ ,  $C_{35}$ ,  $C_{36}$ —.001  $\mu\text{fd}$ , 1000 v. disc ceramic capacitor

$C_7$ ,  $C_8$ ,  $C_9$ ,  $C_{10}$ ,  $C_{11}$ ,  $C_{12}$ ,  $C_{13}$ ,  $C_{14}$ ,  $C_{15}$ ,  $C_{16}$ ,  $C_{17}$ ,  $C_{18}$ ,  $C_{19}$ ,  $C_{20}$ ,  $C_{21}$ ,  $C_{22}$ ,  $C_{23}$ ,  $C_{24}$ ,  $C_{25}$ ,  $C_{26}$ ,  $C_{27}$ ,  $C_{28}$ ,  $C_{29}$ ,  $C_{30}$ ,  $C_{31}$ ,  $C_{32}$ ,  $C_{33}$ ,  $C_{34}$ ,  $C_{35}$ ,  $C_{36}$ —.001  $\mu\text{fd}$ , 2000 v. disc ceramic capacitor

$C_{20}$ ,  $C_{21}$ ,  $C_{22}$ ,  $C_{23}$ —500  $\mu\text{fd}$ , 20 kv. "TV" ceramic capacitor

$C_{24}$ ,  $C_{25}$ —1  $\mu\text{fd}$ , 600 v. a.c. capacitor (Sprague 80P3 "Hypass")

$C_{26}$ ,  $C_{27}$ —16  $\mu\text{fd}$ , 250 v. elec. capacitor

$C_{28}$ ,  $C_{29}$ —10.5 hy., 110 ma. filter choke (Stancor C-1001)

$L_1$ ,  $L_2$ —See Table I

$L_3$ ,  $S_1$ —Part of pi-network inductor (B & W 850A)

$RFC_1$ —2.5 myh., 125 ma. r.f. choke (National R125)

$RFC_2$ ,  $RFC_3$ ,  $RFC_4$ ,  $RFC_5$ ,  $RFC_6$ —7  $\mu\text{hy}$ . r.f. choke (Ohmite Z-50)

$RFC_7$ —225  $\mu\text{hy}$ , 800 ma. r.f. choke (National R-175A)

$RFC_8$ —1 myh., 300 ma. r.f. choke (National R300)

$S_1$ —D.p. 4-pos. rotary switch ceramic insulation (Centralab #2505)

$S_2$ —Part of plate-tank inductor

$S_3$ —D.p.s.t. toggle switch

$SR_1$ —65 ma. selenium rectifier

$J_1$ ,  $J_2$ —R. f. coax jack

$T_1$ —125-volt, 50 ma. trans., 117-volt a.c. primary (Stancor P48421)

$T_2$ —10-volt, 10-amp. trans., 117-volt a.c. primary (UTC S-62)

$M_1$ —500 ma. d.c. meter (2" size)

$M_2$ —50 ma. d.c. meter (2" size)

$M_3$ —100 ma. d.c. meter (2" size)

$V_1$ ,  $V_2$ —813 tube (see text)

Simply by checking  
all the tubes in the TV set with



# YOU CAN INCREASE YOUR INCOME

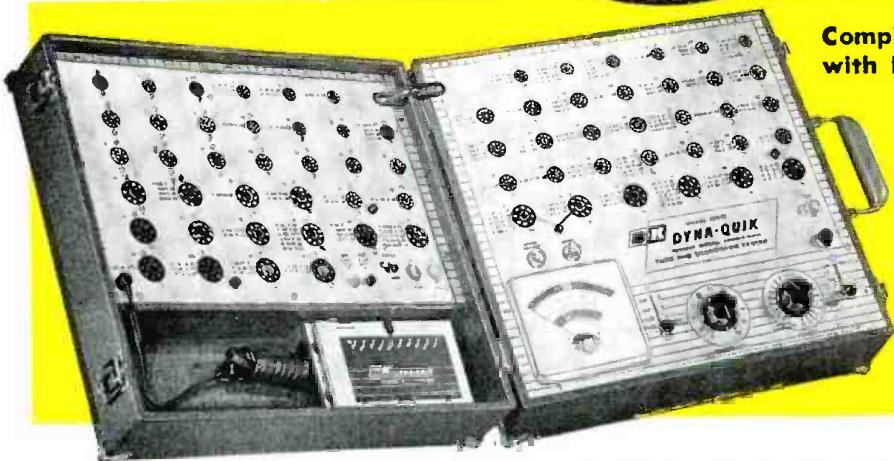
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Completely test each tube  
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Tests and Repairs  
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in a few minutes, right in the home, without re-  
moving tube from set. Restores emission. Checks  
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Test checks gas content and predicts useful life.  
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Model CR48 Adapter. For the new 110° tubes  
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## MEASURE TRUE DYNAMIC MUTUAL CONDUCTANCE

Thousands of technicians are doing a better servicing job  
and are making more money today with the famous  
B&K DYNA-QUIK. Completely tests each tube in seconds, with  
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tubes. Shows customer the true condition and life-expectancy  
of tubes in the set; sells more tube replacements per call.  
Assures customer satisfaction and protects the service guarantee.

### Model 650 Dyna-Quik improves servicing, quickly pays for itself

Checks over 99% of the tubes most widely used in television receivers,  
plus popular home and portable radio tubes. Tests over 500 tube  
types. Lists over 125 most commonly used tube types, with settings,  
on socket panels for maximum operating speed. Complete listing in  
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tubes separately for Gm, Shorts, Grid Emission, and Life. Tests each  
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check. Includes 16 spare sockets and sufficient filament voltages for  
future new tube types. Transistor Section checks junction, point contact  
and barrier transistors, germanium and  
silicon diodes, selenium and silicon rectifiers.

Net, \$169.95



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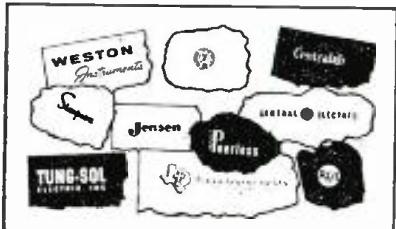
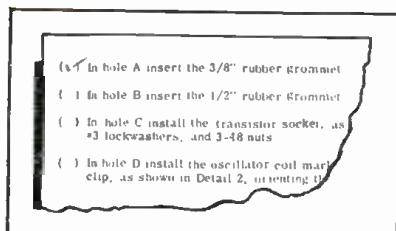
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### **BEST INSTRUCTIONS**

Recognized by leading consumer research organizations as the tops in the field of kit construction manuals, the Heathkit step at a time instructions leave absolutely nothing to question. Giant size pictorial diagrams and everyday, non-technical language make every Heathkit easy for anyone to build. No electronic or soldering experience is required; the Heathkit manuals teach you the right way to do a professional job the first time.

### **BEST QUALITY**

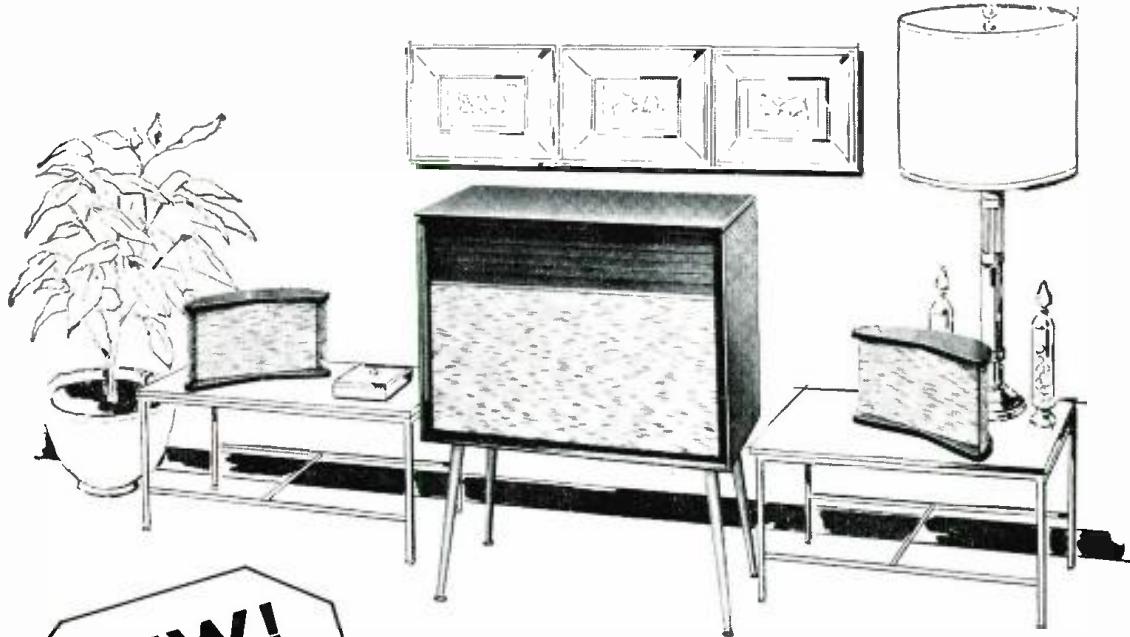
Only top quality, name brand parts go into Heathkit equipment assuring you of a finished product unsurpassed in performance, dependability and endurance. Rigid quality control standards are maintained at the Heath factory; all Heathkits are conservatively rated; no Heathkit performance claims are made that are not thoroughly proven and tested under the most stringent laboratory conditions. You can see as well as hear the quality of Heathkit . . . the neat layout, the sturdy panels and cabinets, the rugged, accurate parts . . . and when you're finished, the incomparable performance of your Heathkit . . . unmatched anywhere.

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The latest developments in circuitry and components are combined into Heathkit equipment that is designed from the start to be beginner built. The Heath engineers, first in the field of kit engineering, are constantly at work creating ever-easier paths to the best in kits for beginner building. New kits from the Heath laboratories are proof-built by beginners to field test the clarity of instructions, ease of physical assembly, and the attainment of advertised specifications. The praise-winning styling of all Heathkit equipment is universal in appeal, function, beauty.



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**BRAND NEW!**  
**a complete Heathkit Stereo "Package"**

**THRILL TO A NEW DIMENSION  
IN STEREO SOUND**

HEATHKIT SD-1 B (birch  
or SD-1 M (mahogany)

**\$179.95**

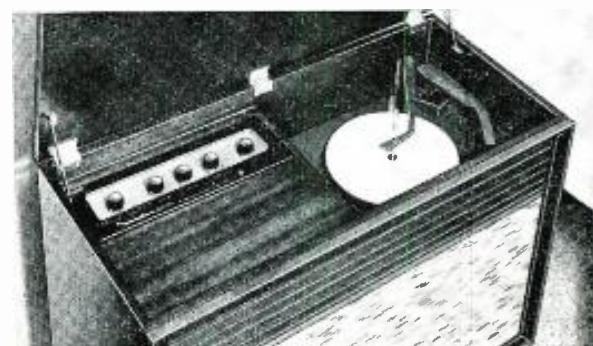
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**HI-FI STEREO SYSTEM KIT**

For the first time anywhere . . . a stereo-kit package, ready-to-play after only a few hours assembly time and complete with cabinet, stereo amplifier, stereo record changer, bass woofer and stereo speaker wings. And the unbelievably low price sets an unprecedented record for stereophonic systems of this quality anywhere on the market. One of the factors behind this phenomenal achievement is the introduction of the revolutionary stereophonic "sum and difference" amplifier used in this kit—licensed in kit form exclusively by Heath Company from CBS Laboratories. This unique development in audio science employs a new principle of stereophonic reproduction. The single chassis amplifier separates the individual stereo channels by utilizing the sum and difference of the total signal and directing the sound to the appropriate right and left channels, reproduced by the stereo wing speakers. The centrally located woofer reproduces the non-directional bass frequencies. The result of this modern stereo reproduction is a breathtaking experience of sound coming to you with depth and direction seldom achieved by conventional stereophonic methods. The beautifully styled console cabinet houses the stereo amplifier, stereo record changer and low-frequency woofer. Controls on the handsome black and gold amplifier panel consist of: on-off switch, bass and treble tone controls, input selector switch and level balancing control. The new CBS sum-and-difference or matrix-type circuit employs only four tubes and is extremely easy to assemble. The woofer, mounted behind the attractive grille cloth, is a high compliance 8" speaker capable of 30 cycle response when housed in the acoustically designed ducted-port enclosure. The specially designed crossover employs a dual bass-mixing 250 cycle network. The twin stereo speakers are 6" x 9" extended range dual cone oval speakers. The completely automatic, four speed record changer employs a ceramic stereo cartridge with micro-groove diamond stylus capable of obtaining the best from the latest stereo or LP monophonic recordings. A 45 RPM spindle is also included for 45 RPM monophonic or stereo records. Separate inputs are provided for AM/FM tuners or multiplex. Both in styling and performance, the all-new SD-1 Stereo offers you the greatest Heathkit value in years. Shpg. Wt. 88 lbs.

- Complete—No "Extras" to Buy
- Revolutionary Stereo Amplifier
- Assemble in Just a Few Hours From Easy Step-By-Step Instructions
- Beautifully Styled Cabinetry
- Stereo Sound With Such Impact You'll Find It Hard to Believe!

**SPECIFICATIONS**—Overall System Frequency Response:  $\pm 5$  cb. 30-16,000 cps. Amplifier: (push-pull conditions except where specified). Power versus Distortion: 10 watts, less than 3% THD from 30-16,000 cps. 9 watts, less than 2% THD from 30-16,000 cps. 1 watt, less than 0.7% from 30-16,000 cps. Peak Power: 20 watts; Mid-range individual channel power, 5 watts. Frequency Response: Tuner input, 1kc controls in mid-position, 1 watt level,  $\pm 1$  db. 30-16,000 cps. Ceramic cartridge circuit—equalized for RIAA characteristics. Input Sensitivity: 0.1 volt at 1000 cps to each tuner input for 10 watt output. Hum and Noise: 70 db below 10 watt level with input shorted. Channel Separation at Significant Frequencies: (2 watt level on operating side) 250 cps—29.0 db. 1 kc—34.0 db. 2 kc—35.0 db. 5 kc—36.0 db. 8 kc—37.0 db. 12 kc—35.0 db. 16 kc—29.0 db. Overall Channel Separation: using RCA test record #1427-1, cartridge supplied, 1000 cps, 20 db. Bass Tone Control 50 cps: accentuation 3 db. Attenuation 9 db. Treble Tone Control 10 kc: accentuation 9 db. Attenuation 7 db. Power Requirements: 117 volts, AC, 60 cycles, 75 watts. Crossover Network: crossover freq.—250 cps. Attenuation rate 12 db per octave. Power rating—5 watts per channel. Changer: speeds—16, 33 $\frac{1}{3}$ , 45, 78 rpm. Cartridge: ceramic stereo, out-of-phase corrected (.0398" diamond stylus). Cabinets: dimensions—main cabinet, 30" wide x 34 $\frac{1}{2}$ " high x 15" deep. Satellite speaker, 14 $\frac{1}{4}$ " wide x 8" high x 6 $\frac{1}{2}$ " deep.



**EASY TIME PAYMENTS**

The thrills of stereo sound from this New Heathkit Stereo System can be yours NOW . . . while you pay in easy installments.

a complete line of stereophonic and monophonic

**NEW!**  
from the  
HEATHKIT  
AUDIO LABS



# Tape Recorders

Field Tested for One Year



**SPECIFICATIONS**—Tape Speed: 7.5 and 3.75" per second. Maximum reel size: 7". Frequency response (record-playback):  $\pm 2.5$  db, 30-12,000 cps at 7.5 IPS.  $\pm 2.5$  db, 30-6,500 cps at 3.75 IPS. Harmonic distortion: 1% or less at normal recording level; 3% or less at peak recording level. Signal-to-noise ratio: 50 db or better, referred to normal recording level. Flutter and wow: 0.3% RMS at 7.5 IPS, 0.35% RMS at 3.75 IPS. Heads (3): erase, record, and in-line stereo playback. Playback equalization: NARTB curve, within  $\pm 2$  db. Inputs (2): microphone and line. Input impedance: 1 megohm. Outputs (2): A and B stereo channels. Output levels: approximately 2 volts maximum. Output impedance: Approximately 600 ohms (cathode followers). Recording level indicator: professional type db meter. Bias-erase frequency: 60 kc. Timing accuracy:  $\pm 2\%$ . Power requirements: 105-125 volts AC, 60 cycles, 32 watts. Dimensions: 15 $\frac{1}{2}$ " W. x 13 $\frac{1}{2}$ " D. Total height 10 $\frac{1}{2}$ ". Mounting: requires minimum of 8 $\frac{1}{2}$ " below and 1 $\frac{1}{2}$ " above mounting surface. May be operated in either horizontal or vertical position.

## NEW PROFESSIONAL-TYPE TAPE RECORDER KITS

Designed to take their place in the finest of hi-fi systems, the new models TR-1C and TR-1D Tape Recorders will provide superb performance for years to come. These completely field tested, precision engineered instruments provide monophonic record and playback in the TR-1C or monophonic record and playback plus stereo playback in the TR-1D.

The mechanical assembly, with fast forward and rewind, is completely finished and adjusted—you build only the tape amplifier. Easy to assemble, the amplifier features two circuit boards which virtually eliminate wiring errors and assure the high stability necessary for consistently good results.

Low noise EF-86 tubes in input stage and push-pull bias erase oscillator assure maximum freedom from hum and noise in recording and playback.

Two inputs are provided (mike and high level line) for recording from microphone, preamplifier, tuner, phono, or TV. In the TR-1D, a separate playback channel with cathode follower output is provided for each stereo track—one of the stereo channels is used for monophonic playback.

Separate record and playback heads and amplifiers allow monitoring from tape while recording. Built-in sound level meter indicates proper recording level and bias for top quality recordings. A pause control allows instant starting and stopping of tape for accurate cueing and tape editing. Kit includes counter for cueing and editing ease.

The precision tape mechanism features heavy duty fan cooled motor, balanced flywheel, long-life bearings, and positive acting braking system. Push button provides instant selection of 3/4 or 7 $\frac{1}{2}$  IPS tape speed. Safety interlock on record switch minimizes the possibility of accidental erasing. The handsome styling includes plastic escutcheon in soft gold mounted on semi-gloss black panel with black knobs with gold inserts. Complete instructions provided for assembly and operation. This outstanding kit offers a combination of features found only in higher priced professional tape decks selling for \$350 to \$400.

**MODEL TR-1C** Monaural Tape Deck: Has all features of model TR-1D with the exception of stereo playback. **\$159.95**

**MODEL TR-1D** Stereo Tape Deck: Provides monaural record and playback and stereophonic playback of the pre-recorded tapes (stereo). **\$169.95**

**MODEL C-TR-1C** Conversion Kit: Converts model TR-1C to include stereo function of model TR-1D. **Price to be announced.**

**Price to be announced.**

## NOW! TWO NEW STEREO-MONO TAPE RECORDERS IN THE TR-1A SERIES

Our most versatile tape recorder kit, the model TR-1A now can be purchased in any one of three versions. You can buy the new half-track (TR-1AH) or quarter-track (TR-1AQ) versions which record and play back stereo and monophonic programming, or you can buy the original monaural version (TR-1A) and add either half-track or quarter-track stereo provisions later using the MK-4 or MK-5 Conversion kits. The tape deck is extremely simple to assemble and uses precision bearings throughout the rugged mechanism assuring long and faithful service. One control lever selects all tape handling functions on the deck, greatly simplifying operation. Speeds of 7.5 or 3.75 IPS are available. Flutter and wow are held to less than 0.35%. Each tape preamplifier features NARTB playback equalization, separate record and playback gain control, cathode follower output and provision for mike or line input. Record level is indicated on "magic eye" tube. A safety interlock is provided to minimize accidental erasure of tape. Filament balance control allows adjustment for minimum hum level. Cathode follower output from playback channel is approximately 600 ohms impedance. Two circuit boards are used for easy assembly. Supplied with attractive vinyl-clad steel cover in black leather texture, with inlaid gold design. Templates and instructions provided for panel mounting or equipment enclosure installation.

### NOW AVAILABLE IN THREE MODELS!

**MODEL TR-1A:** Monaural record/playback with fast forward and rewind functions. Shpg. Wt. 24 lbs. **\$99.95**

**TR-1A SPECIFICATIONS**—Frequency Response: 7.5 IPS  $\pm 3$  db 50-12,000 cps. 3.75 IPS  $\pm 3$  db 50-7,000 cps. Signal to Noise Ratio: Better than 45 db below full output of 1.25 volts/channel. Harmonic Distortion: Less than 2% at full output. Bias Erase Frequency: 60 kc (push-pull oscillator).

**MODEL TR-1AH:** Monaural and half-track stereo record/playback with fast forward and rewind functions. **Price to be announced.**

**TR-1AH SPECIFICATIONS**—Frequency Response: 7.5 IPS  $\pm 3$  db 40-15,000 cps. 3.75 IPS  $\pm 3$  db 40-10,000 cps. Signal to Noise Ratio: 45 db below full output of 1 volt/channel. Harmonic Distortion: Less than 2% at full output. Bias Erase: 55 kc (push-pull oscillator).

**MODEL TR-1AQ:** Monaural and quarter track stereo with record/playback fast forward and rewind functions. **Price to be announced.**

**TR-1AQ SPECIFICATIONS**—Frequency Response: 7.5 IPS  $\pm 3$  db 40-15,000 cps. 3.75 IPS  $\pm 3$  db 40-10,000 cps. Signal to Noise Ratio: 40 db below full output .75 volts/channel. Harmonic Distortion: Less than 2% at full output. Bias Erase: 55 kc (push-pull oscillator).



### NOW! FULL STEREO CONVERSION FOR TR-1A OWNERS

**MK-4 Half-Track Stereo Conversion Kit:** Modifies TR-1A monaural tape recorder to include function of record and playback of half-track stereo program material. Consists of a TE-1 tape preamplifier, a stereo head array plus components and instructions to convert TR-1A to TR-1AH. **\$62.95**

**MK-5 Quarter-Track Stereo Conversion Kit:** Modifies TR-1A monaural tape recorder to include function of record and playback of quarter-track stereo. Allows playing stereo both ways on standard tape for twice the playing time or four times playing time with monophonic recordings. Consists of a TE-1 tape preamplifier, a stereo head array plus components and instructions to convert TR-1A to TR-1AQ. **\$62.95**



monophonic or stereo Hi-Fi



## Program Sources



**NEW**



MODEL FM-4  
**\$34.95**

**SPECIFICATIONS**—Tuning Range: 88–108 mc. Quieting Sensitivity: 2.5 uv for 20 db of quieting. 3.5 uv for 30 db of quieting. 25 uv for maximum quieting (45 db). IF Frequency: 10.7 mc. Image Ratio: 45 db. AFC Correction Factor: 75 kc per volt. AM Suppression: 25 db. Frequency Response:  $\pm 2$  db 20–20,000 cps. Harmonic Distortion: Less than 1.5%. 1100 uv, 400 cycles 100% modulation. Intermodulation Distortion: Less than 1%, 60 cycle and 6 kc mixed 4:1 1100 uv, 30% modulation. Antenna: 300 ohms unbalanced. Output Impedance: 600 ohms (cathode follower). Output Voltage: nominal .5 volt (with 30% modulation, 20 uv signal). Power Requirements: 105–125 volts 50/60 cycle AC at 25 watts. Overall Dimensions: 4 $\frac{1}{4}$ " H. x 13 $\frac{1}{4}$ " W. x 5 $\frac{1}{2}$ " D.



MODEL PT-1  
**\$89.95**



MODEL BC-1A  
**\$26.95**

### HIGH FIDELITY AM TUNER KIT (BC-1A)

Delivers AM broadcast reception comparable to FM quality. Features a special detector using crystal diodes and broad-band IF circuits for low signal distortion. Prealigned RF and IF coils eliminate the need for special alignment equipment. Sensitivity better than 3 microvolts for one volt output. Two output levels provided. Built-in power supply. Special antenna supplied, also provision for outside antenna. Shpg. Wt. 9 lbs.



MODEL FM-3A  
**\$26.95**

### HIGH FIDELITY FM TUNER KIT (FM-3A)

Featuring broad-banded circuits for full fidelity and better than 10 microvolt sensitivity for 20 db of quieting, the FM-3A pulls in stations with clarity and full volume. Incorporates stabilized temperature compensated oscillator, built-in power supply, prealigned IF transformers and ratio detector. The pre-assembled tuning unit is pre-aligned. Two output levels provided. Shpg. Wt. 8 lbs.

### NEW HIGH FIDELITY FM TUNER KIT (FM-4)

This superbly designed unit incorporates advancements in circuit design with features asked for by hi-fi fans everywhere. Better than 2.5 microvolt sensitivity, automatic frequency control (AFC) with defeat switch, flywheel tuning and prewired, pre-aligned and pretested tuning unit... bring you the finest in FM listening entertainment. The exceptionally clean chassis layout, pre-aligned IF transformers and the prewired, pre-aligned tuning unit insure ease of construction with no further need of alignment after the unit is completed. The five tube circuit features a generous power supply utilizing a silicon diode rectifier for cool running operation and low power consumption. The attractive styling of the FM-4 features a vinyl-clad steel cover with leather-like texture, soft black front panel, set off with brushed-gold trim and new soft evenly-lit dial scale. A multiplex adapter output is provided. Feature for feature the FM-4 offers the most outstanding dollar value in FM entertainment available today. Shpg. Wt. 8 lbs.

### MONOPHONIC-STEREO AM-FM TUNER KIT (PT-1)

Outstanding features in both styling and circuitry are combined in this 16-tube deluxe stereo AM-FM combination tuner to bring you the very finest of program sources for your listening enjoyment. Features include three printed circuit boards for easy construction and high stability—wired, pre-aligned 3-tube FM tuning unit—built-in AM rod antenna—tuning meter—automatic frequency control (AFC) with on-off switch—and flywheel tuning. Other features include variable AM bandwidth, 10 kc whistle filter, tuned-cascode FM front end, FM AGC and amplified AVC for AM. AM and FM circuits are separate and individually tuned so they can be used simultaneously for stereo applications. Cathode follower outputs with individual level controls are provided for both AM and FM, with a multiplex adapter output provided. A tuning meter and flywheel tuning combined with two edge-lit slide rule scales provide effortless tuning. Styling features vinyl-clad steel cover in black with inlaid gold design and soft black, rigid die-cast panel set off by brushed gold trim, black knobs with gold inserts. Shpg. Wt. 24 lbs.

### AUTOMATIC HI-FI RECORD CHANGER KIT (RP-3)

Combining automatic convenience with turntable quality through unique and simple design the Heathkit RP-3 handles your records with the finest of care for full fidelity reproduction. The unique "turntable pause" feature during change cycle and smooth friction clutch start prevents record damage. Proper weight distribution and low pivot point friction of the tone arm minimize arm resonance, tracking error, and record wear. All record changer kits come equipped with changer base, stylus pressure gauge, 45 RPM spindle, and necessary wire.



**STEREO MODEL RP-3S:** Equipped with Shure diamond stylus magnetic cartridge providing frequency response of  $\pm 4$  db from 30 to 14,000 CPS. Shpg. Wt. 19 lbs. **\$74.95**

**MONAURAL MODEL RP-3-LP:** (monaural microgroove recordings only): Equipped with Fairchild Magnetic diamond stylus cartridge. Shpg. Wt. 19 lbs. **\$64.95**

**MONAURAL MODEL RP-3:** Features a GE VRII magnetic cartridge with diamond LP and sapphire 78 stylus. Shpg. Wt. 19 lbs. **\$64.95**

**SPECIFICATIONS**—Operates from: 105-130 volts 60 cycles. Wow and Flutter: Less than 0.18% peak at 33-1/3 RPM. Turntable Speed: Accurate within  $\pm 2\%$ . Change Cycle: Completed in 9 seconds. Dimension: 13 $\frac{1}{2}$ " wide x 12" deep, 5" above and 3" below mounting board. Motor Type: 4 Pole hum shielded. Type of Drive: Friction. Record Speeds: 4 speeds. Automatic and manual 33-1/3, 45, 78 RPM. Manual only—16 RPM. Variations in Tracking Force: Less than 0.9 gram from first record to tenth record. Controls: "ON-OFF" switch, Manual Reject, "Speedminder" (automatic speed selection and indexing), Manual speed selector (4 speeds). Finish: Midnight Gray. Base: Maple (unfinished). Mounting Board: Birch (unfinished).



a complete line of monophonic and stereo



# Hi-Fi Amplifiers



MODEL SA-3  
**NEW**  
**\$29.95**



MODEL EA-1  
**NEW**  
**\$15.95**



MODEL EA-2  
**\$28.95**

## PREAMPLIFIERS



Model WA-P2 'Master Control' hi-fi pre-amplifier kit.	7 lbs.	\$19.75
Model SP-2 Mono-Stereo (2 channel mixer) Preamplifier kit.	15 lbs.	\$56.95
Model SP-1 Single Channel version of SP-2.	13 lbs.	\$37.95
Model C-SP-1 Converts SP-1 to SP-2. 5 lbs.		\$21.95

## NEW LOW COST STEREO AMPLIFIER KIT (SA-3)

The answer to budget cost stereo is now found in the all-new Heathkit SA-3 Stereo Amplifier. All the convenience of complete dual channel control can now be yours at a fraction of the cost of comparable equipment. The high level preamplifier section of the SA-3 provides complete control for both channels. Ganged tone controls provide convenient "boost" and "cut" action for bass and treble while dual concentric volume controls make possible precise channel balancing. A channel reversing switch and a speaker phasing switch allows optimum performance. Two separate inputs are provided for each channel to accommodate ceramic cartridge phonographs, AM-FM tuners, or tape recorder. Program source may be reproduced in either monophonic or stereo form. A really big package of stereo performance for the small investment!

**SPECIFICATIONS**—Power Output: 3 watts per channel. Power Response: 10 db to -20 db at 3 watts output. Total Harmonic Distortion: at 100 cps = 1% (1000 cps = 1.5%). Frequency Response: 20 cps to 15,000 cps. Output: 100 ohms. Input: 100 ohms. Controls: dual concentric volume, ganged tone, channel reversing, speaker phasing, on/off switch. Inputs: (each channel) 1/4" phono, crystal or ceramic microphone. Outputs: (each channel) 4 ohms and 16 ohms. Finish: black with gold trim. Dimensions: 12 1/2" W. x 2 1/2" D. x 5 1/2" H.

## NEW "ECONOMY" 3 WATT AMPLIFIER KIT (EA-1)

More than enough for room filling volume . . . ideal for getting started on a low cost individual component system. Designed for use with ceramic cartridge record players, tuners, tape recorders, etc. Built-in preamplifier provides you with all the necessary tone and volume controls for adjusting the sound reproduction to your personal taste. Smart appearance, quality components, assemble it in a few hours for years of trouble-free enjoyment. Shpg. Wt.: 7 lbs.

**SPECIFICATIONS**—Power Output: 3 watts. Input Sensitivity: 1/2" 100 mils for 3 watts. Output: Power Response: 60-20,000 cps with less than 3% total harmonic distortion. Output: 100 ohms. Frequency Response: ±3 db, 20-40,000 cps at 0.5 watt output. Hum and Noise: 47 db below 10 watts. Mag. phono: 70 db to low level output. Power Supply: Transformer operated. Power Requirement: 117 V., 60 cycle AC, 100 watts. Dimensions: 8 1/2" W. x 8 1/4" D. x 4 1/2" H.

## "BOOKSHELF" HI-FI 12 WATT AMPLIFIER KIT (EA-2)

Enjoy superior quality and performance at modest cost. Used with a Heathkit tuner, record player, or tape deck in conjunction with the SS-2 Basic Speaker System, the EA-2 rounds out a splendid, budget, high fidelity system. RIAA record equalization is featured on the mag phono input and neon pilot lamp tells you when amplifier is on. Attractively styled for installation anywhere in the home. Shpg. Wt.: 15 lbs.

**SPECIFICATIONS**—Power Output: 12 watts. Overall Frequency Response: at 12 watts ±1 db 20-20,000 cps. Harmonic Distortion: at 12 watts 2%, or less; 20-20,000 cps. IM Distortion: at 12 watts 2% (4:1 ratio 60 and 6,000 cps). Hum and Noise: 47 db below 12 watts. Mag. phono: 63 db to low level auxiliary inputs. Power Supply: transformer operated. Power Requirement: 117 V., 60 cycle AC, 100 watts. Dimensions: 12 1/2" W. x 8 1/4" D. x 4 1/2" H.

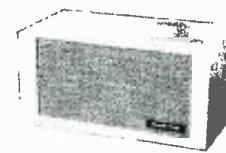
## POWER AMPLIFIERS



Model UA-1 "Universal" hi-fi 12-watt amplifier kit.	13 lbs.	\$21.95
Model W-4AM Single Chassis 20-watt hi-fi amplifier kit.	28 lbs.	\$39.75
Model W-3AM Dual Chassis hi-fi 20-watt amplifier kit.	29 lbs.	\$49.75
Model W-7M "Extra Performance" hi-fi 55-watt amplifier kit.	28 lbs.	\$54.95
Model W-5M high fidelity 25-watt amplifier kit.	31 lbs.	\$59.75
Model W-6M high fidelity 70-watt amplifier kit.	52 lbs.	\$109.95

## SPEAKER SYSTEMS

Model SS-3 "Basic" fir hi-fi speaker system kit.	26 lbs.	\$34.95
Model SS-2 "Basic Range" hi-fi speaker system kit.	26 lbs.	\$39.95
Model SS-1B "Range Extending" hi-fi speaker system kit.	80 lbs.	\$99.95



Model HH-1 "Legato" hi-fi speaker system kit.	195 lbs.	\$299.95
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HEATH COMPANY, Benton Harbor, Michigan

**Da subsidiary of Daystrom, Inc.**

**NEW: Heath Now Puts 2-Way Radiotelephone Communications In Reach of Everyone**

# Citizen's Band Transceiver Kit

**NEW: No Radio Operators License Necessary!**



- Designed to meet all FCC requirements for new 11-meter "Citizens Band" class D operation.
- Any U.S. citizen 18 or older eligible for license.
- No theory to study—no tests to take.
- Hundreds of uses in business or pleasure.
- Top quality components—proven performance—easy to build.



**MODEL CB-1**  
Includes transceiver,  
microphone, and  
special power cords.

**\$42.95**

First and only kit of its kind . . . designed to meet all FCC requirements for two-way radio telephone communication on new class D 11-meter "citizens band" . . . any U.S. citizen eighteen or older eligible for license . . . no code test, no radio theory exams, no knowledge of specialized operating procedures required . . . just fill out simple form included with kit and mail to FCC for registration. The Heathkit CB-1 Transceiver is light, compact, simple to assemble, easy to use. Buy two or more units, have your own communications system . . . talk with family, friends, associates from your car, home, boat or office . . . cover distances from one to ten miles depending on location and type of installation (extensively field tested). A flick of a switch selects "transmit" or "receive" while single receiver tuning control selects any of 23 assigned channels . . . third knob controls volume and turns set on and off. With separate vibrator power supply available from Heath, along with two special power cords included with kit, you can convert transceiver from fixed location at home or office to mobile operation in cars, boats, etc., in minutes, after initial installation, with no tools or adjustments. There's a Heathkit accessory antenna for any application, mobile or fixed. Kit comes complete with microphone, station identification card which fits in plastic window at end of cabinet, all pertinent FCC regulations and application forms, a sheet of adhesive-back letters and numbers to affix call letters in space provided on front panel, and crystal for one channel. Specify your frequency choice or we will supply crystal of appropriate frequency. The famous Heathkit quality coupled with the market-shattering low price of this kit make it truly a value of a lifetime.

**SPECIFICATIONS**—Receiver Type: Superregenerative detector w/rf stage. Power Input: 5 watts to plate of final RF amplifier (FCC maximum). Transmitter Frequency Control: Third overtone type quartz crystal operating within 0.005% of marked channel frequency between 32 F and 140 F. Modulation: AM plate modulation automatically limited to less than 100% (FCC requirements). Power Supply: 117 V 50/60 cycle, AC, 6 V battery using Model VP-1-6 Vibrator Power Supply or 12 V battery using Heathkit VP-1-12. Power Requirements: 117 volts 50/60 cycle AC 35 watts; 6 V battery w/VP-1-6, 6.5 amps., 12 V battery w/VP-1-12, 4.0 amps. Total B+ requirements: 260 volts at 60 mA; total heater requirements: 6.3 volts at 1.8 amps., or 12.6 volts at 0.9 amps. Power Rectifier: 2 silicon diodes in full wave voltage doubler circuit. Microphone: Combination hand-held and desk type, ceramic element, plastic case, with cord and connector. RF Output Impedance: 50 ohms. Speaker Size: 4 inch (round). Undistorted Audio Power Output: Approximately 1 watt. Line Cords: Two supplied, one for AC operation, one for battery operation. Power circuits automatically switched when appropriate line cord is plugged in. Cabinet Dimensions: 8" H. x 6" D. x 9½" W.

## ANTENNAS

### MODEL CBU-1 "UTILITY" ANTENNA

Low cost, portable antenna for CB-1 Transceiver for temporary installations, mobile or fixed, where maximum coverage is not required. Rugged clip for mounting on eaves-trough of house or rain gutters of cars, trucks, etc. Bracket supplied for mounting on transceiver or any flat surface. 45½" base-loaded, antenna with 12' connecting cable comes complete, ready to use.

**\$9.95**

### MODEL CBM-1 "MOBILE" ANTENNA

For CB-1 Transceiver permanent mobile installations where greatest coverage is desired. Easy to install double chain-type bumper mount spring base—no cutting or drilling. Easily adapted to boats, etc. ¼ wave whip antenna approximately 9' from mounting surface to tip—supplied with clip for securing in semi-horizontal position to clear obstructions. Kit is complete with 102" whip in 2 sections, 15' connecting cable and all necessary hardware.

**\$19.95**

### MODEL CBF-1 "FIXED LOCATION" ANTENNA

A ¼ wave "ground plane" type antenna for CB-1 Transceiver using 4 radial elements as the "ground plane" and 1 vertical element as the radiator. Excellent coverage, essentially non-directional, making it ideal for communications between fixed and mobile units. Antenna measures 9' 4" from bottom of mounting bracket to top of vertical radiator. Radial length 9'. Kit is complete with 50' connecting cable and easy to install mounting clamp.

**\$19.95**

### POWER SUPPLIES FOR MOBILE USE OF CB-1:

MODEL VP-1-6 Vibrator Power Supply kit for 6 volt batteries. Shpg. Wt. 4 lbs.

**\$7.95**

Model VP-1-12 Vibrator Power Supply kit for 12 volt batteries. Shpg. Wt. 4 lbs.

**\$7.95**

**NEW**

**MODEL CO-1**  
**\$7.95**

(batteries included)

### NEW TRANSISTOR CODE PRACTICE OSCILLATOR KIT (CO-1)



Your best buy in a high quality code oscillator, the CO-1 is ideal for Boy Scouts or beginning radio hams. Practice code by authentic CW tone or blinker light. Switch selects built-in speaker or light. Contactor provided for practice keying or any standard key can be connected. Completely transistorized for long battery life. Powered by two standard flashlight batteries. Batteries included. Shpg. Wt. 3 lbs.

## TRANSISTOR PORTABLES

### ... and other Do-It-Yourself Hobby Kits

Model XR-1P Transistor Portable Radio kit...	6 lbs.	<b>\$29.95</b>
Model CR-1 Crystal Radio kit...	3 lbs.	<b>\$7.95</b>
Model BT-1 Battery Tester kit...	2 lbs.	<b>\$8.50</b>
Model ET-1 Enlarger Timer kit...	3 lbs.	<b>\$11.50</b>
Model BR-2 Broadcast-Band Receiver kit...	10 lbs. (less cab.)	<b>\$18.95</b>
Model RC-1 Professional Radiation Counter kit...	8 lbs.	<b>\$79.95</b>



**MODEL XR-1P**

## MARINE KITS . . .

### For Fun and Safety Afloat

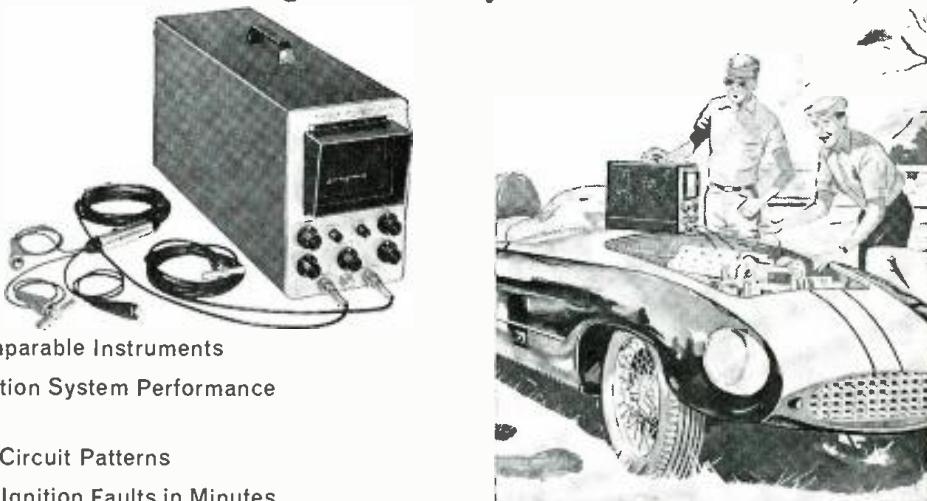
Model DF-2 Two Band Transistor Radio Direction Finder kit	9 lbs.	<b>\$69.95</b>
Model FD-1-6 Fuel Vapor Detector kit (6 v.)	4 lbs.	<b>\$35.95</b>
Model FD-1-12 Fuel Vapor Detector kit (12 v.)	4 lbs.	<b>\$35.95</b>
Model MC-1 Marine Battery Charge kit	16 lbs.	<b>\$39.95</b>
Model PC-1 Power Converter kit	8 lbs.	<b>\$24.95</b>



**MODEL DF-2**



## New—Electronic Ignition Analyzer Kit—IA-1A



- A Fraction of the Cost of Comparable Instruments
- Shows "Picture" of Entire Ignition System Performance on Cathode Ray Screen
- Shows Primary or Secondary Circuit Patterns
- "Trouble-Shoot" Complicated Ignition Faults in Minutes

A revolutionary development in the automotive tune-up field. Heathkit offers the small garage owner, service station operator or hobbyist an ignition analyzer with qualities and features of scopes costing several times as much (comparable to instruments costing as much as \$750.00). The savings you realize through do-it-yourself kit assembly are only part of the story. Heath engineering know-how and tremendous buying power play an important role in keeping prices at rock bottom. Yet, this scope, as with all Heathkits, is designed to be "beginner built". A few hours of your spare time . . . and you're in business. The IA-1A lets you check the complete ignition system of an automobile in operation by merely connecting two leads to observe the tell-tale spark pattern of the cylinders. Can be used with the car under load and in motion by adding a vibrator power supply. Shows condition of coil, condenser, points, plugs and ignition wiring. A switch selects either primary or secondary circuit patterns; or alternately

provides choice of parade or superimposed secondary patterns. It will also indicate coil reserve, a poor spark plug, defective wiring and will even identify the offending plug or wire. Also detects breaker point bounce, a defective condenser, or will allow setting of the dwell-time of the points. The IA-1A is simple to use, with a minimum of controls, yet is completely flexible for all types of internal combustion engines with coil ignition and accessible breaker points. Shows complete engine cycle or just one cylinder at a time. Test leads and comprehensive instruction manuals are supplied with kit. Shpg. Wt. 20 lbs.

### **NEW MODIFICATION KIT FOR OWNERS OF MODEL IA-1 IGNITION ANALYZERS:**

Gives you switch selection of either primary or secondary circuit patterns; or alternately provides choice of parade or superimposed secondary patterns. Kit includes test lead modification parts and comprehensive instructions for modification and use. Shpg. Wt. 2 lbs. Heathkit MK-6. \$4.95.

## A COMPLETE LINE OF INSTRUMENT KITS

### **OSCILLOSCOPES**

Model OM-3 "General Purpose" 5" oscilloscope kit...	22 lbs.....	\$39.95
Model O-12 "Extra Duty" 5" oscilloscope kit...	22 lbs.....	\$65.95
Model OP-1 "Professional" 5" DC oscilloscope kit...	34 lbs.....	\$179.95

### **METERS**

Model V-7A Etched Circuit VTVM kit...	7 lbs.....	\$25.95
Model AV-3 Audio VTVM kit...	6 lbs.....	\$29.95
Model MM-1 20,000 ohms/volt VOM kit...	6 lbs.....	\$29.95
Model AW-1 Audio Wattmeter kit...	7 lbs.....	\$29.50
Model M-1 Handitester kit...	3 lbs.....	\$17.95

### **GENERATORS**

Model TS-4A TV Alignment Generator kit...	16 lbs.....	\$49.50
Model CD-1 Color Bar and Dot Generator kit...	13 lbs.....	\$59.95
Model SG-8 RF Signal Generator kit...	8 lbs.....	\$19.50
Model TO-1 RF Test Oscillator kit...	4 lbs.....	\$16.95
Model LG-1 Laboratory RF Generator kit...	16 lbs.....	\$48.95
Model AG-9A Audio Generator kit...	10 lbs.....	\$34.50
Model AG-10 Sine-Square Generator kit...	12 lbs.....	\$49.95
Model AA-1 Audio Analyzer kit...	13 lbs.....	\$49.95

### **TEST INSTRUMENTS**

Model TC-3 Tube Checker kit...	12 lbs.....	\$39.95
Model CC-1 Cathode Ray Tube Checker kit...	10 lbs.....	\$24.95
Model T-4 Visual-Aural Signal Tracer kit...	5 lbs.....	\$19.95
Model C-3 Condenser Checker kit...	7 lbs.....	\$19.50
Model CM-1 Direct Reading Capacity Meter kit...	7 lbs.....	\$29.50
Model CT-1 In-Circuit Capacitor Tester kit...	5 lbs.....	\$7.95

Plus many more quality instruments for every need!

## A COMPLETE LINE OF HAM GEAR

### **FIXED STATION**

Model DX-20 CW Transmitter kit...	19 lbs.....	\$35.95
Model DX-40 Phone and CW Transmitter kit...	25 lbs.....	\$64.95
Model DX-100-B Phone and CW Transmitter kit...	107 lbs.....	\$189.50
Model VHF-1 "Seneca" VHF Ham Transmitter kit...	56 lbs.....	\$159.95
Model TX-1 "Apache" Ham Transmitter kit...	110 lbs.....	\$234.95
Model RX-1 "Mohawk" Ham Receiver kit		
66 lbs.....		\$274.95

### **MOBILE**

Model MT-1 'Cheyenne' Mobile Ham Transmitter kit...	19 lbs.....	\$99.95
Model MR-1 'Comanche' Mobile Ham Receiver kit...	19 lbs.....	\$119.95
Model MP-1 Mobile Power Supply kit		
8 lbs.....		\$44.95
Model PM-2 Power Meter kit...	2 lbs.....	\$12.95
Model AK-7 Mobile Speaker kit...	4 lbs.....	\$.55.95



# Authorized HEATHKIT Dealers



Convenient "over-the-counter" delivery is now available through any of the Authorized Heathkit Dealers listed below. Although you will find the price of Heathkits slightly higher when buying locally, we're sure you'll agree that this increase is justified. Your dealer absorbs all transportation charges, carries a complete stock of kits for immediate de-

livery, provides demonstration facilities, offers you a reliable source for parts and fast service . . . and stands ready to counsel or advise you on any problem that might arise.

This new service does not affect your continued privilege to buy directly from Heath Company if you prefer.

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182 East Main Street  
  
FRESNO  
Dunlap Radio & TV  
2617 Tulare Street  
  
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MARYSVILLE  
Dunlap Radio & TV  
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234 West 17th Street  
  
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Kierulff & Company  
390 South Mt. Vernon  
  
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Zack Electronics  
1422 Market Street  
  
SANTA BARBARA  
zackIT Corporation  
513 State Street  
  
STOCKTON  
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27 North Grant Street  
  
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18841 Ventura Boulevard  
  
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14511 Delano  
  
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HAMILTON  
Sreco, Inc.  
145 Highland Avenue

*Careful selection of reliable qualified dealers is a slow process . . . so please bear with us if your area has not been covered. Thank you.*

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R.R. #1, Box 308  
  
SPRINGFIELD  
Standard Radio-Springfield, Inc.  
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ZANESVILLE  
Buckeye Electronics Dist., Inc.  
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OREGON  
PORTLAND  
Eccles Electric Company  
237 Northeast Broadway  
  
SALEM  
Cecil Farnes Company  
440 Church Street, Northeast  
  
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Radio Electric Service Co.  
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BRYAN  
Sterling Radio Products, Inc.  
2615 Texas Avenue  
  
DALLAS  
Hillcrest Records, Inc.  
5309 Hillcrest Avenue  
  
HOUSTON  
Sound Equipment, Incorporated  
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HOUSTON  
Sterling Radio Products, Inc.  
1616 McKinney Avenue  
  
LUKFIN  
Sterling Radio Products, Inc.  
428 Atkinson Street  
  
VIRGINIA  
ARLINGTON  
Key Electronics, Inc.  
126 South Wayne Street  
  
WASHINGTON  
SEATTLE  
Seattle Radio Supply, Inc.  
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WISCONSIN  
MADISON  
Hi-Fi Corner  
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Satterfield Electronics, Inc.  
1900 South Park  
  
MILWAUKEE  
Hi-Fi Center  
4236 West Capitol Drive  
Netrow's  
2630 North Downer Avenue

## Mac's Service Shop

(Continued from page 59)

in the service literature, it's very helpful to observe carefully the way the blank position is pointing when the tube is removed from the socket. Don't trust your memory. Make a little diagram. It can save you minutes."

"Another thing," Barney added, "is that a pin straightener is worth its weight in gold in a deal like that. If one of the pins is bent out of line, you can turn that tube around and around until the pin wears a groove in the top of the socket without it's ever dropping into place."

"That's my boy!" Mac applauded. "The fact is that using a pin straightener on every miniature tube before putting it back in the socket is double insurance against socket damage and loss of time."

"Seems to me we're running into quite a bit of socket trouble lately," Barney commented.

"You're right and I don't think it's sheer coincidence. I give lots of credit to the do-it-yourself tube checkers found in drug stores and other places these days. These encourage radio and TV set owners to pull the tubes out of their receivers, check them, and then try to put them back where they belong. Bulb-snatching runs riot. The end result? A lot of mangled sockets!"

"We're getting pretty clever at repairing those messed-up tube sockets, though," Barney observed.

"That we are. With patience, a good eye, and a steady hand, you can use a very sharp-pointed scratchall and work down through the tops of many sockets and carefully pry the spread jaws of the pin receptacles back together so that they again grip, instead of merely touch, the tube pins. With other sockets, especially some types of wafer miniatures, you have to work from the bottom of the socket. You need very sharp-pointed needle-nose pliers. I find a pair of surgical clamps is ideal for the purpose. With these you can go quickly around a socket pinching the spread jaws back together. It is often amazing how much difference this simple operation will make in reception in a radio or TV set in which the tubes have been making a sloppy contact with the socket."

"Mac," Barney said hesitantly, "I want you to know I really intend to remember what you've said about tube-snatching. It makes sense. And anything I do as often as I do taking tubes out of sockets and putting them back I want to do right."

"I know you mean it, Barney," Mac said gruffly; "and I like your saying you want to do right anything you do often. I've often remarked I can tell if a fellow is really a technician or not by watching how he does three things: take a tube out of a socket and put it back, solder a joint, and adjust an alignment trimmer. Keep that in mind and do likewise."



# BLOOD and THUNDER CLASSICS

*Audiotape "speaks for itself" in a spectacular recording  
—available in a money-saving offer you can't afford to miss!*

#### DETAILS OF THE PROGRAM

The stirring "Blood and Thunder Classics" program includes these colorful selections:

Tschaikowski	... Russian Dance
Sibelius	... from Finlandia
de Falla	... Dance of Terror, Ritual Fire Dance (El Amor Brujo)
Brahms	... from Symphony No. 4 in E Minor
Khatchaturian	... Saber Dance
Stravinski	... Infernal Dance of King Kastchei, Finale (Firebird Suite)
Beethoven	... Ode to Joy (Symphony No. 9 in D Minor)

#### DETAILS OF THE OFFER

This exciting recording is available in a special bonus package at all Audiotape dealers. The package contains one 7-inch reel of Audiotape (Type 1251, on 1½-mil acetate base) and the valuable "Blood and Thunder Classics" program (professionally recorded on standard Audiotape). For the entire package, you pay only the price of two boxes of Type 1251 Audiotape, plus \$1. And you have your choice of the half-hour stereo program or the full-hour monaural version. Don't wait. See your Audiotape dealer now.

HERE'S a reel of musical excitement that belongs on *every* tape recorder. "Blood and Thunder Classics" is a program of great passages of fine music, specially selected for their emotional impact.

The makers of Audiotape have not gone into the music business. They are simply using this method to allow Audiotape to "speak for itself." This unusual program shows you how vibrant and colorful music can be when it is recorded on *Audiotape*.

"Blood and Thunder Classics" is available RIGHT NOW from Audiotape dealers everywhere. (And *only* from Audiotape dealers.) Ask to hear a portion of the program, if you like. Then, take your choice of a half-hour of rich stereo or a full hour of dual-track monaural sound — both at 7½ ips. Don't pass up this unusual opportunity.



**audiotape**  
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### CARTRIDGE TAPE PLAYER

*Stereophonic Automation Corporation*, Skokie, Ill. has recently demonstrated a magazine cartridge tape player which is being marketed as the "Fidelivox."

The unit, which incorporates a built-in all-transistor preamp, will plug into almost any existing stereo disc system



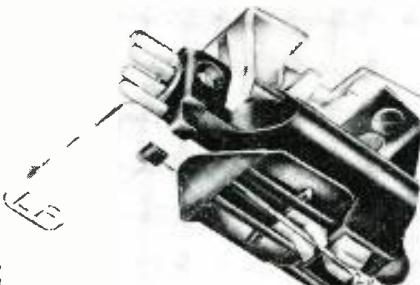
—either console or component. The tape handled by the machine is fully enclosed in a single-spool plastic magazine which is called a "Fidelipac." The magazine is inserted in the machine and plays continuously until the cartridge is removed from the machine—no controls need be actuated.

The machine is being offered in two models, the "Sonata" which plays quarter-track tape and the "Camerata" which plays half-track tape. Tape speed of both models is 3.75 ips. According to the company, a basic "Fidelipac" library of tapes is available for both machines.

### DUOTONE STEREO CARTRIDGE

*Duotone Company* of Keyport, N.J. has added the British Acos "Hi-g" turnover stereo cartridge to its line of audio accessories.

The new unit is a non-magnetic cartridge of the piezo-electric type featuring built-in RIAA equalization with an



output of .8 to 1 volt. This output is sufficient to drive any radio, TV, or phono amplifier, thus enabling the user to employ this equipment as a second channel in a stereo system.

### Product Review

The cartridge has extended flat frequency response from 40 to 15,000 cps  $\pm 1.5$  db with roll-off of 10 db at 18,000 cps. Compliance is  $4 \times 10^{-6}$  cm/dyne with a tracking force of 2 to 4 grams. Channel separation is better than 25 db at 1000 cps. The cartridge can be used for either 3 or 4 terminal installations.

The special "lok-tite" turnover mechanism maintains the stylus at a perfect 45-degree vertical-lateral angle to the record grooves, assuring maximum balanced stereo reproduction at all times.

The cartridge is available in two different models: the GPS73-SS with .7 and 3 mil sapphire styli and the GPS73-S/D with .7 mil diamond and 3 mil sapphire styli.

### TURNTABLE FOR STEREO

*Ercona Corporation*, 16 W. 46th St., New York 36, is now stocking the British-built "Connoisseur" turntable which has been redesigned for stereo applications.

Made by *A. R. Sugden & Company* of England, the new type B turntable is driven by a hysteresis motor which is



synchronous to the 60-cycle power line and will maintain constant speed with line voltage variations of up to 25%. The rotor is dynamically balanced and ground so that all diameters are absolutely concentric. The shafts are precision ground, lapped to mirror finish, and run in nylon graphite bearings.

All tolerances are held to  $\pm 0.001$ . The motor is isolated from the turntable assembly. The speed change is mechanical since the table is built to studio standards. Rumble is better than 50 db at 7 cm/sec. and 500 cps. Wow is less than .15% of rated speed. Dimensions are  $13\frac{1}{2}'' \times 15\frac{3}{4}''$  with top clearance of  $3\frac{3}{4}''$  and bottom clearance  $3\frac{1}{4}''$ .

A stereophonic pickup arm and cartridge, designed specifically for this turntable, are available from the same source.

### 20-WATT STEREO AMP

*Continental Manufacturing, Inc.* of Omaha, Neb. is now marketing a low-cost stereo amplifier which incorporates features usually found only in equipment carrying higher price tags.

The "Harmony" Model SA-20 has an output of 10 watts per channel or 20 watts for monophonic use. Response is 20 to 20,000 cps. There is a total of eight inputs, four in each channel:



magnetic phono, crystal or ceramic phono, tuner, and tape. There is a six-position selector switch calibrated for tuner stereo, tape stereo, phono stereo, with the same positions duplicated for mono operation. Output impedances of 8 and 16 ohms are provided in each channel.

The amplifier uses a total of eight tubes, four ECC83/12AX7's and four 6AQ5's, plus two silicon rectifiers. The circuit provides d.c. operation of the preamp filaments and carries a switched a.c. outlet.

Over-all size, with cover, is 13" x 10" x 5 1/4". Write the manufacturer for additional specifications and price.

#### **NEW ARGOS BAFFLES**

Argos Products Company, Genoa, Ill. is now offering four models of its baffles with speakers already installed. This is the first time any of the company's baffles have been offered with factory-installed speakers.

Currently available as baffle/speaker combinations are: WB-8AS 8" wall baffle with speaker; WB-12AS 12" wall baffle with speaker; SCB-8AS 8" slanting corner baffle with speaker; and SCB-12AS 12" slanting corner baffle with speaker. The 8-inch speakers have 4.64-ounce magnets and the 12-inch units 6.8-ounce magnets. All speakers have screw terminals for easy connection. Average frequency range is 45 to 13,000 cps.

A handy folder describing these new units is available on request.

#### **STEREO AMP KIT**

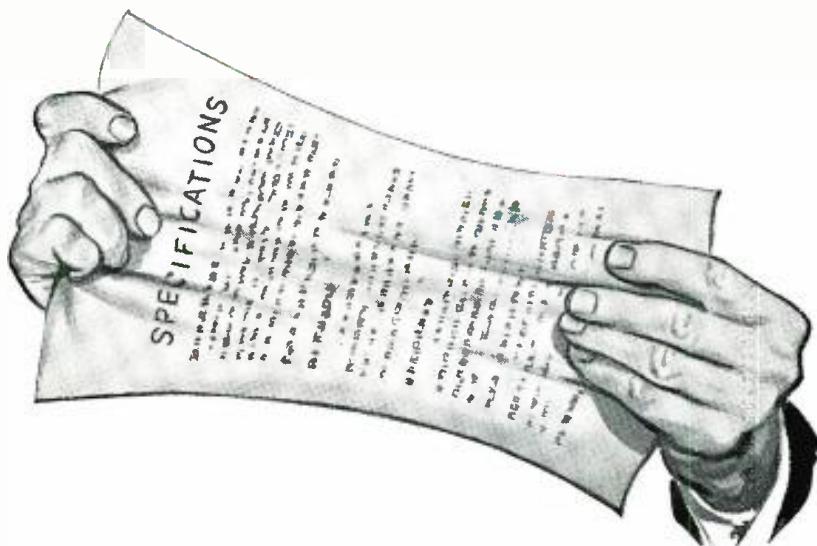
Dynaco Inc., 617 North 41st St., Philadelphia 4, Pa. has introduced a



new triple-function power amplifier, in semi-assembled kit form, as the "Stereo 70".

The new unit contains two independent 35-watt amplifiers which can be used for stereophonic reproduction, monophonic 70-watt amplification, or dual-channel performance. Each channel is capable of 80-watt peak signal

# You can only stretch a spec sheet so far!

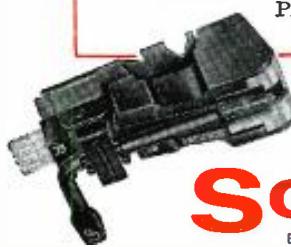


*In a stereo cartridge, it's what you hear that counts. And Sonotone's ceramic cartridge gives you brilliant performance and nothing less.*

More phono makers have specified Sonotone for the top of their line than any other cartridge...because only Sonotone gives true sound without distortion...high-frequency response with less record wear. Sonotone stereo gives a performance so superior you can truly hear the difference. The secret? Sonotone's four exclusive operating features listed below.

1. Extremely high compliance...also means good tracking, longer record life.
2. Amazingly clean wide-range frequency response.
3. First quality jewel stylus tips—correctly cut and optically ground for minimum record wear.
4. Rumble suppressor greatly reduces vertical turntable noise.

Prices start at \$6.45 (including mounting brackets).



Get details on converting to stereo. Send for free booklet: "Stereo Simplified," Sonotone Corp., Dept. CN-69, Elmsford, N. Y.

## Sonotone® CORP.

Electronic Applications Division, Dept. CN-69

ELMSFORD, NEW YORK

In Canada, contact Atlas Radio Corp., Ltd., Toronto

Leading makers of fine ceramic cartridges, speakers, microphones, electronic tubes.

# DYNACO B&W STEREODYNE PHONO PICK UP

This new, unique pickup is made in Denmark by Bang and Olufsen. It features a push pull magnetic principle (patent pending) which permits realization of the full potentialities of the most modern recording techniques. The special attributes which make the Stereodyne an outstanding stereo pickup make it equally exceptional for monophonic discs. On any type of record the Stereodyne offers smooth and natural sound—firm clean bass and sparkling treble—while its light tracking pressure insures negligible record wear.



## BEST in every way . . .

- Wide frequency response  
Smooth peak free response from 30 cps to over 15 Kc
- True Stereo  
Highest channel separation over entire audio spectrum—better than 22 db.
- Precision balance  
Both channels identical  
Same high compliance ( $5 \times 10^{-6}$  cm/dyne) in all directions
- No hum pickup  
Balanced coil structure plus low impedance plus complete shielding eliminate hum from external fields
- High output  
7 millivolts per channel even on low level stereo discs provides gain to spare
- No magnetic pull  
Special magnetic circuit eliminates attraction to steel turntables
- Easy installation  
Compact size and standard mounting centers simplifies mounting. 4 terminals to avoid hum loops.
- Low price  
Only \$29.95 net including .7 mil diamond stylus (replaceable in 2 seconds).

Available from leading high fidelity dealers everywhere

**DYNACO INC.**

617 N. 41st St., Phila. 4, Pa.  
Export Division: 25 Warren St., New York, N. Y.

handling without inter-channel interaction.

The amplifier uses the firm's patented circuitry and is based on the use of a new *Dynaco* output transformer, the A-470. The combination of circuitry and components provides full rated power from 20 to 20,000 cps at less than 1% total distortion. IM distortion ranges from .05% at normal listening levels to .5% at rated power. The amplifier channels are stable for all types of loudspeaker loads and transient signals like pulses and square waves are handled easily and with clean waveform.

The new 7199 pentode-triode tube is used to drive EL34 output tubes. Tubes and capacitors are operated well below normal commercial ratings and conservative operating conditions are the basis for a one-year guarantee on this equipment.

A dual printed-circuit assembly, supplied factory wired, simplifies construction and assures reproducibility of the amplifier's performance characteristics by the constructor.

The amplifier measures 9" x 13" x 6 1/2".

## "DUAL-DIAMETER" SPEAKERS

*Utah Radio & Electronic Corp.*, 1124 E. Franklin St., Huntington, Ind. has recently introduced a new series of speakers for stereo applications as its "Dual Diameter" line.

The new speakers feature magnetic



circuitry which combines two Alnico magnetic material structures into one stepped-down dimension unit. This is processed for a specific molecular orientation and, when used with the new magnetic circuitry, results in an efficiency and magnetic power nearly twice that of slug-type magnets, according to the company.

In addition, the new speakers feature rugged dynamic uni-coils, hand-wound and varnish impregnated; all-new heavy steel frames for improved cone protection and the elimination of crossover response drop-out; phase-coded terminals for solderless installation; and special treatment of cone skiver rolls to improve frequency response and add to cone life.

Full-range 8- and 12-inch speakers are now in production.

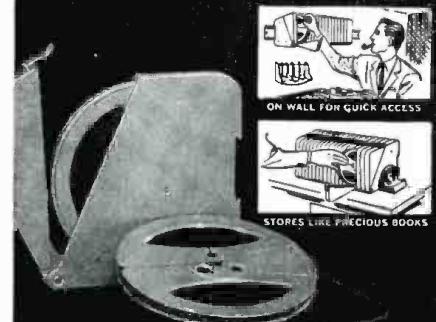
## INTEGRATED SPEAKER SYSTEM

*North American Philips Company, Inc.*, High Fidelity Products Division, 230 Duffy Ave., Hicksville, N. Y. has



## THE CASE FOR BETTER SOUND

Why settle for ordinary tape when Sonoramic gives you so many exclusive extras—brilliant reproduction, permanent plastic container, 3-way indexing system with pressure sensitive labels and V-slot self threading Selection Finder reel.



**FREE** Tape-time ruler. Gives you footage and recording time on reel. Write Dept. NB

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Merit deflection yokes are cosine wound TO FORM, not pressed. Pressing can lead to distortion and poor focusing. Pressing after winding frequently causes breakdown.

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MERIT PLAZA • HOLLYWOOD, FLORIDA

recently added a new series of speaker enclosures and systems to its "Norelco" line.

The Model 1 is a back-loaded folded horn enclosure which is designed for



use with the company's T-7 series of speakers (Models AD-5277M and AD-4277M) or other 12" speakers. The enclosure measures 26" wide, 21½" high, and 17¼" deep. It is supplied in walnut, cherry, blonde, or mahogany finishes and has 8-inch legs.

This same enclosure is also available as a complete, integrated system, mounted with two 8" high-efficiency "Norelco" speakers. All other features of the enclosure are the same.

Further details on this and other enclosures in the company's line can be obtained from the High Fidelity Products Division.

#### AUDIO CATALOGUES

##### USING STEREO CARTRIDGES

General Electric Company's Application Engineering Department, W. Genesee St., Auburn, N. Y. has just released a new 16-page booklet "Application Considerations in the Use of Stereo Cartridges" which is being made available to technicians and dealers without charge.

Included are such subjects as factors influencing stereo performance, cartridge tracking force and loading, problem diagnosis, and cartridge connections and input wiring practices. Numerous diagrams cover a variety of practical applications.

When writing for a copy, please specify Publication EP-681.

##### STEREO HANDBOOK

Bogen-Presto, Division of The Siegler Corporation, Box 500, Paramus, N. J. has issued a stereo edition of its "Understanding High Fidelity."

The handbook will be of interest to both the initiated and the novice. The booklet describes in detail the components required for a complete high-fidelity system, the differences between stereo and monophonic systems, and an evaluation of a number of components used in a stereo system. The booklet contains a number of photographs as well as diagrams.

The 64-page booklet is available from the firm's dealers or the manufacturer direct for 25 cents a copy. -30-



Here are two new additions to the famous Quam line of replacement speakers. You'll find many uses for both of them, in auto radios and in radio-tv applications. When you use them, you'll enjoy knowing that you're avoiding breakdowns and eliminating callbacks by installing quality loudspeakers. Using a brand name product is always your assurance of that . . . especially when the brand name is QUAM.

48A2—Very shallow construction 4" x 8" speaker with 1.4 oz. Alnico V magnet. Used in many 1959 auto radios and in RCA and Sylvania sets. List Price \$6.95  
69A1—A low cost 6" x 9" speaker with "high-price" features—full ¾" voice coil, heavy magnet (1 oz. Alnico V). An exceptional value. List Price \$5.95

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**QUAM-NICHOLS COMPANY** 238 E. Marquette Road, Chicago 37, Illinois

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**ZALYTRON** Tubes for TV-Radio Servicemen, Dealers, Experimenters.  
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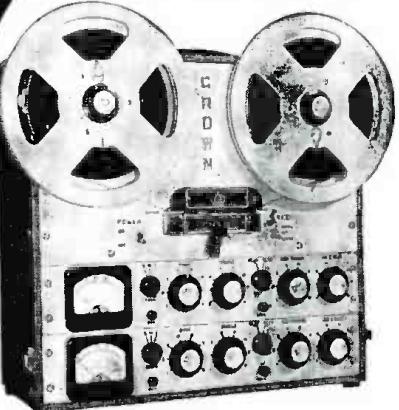
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**GOLD CROWN**  
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FREQUENCY RESPONSE IPS SPEED & WOW RATIO \$695  
 ±2 db 30-30000 CPS 15 .06% 57 db Less Case  
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 (Recording quality for 4-track slightly less)

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- Rek-O-Kut
- Components
- Norelco
- Fairchild
- Pickering • Gray
- Audio Tape
- Conrac TV
- Full Line of Cabinets

## Portable Transistor Intercom (Continued from page 55)

transistors is inefficient compared to the proper matching transformer due to the mismatch of the high output and low input impedances involved.  $R_o$  is again chosen for the lowest internal noise level, as described previously. In addition, selected CK722's or equivalent low-noise types may be used for optimum performance. The resulting circuit is a high-gain, low-noise voltage amplifier. Best of all, no 60-cycle power is used; thus, no complications from 60-cycle hum levels arise, resulting in less critical construction.

A simple pickup consists of a high output crystal cartridge with a 4" length of stiff piano wire inserted in the needle chuck for use as a probe. Flexible, single-conductor shielded microphone cable is used to feed the signal to the amplifier. The cartridge is shielded magnetically by a small steel case fabricated to size and grounded to the shield of the cable. The 2000-ohm variety of headphones is used on the output for the maximum amount of sensitivity.

Using such a probe, the condition of a wristwatch could be determined from the various operating sounds by the trained ear of a watch repairman. Other purposes for which such a unit has been used include locating noisy bearings or faulty parts in rotating machines, locating areas of contact of a rubbing speaker cone, checking friction within the working parts of delicate instruments, measuring small vibratory motions, and so forth. —30—

Advanced Acoustics Band Extender components meet the highly diversified need for top performance in the middle and treble regions. These Extenders — Three, Two and Top Bands — bring new presence, brightness and brilliance to speaker systems... serve individual needs of frequency extension, system efficiencies and mounting considerations. For your own fine system, use Advanced components. Three Band Extender \$10.95; Two Band and Top Band \$10.55 each.

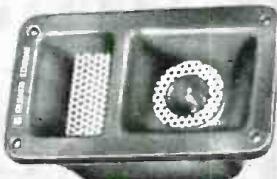


THREE BAND EXTENDER — Model 24  
Most versatile reproducer of lower middle, middle and high frequencies. Full three acoustic channels, flared horns and aperture radiation, with network element, complement any size quality speaker component... provides wide angle radiation from 1 Kc. to inaudibility. Mounts directly on 12" speaker, or independently on main baffle.

**ADVANCED ACOUSTICS CO. • 1875 CARTER AVENUE • NEW YORK 57, N.Y.**

TWO BAND EXTENDER Model 25

Ultra compact, new design for mid-range and treble response. Rear phase balanced, and front radiation covers dual range from 700 cps. to 18 Kc.



TOP BAND EXTENDER — Model 26  
Compression driven, wide angle horn radiator. Features improved phase correcting and throat loading element for maximum cleanliness at top efficiency. Covers 2 Kc. to above 18 Kc.

DEALER INQUIRIES INVITED



## EXCITING NEW TWEETER COMPONENTS FOR ADVANCED HI-FI



The front panel of the attractive 90-watt ham rig is shown in this photograph.

ELECTRONICS WORLD

LAB TESTED

## 90-Watt Ham Transmitter Kit

FOR the amateur who wants to start out in ham radio with a simple, well-designed rig that will stand him in good stead for a long time, this *EICO* Model 720 c.w. transmitter kit is a good buy. The unit is also an effective "building block" for the more advanced ham. For example, for phone operation, an external modulator may be plugged into the transmitter; a v.f.o. may be added ahead of the crystal oscillator; and a power amplifier may be built to increase the power output.

The rig is able to deliver up to 90 watts input, although it must be operated at no more than 75 watts by the Novice. The plate current meter is marked at this power limit to allow the beginner to stay within the law. One-knob bandswitching is provided to permit coverage of all ham bands between 80 and 10 meters. Adequate shielding and filtering will keep TVI to a minimum. The "low-silhouette" cabinet makes an attractive addition to any ham shack.

### Construction and Operation

Construction of the transmitter is straightforward and no problems

should be encountered if the assembly instructions are followed carefully. We were particularly pleased with the layout of the instruction manual. Every other page in the construction section is a full-page drawing illustrating a fairly limited number of steps to be followed. These steps are listed in the page facing the drawing. In this way, it was not necessary to search for the proper drawing illustrating any particular step. Thanks are certainly due to *EICO* for the convenience of this arrangement which saves considerable building time. Although some of the lead lengths specified were a little generous, we could find no fault with the clear instructions given.

The actual construction time for the kit was 16 hours in all including the 2 hours that were spent in unpacking and checking parts and, after finishing the job, checking the wiring and making the tuning adjustments.

We don't know whether or not the oscillator plate coil was pre-adjusted, but in our case, perhaps by accident, the setting of the slug happened to be "right on the button." We feel it's a good idea to go through the complete

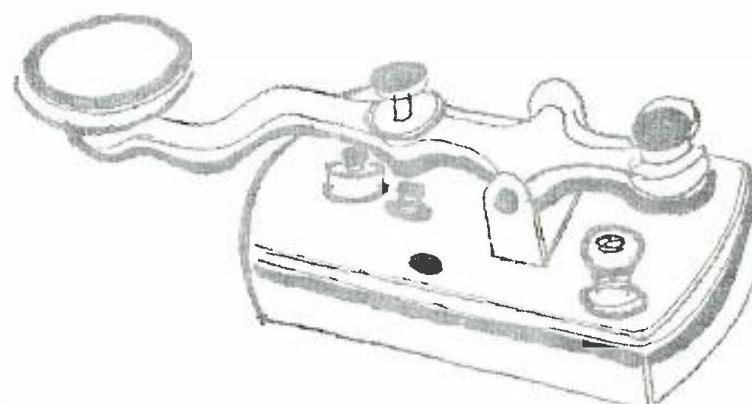
resistance chart of the transmitter just as a double-check on wiring and components. Once this has been done, and the resistances match those given, there is little danger of blowing fuses or damaging tubes and parts.

Upon completion of the wiring, we connected a 60-watt light bulb as a dummy load between antenna and ground. We had no trouble at all in lighting the lamp to just about full brilliance on all the bands. On the lower bands it was only necessary to barely "crack" the drive control in order to get full rated plate current. A quick check with our receiver indicated that the c.w. note was "clean" with no clicks or chirps. An on-the-air check with the rig netted us several RST 599X reports.

### Circuit

The schematic diagram (Fig. 1) shows that the rig employs a simple, conventional circuit. A high  $G_m$  6CL6 pentode is used as an electron-coupled Colpitts crystal oscillator. This circuit has high stability and high harmonic output. A slug-tuned coil, broadly tuned to 40 meters, is used as plate load

**Here is a simple and conservatively designed c.w. transmitter kit for the beginning amateur or Novice class licensee.**



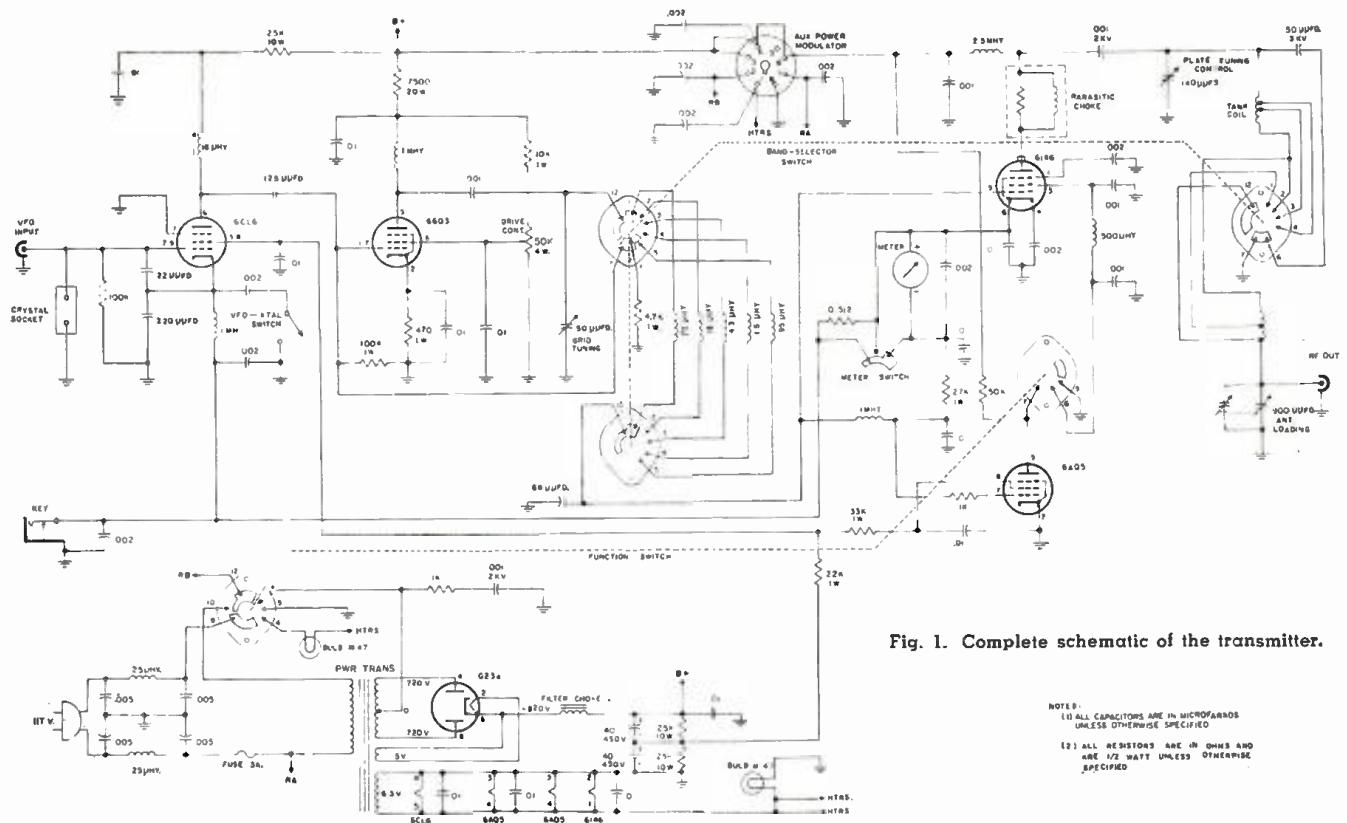


Fig. 1. Complete schematic of the transmitter.

NOTES:  
 (1) ALL CAPACITORS ARE IN MICROFARADS  
 UNLESS OTHERWISE SPECIFIED  
 (2) ALL RESISTORS ARE IN OHMS AND  
 ARE 1/2 WATT UNLESS OTHERWISE  
 SPECIFIED

for all bands. This coil simply acts as an r.f. choke on 80 meters. A v.f.o. input jack is wired directly across the crystal socket. For use with a separate v.f.o., the crystal is removed and the slide switch in the 6CL6 cathode circuit is closed. This connects the 22- $\mu$ fd. grid capacitor to ground through a .002- $\mu$ fd. capacitor. The stage now operates as an ordinary amplifier.

Next in line is a 6AQ5 buffer-multiplier. On the two lower bands, the tube operates as a class A buffer, while on the upper bands, it is a class C multiplier. Screen-grid voltage control of this stage allows the operator to vary the grid drive to the final amplifier from zero to well over the amount needed for full-power output. Pi-network coupling is used from this stage to the final.

The final power amplifier is a high permeance 6146 beam power tube operating as a straight-through class C stage. A bandswitched  $\pi$ -network output tank is used to match the antenna employed. To protect the output tube in the event that excitation fails, a 6AQ5 clamper tube is in the circuit. The grid of this tube is connected to the grid circuit of the final. As long as excitation is present, the clamper is held cut off. But just as soon as someone pulls the crystal out of the socket, or if the oscillator or buffer tubes should fail, there will be no signal at the grid. The clamper tube now conducts heavily through the screen-dropping resistor of the 6146. This lowers the screen voltage and keeps the output tube current down to a safe value.

The clamper tube also acts as an

oscillator screen-grid regulator when the transmitter is keyed. Keying takes place in the oscillator and final cathode circuits and there is only about 12 volts across the key terminals at all times.

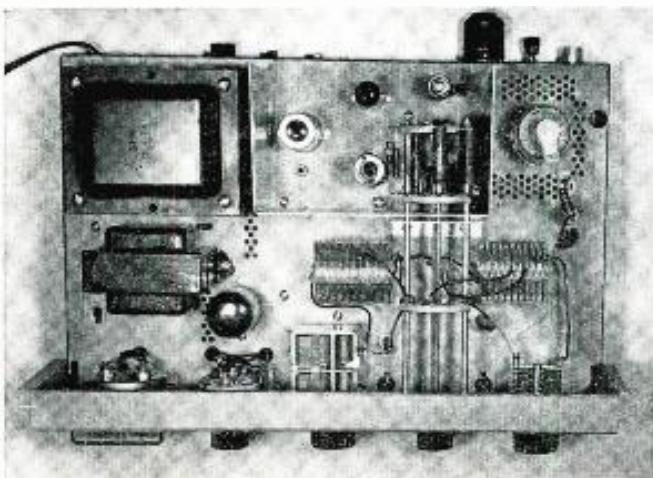
The power supply is a conventional full-wave rectifier with choke-input filter providing about 600 volts of "B+." A high-efficiency, indirectly heated GZ34 is the rectifier tube used.

A meter-switching arrangement is employed to permit monitoring of the final plate and grid currents.

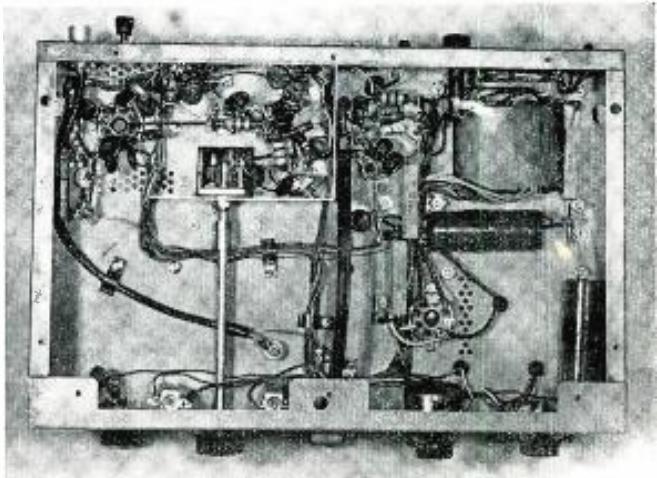
Once the transmitter is "all buttoned up" and its attractive cover installed, quite a few screws have to be removed in order to get at the tubes. However, with the conservative design of this rig we do not anticipate that we will have to worry about this for some time to come.

-30-

Top-view of unit with exciter shielding removed to show tubes.



Under-chassis view shows the wiring and layout of small parts.



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Newest complete stereo high-fidelity amplifier at an amazing low \$44.50—the most sensational value ever offered in a stereo amplifier kit. It's a pleasure to assemble. It's a truly fine instrument—the worthy heart of the finest stereo hi-fi music system. Ideal for use with newest stereo records or stereo radio broadcasts. Delivers 10 watts per channel into each of two speaker systems for 20 watts of stereo—or 20 watts into one or more speakers for monaural use. Includes two fully integrated built-in preamps to accommodate magnetic cartridges. Single switch selects phono, tuner or auxiliary stereo inputs, plus stereo reverse on each; also switches monaural input to both amplifier channels. Has separate bass and treble controls with both boost and attenuation for complete control of tonal color. Special clutch-type concentric volume control permits individual channel balance adjustment, plus overall volume control. RIAA equalized for stereo discs. Has four pairs of stereo inputs: magnetic cartridge, ceramic cartridge, tuner and auxiliary. With switched AC accessory outlet for added convenience. Response is 20-20,000 cps,  $\pm$  1.5 db. Hum and noise, better than 85 db below full output. Distortion less than 1½%. Simple point-to-point wiring for easy assembly—even without previous electronic experience. Custom cabinet attractively finished in French gray; aluminum front panel with ebony trim;  $4\frac{1}{4} \times 13\frac{1}{4} \times 9''$ . With case, tubes, all parts, wires, solder and instructions. Shpg. wt., 27 lbs.

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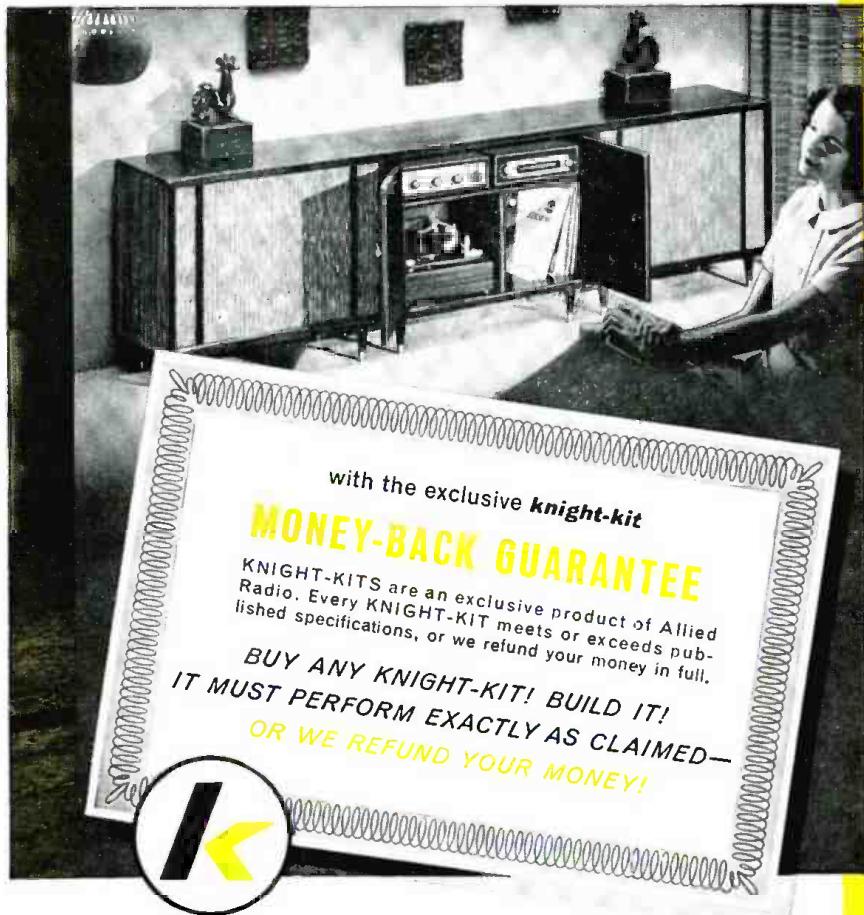
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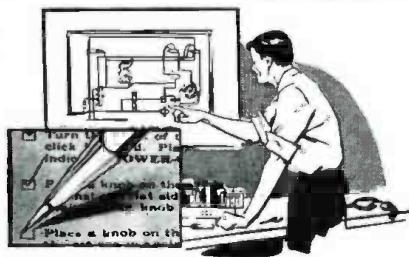


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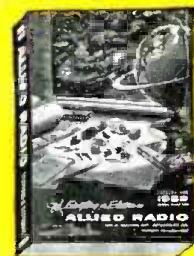


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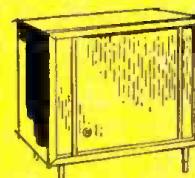
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Perma-Power's unique TV Tube Restorer can be used on electro-static or electromagnetic focus picture tubes in series or parallel wired filament TV sets. This one simple unit corrects for dozens of picture tube faults. Engineered for quality... and fully guaranteed.

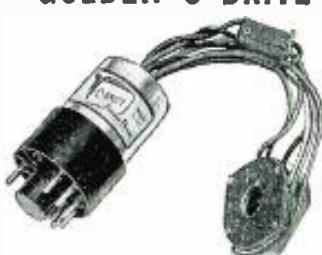
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MODEL C-201

List Price \$2.48



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## Reflex Enclosures

(Continued from page 36)

a cube. More amateur-designed enclosures probably go wrong on this point than any other—a broom closet with a speaker at one end and a hole at the other simply will not behave as a bass-reflex system. The thing to avoid is a cabinet in which the ratio between any two dimensions is more than 3:1. An enclosure 13" x 20" x 50", for example, is obviously a pipe, not a box, and will behave as such.

### Reflex Port

The resonant frequency of the enclosure is usually tuned to the free-air resonance of the speaker to be used since this seems to give smoothest bass response. This frequency is determined largely by the volume of the enclosure in relation to the size of the port. It makes little difference if the port consists of one rectangular hole, two slots, or a number of round holes as long as the total area is correct.

Table 1 provides data which can be used to build reflex enclosures with reasonable assurance of satisfactory performance. The table is compiled from the characteristics of actual commercial designs and balances the resonant frequency of the system against the size of the cabinet and the size of the speaker, as well as the speaker's free-air resonance, for best over-all performance.

The exact position of the port or ports is not critical. Theoretically, there is some advantage in having the port close to the speaker, but if it is closer than three or four inches there will be a band of frequencies attenuated because of cancellation between the front and rear of the speaker cone. If close spacing is dictated by the configuration of the cabinet, cancellation can be avoided by inserting a 3 to 4-inch shelf between the speaker and the port on the inside of the enclosure.

A duct or tunnel increases the effective mass of air in the port and thus allows a smaller volume to be used with a given port area. Within limits, this idea works well. The main disadvantage is that even though system resonances can be lowered, the frequency of the upper impedance peak remains very nearly the same. Consequently, if a long tunnel is used in a very small cabinet, there will be an unpleasant boom in the upper bass region and a hole in the response curve below this point.

### Construction

In even the most rigidly constructed cabinet, there is always some flexion of panels. The ideal method of building a reflex enclosure seems to be to use brick or concrete. For most applications however, wood is still the most practical material, and a carefully built wooden cabinet can closely approach theoretically optimum performance.

The enclosure should be made of pl-

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**RA-20 POWER SUPPLY.** To convert above receiver to 110 V. AC operation. Used—Tested. EACH. .... \$84.50

**BC-312, 342, 344 INSTRUCTION BOOK, postpaid.** .... \$2.50

**BC-344 LOW FREQUENCY RECEIVER.** Same appearance & construction as BC-312. Sensitivity Superhet covering 150 to 1500 KC in 4 bands. Includes BFO for CW reception. For 110 V. AC operation. **NEW**. Units. Tested. Shpg. wt. 80 lbs. EACH. .... \$79.50

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**BC-659 FM TRANSCOMM.** 2-Channel, 27.0 to 38.0 MC. 2 Watts Output. Can be modified for use on new Citizens Band in 26.90 to 27.23 MC range. **NEW UNITS**, complete with tubes and built-in loudspeaker. Shpg. wt. 45 lbs. EACH. .... \$11.95

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**BC-1325 FM TRANSCOMM.** 2-Channel, 27.0 to 38.0 MC, with built-in 6 or 12 V. DC Power Supply. Small, compact Transistor measuring only 6 3/4" x 11 1/2" x 14 1/2" with miniature tubes, yet has power output of 2 Watts. By adding a Miller or similar circuit to transmitter to crystal control, and converting to AM, can be applicable for use on new "Class D" Citizen Band. Almost-New condition units, with all tubes, and schematic. Shpg. wt. 35 lbs. EACH. .... \$24.95

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wood  $\frac{3}{4}$ - to one-inch thick and any panels larger than two feet square should be braced internally. If there is noticeable panel vibration once the system is in use, more struts should be added until all surfaces are rigid and free from resonance.

#### Interior Padding

Considerable misunderstanding exists concerning the function of acoustic padding in reflex cabinets. Contrary to published information, varying the amount of interior padding over wide limits will not noticeably change the resonant frequency of the system nor will it affect bass transient response.

The real purpose of lining the interior walls with absorbent material is to smooth out mid-range response. The more padding used, the smoother the measured frequency response, but the "deader" the mid-range will sound. Obviously, the correct amount of treatment depends on the mid-range characteristics of the speaker, the acoustics of the room in which the system is used, and the degree of liveness which the listener finds natural. A general rule of thumb is to pad four interior surfaces and arrange to have each blank wall face a padded wall.

In computing the volume of a reflex enclosure, the space occupied by padding should not be subtracted from the internal dimensions. As a matter of fact, if a great deal of absorptive material is used, the effective volume of the cabinet is increased rather than decreased. Lining all surfaces with four or five inches of glass fiber will effectively increase the volume of a sealed enclosure by about 20%. The reason for this is that acoustic padding dissipates sound energy as heat. During a compression cycle, some of the springiness of the enclosed air is lost, rather than being retained as potential energy.

—30—

#### SEALED CIRCUITS RELIABLE

ACCORDING to Donald H. Kunzman, president of the RCA Service Company, the sealed circuits in television sets have proven so reliable that, on the average, a technician would have to replace only one circuit board in two-and-a-half years of servicing sets so equipped.

This estimate was based on an analysis of service calls over a six-month period in the company's service branches throughout the country, which have replaced one board for every 5000 service calls. Since a good technician can handle 40 calls per week, 50 weeks per year, this means that a top-notch technician working on RCA Victor sets exclusively would replace a board once in two-and-a-half years.

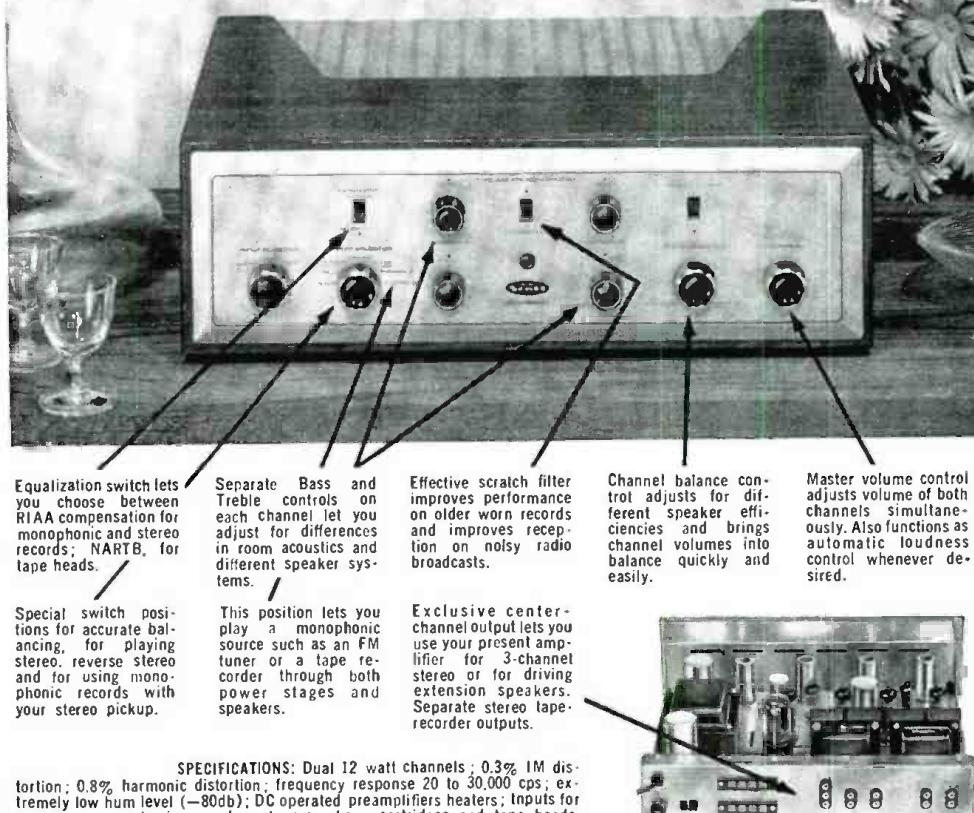
A further study of the 5000 service calls disclosed that less than 2 percent of these calls—less than one in 50—have anything to do with the boards themselves.

Mr. Kunzman also cited another service company survey which showed that ten leading brands of television sets required less than three-quarters of a service call per set during the first 90 days—the period of the labor warranty now being granted by many dealers.

—30—

# New H.H. Scott Stereo Amplifier has features never before offered at \$139.95\*

The new H.H. Scott 24 watt stereophonic amplifier, Model 222, puts top quality within the reach of all. This new amplifier has many features never before available for less than \$200. It is backed by H.H. Scott's fine reputation. Check the features below and you'll see why you should build your new stereo system around the H.H. Scott Model 222.



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This position lets you play a monophonic source such as an FM tuner or a tape recorder through both power stages and speakers.

Exclusive center-channel output lets you use your present amplifier for 3-channel stereo or for driving extension speakers. Separate stereo tape recorder outputs.

SPECIFICATIONS: Dual 12 watt channels; 0.3% IM distortion; 0.8% harmonic distortion; frequency response 20 to 30,000 cps; extremely low hum level (-80db); DC operated preamplifiers heaters; Inputs for stereo or monophonic recorders, tuners, phono cartridges and tape heads. Phono sensitivity 3 mv. Sub-sonic rumble filter prevents overload from noisy changers or turntables. Price \$139.95\*

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- ✓ Transformer, socket and wiring leakage capacity



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SIZE: W-6" H-7" D-3½"

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

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Checks all power rectifiers in-circuit whether SELENIUM, GERMANIUM, SILICON, etc.



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

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

SIZE: W-6" H-7" D-3½"

#### SPECIFICATIONS

- Checks all types of power rectifiers rated from 10 ma. to 500 ma. (selenium, germanium, silicon, etc.) both in-circuit or out-of-circuit.
- Will not blow fuses even when connected to a dead short.
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Just clip SRT-1 test leads across rectifier under test right in the circuit without disconnecting rectifier from circuit. Press test switch and get an instant indication on the easy-to-read three-color meter scales . . .

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### A Real ECONOMY MULTIPLE SOCKET TUBE TESTER without sacrifice in ACCURACY, SPEED or VERSATILITY

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\$39.50 Net

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#### SPECIFICATIONS

- Checks emission, inter-element shorts and leakage of over 600 tube types. This covers OZAs, series-string TV tubes, gas regulators, auto 12 plate volt, 10 seconds • 3 settings enable a test of any tube in less than D'Arsonval type meter — most accurate type available . . . its greater sensitivity means more accuracy . . . its jewel bearing means longer life • 17 long lasting phosphor bronze tube sockets • Combination gas and short jewel compartment • 9 filament positions • Handy tube chart contained in special back tachable line cord

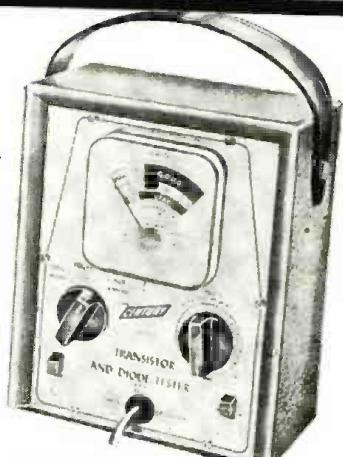
*plus* these BONUS FEATURES . . . found in no other low price tube tester

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

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

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Model  
VT-1

WITH LARGE EASY-TO-READ 6" METER —

featuring the sensational new **MULTI-PROBE** \* Patent Pending

No extra probes to buy! The versatile MULTI-PROBE does the work of 4 probes

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- ③ Lo-Cap Probe
- ④ RF Probe

The VT-1 is a tremendous achievement in test equipment. With its unique MULTI-PROBE it will do all the jobs a V.T.V.M. should do without the expense of buying additional probes. No longer do you have to cart around a maze of entangled cables, lose time alternating cables or hunting for a misplaced probe. With just a twist of the MULTI-PROBE tip you can set it to do any one of many time-saving jobs. A special holder on side of case keeps MULTI-PROBE firmly in place ready for use.

## FUNCTIONS

**DC VOLTMETER** . . . Will measure D.C. down to 1.5 volts full scale with minimum circuit loading, and give accurate readings of scale divisions as low as .025 volts. Will measure low AGC and oscillator bias voltages from .1 volts or less up to 1500 volts with consistent laboratory accuracy on all ranges . . . Zero center provided for all balancing measurements such as discriminator, ratio detector alignment and hi-fi amplifier balancing.

**AC VOLTMETER** . . . True Peak-to-Peak measurements as low as 3 volts of any wave form including TV sync, deflection voltages, video pulses, distortion in hi-fi amplifiers, AGC and color TV gating pulses . . . Scale divisions are easily read down to .1 volts . . . Measures RMS at 1/20th the circuit loading of a V.O.M. . . . Unlike most other V.T.V.M.'s there is no loss in accuracy on the lowest AC range.

**ELECTRONIC OHMMETER** . . . Measures from 0 to 1000 megohms . . . Scale divisions are easily read down to .2 ohms . . . Will measure resistance values from .2 ohms to one billion ohms . . . Will detect high resistance leakage in electrolytic and by-pass condensers.

## RF and LO-CAP MEASUREMENTS

With these extra VT-1 functions you can measure voltages in extremely high-impedance circuits such as sync and AGC pulses, driving saw tooth voltages, color TV gating pulses, mixer output levels, I.F. stage-by-stage gain and detector inputs.

## OUTSTANDING FEATURES

- Completely portable — self powered with long life batteries — permits use everywhere . . . New advanced pentode amplifier circuit assures amazingly low battery drain
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- Simplified multi-color easy-to-read 4-scale meter
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- Amplifier rectifier circuit with frequency compensated attenuator — a feature found only in costly laboratory instruments
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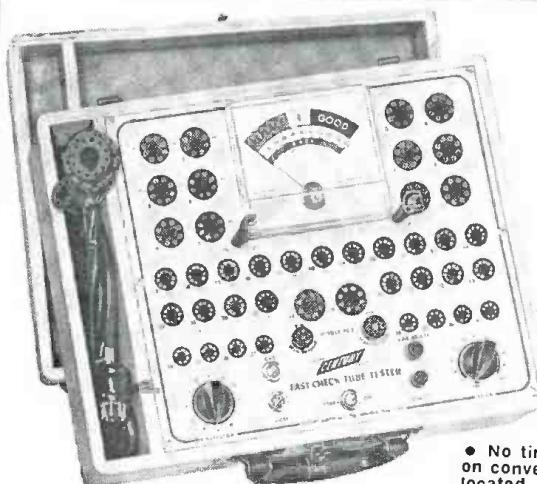


SIZE:  
W-7 3/8"  
H-9"  
D-4 1/4"

Model VT-1 — fully wired and calibrated, housed in handsome hammetone finish steel case, complete with MULTI-PROBE and thorough instruction manual covering \$58.50 all the applications in detail.

## SPECIFICATIONS

- DC Volts — 0 to 1.5/6/30/150/300/600/1500 volts
- AC Volts (RMS and Peak-to-Peak) — 0 to 3/12 60.300 1200 volts
- Ohms — 0 to a billion ohms, 10 ohms center scale — Rx1/10/100/1K/10K/100K/1M
- RF — Peak reading demodulator supplied for use on all DC ranges
- Zero Center — available on all DC volt ranges with zero at mid-scale
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- Input Capacity — 130 mmfd. RMS, 250 mmfd. Peak-to-Peak, 25 mmfd. Lo-Cap



SIZE: W-14 5/8" H-11 1/4" D-4 3/8"

Model FC-2 — housed in hand-rubbed oak carrying case complete with CRT adapter

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Simply set two controls . . . insert tube . . . and press quality button to test any of over 700 tube types completely, accurately . . . IN JUST SECONDS!

Over 20,000 servicemen are now using the FAST-CHECK in their every day work and are cutting servicing time way down, eliminating unprofitable call-backs and increasing their dollar earnings by selling more tubes with very little effort. See for yourself at no risk why so many servicemen choose the FAST-CHECK above all other tube testers.

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

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- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

## SPECIFICATIONS

- No time consuming multiple switching . . . only two settings are required instead of banks of switches located inside cover. New listings are added without costly roll chart replacement
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**SCOPING UNIT**: BC 704 Radar Indicator. Ideal foundation unit for 5-12 inch scope, padamptor, monitor, etc. Size: 19" x 9" x 8". Required: 1A/C, 3-611, and 5RPI. New, less tubes, put with viewing hood, and neat wooden carrying chest (11" x 12" x 30") which may be used for tool chest. \$2.50

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## Direction Finders

(Continued from page 32)

of voice or music that may be used.

Most DF units are provided with two bands for coverage of the beacon and broadcast frequencies. Some are also equipped for reception, but not direction finding, in the 2-3 mc. marine band. There are even some communications receivers that cover the ham and short-wave broadcast bands which can be used as direction finders.

### Stations

There are plenty of stations on which bearings can be taken. In the isolated areas where all broadcasting stations are at a considerable distance or on the air only during certain hours, private short-range beacon stations can be installed for which no FCC license is required. Range, however, is limited to about 1000 feet which makes beacon stations of this type suitable mainly for finding a wharf or cove in the dark or fog. When operated between 160 and 190 kc., which is in the tuning range of many DF units, up to one watt of input power may be applied to the final r.f. stage of the transmitter. The antenna and its transmission line may be up to 50 feet in length over-all. While such transmitters are not yet available commercially, they can be easily built by anyone familiar with simple transmitters. However, no operation should be attempted until FCC rules and regulations, Part #15, defining operating conditions, is reviewed.

U.S. radio beacon stations operate on frequencies between 285-315 kc. More than one beacon station may operate on the same frequency on a time-sharing basis. It is therefore necessary to identify the station by its code signal when taking a bearing so its location can be determined. There are four classes of beacon stations: Class A—200 mile range; Class B—100 mile range; Class C—20 mile range; and Class D—at breakwaters and harbor entrances.

These low-frequency radio beacon stations serve extremely valuable functions. Since more accurate bearings can be taken at low frequencies, they are most commonly used by boatmen for direction finding and location plotting. Also, when close to the shore in fog, it is sometimes possible to hear an audible fog horn blast from a beacon station location. By listening to the radio signal from the same station and then to the fog horn, the distance from the beacon station can be determined by counting the number of seconds between receipt of the two signals. The radio signal arrives in a matter of microseconds but the sound requires 5 seconds per statute mile or 5.6-6 seconds per nautical mile.

Bearing accuracy is affected somewhat by the frequency of the radio station on which a bearing is taken. The lower the frequency, the more reliable the bearing. While DF bearings

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are customarily taken on radio stations operating in the low-frequency marine band and in the broadcast band, it is possible to take bearings with some DF units in the medium-frequency (m.f.) marine band. While bearing accuracy is not as good as at lower frequencies, the ability to take bearings on other boats is of significance. The position of a boat not equipped with a DF can be determined by two other boats equipped for taking bearings on the marine band. The boat without a DF turns on his transmitter long enough for the other two boats to take bearings.

While it is very easy to "home" with a DF, it requires good judgment, care, and some knowledge of navigation to obtain an accurate position "fix" with a DF. There are many books on the subject including "Radio Navigation Aids" which is available for \$5.00 from the Hydrographic Office of the Department of the Navy, Washington 25, D. C.

Navigation charts, obviously, are required. Special plotting devices are available which make it easy for the amateur navigator to determine his position.

#### Installation

Direction finders are customarily sold through specialized marine radio dealers who provide service. Portable types are also sold by some electronic parts mail-order houses and sporting goods stores.

Anyone can install a portable DF by following the simple instructions customarily furnished with the equipment. Some of this gear is so compact that it can be used at home as a radio receiver and taken aboard only when going on a cruise. (See Fig. 6.)

The more elaborate DF units, intended for permanent installation, should be handled by the dealer or a qualified service technician. It is the technician with DF experience who prepares the deviation correction charts and instructs the owner on their proper use. If the DF is equipped with a "sense" antenna, the DF becomes a radio compass. The sense antenna should be specified and installed by an experienced technician because if it is too long, too short, or improperly located, operation will be impaired.

In addition to the rotatable loop-type DF, there are DF units which employ fixed loops. A DF of this type is used primarily on large commercial vessels. There are two loops, oriented at right angles to each other. Direction and bearing are determined by a goniometer located in the receiver which may be at a considerable distance from the fixed loop.

Even a portable TV set equipped with a rabbit-ear antenna can be used as a DF. The null points are clearly defined but there is a chance of error because the easily reflected v.h.f. TV signals may not reach the receiver by a direct route. The rabbit ear's directional characteristics are diametrically opposite to those of the loop antenna. Maximum signal is received when the

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broadside of the antenna faces the station and the nulls are at each end.

While some airborne direction-determining systems operate at very high frequencies because of the high directivity of the radio signals, reflections may cause serious errors when used on water or close to the earth's surface.

Many fishermen and boatsmen have lost their lives when they got lost in heavy fog or darkness. Many of these casualties could have been prevented had their boats been equipped with direction finders with which the occupants could have found their way. DF units are now inexpensive. Even a rowboat can use a DF that operates from self-contained batteries. When in close proximity to big cities where there are powerful broadcasting stations, even the cheapest of transistor portables will usually function as a DF of sorts. And, someone will get smart and make a very simple but sensitive regenerative single-tube or single-transistor, vest-pocket-size, short-range DF which will be within the budget of even the man who has to limit his "yachting" to a rented rowboat. While such a device will be far from ideal, it might be just the gadget that will save his life.

-30-

### CHIP CHASING

By JOSEPH L. REIFFIN, W5CWP

THE problem of drilling a hole in a completed chassis is one that faces every ham and experimenter at one time or another. Clearing away existing wiring and small components is difficult enough, but the real "fly in the ointment" is the "shavings in the circuitry."

Solutions to this problem, ranging all the way from the application of a constant stream of air under pressure to the use of magnets to catch the troublesome metal chips, have been offered by the ingenious among us. However, compressed air is available only to a fortunate few. The less fortunate majority of us can develop air pressure by lung power but this is difficult, if not downright impossible, to sustain at high enough levels to do any good. The magnet idea is helpful if the chassis is made of steel but absolutely useless if the chassis happens to be made of aluminum—which is often the case.

A method currently being employed to eliminate this problem when modifying sections of the huge Burroughs Corporation computers used in the Air Force SAGE system, is both easy and effective.

A small blob of ordinary soft modeling clay, such as is used in children's modeling sets, is stuck against the back side of the chassis over the spot where the hole is to be drilled. Another blob is stuck on the top side of the chassis, doughnut fashion, around the marking for the hole. The hole is then drilled and the metal shavings are automatically caught up in the clay. It then becomes a simple matter to remove the blobs of clay and the danger of the metal shavings falling into the circuitry is eliminated.

The clay can be used over and over again until it becomes so full of metal shavings that it should be discarded.

-30-

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#### SPECIFICATIONS

##### Measures:

DC Volts—0.02 volt to 1500 volts in 7 overlapping ranges

AC Volts (RMS)—0.1 volt to 1500 volts in 7 overlapping ranges

AC Volts (peak-to-peak)—0.2 volt to 4000 volts in 7 overlapping ranges

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

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

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

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



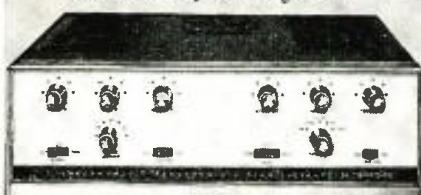
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*Electron Tube Division*

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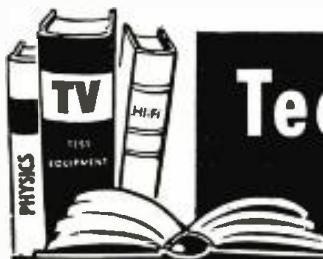
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High Fidelity Division  
OCEANSIDE, LONG ISLAND, NEW YORK



# Technical Books



"TUBE & SEMICONDUCTOR SELECTION GUIDE" compiled by Th. J. Kroes. Published by Philips' Technical Library, Eindhoven, Netherlands. 160 pages. Price \$1.50. Soft binding.

This revised edition of a manual which first appeared in 1957 contains considerable new material regarding tubes and semiconductors released since that date.

The publication carries tables of all tubes which can also be found in the Philips manufacturing range or which can be replaced by suitable equivalent types, tables in which the tubes are grouped according to their most important properties, preferred types for new equipment, replacement tubes for obsolete types, a description of type-number systems, and data on a number of tube bases and holders, plus data on diodes and transistors.

The tables are printed in English only but explanatory material is given in French, German, and Spanish as well. The guide is divided into sections covering tubes for receivers and amplifiers, CR tubes, transmitting tubes, tubes for microwave, etc.

\* \* \*

"THE PULSE OF RADAR" by Sir Robert Watson-Watt. Published by The Dial Press, New York, N.Y. 438 pages. Price \$6.00.

Those of us who have worked with radar during and after the war are apt to forget the crude beginnings and early history of this remarkable tool. This autobiographical work by one who has been called "the father of radar" covers this ground as well as the use of radar during the war. The writing is highly articulate, although the story is quite rambling and not wholly modest in spots. For those who are interested in the highly important British contribution to radar, and this is mainly the story of Sir Robert Watson-Watt, this book is fascinating reading.

\* \* \*

"APPLIED PRACTICAL RADIO-TELEVISION" edited by Coyne Technical Staff. Published by Coyne Electrical School, Chicago. 7 volumes. Price \$24.95 complete.

Here is a technical library which will take up no more than 9 inches on the service bookshelf yet provide the answers to almost any problem confronting the technician. The seven volumes of this set include separate texts on "Radio and Television Principles;" "Radio, Television, and FM Receivers;" "Radio and Television Circuits;" "Latest Instruments for Servicing Radio-Television;" "Television Servicing Encyclopedia;" and "Transistor Circuits."

Many authors and commercial firms

contributed material for these volumes but, under the over-all editorship of the publisher's Technical Staff, the text retains a uniformity of treatment and style which users will find helpful. As with all books from Coyne, this material is intensely practical and theoretical discussions and concepts are held to an absolute minimum.

In order to eliminate the obsolescence which is practically inevitable in a fast-moving industry like electronics, the publisher is providing a five-year "supplement service" which will keep the material up-to-date—following the precedent established by the publishers of the "Encyclopedia Britannica" in the general field.

This "library" can serve equally well as a "home study course" and as a permanent reference file for the practicing and experienced radio-TV technician.

\* \* \*

"ELECTRONIC AVIATION ENGINEERING" by Peter C. Sandretto. Published by International Telephone and Telegraph Corporation, 67 Broad St., New York 4, N.Y. 755 pages. Price \$9.50 postage prepaid.

If correspondence is any criterion there are literally hundreds of our readers who have been looking for just such a book as this. Evidently there are many young men with a bent toward electronics and aviation who want a career in "aviation" and are seeking information on the equipment with which they will be working. This volume should meet the needs of this group admirably.

The text covers the various radio and electronic aids to aviation. The systems are grouped in four classes based on the operational problems of aircraft in flight toward a destination airport, in flight near the airport, approach and landing, and movement on the airport surface.

The author discusses direction finders; four-course, TL, and omnidirectional ranges; consol, Post Office position indicator, nagaglobe-navarho, decra, delrac, destra, radux, loran, radar, radio high-altitude and landing altimeters, doppler drift, inertial systems, distance measurement, gee, tacan, surveillance radar, fixed-beam and radar low-approach systems; traffic pads, ground magnetic loops, and surface radar.

Before taking up each of the equipment items in detail, the author includes introductory material which lays the historic groundwork for the device's development and a description of the requirements of the avigation fa-

cilities as outlined by the users of such gear—whether operators of commercial or military craft, jet or propeller driven. Comprehensive bibliographies are included at the end of each chapter for further reference.

While this volume appears to "fill the bill" for the electronics man of the space age, the student is hereby warned to have mathematical faculties well sharpened before tackling this text.

\* \* \*

"TELEVISION SERVICING" by Alex Levy & Murray Frankel. Published by McGraw-Hill Book Co., Inc., New York. 534 pages. Price \$7.75.

The entirely valid title chosen for this useful volume may prove to be a handicap: it invites the assumption that the book is in a class with several other disappointing ones masquerading under similar names. No mere "arm-chair" technicians, the authors have turned out a job redolent with the feel and the terminology of practical field and bench service. At the same time, they have avoided going overboard. The customary theoretical presentation of TV receiver circuits—beyond which other volumes purporting to cover the same ground seldom venture—is not omitted. The result is a notably worthwhile presentation that will be welcomed by technicians on many levels: the learner seeking basic material, the experienced service technician, and the technical school graduate whose head is crammed with theory but has difficulty correlating it with the actual, physical handling of sick sets.

Scorning a "safe," well-worn organization of materials, the authors choose as their starting point the home service call and what can be done in the field. There is careful adherence to the logical procession from the symptom itself, to probable causes, to remedial analysis, with the reader moving to the shop bench for a complete tour of the receiver.

It is gratifying to see as much willingness to discuss cheater cords, fusible resistors, gunboating, and shelf-type (stacked "B+") power supplies as there is to cover sync pulses, blocking oscillators, and sync separation. The material comes from the authors' heads, but from their busy benches as well.

—30—

#### A. F. WESTERN NET

THE U. S. Air Force MARS Western Technical Net schedule for June (Sundays 2-4 p.m., PST, 7832.5 and 3295 kc. and 143.46 mc.) is as follows:

June 7—"Air-Ground Communications on Historical Long Range Flights" by Col. Frank Shannon USAF (Ret.), manager, Technical Field Service, Packard Bell Electronics.

June 14—"Storage of Intelligence: Sight and Sound" by Jim Stultz, administrative sales manager, Ampex Corporation.

June 21—"The Space Age and California" by Charles F. Horne, vice-president and division manager, Convair.

June 28—"Equipment Utilization and Conversion Information" by USAF MARS W. T. N. Members.

—30—

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**TEST ANY TUBE IN  
10 SECONDS FLAT!**

- 1 Turn the filament selector switch to position specified.
- 2 Insert tube into a numbered socket as designated on our chart (over 600 types included).
- 3 Press down the quality button—

**THAT'S ALL!** Read emission quality direct on bad-good meter scale.

#### SPECIFICATIONS

- Tests over 600 tube types
- Tests OZ4 and other gas-filled tubes
- Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings
- Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence
- Dual Scale meter permits testing of low current tubes
- 7 and 9 pin straighteners mounted on panel
- All sections of multi-element tubes tested simultaneously
- Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms

Model 82A comes housed in handsome, portable Saddle-Stitched Texon case. Only

**\$36.50**

SUPERIOR'S NEW MODEL TV-12

# TRANS-CONDUCTANCE TUBE TESTER



#### TESTING TUBES

- Employs improved TRANS-CONDUCTANCE circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- NEW LINE VOLTAGE ADJUSTING SYSTEM. A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.

#### ALSO TESTS TRANSISTORS!

- SAFETY BUTTON—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

- NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY. Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

#### TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 comes housed in handsome rugged portable cabinet and sells for only ...

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SUPERIOR'S NEW MODEL TW-11 STANDARD PROFESSIONAL

# TUBE TESTER



★ Tests all tubes, including 4, 5, 8, 7, Octal, Lock-in, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin any of the pins may be placed in the neutral position when necessary.

★ The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

★ Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

NOISE TEST: Phono-Jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

#### EXTRAORDINARY FEATURE

SEPARATE SCALE FOR LOW-CURRENT TUBES: Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet

**\$47.50**

SUPERIOR'S NEW MODEL 83

# C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES



#### ALL BLACK AND WHITE TUBES

From 50 degree to 110 degree types—from 8" to 30" types.

#### ALL COLOR TUBES

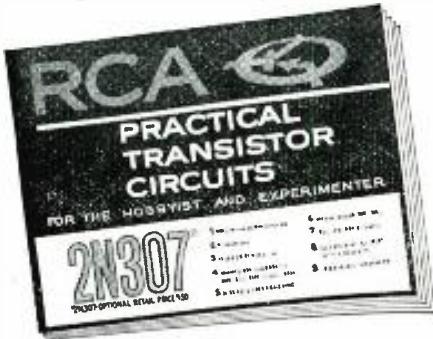
Test ALL picture tubes—in the carton—out of the carton—in the set!

- Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes.
- Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types.
- Model 83 employs a 4" air-damped meter with quality and calibrated scales.
- Model 83 properly tests the red, green and blue sections of color tubes individually—for each section of a color tube contains its own filament, plate, grid and cathode.
- Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition.
- Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltage improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Model 83 comes housed in handsome portable Saddle-Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only

**\$38.50**

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featuring 2N307  
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RCA's high-performance, low-cost 2N307 power transistor is a "natural" for hams, experimenters, hobbyists and others who enjoy building electronic devices for education and fun. The new 16-page RCA booklet shown above provides complete, easy-to-build circuits and parts lists for the following devices using RCA-2N307 transistors.

- 12-watt "Hi-Fi" Amplifier • Sinusoidal Power Oscillator • Regulated Power Supply
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OF AMERICA**

Semiconductor Products—Distributor Sales  
Harrison, N. J.

## Those Marginal TV Defects (Continued from page 43)

ground is dark and relatively few light objects are shown. This is due to a variation in the d.c. level at the sync clipper stage and the resultant delay in horizontal locking action. The appearance of "snivets"—white or black ragged, vertical lines at either side of the screen, but usually on the left, is easily recognized as Barkhausen oscillation and curable by changing the horizontal-output tube or some of the other tubes in this section.

Compression of the picture at one side, stretching, and wavy lines are all familiar defects of the horizontal-sweep section. Even when present only to a slight degree, they are easily recognized.

Deformed pictures are not always caused by either of the sweep sections. Overloading of the i.f. or video stages can also cause such defects. When the a.g.c. control is misadjusted or the a.g.c. bus is shorted, overload conditions will appear quite drastically. A picture that is too black and has all sorts of distortions is easily recognized as defective, but the set owner can reduce the appearance of overloading on some sets by adjustment of the contrast control. If the take-off for the sync separator from the video section is located where it is unaffected by contrast control settings, then the effect of overloading will be masked and appear just as distortion. The presence of slight hum is also often a marginal complaint but, to the service technician, 60- or 120-cps hum in the picture are unmistakable and indicate a definite defect.

### Sound Trouble

The person who closely observes the quality of the sound during a TV program is rare. Only real audiophiles are concerned with the fidelity of TV sound, as a rule, and they usually are aware of the inherent limitations of most TV receivers. Recently many more people have become conscious of audio quality and they often object to the output of their low-cost TV sets. The only remedy for that is to connect the sound from the TV set to their high-fidelity equipment.

Complaints of distortion, garbling, or buzzing in the sound are usually specific enough to enable the technician to determine the approximate cause. In any event, a short listening test and, if desired, injection of a sine-wave test signal will quickly pinpoint the defect.

### Educating the Customer

Before telling the set owner the bad news, the technician might as well point out a few general facts from his past experience. Marginal troubles are more difficult to fix than such obvious things as a dead receiver. Many defects start out as aging of just one part and end up by causing a whole group of components to fail. A leaky

## TV PICTURE TUBES At Lowest Prices

10BP4	\$ 7.95	17BP4	\$10.95	21AMP4	\$19.95
12LP4	8.95	17CP4	17.00	21ATP4	20.95
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1 Year Warranty  
Aluminized Tubes \$5.00 more than above prices.  
Prices include the return of an acceptable similar tube  
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capacitor may cause lower "B+" voltage and therefore a weaker picture. In time this draws more and more current through the rectifiers and the filter, and eventually these components will also become defective. The proverb about a "stitch in time" holds true for TV receivers as well as any other equipment.

The customer often feels that, just because the picture is a little fuzzy or the sound is garbled, a \$15.00 repair job is too expensive. Often he will decide not to bother but let the set go as it is until more serious trouble develops. It is up to the technician to demonstrate the possibility of avoiding a more costly repair job later. At the same time, honesty requires that we tell the customer that repair in one section of the set does not mean that another section cannot become defective at some later date. This point, the fact that perfect over-all receiver performance cannot be guaranteed, is one of the major complaints of set owners. One service technician we know counters any arguments in this direction by remarking that, just because a man has just had his appendix removed, he has no guarantee that he will not break his leg as soon as he steps out of bed.

The most decisive argument in any discussion with the customer is the technician's reputation for honesty and technical know-how. If a person goes to the doctor for a check-up and the physician suggests medication, a diet, or an operation, the patient either has to accept the doctor's word or else take the consequences. A service technician takes the place of the "doctor" when it comes to "sick" TV receivers, and his judgment must be accepted as being the result of his technical knowledge and experience.

Another important part of such a discussion is to avoid seeming eager for the work. It is just as bad, however, to appear disinterested. Probably the best attitude to take is that, as long as the customer is already paying for the service call, he might as well have the job done. The next call would again cost at least the minimum service charge. Good-will is one of the most precious assets in any type of business.

-30-

#### TRANSISTOR SOCKET HOLDER FROM FAHNESTOCK CLIP

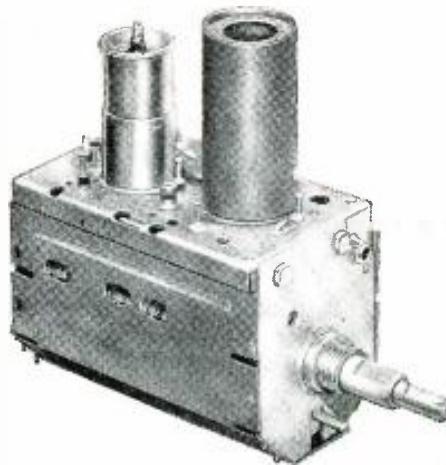
By JOSEPH A. BORSOS, W8CBG

WHILE building my second transistor radio recently and ruining an expensive "p-n-p" transistor when I soldered it in the circuit, I looked around my shack and spotted a Fahnestock clip in my junk box.

Simply straightening the top portion of this spring connector clip and pressing in the wire-holding prong yields a most economical transistor socket holder, which is unusually adapted to the breadboard circuit since it can be mounted with a single screw! It may be necessary to file out the slot a little in order to accommodate some transistor sockets.

-30-

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### The Sarkes Tarzian "HOT ROD"

The new, turret-type tuner is the result of over 15 years of specialization in the design . . . development and manufacture of television tuners.

Modern manufacturing methods—with stress on automation—enable us to offer the "Hot Rod" at the attractive, low price. And, it's the smallest unit on the market with these outstanding features:

*Tetrode R. F. stage . . . high gain . . . low noise . . . 13 permanent positions . . . adaptable for remote control operation . . . easily converted to UHF . . . very low oscillator drift . . . individual oscillator front adjustment . . . good resetability and I.F. output is tunable from the front.*



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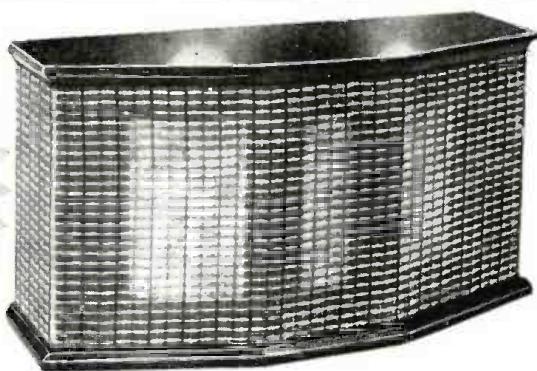


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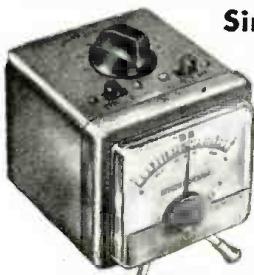
Complete listings of the NEWEST in Stereo and Monaural Hi-Fi, Short Wave, Audio, Transistor, and many other Lafayette electronics kits as well as thousands upon thousands of standard brand nationally advertised kits and electronic parts and components are described in LAFAYETTE'S GIANT NEW 260-PAGE CATALOG. SEND FOR IT—IT'S FREE! Just fill in coupon below and present it at any Lafayette store, or paste it on a postcard and send it to us. THAT'S ALL YOU HAVE TO DO to get your FREE 1959 LAFAYETTE CATALOG!

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27.50



**NEW! "STEREO ANALYST"  
Single Needle  
VU Balance  
Meter**



only **11.95**

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Versatile  
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Offered  
The Hi-Fi  
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- UNIQUE 2 COIL GALVANOMETER-TYPE PRECISION METER MOVEMENT
- 7 RANGES OF METER SENSITIVITY
- EFFORTLESS BALANCING OF STEREO SYSTEMS
- MAY BE USED AS VU METER AND TAPE RECORDER LEVEL INDICATOR

Solves all stereo balancing problems. Each stereo channel feeds a separate coil through a full-wave bridge rectifier. Balanced signals result in a 0 deflection. 2 slide switches permit individual channel measurements. Metal case, satin gold finish. Size: 4 1/4" x 5 1/2" x 4 1/4". Shpg. Wt., 3 lbs.

TM-66 Stereo Balance Indicator.....Net 11.95

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Leave it to Lafayette to bring you the "hottest" tweeter—the superlative electrostatic 3 element tweeter, rated best regardless of price. This smooth performing tweeter—superior to units costing many times more—improves ANY speaker system, bringing forth the realism and acoustic brilliance of the high frequencies. Simple to connect and use, comes complete with detailed instructions. In mahogany, walnut or blonde finishes with attractive plastic grilles. Size 11 1/4" x 6 x 4 1/2". Shpg. wt., 7 lbs.

SK-150 Electrostatic 3 Element Tweeter Mahogany Finish

SK-151 Same in Walnut Finish

SK-152 Same in Blonde Finish

**27.50**

- BUILT-IN CROSSOVER NETWORK 5000 Cycle Crossover Frequency
- WIDE 120° DISPERSION ANGLE Achieved by 3 Electrostatic Element Design
- MEASURABLY IMPROVES ANY SPEAKER SYSTEM Superb High Frequency Response from 5000 Cycles to Beyond 25,000 Cycles
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**99.50**

SAVE 26.60

PK-245 hysteresis-synchronous turntable with new Lafayette PK-270 12" professional stereo tone arm plus Shure M3D Dynetic Compatible Stereo Cartridge with .7 mil diamond stylus. Shpg. wt., 19 lbs. Special.....Net 99.50



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MONEY-SAVER COMBINATION  
Garrard latest model RC121/II with Shure model M3D professional Dynetic Compatible Stereo cartridge with .7 mil diamond stylus. Regular 83.15 value. Shpg. wt., 15 lbs.....Net 52.50

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Use it as a Binaural-Stereophonic FM-AM tuner

Use it as a Dual-Monaural FM-AM tuner

Use it as a straight Monaural FM or AM tuner



KT-500 IN KIT  
74.50 FORM  
ONLY 7.45 DOWN  
7.00 MONTHLY

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

FM specifications include grounded-grid triode low noise front end with triode mixer, double-tuned dual limiters with Foster-Seeley discriminator, less than 1% harmonic distortion, frequency response 20-20,000 cps  $\pm \frac{1}{2}$  db, full 200 kc bandwidth and sensitivity of 2 microvolts for 30 db quieting with full limiting of one microvolt. AM specifications include 3 stages of AVC, 10 kc whistle filter, built-in ferrite loop antenna, less than 1% harmonic distortion, sensitivity of 5 microvolts, 8 kc bandwidth and frequency response 20-50,000 cps  $\pm 3$  db.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheons having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13 $\frac{3}{4}$ " W x 10 $\frac{1}{2}$ " D x 4 $\frac{1}{2}$ " H. Shpg. wt., 22 lbs.

KT-500 ..... Net 74.50  
LT-50 Same as above, completely factory wired and tested ...Net 124.50

## NEW! LAFAYETTE PROFESSIONAL STEREO MASTER AUDIO CONTROL CENTER

Solves Every Stereo/Monaural Control Problem!

- UNIQUE STEREO & MONAURAL CONTROL FEATURES
- AMAZING NEW BRIDGE CIRCUITRY FOR VARIABLE 3D CHANNEL OUTPUT & CROSS-CHANNEL FEED
- PRECISE "NULL" BALANCING SYSTEM

A REVOLUTIONARY DEVELOPMENT IN STEREO HIGH FIDELITY. Provides such unusual features as a Bridge Control, for variable cross-channel signal feed for elimination of "ping-pong" (exaggerated separation) effects and for 3d channel output volume control for 3-speaker stereo systems; 3d channel output also serves for mixing stereo to produce excellent monaural recordings. Also has full input mixing of monaural program sources, special "null" stereo balancing and calibrating system (better than meters), 24 equalization positions, all-concentric controls, rumble and scratch filters, loudness switch. Clutch type volume controls for balancing or as 1 Master Volume Control. Has channel reverse, electronic phasing, input level controls. Sensitivity 1.78 millivolts for 1 volt out. Dual low-impedance outputs (plate followers), 1300 ohms. Response 10-25,000 cps  $\pm 0.5$  db. Less than .03% IM distortion. Uses 7 new 7025 low-noise dual triodes. Size 14" x 4 $\frac{1}{2}$ " x 10 $\frac{1}{2}$ ". Shpg. wt., 16 lbs. Complete with printed circuit board, cage, profusely illustrated instructions, all necessary parts.

LAFAYETTE KT-600 — Stereo Preamplifier kit ..... Net 79.50  
LAFAYETTE LA-600 — Stereo Preamplifier, Wired ...Net 134.50

## NEW! LAFAYETTE STEREO/MONAURAL BASIC POWER AMPLIFIER KIT



KT-310  
47.50  
ONLY 4.75 DOWN—  
5.00 MONTHLY

- 36-WATT STEREO AMPLIFIER—18-WATTS EACH CHANNEL
- FOR OPTIONAL USE AS 36-WATT MONAURAL AMPLIFIER
- EMPLOYS 4 NEW PREMIUM-TYPE 7189 OUTPUT TUBES

- 2 PRINTED CIRCUIT BOARDS FOR NEAT, SIMPLIFIED WIRING
- RESPONSE BETTER THAN 35-30,000 CPS  $\pm \frac{1}{2}$  DB AT 18 WATTS
- LESS THAN 1% HARMONIC OR INTERMODULATION DISTORTION

A super-performing basic stereo amplifier, in easy-to-build kit form to save you lots of money and let you get into stereo now at minimum expense! Dual inputs are provided, each with individual volume control, and the unit may be used with a stereo preamplifier, for 2-18 watt stereo channels or, at the flick of a switch, as a fine 36-watt monaural amplifier—or, if desired, it may be used as 2 separate monaural 18-watt amplifiers! CONTROLS include input volume controls, channel Reverse switch (AB-BA), Monaural-Stereo switch. DUAL OUTPUT IMPEDANCES are: 4, 8, 16 and 32 ohms (permitting parallel [monaural] operation of 2 speaker systems of up to 16 ohms). INPUT SENSITIVITY is 0.45 volt per channel for full output. TUBES are 2-6AN8, 4-7189; GZ-34 rectifier. SIZE 9-3/16" (10.9-16" with controls) x 5 $\frac{1}{4}$ " h x 13 $\frac{1}{4}$ " w. Supplied complete with perforated metal cage, all necessary parts and detailed instructions. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit ..... Net 47.50

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FORDHAM 7-8813

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- Multiflex Output for New Stereo FM
- 11 Tubes (including 4 dual-purpose) + Tuning Eye + Selenium rectifier Provide 17 Tube Performance
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- Pre-aligned IF's
- Tuned Cascade FM
- 12 Tuned Circuits
- Dual Cathode Follower Output
- Separately Tuned FM and AM Sections
- Armstrong Circuit with FM/AFC and AFC Defeat
- Dual Double-Tuned Transformer Coupled Limiters.

## STEREO REMOTE CONTROL CENTER KIT MODEL KT-315



27.50

- TWO LOW NOISE 7025 DUAL-TRIODES
- POSITIVE CONTROL 50 FEET OR MORE
- BRIDGE BALANCING CIRCUIT
- OUTPUT FOR "THIRD CHANNEL"
- CLUTCH-TYPE VOLUME CONTROL

Self-powered electronic adapter with unique features including low-impedance "plate follower" outputs for remote operation of from 50 feet or more from controlled amplifier. Cross-feeding various amounts of audio from each channel eliminates objectionable "hole in the middle" effect. Phase reversal with or without channel reversal. Premium type 7025 dual triodes. Printed circuit board for easy error-free assembly. Complete with case and simple detailed instruction manual. Size 6 $\frac{1}{4}$  x 4 $\frac{1}{4}$  x 7 $\frac{1}{4}$ ". Shpg. wt., 7 $\frac{1}{2}$  lbs. KT-315 Electronic Stereo Adapter Kit (with case) Net 27.50

## EXCITING "EXPLOR-AIR" 4 BAND RECEIVER KIT



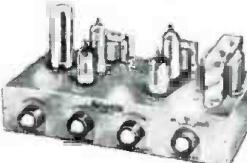
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- 4 Bands for total coverage:
- 550-1600 Kc broad cast band
- 1.7-5.0 Mc., 5.0-14 Mc., 14-30 Mc. shortwave bands
- Complete band-switching from front panel
- Built-in Big 4" PM Loud-speaker

A complete regenerative shortwave and standard broadcast set covering from 550KC to 30MC. Features include pre-wound coils, isolated chassis and freedom from shock hazard and sensitive circuitry. Perfect for amateurs, students and casual listeners. Simple to build, this kit is complete, including all parts needed and a detailed step-by-step instruction book. Shpg. wt., 8 lbs. KT-135 EXPLOR-AIR RECEIVER KIT (less cabinet) Net 18.50

ML-150 Leatherette, covered wooden cabinet for above Net 2.75

## NEW! LAFAYETTE STEREO AMPLIFIER KIT



18.95

- GANGED TONE CONTROLS
- STEREO-MONAURAL SWITCH
- .04 VOLT SENSITIVITY
- 4 WATTS STEREO OUTPUT
- ISOLATION TRANSFORMER
- SEPARATE VOLUME CONTROLS

Brand new stereo amplifier kit for that extra small stereo hi-fi set, featuring separate volume controls; ganged tone control; stereo, reverse and monaural switch. .04 millivolt sensitivity. Complete kit with tubes, rectifier, oil parts and instructions. Only 9 $\frac{1}{2}$ " x 5" x 4 $\frac{1}{2}$ ". For 110-120 60 cycle AC. Shpg. wt., 7 lbs. KT-126 — Complete Kit Net 18.95

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# Service Association of the Month



## BETTER ELECTRONIC SERVICE TECHNICIANS OF ARIZONA

DRAWING special attention to the very special and elaborate apprentice training program developed by BEST of Arizona may, in the long run, be a disservice to this alert group. Excellent as it is, it tends to take the observer's attention away from the fact that the group can boast of a number of other accomplishments. Its annual Seminar for TV service technicians—the third was held in Phoenix on March 1, 1959—attracts industry people from all over the state. Its low-cost group insurance plan comprehensively covering many surgical and medical benefits is as good as any provided by an association. Its suggested minimum price chart, a copy of which has been registered with the Better Business Bureau, is a model of completeness and yet of sufficient flexibility to provide for unusual contingencies.

It would be difficult to isolate a single effort as the "best of BEST." However, the apprenticeship program is the most distinctive, if not the best. Its entire operation is detailed in an exhaustive document, prepared by the association, that runs almost to the length of a modest book. It is administered directly by a special committee set up by BEST. It was also, in the last month of 1958, approved by the Bureau of Apprenticeship and Training of the U. S. Dept. of Labor and by the Apprenticeship Council of the State of Arizona.

At the outset, the document underscores the foresight of its planners. Instead of taking a narrow view toward newcomers and beginners in electronic service, it fixes the responsibility for providing them with an opportunity to develop into fully qualified technicians on the established portion of the service industry. This is seen as establishing high standards and constant upgrading for the entire profession in the

long run, for the benefit of all.

Running for four years, the program provides a schedule of minimum hours of prescribed work, as carefully distributed as that of a hospital intern, that insures practical experience in every area with which the skilled practitioner should have contact. During this period there is also a schedule of classroom instruction that must be fulfilled. If necessary, the Apprenticeship Committee will transfer a trainee from the shop of one cooperating dealer to another to obtain the required variety in experience. Every half year, the apprentice is examined on his progress to make sure that he is ready for the next phase. Until his final year, the trainee always works with and under the tutelage of a full-fledged technician. His pay during this 4-year period is also prescribed, as a percentage of the salary drawn by the experienced technicians about him. At the outset, he draws 52% of prevailing technician wages and works up to 90% by the end of his training.

With its 50-plus member shops located throughout the state, BEST maintains headquarters at P.O. Box 1284, Phoenix, Arizona. A quarterly publication, "It's BEST for You," is edited by David J. Gordon. Officers include Phil Prentice, president; Neil Anderson, vice-president; Dick Ramos, secretary; David Gordon, executive secretary; and Hal Horowitz, treasurer. New elections are probably underway, however, as you read this.

Another distinctive plan is a picture-tube warranty underwritten by the association. Members sell a 1-year contract on any good monochrome CRT for \$15, with \$10 going to the BEST warranty fund. If the tube needs replacement, cost of the latter is borne by BEST.

-30-

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We want to tell you more about our association. Please send us your questionnaire.

Name of Association.....

Mailing Address.....

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# **How Radio-TV Servicemen are increasing their Annual Income \$2,000 to \$10,000**

## **HERE'S YOUR KEY...A.S.P.G.**

Throughout the country, ever-increasing numbers of service technicians like yourself are realizing increased business and profits, *without* additional effort or expense, through membership in the APPLIANCE SERVICEMEN'S PURCHASING GROUP. This dynamic, new merchandising group can help you increase your annual income too, easily, simply, with no interference with your regular service calls.

**WHY IT'S "GOOD BUSINESS" TO BELONG TO A.S.P.G.**  
There's no magic formula to A.S.P.G., no secrets, no gimmicks. IT'S THIS SIMPLE! Through the tremendous purchasing power created by you and your numerous fellow servicemen, you are able to offer your *present* customers NATIONALLY ADVERTISED APPLIANCES (such as those you service) AT SUBSTANTIAL SAVINGS. Your mass purchasing power, through one central source (A.S.P.G.) enables you to buy for less, create customer good will by selling for less, and assures healthy profits for yourself on every sale!

### **SELLING IS EASY... THE A.S.P.G. WAY**

When you make your normal service calls, simply inform your customers that you can offer them any and all nationally advertised appliances at substantial discounts. Show your customer the MASTER A.S.P.G. catalog, impressing the point that your professional experience can help her make a wiser decision. (REMEMBER, YOUR SALE IS 90% COMPLETED BEFORE YOU START... YOU ALREADY HAVE THE CUSTOMER'S CONFIDENCE!) Now, give her a chance to sell herself while you proceed with your repair work.

### **QUALITY AND DEPENDABILITY**

### **ARE ALWAYS ASSURED... THE A.S.P.G. WAY**

The MASTER A.S.P.G. CATALOG, which is included with your membership, lists the biggest, most accepted names in the appliance industry. You sell only the best... all nationally advertised, "pre-sold" merchandise that denotes quality and dependability... made by famous manufacturers who make your selling job easier by advertising in newspapers, radio, television and magazines. Such household appliances as refrigerators, ranges, washers, dryers, television receivers, radios, stereophonic hi-fis, etc., that carry internationally-known brand names like Westinghouse, RCA, G.E., Grundig Majestic, Admiral, Zenith, Hotpoint, Philco, Sunbeam, Motorola, etc., are already known by your customers. YOU SELL MORE CONFIDENTLY BECAUSE THE CUSTOMER HAS MORE CONFIDENCE IN THE PRODUCTS YOU SELL!

### **A.S.P.G. FULL REFUND PRIVILEGE**

If, after receiving the current copy of the Master A.S.P.G. Catalog and your Confidential Cost Book, you are not 100% satisfied with the A.S.P.G. program, return the catalog and cost book within 10 days. A.S.P.G. GUARANTEES TO RETURN YOUR MEMBERSHIP FEE IMMEDIATELY.

### **HERE'S HOW YOU JOIN A.S.P.G.**

FILL OUT THIS MEMBERSHIP APPLICATION AND RETURN TO A.S.P.G. WITH YOUR MEMBERSHIP FEE... TODAY!

### **PROFITS COME EASY... THE A.S.P.G. WAY**

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TWO ISSUES ARE PUBLISHED EVERY 12 MONTHS, SO THAT YOU AND YOUR CUSTOMERS CAN KEEP ABREAST OF THE LATEST STYLES AND MODELS AVAILABLE.

- You get the MASTER A.S.P.G. CONFIDENTIAL COST BOOK, showing your actual net cost on all merchandise displayed in the A.S.P.G. catalog. THIS COST BOOK IS ISSUED TWICE A YEAR IN CONJUNCTION WITH THE CATALOG.
- YOU BENEFIT FROM A.S.P.G.'s collective purchasing power, whether you buy one item at a time or a hundred. You deal with one—and only one source of supply, with no inventory to worry about!
- Your service business is not disturbed—you don't stock any inventory—you make no capital investment—you have no extra overhead, expend no extra effort.
- You sell only the best products—all backed by name-brand manufacturers.
- You set your own profit margins—you collect from your own customers.
- You receive all necessary sales "tools" to help your program—you are guided in all sales efforts by A.S.P.G.

**A-S-P-G**

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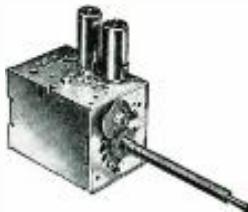
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Send them to TARZIAN!**

● Sarkes Tarzian, Inc., announces a new tuner repair service and factory replacement program for Tarzian-manufactured tuners. Distributors, dealers and servicemen will welcome this direct factory service program which is designed to take delay and confusion out of the tuner repair business.

We're set up to offer a 48 hour service from the date of receipt to shipment to you.

Cost is reasonable, too. Only \$7.50 per unit (\$15 for UV combinations) and that includes ALL replacement parts! Both repaired—or exchange units if available from stock—carry a 90 day warranty against defective workmanship and part failure.

Replacements will be offered at these current prices\* on units not repairable:

VHF 12 position tuner	\$22.00
VHF 13 or 16 position tuner	23.00
VHF/UHF combination.	25.00
UHF only.....	15.50

\*Subject to change

When inquiring about tuner service, always refer to tuner by part number. When inquiring about direct replacements for tuners other than Sarkes Tarzian-manufactured, please indicate tube complement, shaft length, filament voltage, series or shunt heater. Use this address for quickest service:

**SARKES TARZIAN, Inc.**

At: Service Mgr., Tuner Division  
East Hillside Drive  
Bloomington, Indiana



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# Foreign Tube Substitution Data

*Sylvania's list of hard-to-replace foreign tubes, with available European-American substitutions.*

EUR. TYPE	EUR./AMER. TYPE	CODE*	EUR. TYPE	EUR./AMER. TYPE	CODE*
1C2	1AC6	ER	EL86	6CW5	ER
6F12	6AM6	NR	EL91	6AM5	ER
7D9	6AM5	ER	EL821	6CH6	NR
8D3	6AM6	ER	EM34	6CD7	ER
30C1	8A8	NR	EM80	6BR5	ER
30L1	7AN7	NR	EQ80	6BE7	ER
64ME	6CD7	NR	EY51	6X2	ER
85A1	OE3	NR	EY80	6U3	ER
85A2	OG3	ER	EY84	6374	ER
B319	7AN7	NR	EY86	6S2	ER
B719	6AQ8	NR	EZ80	6V4	ER
DAF96	1AH5	ER	EZ81	6CA4	ER
DC70	6375	ER	KT61	6AG6	ER
DC80	1E3	ER	LN152	6AB8	NR
DDR7	6AM5	ER	LZ319	8A8	NR
DF96	1AJ4	ER	N78	6BJ5	ER
DK92	1AC6	ER	N144	6AM5	NR
DK96	1AB6	ER	N147	6AC6	ER
DL96	3C4	ER	N152	21A6	NR
DM70	1M3	NR	N329	16A5	NR
DY86	1S2	ER	N359	21A6	NR
E80F	6084	NR	PABC80	9AK8	ER
E90CC	5920	NR	PCC84	7AN7	ER
E180F	6688	ER	PCC85	9AQ8	ER
EA76	6489	ER	PCF80	9A8	ER
EABC80	6AK8	ER	PCF80	8A8	NR
EBC81	6BD7A	ER	PCL82	16A8	ER
EBF80	6N8	ER	PL36	25ES	NR
EC80	6Q4	ER	PL81	21A6	ER
EC81	6R4	ER	PL82	16A5	ER
EC91	6AQ4	ER	PL83	15A6	ER
ECC85	6AQ8	ER	PMO7	6AM6	NR
ECH35	6E8	ER	PY80	19X3	NR
ECH42	6C9	ER	PY81	17Z3	ER
ECH81	6AJ8	ER	PY82	19Y3	NR
ECL80	6AB8	ER	QQVO3-10	6360	NR
ECL82	6BM8	ER	QQVO3-28	6252	NR
EF70	6487	NR	SP6	6AM6	NR
EF73	6488	ER	TDO3-10	5861	NR
EF80	6BX6	ER	U154	19Y3	NR
EF85	6BY7	ER	U319	19Y3	NR
EF86	6267	ER	UBC41	14L7	ER
EF89	6DA6	ER	UCH42	14K7	ER
EF91	6AM6	ER	W77	6065	NR
EF92	6CQ6	ER	W179	6BY7	NR
EL33	6AG6	ER	X18	1AC6	ER
EL33	6M6G	ER	X79	6AE8	ER
EL34	6CA7	ER	Z77	6AM6	NR
EL38	6CN6	ER	Z77	6064	NR
EL70	6373	NR	Z152	6BX6	NR
EL81	6CJ6	ER	Z179	6BX6	NR
EL83	6CK6	NR	Z719	6BX6	NR
EL85	6BN5	ER	Z719	6BX6	ER

Code\*: ER denotes exact replacement. NR denotes nearest replacement. Socket and/or wiring changes may be involved here, or slightly different electrical characteristics and ratings may have to be considered in some circuits.

NOTE: The increasing sale of imported receivers and audio equipment has resulted in the problem of obtaining replacements for some of the unfamiliar tubes used. This list, reprinted through the courtesy of Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., is believed to be accurate. However, neither Sylvania nor ELECTRONICS WORLD assumes responsibility in case of error. The first portion of the Sylvania list appeared in the May, 1959 issue. Covered in that section were foreign tubes for which domestically manufactured replacements were recommended. The remainder of the list, reprinted here, covers European types for which the recommended replacements, although domestically available, are generally made abroad and imported for sale in this country either under the original brand names or the brand names of the organizations who import them.

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OZ4	3BC5	6AB4	6BA6	6CL6	6S8GT	785	12AT7	12S7	38		
1A7GT	3BN6	6AC7	6BC5	6CM6	6S9AT	786	12AU6	12SK7	39/44		
1B3GT	3BZ6	6AF4	6BC8	6CM7	6SD7GT	787	12AU7	12SN7GT	41		
1C6	3CB6	6AG5	6BD6	6CN7	6SF5	788	12AV6	12SQ7	42		
1C7	3Q4	6AH4GT	6BE6	6CQB	6SF7	7C4	12AV7	12V6GT	43		
1F4	354	6AH6	6BF5	6CR6	6SG7	7C5	12AX4GT	12W6GT	45		
1FS	3V4	6AK5	6BG6C	6CS6	6SH7	7C6	12AX7	12X4	50A5		
1G4	4BQ7A	6AL5	6BH6	6CU5	6SJ7	7C7	12AZ7	14A7/12B7	50B5		
1H5GT	4BS8	6AM8	6BJ6	6CU6	6SK7	7E5	12B84	14B6	50C5		
1I4	4BZ7	6AN8	6BK5	6D6	6SL7	7E6	12BA6	14Q7	50L6		
1L6	4CB6	6AQ5	6BK7	6DE6	6SQ7	7E7	12BA7	19	56		
1NSGT	5AM8	6AQ6	6BL7GT	6DG6GT	6SR7	7F7	12BD6	19AU4GT	57		
1RS	5AN8	6AQ7	6BN6	6DQ6	6T4	7FB	12BE6	19BG6	58		
1SS	5AT8	6ARS	6BQ6GT	6F5	6UB	7G7	12BF6	19J6	71A		
1T4	5AVB	6AS5	6BQ7	6F6	6V6GT	7H7	12BH7	19TB	75		
1U4	5AZ4	6AT6	6BR8	6H6	6W6GT	7N7	12BQ6	24A	76		
1U5	5BRB	6AU4GT	6BS8	6J4	6X4	7Q7	12BR7	25Z6GT	77		
1V2	5J6	6AU5GT	6BY5G	6JS	6X5GT	7S7	12BY7	26	78		
1X2	5R4	6AU6	6BZ6	6J6	6XB	7X6	12CA5	27	80		
2AF4	5U4	6AU8	6BZ7	6J7	6Y6G	7X7	12CN5	35	84/624		
2BN4	5UB	6AV5GT	6C4	6K6GT	7A4/XXL	7Y4	12D4	35A5	11723		
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3A4	5V6GT	6AWB	6CD6G	6N7	7A6	12AB	12K7	35C5			
3AS	5XB	6AX4GT	6CF6	6Q7	7A7	12AB5	12L6	35W4			
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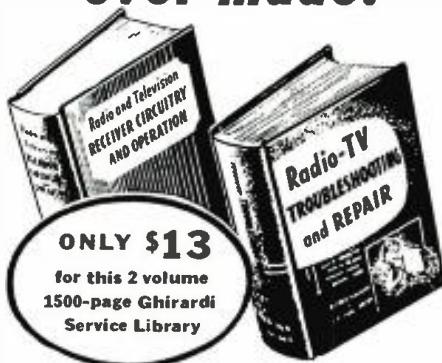
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By  
**BERT WHYTE**

## CERTIFIED RECORD REVUE

BY THE time you read this column, the first golden days of summer will be with us and they will signal the beginning of the annual sales hiatus for the record industry. There is not much doubt about this phenomenon any more . . . when the temperature goes up . . . the sales go down. This has been the norm for years now, a period of enforced idleness that is the despair of some and the delight of others. But this summer . . . things will be different. This difference will not make itself felt in sales figures . . . these will remain in their summer stasis. Instead of the tropic torpor and indolence, the laboratories and production facilities of the record companies and phono manufacturers will hum with frantic activity. And to what end, cousin? Why friends, it's ammunition they are making. Bright, shiny ammunition for the big stereo push in the Fall.

Yessir, if the plans of the industry for stereo promotion all reach fruition, there will be no escape. You might just as well accept things gracefully because the industry is determined that you shall have stereo . . . or perhaps I should say a "reasonable facsimile thereof." All kidding aside, the pressures that will be applied to the citizenry to "go stereo" will be tremendous. Stereo has become the new "Comstock lode" a sales instrument of boundless potential, from which everyone expects to reap a rich harvest of profits.

Old established companies and "johnny-come-latelies" . . . big companies and small ones, all will be vying for their share of the stereo dollar. You'll be inundated with advertising in every medium. Your head will reel with claims for their products. Brother, you're going to get all the "boola-boola and bombast" in their book! And what do you think will happen? Yup! The confused citizenry, will become still further confused and in sheer self defense will just keep their hands . . . and their money . . . in their pockets.

You think this sounds far-fetched? Well, believe me, this has happened aplenty already! Poor John Q. Public has been subjected to the stereo sales onslaught like a wide-eyed innocent. He was just barely oriented to this "hi-fi" thing and now he is being told he is obsolete. Now, of course, there is nothing wrong in trying to convert everyone in the country to stereo music listening. A laudable goal, to say the least. The trouble is that even at this relatively early stage of the "age of stereo", the sharpies are busily confounding the issue. Unfortunately for the average man, there just aren't enough legitimate hi-fi stores that sell quality stereo components to handle the country-wide interest in stereo. At these stores, whether the customer is an old hi-fi buff or the greenest of "rookies" totally unversed in sound and music, they will be introduced to stereo and have it sold to them in a civilized manner . . . through courteous and patient education.

They will have the "mysteries" of stereo unveiled to them and hear it on good component systems in various price brackets. They will hear stereo records that have been carefully selected for optimum quality.

Now let us contrast this approach with what is unhappily the lot of most people. To begin with the store we are dealing with is not a specialty house like a hi-fi salon. It is a general merchandise establishment, departmentalized to be sure, and in one of them is tucked what is purported to be stereo equipment. As standard equipment these departments have two types of sales clerks. One is a hapless and harried individual whose main failing as a stereo sales person is that he knows absolutely nothing about stereo! But he would like to keep his job so has got to sell you. And as if this weren't bad enough, look at what the poor guy is trying to sell! A jim dandy "stereo portable" complete with 6 (count 'em) giant 3-inch speakers . . . 3 to each channel and separated by all of 18 inches . . . a powerful hi-fi amplifier for each channel and a smooth-running turntable with the magic new feather-float pickup. Arrayed alongside this gem is the deluxe model in "Genuine hand-rubbed finish" with special "satellite" speaker for those who want to "flood their rooms with glorious concert hall sound." And for those with discriminating taste (and pocketbook to match) there is the imposing Queen Anne console with 12 speakers (now separated by a breathtaking 3½ feet) and two heavy duty power-monger amplifiers.

And the demonstration records? Common with all the selection is their fine state of decay . . . a light gray film of wear, an interesting variety of scratches, and a rich patina of dirt and fingermarks. The favorite is, of course, that classic from the Utter-Fidelity catalogue, wherein we are treated to 45 exciting minutes of the International Ping-Pong Tourney at Zanzibar. For those with more musical interests a special treat is excerpts from "My Fair Lady" performed by the Edelweiss Swiss Bell Ringers Orchestra.

The scene can only be imagined as the clerk bumbles his way through the alleged demonstration. He never heard of phase, of course, and in fact, admits secretly to himself that he can't tell the difference when he switches from stereo to mono and back again. So this poor inept creature usually winds up with a completely befuddled customer who has heard little more than a semi-directional amalgam of noise, hum, rumble, and a bass-less, frequency-restricted distorted parody of music.

Now the other sales clerk is a real sharpie. He, too, is devoid of any stereo knowledge, but glibly sprays technical terms all over the place in his best fast-talking manner. He makes the customer think he is a real expert and it matters little to him that he is drowning the man in misinformation. This type

can occasionally con a "Milquetoast" type into actually buying one of his sterling rigs and thus the customer's misadventure is compounded. Soon he thoroughly despises stereo and tells everyone he knows about how he was "clipped."

Naturally there is another side to this coin. In many of the better stores handling music merchandise the clerks are given a stereo indoctrination, which while it doesn't make experts of them, at least cuts down on the misleading information. Now the root of this whole problem is that too many people are trying to make a "fast buck" on stereo. They are running about, beating the drums, and shouting their fantastic claims. And they are turning out a great deal of equipment that is substandard and still more that, in the most charitable terms, might qualify as "marginal stereo."

With an advertising blast of unprecedented size and energy this fall, heralding the products now aborning in the summer sun, Mr. Average Man is really going to feel the impact as the star stereo target. If the stereophonic sound bubble is not to burst, it needs decisive action from all those involved. The manufacturer had better do a little soul-searching about his products, irrespective of the price range. Mr. Average Man is not a complete cluck. If he is dealt with fairly and intelligently, he will have no difficulty in perceiving the advantages of stereo and he will buy according to his pocketbook. The overwhelming need and the key to the preservation of this fantastic stereo boom is *education*. Engineers must design equipment that meets at least the basic requirement that it be truly capable of stereo reproduction, no matter how cost is figured. And they must tell the sales people of their firm what this equipment can and cannot do. The sales force, in turn, must merchandise and advertise their product with at least a semblance of integrity and without utter disregard of performance claims. And most important of all is the last link, the retailer-to-consumer relation. The sales clerk must be given at least a rudimentary knowledge of the workings of stereo and more particularly how to successfully set up and balance the various units he sells. Without this *education* of all concerned, all the long years of work it took to bring stereo into commercial reality will be lost . . . borne away by the wrathful winds of public rejection.

#### **DELIBES**

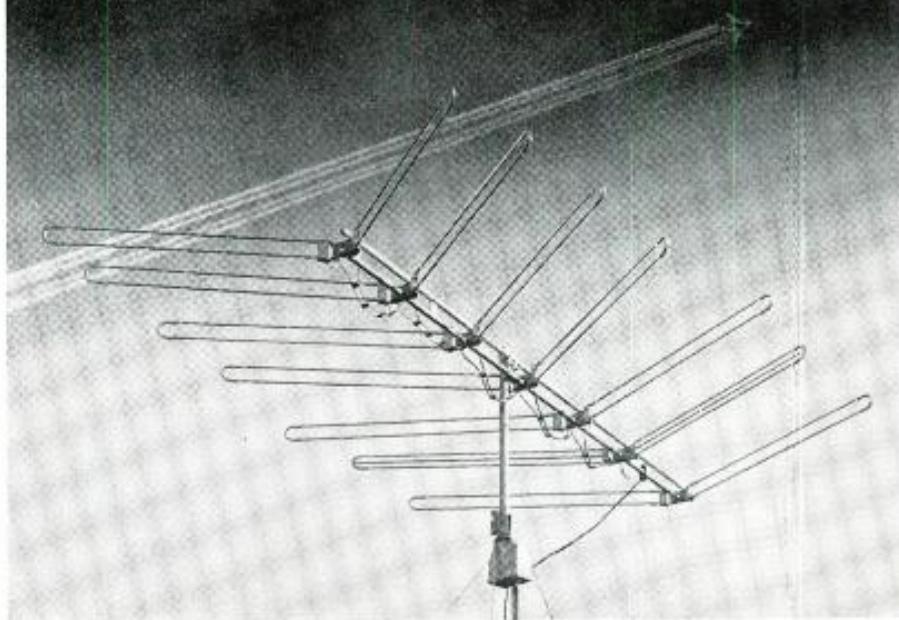
**SYLVIA (COMPLETE BALLET)**  
London Symphony Orchestra conducted  
by Anatole Fistoulari. Mercury Stereo  
**SR-2-9006.** Price \$11.90. Two discs.

This is the first of *Mercury's* complete ballet packages to emanate from London and it is a stellar effort from all concerned. Fistoulari has a long and distinguished history as a conductor of ballet and I feel that in this album he has reached the summit of his career. There is a "just rightness" to his performance that countenances no competition. His smooth tempi, his expressive phrasing, and his almost miraculous control of dynamics is an audible tribute to his skill and to the fine musicianship of the London Symphony. He makes the most of his material and "Sylvia" emerges as a most attractive wench, charmingly petite, endowed with all the graces.

Contributing heavily to the success of this album is the superb stereo sound. This has all the usual stereo virtues of directivity and instrumental separation with fine "ghost channel" fill, but beyond this is the unusual degree of depth perception that was present. I was also impressed with the subtlety and delicacy of some of the quieter passages, where one could still hear detail preserved in spite of the very low dynamic plane. Con-

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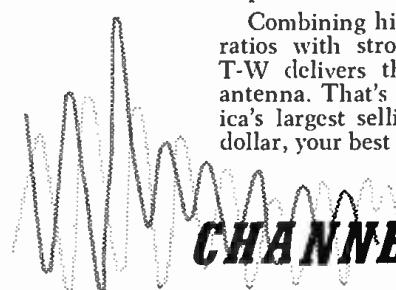
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versely, the big climaxes are projected with great impact and with no sign of overcutting. All is very clean and certainly one of the best examples of a high-quality stereo disc.

**STRAVINSKY**  
**APOLLON MUSAGETE**  
**RENARD**

Michel Senechal, Hugues Cuenod, Heinz Rehfuss, Xavier Depraz, soloists with L'Orchestre de La Suisse Romande, conducted by Ernest Ansermet. London Stereo CS6034. Price \$5.95.

Here are two works which will find most favor with devoted Stravinsky-ites since these are among the composer's most "off-beat" scores. "Apollon Musagete" is scored entirely for string orchestra and most effectively too . . . although it must be admitted that most people will find the writing somewhat astringent. "Renard" is a delightful derivation from an old Russian folk tale in which Stravinsky has masterfully combined the elements of ballet and opera.

The four soloists convey the main action of the story against a background of colorfully orchestrated music. And, incidentally, the soloists are due high praise for their convincing performances. There is an exotic slant to the orchestral writing here and the opening section displays an interesting and typically Stravinskyan use of percussion.

The sound throughout is very clean and well balanced with excellent directivity and depth. Quite sensibly the singers are disposed so that stereo can highlight the interplay among the voices.

**DVORAK**  
**SYMPHONY #5 ("NEW WORLD")**  
Vienna Philharmonic Orchestra conducted by Rafael Kubelik. London Stereo CS6020. Price \$5.95.

Kubelik is, of course, one of the foremost interpreters of this work and in the earlier monophonic disc received wide praise for his fine performance. Here in stereo the performance gains further distinction as we hear many things denied us in the monophonic edition. We are impressed anew by Kubelik's superb sense of timing, the way he paces the orchestra and keeps a smooth flowing line in the work. The score is romantic in concept and Kubelik's performance is romantic, but never sounds overblown or slickly insincere. Rich-glowing sonority from the Vienna Philharmonic, with stereo sound of grandiose proportions. Generally the sound is clean with the special blandishments of stereo much in evidence.

My only quibble here is that the bass seems a bit on the heavy side and a slight cut in your bass control would have a most salutary effect.

**KODALY**  
**HARY JANOS SUITE**  
**BARTOK**  
**HUNGARIAN SKETCHES**  
**ROUMANIAN DANCES**

Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury Stereo SR90132. Price \$5.95.

The "Hary Janos" was one of Mercury's most eminently successful stereo tapes and now we have it on a stereo disc. The transfer has been very well done and this is one of the few times that on comparison with the tape, the decision was almost a toss-up. On the tape there is a definitely greater dynamic range. One the other hand, the signal-to-noise ratio is better on the disc if we overlook an occasional static "pop." I'd say that frequency response was about even, with the tape a little better in the distortion department. Forced to make a choice, I'd still pick the tape . . . because the one thing most people forget when they compare tape and

# RCA Sound Tape

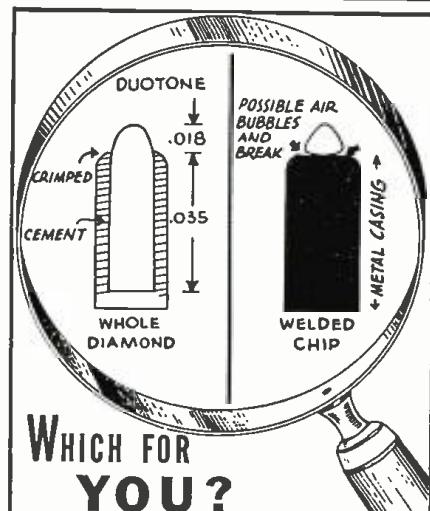


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stereo disc is that the comparison is only valid with virgin discs. Maybe it might take only ten plays . . . maybe fifty . . . but inevitably the disc will wear and deteriorate in quality while the tape with common sense care can retain its quality practically indefinitely.

For those who have never heard this work in stereo in this performance . . . you're in for a sonic feast! There is some of the most exciting music ever recorded in the various sections and the solid cleanliness of the brass and percussion will startle you! Dorati's reading is justly considered near definitive, so you gain on all fronts. The Bartók works are equally well recorded and interesting without having the huge emotional impact of the Kodály.

#### HANDEL DETTINGEN TE DEUM

**Soloists and Choir of the Netherlands, Bach Society Orchestra, and organ conducted by Anthon van der Horst. Epic Mono LC3540. Price \$4.98.**

At one time there was another recording of this work in the LP lists, but it has been long deleted and in any case was inferior to this present recording. This was recorded at the Holland Festival in commemoration of the Handel Bicentennial and although, in a strict sense, this is a non-professional musical organization, they acquit themselves most creditably.

The record begins most interestingly with the carillon of the St. John's Church in Gouda playing the theme of Handel's "The Harmonious Blacksmith." The quaint authenticity of the sound is heightened by the chirping of birds in the nearby trees. The work is, of course, one of Handel's masterpieces and if you favor his "Messiah," you'll like this music.

The recording is quite good, being fairly clean even in the choral climaxes, but how evident is the need for stereo with its special ability to clarify and reveal the details of massive works like this. The soloists are good without being outstanding and, all-in-all, it's the kind of record it isn't difficult to enjoy for the music itself and forgive the technical sins.

#### HANDEL WATER MUSIC SUITE

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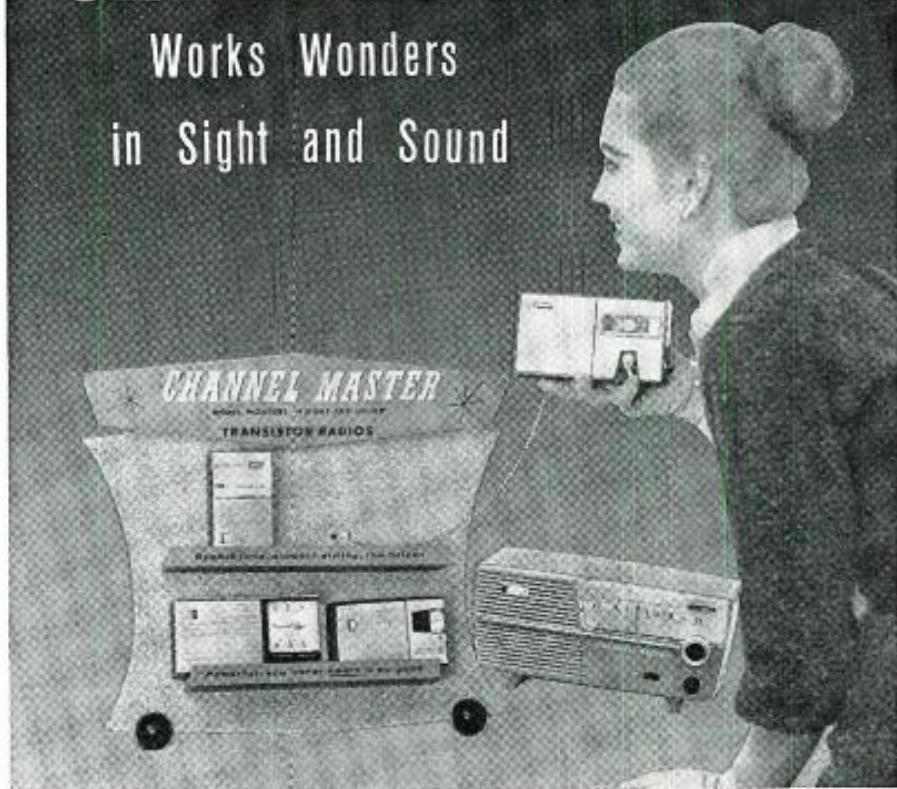
With the richly sonorous acoustics of the Concertgebouw auditorium as a background for *Epic's* moderately close pickup, the sound is distinguished by its smooth, unrestrained quality. Sonic perfection would have demanded more inner detail, but in order to achieve this *Epic* may have been afraid of upsetting the "concert hall" type of balance they seem to favor.

This recording won't find favor with the purists who demand the "Water Music" in its complete format, nor please those who want a more sharply focussed sound, but for the many to whom neither point is important, they will enjoy the music for itself, the fine reading, the outstanding virtuosity of the orchestra.

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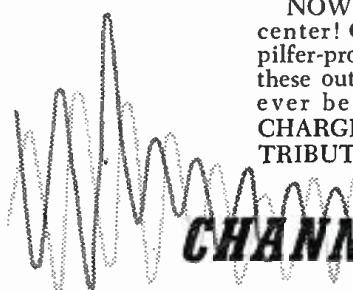
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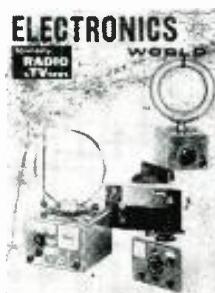
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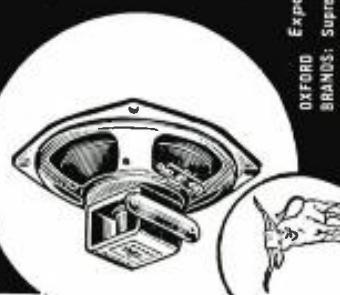
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# SOUND ON TAPE

By BERT WHYTE

AS MOST readers of this column are well aware, the recorded tape industry has been in rather chaotic shape ever since the general introduction of the stereo disc. Sales have declined drastically and most record companies have stopped production of tapes. Naturally, the most interested parties...the tape machine manufacturers and the makers of raw tape were faced with what appeared to be a rather bleak future. It goes without saying that remedial measures were of prime importance, but many schemes and ideas, when reduced to matters of practical application, were found wanting for one reason or another.

Then suddenly and dramatically it seemed an answer had been found. This was the idea of a new head configuration which utilized 4 tracks on standard quarter-inch tape and was to offer stereo reproduction based on the old half track monophonic system. In other words, the reel of tape was started and when completely wound on the takeup reel was simply turned about and the second track played. Of course when this play was finished the tape was back on the original reel eliminating the rewind function. With four tracks occupying the area formerly devoted to one stereo channel, this "half-track" stereo became possible. This naturally cut in half the length of tape required for any given piece of music.

Going a step farther, the speed of the tape was reduced to 3.75 inches-per-second, again cutting in half the amount of tape that was necessary at the old 7.5 ips speed. With these two reductions in the amount of tape needed for any recorded tape program, it was felt that the tapes could be priced to be competitive with the stereo discs. This appeared to be a step in the right direction towards the recovery of the tape market.

But it remained for RCA Victor to add the final fillip to this new sales concept. It announced that it was going to use this 4-track, 3.75 ips stereo packaged in "cartridges." These were, in essence, magazine-loading devices similar to those used in amateur movie cameras. Just slip one of these cartridges on the machine and by a clever setup, the tape was played and rewound and the whole procedure of playing stereo tape was as simple and uncomplicated as playing a disc. At least this is what the device was supposed to do...alas, the complications of the cartridge system were considerable.

The big drawback, of course, was the necessity for a special tape machine

which would play the cartridges. Since this was wholly incompatible with the type of tape machines on the market, opposition to the idea mounted swiftly. It became apparent that the 4-track, slow-speed stereo was workable on a standard reel-to-reel basis and it was felt that simple inexpensive conversion kits could be made available to the consumer enabling him to play these new low-priced stereo tapes. At the same time many tape machine manufacturers could furnish original equipment embodying the 4-track stereo playback system.

Well, friends, that was a long time ago. Up to now there have been reams of talk and publicity about the reel type and cartridges type of 4-track stereo, but scant action of any kind. Oh, RCA announced a target date for the introduction of its cartridges and machines for their reproduction. The date came . . . and it went . . . and still no results. And a number of new 4-track stereo machines using the reel principle were offered to the public, who did not respond in any great number for the simple fact that no 4-track stereo tapes were being marketed! As time went by, the stalemate continued . . . with rumors and recriminations and just about everything except concrete progress towards the general introduction of these new format tapes.

Now from where we sit, still another dramatic possibility is in store for those of us who are interested in tape—and that is the probable emergence of 4-track tape but operating at a speed of 7.5 inches-per-second on the standard reel-to-reel basis. Although we can't say too much about this development right now, some members of the industry are certainly very hot about the idea, and it appears to us to make a lot of sense.

One of the most compelling reasons for the return to the 7.5 ips tape speed is that the advances in the sound quality of stereo discs were much more rapid than anticipated and of greater magnitude. Now as any well-informed tape buff knows, much of the fidelity of a magnetic tape is based on the speed of the tape past the heads. Top professional quality nowadays is 15 ips, 7.5 ips was the accepted amateur and secondary standard which in top quality machines permitted response to 15,000 cycles. The 3.75 ips speed has always been regarded as not suited for true high-fidelity reproduction and in those machines with this speed, response was limited.

Tape speed and frequency response is, of course, only a part of the over-all requirement for high-quality tape sound. There is the matter of amplifiers and equalization and head structure and their effect on distortion content on the tape and the signal-to-noise-ratio. It was a well-known fact that as the gap area in a magnetic recording head is decreased, the signal-to-noise ratio is impaired. In other words, tape hiss is more prominent. On a half-track monophonic tape the noise figure is not as good as the full track.



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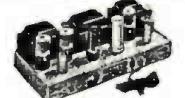
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Now cut the half-track in half again . . . as in the 4-track stereo tape. Result? Still smaller magnetic gap area and still more noise. Now combine the small gap area and the slow 3.75 ips speed and the quality problems begin to look formidable. There are tricks to every trade, of course, and there are techniques that can be brought to bear to cope with some of these problems. But it is now felt that at the present state of the art and with the present materials, including tape, it is not a commercially practical proposition to have 4-track, 3.75 ips stereo tapes genuinely competitive with today's stereo discs!

Thus was born the idea of the new 4-track, 7.5 ips proposal. Now this doesn't mean that the research boys did not pick up a great deal of new information while working on the problem. For remember, even though they will probably go back to the 7.5 ips speed there remains the problem of reduced gap area in the 4-track stereo.

Briefly, here is the essence of the technique which now affords a practical achievement of 4-track, 7.5 ips stereo tape. There is reportedly a new head design and an improved and faster production method for making these heads. The main feature is a gap of incredibly tiny size, held to very close tolerances, polished to a smoothness beyond anything previously employed and . . . most important . . . the gap is maintained in a degree of parallelism heretofore unknown. Then there are new equalization circuits employed in conjunction with what is known as "pre-polished tape." This is a raw tape so manufactured that it has a finish equivalent to having been run over heads and rollers perhaps a dozen times. Now this affords a very close "wrap" over the gap area and in conjunction with the 7.5 ips, the new equalization, and the new head, is said to have response and distortion characteristics equal to or better than the old 7.5 ips standard stereo, and in spite of the 4-tracks, a signal-to-noise ratio at least as good as the old standard and, under the optimum conditions, even better!

Next item is that a tentative price of \$7.95 for roughly an hour's music will no doubt be set. This a far cry from the old stereo tape prices and considering the vastly superior wearing qualities of tape over disc, is actually cheaper than a \$5.95 stereo disc, to say nothing of the generally superior quality of the tape.

RCA is uncommitted at the moment and, as far as can be determined, still intends to pursue its 3.75 ips cartridge concept. There is no doubt that a market exists for this quality level of tape reproduction and, indeed, in spite of the adoption of this, there is every indication that if the situation warrants it and the technical difficulties can be overcome some industry members will probably produce this type of equipment as well.

The one snag in this otherwise rosy picture of the possible rebirth of

stereo tape, is an old and familiar one . . . assuming you have one of the new machines . . . what do you play on it? Even though the record companies will probably produce the new tapes, they are faced with the problem of duplication. The number of 4-track duplicators in the hands of stereo tape producers is quite small . . . and these were all set up for the 3.75 ips tape speed. Presumably these units would have to be modified to the new specifications. The rest will have to wait for new duplicators or have their old two-track units modified. By the time the National Association of Music Merchants convenes in New York in June, there should be a healthy supply of tapes for demonstration. . . for you see, the record companies will have a fine incentive.

#### VIVALDI BASSOON CONCERTOS

Virginio Bianchi, bassoonist with Gli Accademici di Milano conducted by Piero Santi. Vox Stereo MTV-10. Price \$11.95.

Tapes scarcer than ever (and likely to be more so with the summer slump) but here is one I somehow missed. Not the most accessible music for many people, but a fine job of its type. The bassoonist is an exceptional artist and plays these difficult concertos with fine intonation and in solidly founded authoritarian style.

The orchestral accompaniment is adequate for the purpose and is nicely balanced against the solo instrument. The stereo effects are well displayed, with fine directivity and good depth perception. A nice open acoustic climate lends a rounded contour to the sound that is very pleasing. Generally very clean sound, with negligible distortion and reasonably low tape hiss.

-30-

#### HALICRAFTERS' WINNERS

THE Halicrafters Company, Fifth and Kostner Avenues, Chicago 24, Illinois, has announced the names of the five amateur radio operators who have been selected as the national winners of the SSB-VHF contest conducted by the firm last fall. A total amount of \$15,000 in prizes was awarded.

The grand prize award, which is an FPM-200 transistorized transceiver, goes to J. W. Brantner, W8BCK, Columbus, Ohio.

Donald W. Richards, W7UPF, of Tucson, Arizona, has been named as the winner of the second prize. This award is an HT-33A kilowatt linear amplifier.

An HT-32A single-sideband transmitter was presented as the third prize. It went to Robert W. Dorn, W8SQK, of Canton, Ohio.

Fourth prize, an SR-34 two and six-meter transceiver, was won by Jack C. Baker, W7SXT, Seattle, Washington.

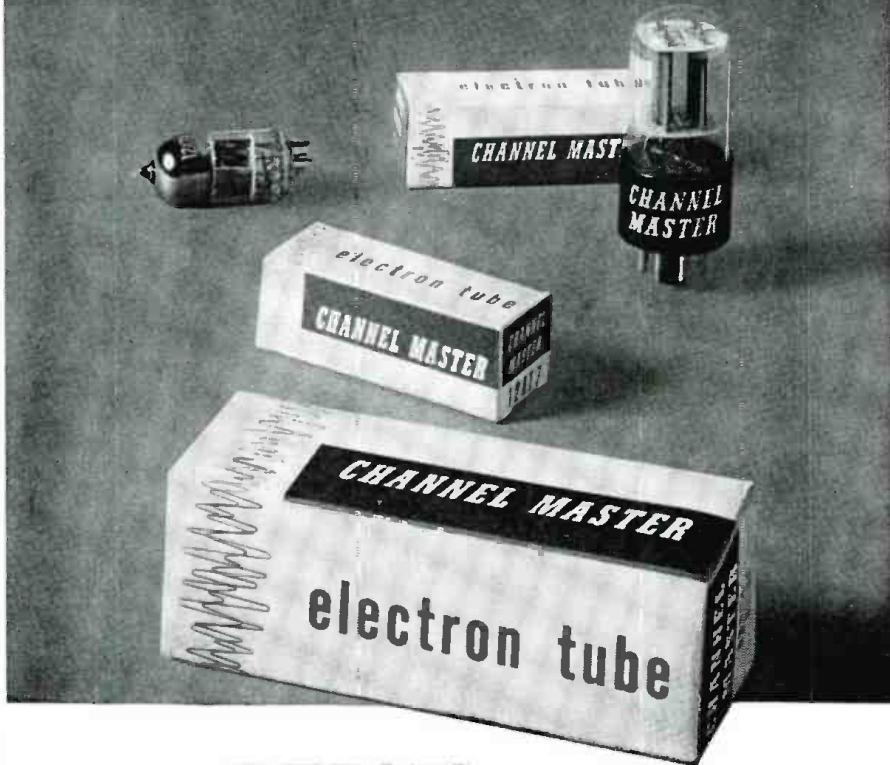
The fifth prize went to Wendall S. Johnson, KII6CZC, of Wahiawa, Hawaii. This award consisted of an SX-101 receiver.

In addition to the above-listed five national winners, over one hundred amateurs received local awards. These consisted of \$100.00 in merchandise certificates.

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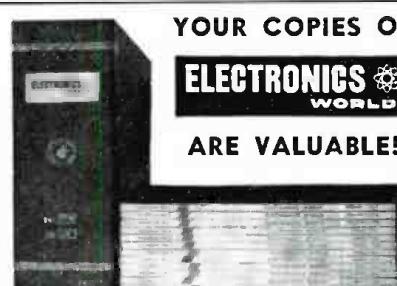


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## "Carillon" Stereo Amp

(Continued from page 52)

both open and shorted input circuit.

**Frequency Response:** With tone controls mechanically centered frequency response was  $\pm 1.1$  db from 30 to 15 kc., the limits of our test. For perfect electrical centering of controls the treble should be used at about the 11:00 o'clock position.

**Loudness Control:** A continuously variable type of control is used in this design and it effectively boosts both the bass and high end of the audio band.

**Equalization:**  $\pm .5$  db from standard RIAA curve between 30 and 15,000 cps.

**Bass Control:**  $-18.5$  db and  $+14.8$  db at 30 cps.

**Treble Control:**  $-19.4$  db and  $+9.6$  db at 15 kc.

**Rumble Filter:** Both the 40 and 80 cps positions provide sharp cut off. For 40 cps, response was  $-7.2$  db at 30 cps,  $-1.3$  db at 100 cps. For 80 cps position response was  $-11.2$  db at 30 cps and  $-1.8$  db at 100 cps.

**High-Frequency Filter:** For 4000 cps position,  $-14.5$  db at 15 kc. and for 8000 cps position,  $-9.8$  db at 15 kc.

**Channel Separation:**  $-57$  db at 1000 cps.

**IM Distortion:** (60 and 6000 cps, 4 to 1 ratio) With controls wide open the IM distortion varied gradually from  $.044\%$  at 2 watts output to  $.057\%$  at 30 watts output for one channel. With controls adjusted for 1 volt input the IM distortion varied gradually from  $.05\%$  at 2 watts to  $.07\%$  at 30 watts. These figures are exceptionally good in that they are far below our  $1\%$  figure which we feel is a point at which only the most critical ear can detect this type of distortion. These measurements were taken through the high-level input of the preamplifier.

**Harmonic Distortion:** At 1000 cps, the harmonic distortion varied gradually from  $.13\%$  at 2 watts to  $1.75\%$  at 30 watts. At 27.5 watts the harmonic distortion was  $.35\%$ , showing a sharp increase beyond this point. At 15 kc. the distortion increased gradually from  $.13\%$  at 2 watts to  $.58\%$  at 30 watts. At 30 cps the harmonic distortion was  $.26\%$  at 2 watts and  $.53\%$  at 25 watts, rising sharply from this point to  $3.3\%$  at 27.5 watts. The  $3.3\%$  figure is a little high at 27.5 watts but remember that these tests were made with the 125-volt power transformer tap at a 117-volt line voltage. We made further tests changing the power transformer connection so that the 117-volt tap was used and we found that the harmonic distortion at 30 cps was only  $.5\%$  at 30 watts output. It did rise sharply above this point to  $4.8\%$  at 32 watts. This is really the only place where the power-line voltage proved critical.

The sensitivity did not change materially. We had previously a figure of  $.0013$  volt at magnetic input for 2 watts output. With the 117-volt connection, sensitivity increased so that only  $.0011$



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<b>60 RADIO-TV KNOBS</b> Ass'd, colors, insulation. Value, worth \$1.88¢ ea. 2 lbs. Reg. 817.	<b>60 CA PLUG-N-JACK</b> Sets, matched. Most pop. amps., tuners, 88¢ phones.	<b>6 SILICON DIODES</b> Virginia 1N22. 88¢ 1N23. Reg. 816.
<b>16-END HOOKUP WIRE</b> For tools, auto, etc. Open, 15/64" thru 16" sizes. Reg. 88¢ 82.50.	<b>60 TERMINAL STRIPS</b> Solder-lug & binding to 20 terms. 88¢	<b>25 SURPRISE PACK!</b> Large, varied assort- ment. radio, TV, 88¢
<b>70 ONE-WATTERS</b> Ass'd, value carbon. 88¢ various sizes. 1-6. 88¢	<b>60 COILS, CHOKES</b> 1W, RF, anti. slug- tuned, too. 3 lbs. Reg. 815.	<b>60 PLUGS-N-RECTICLES</b> Audio, power line, bat- tery, spike. 3 lbs. Reg. 88¢
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<b>2 VARI-LOOPSTICKS</b> Adj., 500-1500. Reg. etc. 1 lb. 88¢	<b>15 ROTARY SWITCHES</b> Ass'd, gongs. 3 88¢	<b>1500 PCS. HARDWARE</b> Nuts, screws, washers, etc. 1/2 lbs. Reg. 84.
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volt input was needed for the same output.

We do not recall any other unit that we've tested that has had as low IM and harmonic distortion figures at full rated output as this new unit. It is in the truest sense a full dual 30-watt power amplifier.

One further point of comment is in regards to the instructions provided with the unit for hooking up the two channels for parallel monophonic operation. This design does not include a 32-ohm tap on each of the output transformers. In view of this when paralleling the channels it will be necessary to connect the two 16-ohm terminals of the amplifier together and use the same terminals for both 8-ohm and 16-ohm speakers. The 16-ohm load is incorrectly matched in this case. However, this does not affect the distortion of the amplifier to any important degree but it does reduce the power output capabilities somewhat. If a 4-ohm speaker is to be used, the two 8-ohm output terminals should be connected together and the speaker hooked up here.

-30-

## Transistor-Regulated Supply (Continued from page 61)

transistors, almost all parts can be obtained at the bargain counter or from mail-order surplus suppliers. The transistors, except for  $V_4$ , are of the low-cost variety. This latter transistor costs about \$6.00.

The circuits are not critical and parts can be arranged on the chassis in any convenient fashion. The circuitry of the supply is completely isolated from the chassis to permit use with both  $p-n-p$  and  $n-p-n$  transistors. In any specific application, the "ground" side of the supply can be connected to the chassis with the jacks mounted on the front. The collectors of  $V_2$  and  $V_3$  form the shell of the transistors and these shells must be insulated from the chassis. In the case of  $V_4$ , the entire heat sink must be insulated, but the low dissipation of  $V_2$  allows it to be mounted on any kind of insulating material. Connections to these transistors are made with pins removed from a standard 7-pin miniature socket. The other transistors are soldered directly into the circuit as shown in the photographs.

-30-

## V.H.F. "QSO PARTY"

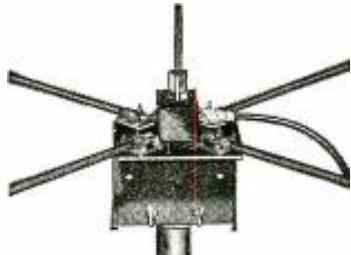
THE Inter County 220 me. Net of Southern California is holding its first V.H.F. "QSO Party" on June 13 and 14. The contest is being held to stimulate interest in traffic and Civil Defense communications in the v.h.f. bands.

More than 40 stations will participate in the contest and those interested in getting in on the event are invited to write Ralph Steinberg, 110 Argonne Ave., Long Beach 3, Calif.

The Net, which was organized in September 1958, operates on 221.5 me. and is said to be the only traffic and emergency net operating in the v.h.f. bands at the present time.

-30-

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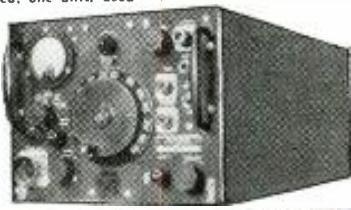
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Can be used as microphone or receiver. 1 pair makes intercom set, good for 1,000 ft., no batteries required, sponge facing, brand new. .... pr. \$4.75

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BC-458 TRANSMITTER—5.3 to 7 Mc. complete with tubes and crystal. BRAND NEW. .... \$6.95

BC-459 TRANSMITTER—6.5 Mc. complete with tubes and crystal. BRAND NEW. .... \$10.00

ARC-5 TRANSMITTER—3 to 4 Mc. complete with tubes & crystal. BRAND NEW. .... \$10.00

ARC-5 R2B RECEIVERS—2-meter Superhet. 156 Mc in 4 crystal channels. Complete with 10 Tubes. BRAND NEW. .... \$24.45

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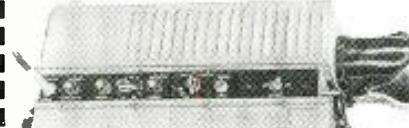
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June, 1959

### Inductor Test Probe

(Continued from page 33)

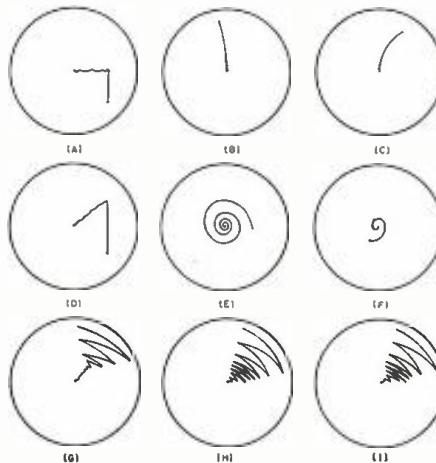
Avoid tube burn: it might be helpful, in this connection, to throw the spot slightly out of focus. Operate the trigger switch and adjust the vertical and horizontal gain controls to produce an inverted "L" pattern, characteristic of the open-circuit indication. No part of the trace should extend beyond the tube face. This avoids overloading of the scope amplifiers. This calibration will now serve for all inductance tests with very little further adjustment.

To test a specific inductance, both the primary and secondary windings must generally be opened to prevent loading by associated circuit components. While only the high-impedance winding of an output transformer, for instance, can be checked directly by the probe, any short or partial short in the other winding will reflect back to produce a faulty trace.

Connect the test leads to the high-impedance side of a good audio-output transformer, for example, trigger the probe, and note the spiral trace on the scope. This will give you an idea of the type of normal trace to expect. Some slight adjustment of the scope may be necessary to keep the pattern on the face of the tube. The number of spirals will vary with the particular inductance being tested (Figs. 2E and 2F) but one complete spiral or more is assurance that there are no shorted turns in either winding. You can prove the truth of this statement by shorting the low-impedance winding and observing the change in the scope pattern.

The probe may also be used for testing for leakage between windings or between a winding and the core. Here the "no leakage" pattern is the inverted "L" open-circuit trace (Fig. 2A). Varying degrees of leakage are indicated by the slope of the horizontal line of the "L" (Fig. 2D). As leakage increases, the horizontal line becomes more nearly vertical until it achieves

Fig. 2. Scope indications: (A) Open winding, or no leakage. (B, C) Shorted turns. (D) Leakage. (E, F) Inductors OK. (G, H, I) Yoke-winding traces.



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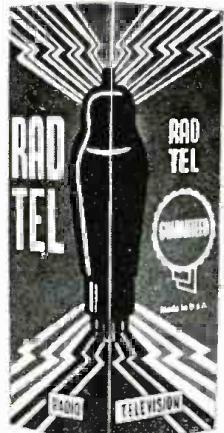
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2BN4	.60	6AC7M	.96	6BR8	.78	5W6GT	.69	12L6	.58		
3ALS	.42	6AF4	.97	6BY6	.54	6X4	.39	12SA7M	.86		
3AU6	.51	6AG5	.65	6BZ6	.54	6X8	.77	12SK7GT			
3AV6	.41	6AH6	.99	6BZ7	.97	6Y6G	.65		.74		
3BZ6	.55	6AK5	.95	6C4	.43	8AU8	.83	12SN7GT			
3BY6	.55	6AL5	.47	6CB6	.54	8AW8	.93		.64		
3CB6	.54	6AM8	.78	6CD6	1.42	11CY7	.75	12V6GT	.53		
3CF6	.60	6AN8	.85	6CF6	.64	12A4	.60	12W6	.69		
3DT6	.50	6AQ5	.50	6CG7	.60	12AD6	.57	17AX4	.67		
3V4	.58	6AT6	.43	6CG8	.77	12AF6	.49	17BQ6	1.09		
4BN6	.75	6AT8	.79	6CM7	.66	12AQ5	.59	19AU4	.83		
4BQ7	.96	6AU4GT	.82	6CN7	.65	12AT6	.43	19BG6	1.39		
4DT6	.55	6AU6	.50	6CS6	.57	12AT7	.76	19TB8	.80		
4BZ7	.96	6AU8	.87	6CU6	1.08	12AU6	.50	25BQ6GT			
4CB6	.59	6AV6	.40	6CY7	.71	12AU7	.60		1.11		
5AMB	.79	6BA6	.49	6DE6	.58	12AV6	.41	25C5	.53		
5AN8	.86	6BC5	.54	6DG6GT	.59	12AV7	.75	25CD6	1.44		
5AQ5	.52	6BD6	.51	6DQ6	1.10	12AX7	.63	25CU6	1.11		
5AT8	.80	6BE6	.55	6DT6	.53	12AZ7	.86	25L6	.57		
5BK7A	.82	6BF6	.44	6JS7GT	.51	12B84	.63	35C5	.51		
5BQ7	.97	6BG6G	1.66	6J6	.67	12BD6	.50	35Z5GT	.60		
5CG8	.76	6BH8	.87	6K6GT	.58	12BE6	.53	50B5	.60		
5CL8	.76	6BK7	.85	6L6	.84	12BH7	.73	50C5	.53		
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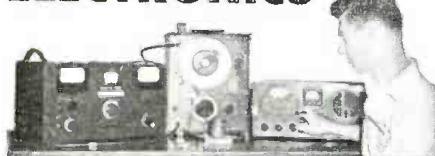
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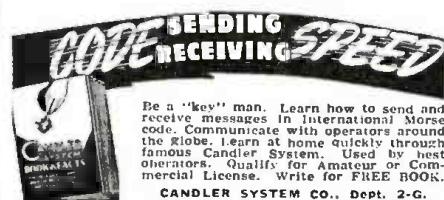


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the typical "short" scope pattern.

The yoke windings of TV receivers can be especially troublesome when shorted turns develop. Because of their low inductance, the probe will not produce the customary spiral pattern when applied to a yoke winding. A characteristic trace is produced, however, which may be used by checking separately each half of either a vertical or horizontal yoke winding and comparing the trace with that produced by the other half of the winding. If the two traces are very similar (for example, Figs. 2H and 2I) the winding is OK. If they differ (Figs. 2G and 2H), an unbalanced condition exists that will cause faulty operation of the set. Remember that windings being tested must be isolated from the rest of the circuitry and be sure to disconnect any parallel impedance or damping resistors before making this test. Vertical-to-horizontal yoke leakage is not uncommon and this should be checked.

Like most simple inductance checkers, this probe has limitations. For example, it will not be of much help in testing such windings as r.f. and i.f. coils. However, in terms of simplicity of construction and use, it is gratifyingly versatile. Even though the direct check of such low-impedance windings as the secondaries of output transformers and the filament windings of power transformers is not feasible, their indirect testing through the high-impedance windings is definitely useful. The probe also works well on such things as fluorescent starter ballasts and the windings on many fractional-horsepower motors.

—30—

## HANDY "LACING TWINE"

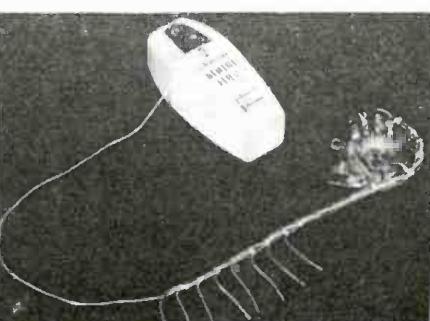
By ROY E. PAFFENBERG

FORMING and lacing of wiring in electronic equipment has long been a mark of professional craftsmanship and certainly should be considered in an amateur construction project. For miniature assembly work, however, suitable twine is not always available.

As shown in the photograph, ordinary dental floss is an ideal answer to this problem. In addition to its ready, low-cost availability it has the following advantages: small diameter for compact cable assemblies; wax impregnation for easy knotting, durability, and strength; packaged in snarl-proof plastic bobbin for ready use and minimum waste; and built-in cutter for the twine.

For all of these reasons, a spool of dental floss makes a valuable addition to the tool box.

—30—



## Slow-Speed Tape Recording

(Continued from page 58)

playback head manufacture is such that frequency response at 3.75 ips is comparable to that obtained with present-day single laminar half-track heads at 7.5 ips. In addition to frequency response, however, the importance of usable linear dynamic range at any specific frequency in the audio band should not be overlooked. The family of curves of Fig. 6 shows maximum usable linearity ranges at 1 kc., 3 kc., 7 kc., and 10 kc. at 3.75 ips. with a Nortronics TLD-L laminated quarter-track head in the setup of Fig. 7. This effective signal-handling ability will cover most orchestral selections adequately. Exceptions to this will include music with large energy levels in the range between 7 kc. and 15 kc. Coinciding with this limitation is the associated erasure which results from an over-biasing effect or recording high-frequency, high-level audio energy. In other words, if a composite signal is being recorded on tape—a signal containing energy at various levels and frequencies—along with a high-level signal of relatively high frequency, the latter signal will act as an over bias and correspondingly reduce the amplitude of the other signals.

The obvious solution in recording this type of music at a lower level is not satisfactory because the reduced

over-all dynamic range will be equally objectionable. Advance in the art of making oxide tapes will gradually eliminate this problem.

Erase heads which are generally energized by the bias oscillator are now available in either stacked or side-by-side configurations as required for stereophonic quarter-track erase. They are remarkably efficient, providing 50 to 60 db erase with inputs of .4-volt-ampere or less.

In the early days of magnetic recording, technical personnel using recording equipment for broadcast and other professional applications set up equalization standards which are still applied to most professional recorders and the majority of home machines as well. The equalization set forth in the standard was developed in an effort to obtain maximum dynamic range over as wide an audio band as possible. A further compromise was dictated by the wish to obtain wide range with relatively simple circuitry in the record and playback amplifiers.

Typical NAB-type equalization curves for the 3.75-ips system with a Nortronics TLD-L laminated head are shown in Fig. 8. Curve 1 represents the constant-current-record, unequalized-playback curve of the head with a bias chosen as previously outlined. Curve 2 represents the record-current equalization. This curve, in conjunction with Curve 1, will produce the unequalized playback response of Curve 3. Curve 4

(Continued on page 120)

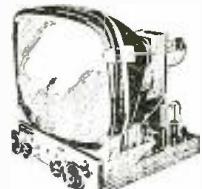
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represents the playback equalization necessary for the complete system.

It is interesting to note that the TLD-L laminated narrow-gap, quarter-track head has approximately the same response at 3.75 ips as the older TLD-S single laminar half-track head has at 7.5 ips. There are two reasons for this: the gap length of the TLD-L head is about one-half the gap length of the TLD-S and the core losses are considerably less, as shown in Fig. 9.

Amplifiers designed for older half-track recorders will usually perform very well with the 3.75 quarter-track tape. Bias and record current calibration, with the recording level indicator, might require closer tolerances.

### Cartridge Machines

Several manufacturers are currently producing magazine or cartridge-type machines which is good news for those audiophiles who have objected to the loading operation required with reels. The success of such a machine would seem to be assured since the magazine can be priced to compete with stereophonic discs. Without dwelling too heavily on the specific merits of magnetic recording and playback, it would seem that the advent of the quarter-track system, as applied to either reel or magazine use, will finally open the door to wider public acceptance.

### REFERENCE

1. Stewart, W. Earl: "Magnetic Recording Techniques," McGraw-Hill Book Company, 1958.

-30-

### HAMFEST SCHEDULES

THE Starved Rock Radio Club has set Sunday, June 7th as the date for its annual hamfest. The affair will be held at the LaSalle County 4-H Home and Picnic Area southwest of Ottawa, Ill.

There will be a free "swap section" and free coffee and doughnuts at 10 a.m. Food can be purchased on the grounds. Advance registration (before May 30th) is \$1.00 with \$1.50 the tab later.

Contact W9MKS, RFD #1, Box 171, Oglesby, Ill., the club station, for further information.

\* \* \*

THE Southwestern Division Convention of the ARRL will be held July 24-25-26 in Pasadena, Calif. General headquarters will be at the Hotel Huntington-Sheraton.

The affair will include exhibits, contests, banquet, and free prizes. Convention chairman is Dr. Henry Richter, W6VZA.

The Committee expects 2000 hams to attend. Those living or vacationing in the area are cordially invited.

\* \* \*

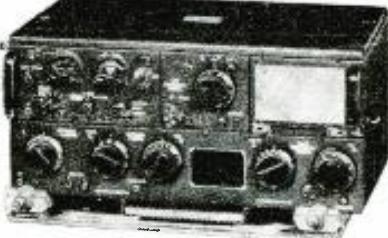
SHERIDAN Radio Amateur League will be the sponsor for this year's Annual Wyoming Hamfest which will be held in the South Fork Recreational Area of the Big Horn National Forest on July 25-26.

Cabins or camp sites will be available. The Committee has planned a full program which will include a banquet, contests, transmitter hunts, and valuable prizes. Registration, including banquet ticket, is \$5.00.

Register with W7QPP, 362 E. Loucks St., Sheridan, Wyo. or contact any Wyoming ham for further details.

-30-

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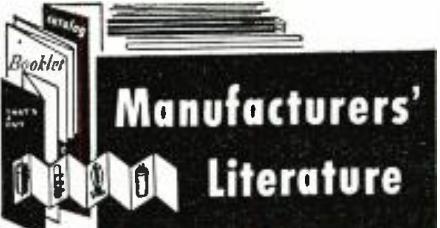
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### 1959 TECHNICIAN'S HANDBOOK

*CBS-Hytron* has announced its "Technician's Handbook" for 1959. It is available for immediate delivery through the firm's distributors or from the company's advertising service, Parker Street, Newburyport, Mass.

This 550-page booklet is packed with up-to-the-minute information on electron tubes and semiconductors. It features over 1000 receiving tubes and 330 picture tubes as well as data on transistors, crystal diodes and special-purpose tubes.

The "Handbook" lies flat for handy bench reference, is designed throughout to withstand rough treatment, and the styling is clean-cut and modern for quick, easy reading.

### TEST EQUIPMENT CATALOGUE

*Triplette Electrical Instrument Company*, Bluffton, Ohio, now has available its new test equipment catalogue No. 38-T.

This brochure describes the latest electronic, electrical, radio, television, and industrial testers.

Copies of the catalogue may be obtained direct from the company upon request.

### RECEIVING TUBES

*Sylvania Electric Products Inc.* is making available through electron tube distributors a handy wall chart listing the proper American receiving tube replacement for European manufactured types.

This new guide lists over 250 European tubes and their American counterparts. Tubes are labeled NR for nearest substitute and ER for exact replacement. Tubes listed as NR may require socket and wiring changes or may have slightly different electrical characteristics.

This chart should prove especially valuable to service technicians called upon to service foreign-made radios, high-fidelity equipment, and tape recorders.

### SOLDERING IRON BROCHURE

*Heracon Electric Company*, 119 W. Clay Avenue, Roselle Park, N. J., has announced a new catalogue covering soldering iron tips. Copies of this new brochure, No. 601, may be obtained direct from the company.

Various tip shapes are illustrated and complete dimensions are given as well as advice on use and care. Also included are list prices.

### ENGINEERING SUPPLEMENT

*CBS-Hytron*, tube and semiconductor division of *Columbia Broadcasting System, Inc.*, has issued a new supplement to owners of its Engineer's Handbook. The Handbook, with this latest supplement, is available through the firm's distributors or from the company at Danvers, Mass.

The 40-page supplement offers new and revised data for fourteen types as well as eight pages of new and revised curves. An up-to-date table of contents lists more than 500 types now included in the handbook.

### CATHODE-RAY TUBE BOOKLET

*Sylvania Electric Products Inc.* has a new booklet which lists the characteristics of television picture tubes and cathode-ray tubes for specialized commercial, industrial, and military applications. It is available through the company's distributors of electronic tube products.

The 42-page booklet constitutes a handy reference to all of the popular tube types of American manufacturers as well as many European-made models. It includes the electrical and screen characteristics and mechanical dimensions of nearly every EIA-registered tube on the market today.

Tubes listed are grouped under two general headings depending on whether they employ magnetic or electrostatic

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focus. Within these groups the tubes are listed numerically and alphabetically. Special sections on phosphor characteristics and proper tube handling highlight the presentation.

#### TUBE REPLACEMENT GUIDE

Vis-U-All Products Company, 303 Fuller Avenue, N. E. Grand Rapids, Mich., has produced a new Tube Substitution Guide to aid radio and television service dealers in selecting tubes for replacement.

Available free of charge to all radio and television service technicians through the firm's distributors or directly from the company, the compact 6" x 9", four-page chart easily fits into the technician's caddy or tube tester. The chart lists approximately 150 of the most commonly used tubes and shows the possible substitutions for each.

#### EIA "FACT BOOK"

Electronic Industries Association is offering its 5th Annual "Fact Book" for 1959. Copies are available to non-EIA members and the general public at \$.75 per copy from the Association's headquarters, 1721 DeSales St., N.W., Washington 6, D.C.

The new book has been expanded in several areas, including added statistics and products in the consumer area, a complete dossier on the industrial products of the industry, and more statistical data on military elec-

tronics such as government expenditures and aircraft and missile electronics.

In addition, it includes figures on electronic equipment purchased by the military during 1958, equipment sold to industrial users, sales of replacement parts, tubes and semiconductors, factory sales of consumer products, closed-circuit TV sales, transistors, and employment in electronics.

#### NEW NATIONAL CATALOGUE

National Company, Malden, Mass., now has available its new catalogue featuring the firm's line of amateur and short-wave receivers. This is available free of charge by writing directly to the company.

The catalogue, known as the RC-100, is eight pages and in two colors. It is well illustrated and includes all technical data and specifications on the firm's complete line of receivers.

#### NEW HEATH FLYER

Heath Company, Benton Harbor, Michigan, is offering a new flyer which covers its line of "Heathkit" components. The brochure is available without cost from the company.

The 24-page booklet carries information on computers, test equipment, ham gear, high-fidelity monophonic and stereophonic components, and marine accessories. A handy order blank is also included for the customer's convenience.

-30-

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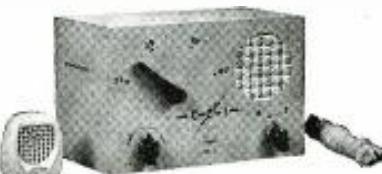
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# Chickasha Electronics, Inc.

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## TV Service and the Ladies

(Continued from page 45)

As Eddie entered the house, he paused, sniffed, and said, "Hmm; smells like somebody left the peanut butter jar open." The lady smiled. "Yes, it's a terrible odor, isn't it? I thought it was giving off gas or something." "Well," Eddie replied, "there's no gas in a TV set as there is in a refrigerator. Anytime you smell something unusual, just pull the plug and call for service. It's usually a short."

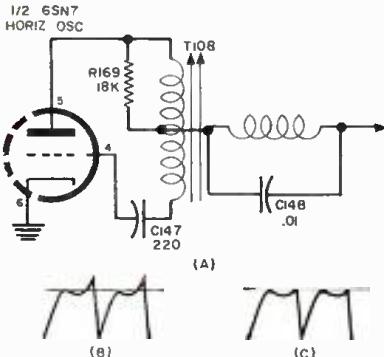
Eddie, having recognized the odor, pulled the chassis and set it up on his dropcloth. He turned the set on and examined the selenium rectifiers. Immediately, there was a soft crackling sound and a more pungent odor than just "peanut butter." He pulled the plug and installed a new pair of rectifiers.

When he turned the set on again, the customer remarked, "My, look how bright the picture is now; and it's full on both sides too. We haven't had it that good for a long time." "Yes, those are two of the symptoms caused by defective rectifiers," Eddie replied. "Actually, you should call us as soon as they start. In this case, you might have avoided the—uh—gas. Incidentally," he went on, "that odor will probably linger for a while, but it's not coming from the set any more. Airing out the room might help." She thanked him and he left.

The call we enjoyed the most involved Eddie and an elderly, white-haired lady who discussed television in technical terms. When she suggested, on the phone, that he bring along an oscilloscope as her set needed horizontal alignment, Eddie was only mildly surprised. He was quite accustomed to hearing female customers use terms normally reserved for technicians. They pick up a word here and there and, whenever they think it fits, they use it. However, to be on the safe side, he took along his portable scope.

The TV receiver was all set up when he arrived. It had been swung away from the wall, the back was removed, and a portable work light was in position to illuminate the chassis. Eddie raised his eyebrows and looked around

Fig. 3. The female owner knew all about this horizontal oscillator.



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for the man of the house but, seeing none, went ahead and turned the set on. The picture came in normal and the lady who had greeted him at the door said, in a pleasant voice, "it will be all right for a short while, Sonny, then it begins spiking." Eddie looked at her quizzically. "Spiking?" "Yes, that's right," she replied sweetly. Eddie shrugged and turned his attention to the set, a vertical-chassis Crosley.

In a few minutes the picture began pulling to one side. Then a series of bright flashes covered it, taking the outline of a Christmas tree. Eddie turned to the customer, who was watching intently. "It's spiking," he said quietly. "Yes it is," she returned. Eddie stared at her questioningly for a second. As she offered no further comment, he started to remove the knobs and chassis bolts. After setting the receiver up on his dropcloth, he plugged it and his oscilloscope in and waited a few minutes for the two to warm up.

While waiting, he glanced at the customer several times. She returned his stares with a pleasant smile, swaying slowly back and forth in her rocking chair. Eddie tried to force his attention back to the set's horizontal oscillator (Fig. 3A). He turned the horizontal lock trimmer completely clockwise, then backed it off a half turn. He placed a 10- $\mu$ fd. capacitor in series with the hot lead of the scope and clipped it at the junction of  $C_{118}$  and  $R_{100}$ . Since the resultant waveform was distorted (Fig. 3B), he prepared to adjust the coil slug with his alignment tool.

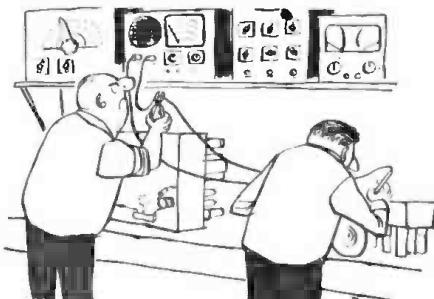
The customer leaned forward in her rocker, looked at the green trace on the scope, and remarked, "My, those peaks are out of line, aren't they?" Eddie nodded his head in a daze and adjusted

until the two peaks of the waveform were "in line" (Fig. 3C). Then he removed the scope connection and checked the horizontal-hold control. He noted that the picture would lose horizontal sync only at the extreme ends of the control's range. Satisfied, he installed the chassis, made a few vertical adjustments, and wrote up his bill. The lady paid him and thanked him for the prompt service.

As he started to leave, he could contain himself no longer. He turned to her and said, "Madam, I give up. Tell me, how do you know so much about television?" "Oh, I fool all the service people," she smiled brightly. "You see, my grandson is a technician too. He's in the Navy now and can't take care of my TV. I was always interested in electrical things and when he was home, working on different sets, he would explain what he was doing while I watched. Why I've seen this horizontal trouble many times. If I had the right equipment, perhaps I could have aligned it myself." Eddie scratched his head and grinned. "I bet you could at that." She held the door open for him.

Still shaking his head, he went down the steps, muttering to himself, "A grandma TV technician. If that ain't the end!"

-30-



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# Crossword Capers

By WILLIAM R. SHIPPEE

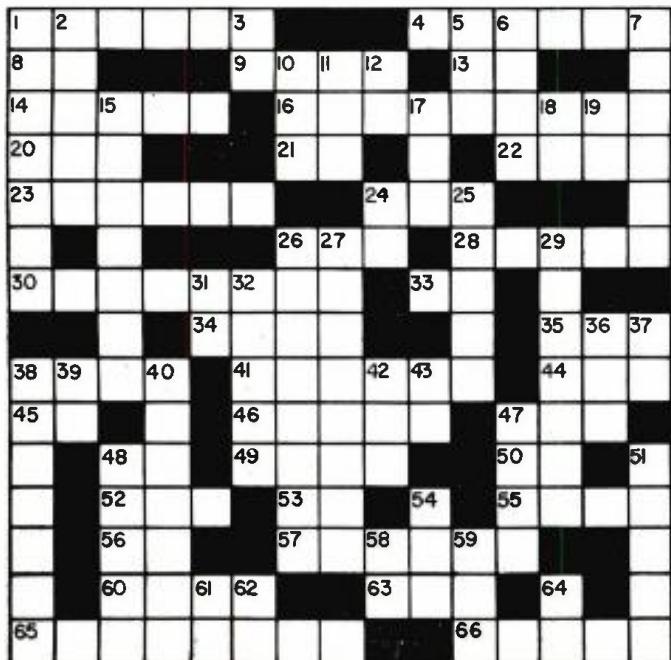
(Answer on page 136)

## ACROSS

1. Six-electrode tube.
4. Alloy for PM speaker magnets.
8. And (Latin).
9. Ratio of output voltage to input voltage.
13. Abbreviation or "that is" (Latin).
14. Voice transmission on the ham bands.
16. Small change in the value of a variable.
20. Starting point on a golf course.
21. Control from afar (abbr.).
22. Prefix meaning "oil."
23. Apparatus found in a planetarium.
24. Greek letter.
26. Unit of relative power.
28. Effect produced by interference.
30. On the outside.
33. Intermediate frequency (abbr.).
34. Used in TV to deflect the electron beam.
35. Type of transistor.
38. To reduce signal amplitude gradually.
41. Quantity having magnitude and direction.
44. Prefix meaning "three."
45. Ratio of inductance to capacitance.
46. To change.
47. Type of receiver (abbr.).
48. To exist.
49. Italian monetary unit.
50. Egyptian sun god.
52. Automatic chrome control (abbr.).
53. Toward.
55. Capacitors sometimes do this.
56. Officer (abbr.).
57. Capacity for performing work.
60. To force onward.
63. Airport control system (abbr.).
65. A high-vacuum, high-voltage diode.
66. Position of a periodic wave at any instant.

## DOWN

1. Seven-electrode tube.
2. Popular term used to designate transmission medium for radio waves.
3. Symbol for grid potential.
5. False statement.
6. Also called a "remote broadcast."
7. Eight-electrode tube.
10. Dielectric used in tuning capacitors.
11. Legal corporate entity (abbr.).
12. Type of relay contacts (abbr.).
15. Unit of magnetic intensity.
17. Effective value of an alternating current (abbr.).
18. The (Spanish).
19. Element No. 10 (abbr.).
24. It goes into a Jack (abbr.).
25. To conclude by reasoning.
26. Insulating material often used in radios.
27. Elementary charge of negative electricity.
29. Sometimes called a "beam bender."
31. Symbol on a schematic.
32. Miniature tube with nine pins.
36. Pulse repetition frequency (abbr.).
37. Abbreviation for the 28th element.
38. High-voltage TV transformer.
39. Not d.c.
40. Prefix meaning "electric."
42. Beverage.
43. Correlative of "either."
47. A system of weights for precious metals.
48. Antenna matching device.
51. Commonly called the "plate."
54. Electrical discharge through the air.
58. Grid potential (abbr.).
59. Space between the surfaces of two electrodes.
61. Type of tube
62. Suffix meaning "one who has to do with."
64. Tube designed to boost signal voltage. (abbr.).



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Richard J. Falk, 2303 Holman St., Bremerton, Wash.	1st	22
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# Service Industry News

THE FEDERATION of Radio-Television Service Associations of Pennsylvania recently presented its honor plaque for distinguished service to the service industry in 1958, to the *Raytheon Manufacturing Co.* In the presentation ceremonies, David Krantz, chairman of FRTSAP, said the award was given in recognition of *Raytheon's* aggressive program to support the efforts of independent TV and radio service technicians.

The plaque was accepted by E. I. Montague, trade relations manager for *Raytheon's* Distributor Products Division. It was officially presented by Wayne Prather, vice-chairman of the State Federation and president of the Electronic Service Dealers Association of Mid-State Pennsylvania.

In discussing the nature of the award, Mr. Krantz pointed out that it is the industry's oldest program of recognition for manufacturers and individuals who make outstanding contributions in the best interests of the independent service industry. With the exception of 1957, the award has been presented annually for eleven years.

More than fifty representatives from service associations in all parts of the state attended the presentation dinner and the business meeting which followed. Officers of the FRTSAP are: David Krantz, chairman, 1298 Cheltenham Ave., Philadelphia, Pa.; Wayne Prather, vice-chairman, 17th & Herr Street, Harrisburg, Pa.; Adam Deets, recording secretary, 37 Church Street, Edwardsville, Pa.; Leon J. Helk, secretary, 67 South Main Street, Carbondale, Pa.; and L. B. Smith, treasurer, Box 162, Hershey, Pa.

## New Group in New Jersey

Earlier this year, the Television Service Association of Ocean City, N. J., was formally organized with an initial membership of 15 dealers. The slate of officers selected to serve for a six-month period include:

President, John Bartlett, of *Bartlett & Brown*, Atlantic City Blvd., Pine Beech, N. J.; vice-president, Don Marcy, *Don's Radio & Television*, 17 Sumner Ave., Seaside Heights, N. J.; Jack Pyenson, secretary, *Pyenson Precision Co.*, Church Road, Toms River, N. J.; John Frayman, treasurer, *Shore Line Television Service*, 120 New Brunswick Ave., Lavalette, N. J.; Bob Johnson, publicity director, *Bob's Radio & TV Service*, Box 623A, Route 37, Toms River, N. J.

Trustees for the association are: A. E. Graham and Jerrold Graham of *A. E. Graham & Sons*, 10 East Water Street, Toms River, N. J.; and John

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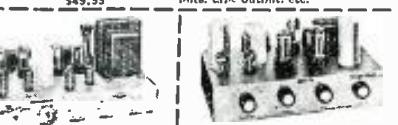
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Gillon of Oliver's Television Repair Service, 424 Capstan Ave., Beachwood, N. J. The association hopes to expand its membership to 25 technicians in the very near future.

#### Delaware Valley Forum

The Television Service Association of Delaware Valley recently announced that it will sponsor an Electronic Technicians' Forum at the Benjamin Franklin Hotel in Philadelphia during the period June 12 to 14. Dave Krantz was named chairman and coordinator of the event.

Electronic parts distributors, manufacturers representatives, and manufacturers will cooperate with the service association to make the three-day forum an outstanding affair. Subjects planned for presentation in lectures and demonstrations include small-business management methods, repairs and adjustments of tape recorders and changers, printed-circuit boards, advanced circuitry in color television, industrial electronics equipment of interest to the service industry, and modern test equipment. Information about the three-day exhibit and seminar may be obtained by writing to: David Krantz, Program Chairman, 1298 West Cheltenham Ave., Philadelphia, Pa.

#### New Santa Clara Officers

The Radio & TV Association of Santa Clara Valley, California, recently installed its new corps of officers at a dinner-dance believed to be the greatest event in the history of the central west-coast association. Officers officially inducted at the ceremonies were Jack J. Morrisroe, president, *Jack Morrisroe's TV*, 2333 Birch Street, Palo Alto; Russell J. Hamm, vice-president, *Hamm's TV*, 4621 Soquel Drive, Soquel, Cal.; and John C. Murphy, secretary-treasurer, *Alliance Electronics*, 169 South Third Street, San Jose.

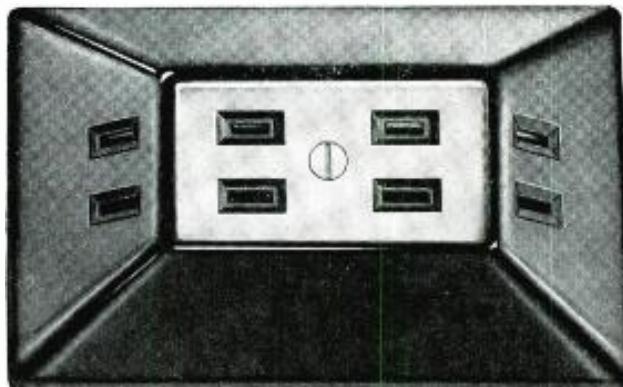
Directors of the association are: George A. Akers of *Allied-Paramount*, 79 South Third Street, San Jose; Harley Boltz of *Inter-City Sales & Service*, 457 El Camino Real, Menlo Park; James C. Davis of *Davis TV*, 4846 El Camino Real, Los Altos; C. S. Dawson of *Aero-Appliance Electronic Research Co.*, San Jose; Roy F. Fakler, *National Radio & TV*, 3741 Stevens Creek Blvd., San Jose; and Richard J. Kelso of *Modern Radio Sales & Service*, 1030 S.J.-L.G. Road, San Jose.

RTASCV is sponsoring an apprentice-training program in cooperation with the San Jose Unified School District and the Division of Apprenticeship Standards of the State of California Department of Industrial Relations.

#### Winston-Salem Elections

At the recent annual election of the Electronic Technicians' Association of Winston-Salem, N. C., Archie Bartlett of *Archie's TV Service* was elected president. He succeeds David Drage, who is withdrawing from the electronic service business. Those named to serve with Mr. Bartlett include Otis Beasley

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radio is  
bursting at  
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maintenance!

105-B  
MICROMETER FREQUENCY METER



Heterodyne type, measures nearby transmitters 100 KC to 175 MC (to 3000 MC by measuring multiplier stages of crystal-controlled transmitters). Price \$220.00 net.

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test equipment is preferred  
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**LAMPKIN LABORATORIES, INC.**  
MFM Division  
BRADENTON, FLORIDA

205-A FM MODULATION METER



Measures peak deviation, plus or minus, on 0-12.5 or 0-25.0 KC scales. Tunable 25-500 MC in one band. Small, rugged. Price \$240.00 net.

LAMPKIN LABORATORIES, INC.  
MFM Division, Bradenton, Florida  
At no obligation to me, please send  
 Free booklet    Data on Lampkin meters.  
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0-500 Microamps (Basic Movement) 3 1/4 Aircraft Meter. Marked fuel Air Ratio mfd. by Cambridge Instrument.	2 for 3.00; 1.59 ea.
<b>BC-652</b> Receiver 2-Gm w/tubes & dyn. Like new. Less Tubes & Dyn. Good Cond.	14.95
<b>Heavy Duty Power Transistor</b> 220 V 60 cyc. can be tapped for 115V. S-1800 VCT-350. Mfg. Metal W. E. Co. 85% h x 9 1/2 w x 9 1/2 d. 2 for 30.00	
<b>POWER TRANX PRI.</b> 115v or 220v 60 cyc. S-1800. VCT 300 MA (Conservative) 6.3V-1A/6.3V-1A. Mfg. Metal W. E. Co. Body Dim. 7 21/32" h x 9 1/2" w x 9 1/2" d. 7.95 2 for 15.00	
<b>HEAVY DUTY CHOKE.</b> 13.7 Hy 450 MA (GOMMA Conservatve) Mfd. by Merit. 3200 VRHMS 120 DCR. 6.95	
<b>GLOBAR</b> non-inductive resistor 600 ohms 118 watts. New .98 ea. 12 for 10.00	
<b>Portable Amplifying Megohmmeter.</b> Built-in 1000 volt Filter Choke—5 HYS-500 ma 91 ohms DCR 111 Pol. 2000 VRHMS (small).	2.95
<b>BC-645 XMTX</b> Receiver W/tubes 435 to 500 mc. Brand New 1.95	
Control Box for above. ....	Brand New 1.49
<b>PE-101C</b> Dynamotor. ....	Brand New 5.95
<b>Variable Capacitor.</b> Glass Dielectric Concentric Type 1-8 MMFD. ....	1.95
<b>Power Supply Unit PE-110-B</b> 115 V/60 cyc. (Same with BC-6691). ....	49.95
<b>Test Set TS-545/up</b> Echo Box Manual. ....	39.95
<b>RM-52</b> Remote Control Unit. ....	1.95
<b>Variable Capacitor</b> Stator Dual 250 mmfd. 6000 volts. ....	6.95
<b>Variable Capacitor</b> 7 sections 4-200 mmfd. 4-200 mmfd. Peak voltage 1000 volts-Special. ....	2.95
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59c ea. 2 for 1.00	
Receiver Type 557. 200 to 400 MC. Contains 22 tubes. No power supply. ....	22
12 Volt Dynamotor output 172 V-138 MA. ....	Special 24.95
6 Volt Dyn. output 600 V/150 MA. ....	Brand New 4.95
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Horizontal Output Tran. RCA No. 102285 (Color). ....	NEW 9.95
Yoke RCA No. 102132 (Color). ....	NEW 14.95
BC-639 Receiver 100-150 MC with manual rectifier RA-12A 115 V AC 60 cyc. With manual rectifier. ....	Brand New 79.95
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<b>STANCOR TRANSFORMERS</b> —All 115 Volts 60 Cyc. Pri-NEW	
Tranx No. 1-760 VCT-200 MA/5V-3A/4.2V. ....	1.95
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Tranx No. 3-740 VCT-200 MA/5V-3A/3V-4A 1.95	
Tranx No. 4-740 VCT-200 MA/26V-5A/26V-1A 1.95	
Tranx No. 5-1010 12.5V-2.5V-3A/20V-7Amp. ....	1.95
Tranx No. 6-36V-3A/165V-75 MA Tapped at 5.5V-1A 1V-4A 20V-1A. ....	1.95
Set of 6 Tranz. Super Special. ....	\$10.00

**SPARKS RADIO SUPPLY**  
194 GENESEE ST., BUFFALO 3, N.Y.

PROMPT DELIVERY ASSURED

of Southern TV Service, vice-president; B. D. Moorfield of Northside TV Service, secretary; and Raymond Jones of Jones TV Service, treasurer. Clifton Lynch of D & R TV Service was named to the post of editor of the "ETA Bulletin." The Association mailing address is P. O. Box 5193, Winston-Salem, N. C.

### Change in Ohio Monthly

Issue No. 1 of Vol. 15 of the Columbus, O., "ARTSD News" introduced, without fanfare, its new printed format for this long-lived association house organ. As the official publication for the Associated Radio-Television Service Dealers of Columbus, Ohio, the "News" was issued regularly in the form of a mimeographed bulletin for a period of fifteen years. Edited by John Graham, current president of ARTSD and a genuine "old timer" in the radio industry, it reflected the month-by-month developments in one of the industry's early formal associations of service dealers. Don Hamill has now assumed the mantle of editor. Official headquarters are at 2552 North High Street, Columbus 2, Ohio.

The transition of the "ARTSD News" to a printed format serves to emphasize the important role association house organs now play in crystallizing service thinking on problems that affect the activities of independent dealers. Five years ago there were less than a half a dozen such publications that were issued regularly. Today, dozens of magazines of this type are delivered regularly by mail to service dealers in every section of the country.

### Service Dealer Problems

Three of the major service problems that are constantly covered in editorials in association magazines were ably epitomized in an editorial in the "Printed Circuit" by Garland E. Hoke, president of the North Carolina Federation of Electronic Service Associations, Inc. Mr. Hoke said:

"In the past few months, there have appeared various trends which seem to be hurting the TV service industry. One of these trends is the ever increasing number of people who service TV as part-time work."

Mr. Hoke then went on to criticize those among the part-time technicians who do not have adequate technical qualifications and who are able to cut prices unfairly because they can avoid legal tax payments that are part of the overhead for established shops.

"Another trend is that we are losing to other industries many good technicians. The main reason is poor pay and no fringe benefits. I have never been one to advocate price increases as the solution to all our business problems. This is not the complete problem, but let me emphasize one point—most of the shops in this state do not charge enough for service calls in homes and for shop labor. Not only this, but I sincerely question whether one shop in every fifty even knows the cost of making calls. If we are to be successful we

## CITIZENS RADIO HEADQUARTERS

IN STOCK



Gonset Model 3303-G11 (115V AC) ... \$124.50

Gonset Model 3304-G11 (12V DC) ... 124.50

Ground Plane Antenna Kit ..... 39.95

Mobile Antenna Kit ..... 13.50

The above complete with press to talk microphone and crystals for one channel.

We stock parts for transceiver described in Radio & TV News, March 1959.

Crystals for any of the channels .005% \$3.85

New Citran-22 Transmitter Kit or Wired Use this one with your receiver that covers the 11 meter Band.

Send for FREE BOOKLET—Citizens Radio on 11 Meters.

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must study our costs of doing business and get our prices in line with what we need to make a profit. Let's do something about this before it gets to be an impossible problem.

"Another trend is for the public to buy parts at wholesale prices and ask service technicians to install them at regular labor charges. If we give up profit on parts, then it becomes more difficult to make ends meet. There are two courses of action to prevent this. One is to explain to the customer that you must have more for your labor to offset the loss of profit on the part. The other is just to refuse to install the part. I'm of the opinion that if enough service shops refuse to install these customer-purchased parts, it would help to eliminate much of this problem."

### NATESA Award to Sylvania

For the eighth year in a row, a NATESA "Friends of Service Management" award has gone to *Sylvania Electric Products Inc.* The latest one, given for outstanding service to the service industry in 1958, was presented at NATESA's Spring Directors Meeting in Nashville, Tenn.

Another assist to radio and TV service dealers from this manufacturer is an inventory control book to be used in maintaining accurate records on the delivery, stocking, and movement of receiving and picture tubes and semiconductor devices. All currently popular types are listed, with space for future additions. The objective is determination and regulation of stock levels. Copies of the inventory control booklet may be obtained from *Sylvania* tube distributors. The same manufacturer is now conducting a series of 400 service clinics on its new chassis line throughout the country.

### Printed Circuit Question

In cooperation with the Institute of Printed Circuits, a non-profit manufacturers' group, the National Alliance of Television and Electronic Service Associations has given wide circulation to a questionnaire intended to nail down the actual reaction of service dealers to the controversial boards. Results of the poll may settle many questions concerning printed wiring. The questions not only attempt to find out how service actually feels about this subject but why. For example, distinctions are made between difficulties involving the boards directly and those that grow out of mounting methods.

### Manufacturers and Service

The Service Committee of the Electronic Industries Association is working on a plan to provide service technicians, as individuals and as members of associations, with non-technical information. While technical data has been widely available for some time, the committee feels that more can be done in such areas as customer relations, merchandising, and expense control.

## AMPLIFIER — INDICATOR NEW ITEM ID-80/APA-17

Amplifies and gives visual indication of the relative bearing of radar or radio signals in the freq. range of 250 to 1000 megacycles when used in conjunction with a receiver covering this range. May be adapted to use on other freq. Complete with tubes: 1/51P2, 2/6AC7, 2/6H6, 1/6SH7, 1/6SJ7, 1/6V6, & 1/2X2. Voltage required 115 V 400 cycle & 24 VDC. Re-New \$39.50

### RADAR JAMMING TRANSMITTERS:

The transmitters listed below are the type used in aircraft for jamming Radar & Radio signals. They all operate from 115 V 400 to 2600 cycle—  
T-9/APQ-2 AM 200-500 MC Used: \$1.00  
T-9/APQ-9 AM 500-555 MC With Tubes: 931 (Noise Tube), 2/807, 2/6AC7, 1/6AG7 & 2/8012. No Power Supply Used: \$0.95 RE-New: \$14.50  
T-28/APT-1 AM 140-210 MC With Tubes: 931 (Noise Tube), 2/832, 2/6C4, 2/5R4, 3/6AC7, 1/6V6, & 1/6X5. With 115 V 400 to 2600 cycle Power Supply Used: \$1.00 RE-New: \$24.50  
T-116/APT-5 AM 300-1400 MC With 931 (Noise Tube), 2/829, 2/6AC7, 2/6L6, 2/5R4, 2/1616, 1/6AG7. With 115 V 400 to 2600 cycle Power Supply Used: \$1.00 RE-New: \$19.50

BC-663 FM RECIEVER—27 to 39.1 MC Used: \$27.95  
BC-684 TRANSMITTER 27 to 39.1 MC Used: \$7.95  
AC PDWER SUPPLY for BC-683-603 Kit: \$10.00-Wired: \$14.50  
BC-604—Transmitter—20 to 27.9 MC. U: \$4.95 R-N: \$7.95  
DM-34 12 V Dyn. F/BC-683-603.U: \$2.95 R-N: 4.95  
DM-35 Dyn. F/BC-684-604.U: \$7.95 R-N: 9.95

**KEYERS, TELEPHONES, HEADSETS, MICS.**  
TS-9 Handset. Used: \$2.95 New: \$3.45  
TS-13 Handset, w/PL-55 & PL-68. U: \$2.95 New: \$3.45  
T-17 Microphone. Used: \$3.00 New: \$3.45  
CM-1-SC Hand Carbon Mic.—Module type. New: 6.95  
EE-8 Field Telephones. Used: \$12.95 Record: 16.95  
BD-71 Switchboard—12 Line. U: \$14.95 New: 24.95  
BD-72 Switchboard—12 Line. U: \$14.95 New: 31.95  
RM-29 Control Unit... New: \$6.95 W Handset 8  
RM-32 Control Unit (Patch Found). U: \$1.95 New: 3.45  
H-16/U Headset—8000 ohm U: \$1.95 New: 2.95  
HS-33 Headset—300 ohm U: \$4.05 New: 5.95  
TG-34 Keyp F/Code Practice. Re-New: \$16.95  
Code Practice Tapes, Inked Paper—15 to Set N: 16.95  
J-45 Tel. Key with cord and plug New: 1.50

### COLLINS ART-13 TRANS.—\$49.50



### 2 TO 18.1 MC—100 WATT—PHONE, CW, MCW

The most desired Set on the surplus market—Easily converted to 10 Meters (See Surplus Conversion Manual No. 2—\$2.50) Automatic Tuning for selection of 11 Channels in the freq. Range. Tube Line-Up: 1/837, 1/813, 2/1625, 1/12S17, 2/6V6, 2/811, 2/12SL7, 1/12SA7, AC Power Supply requirements: 28 VDC/10 A 1600 VDC/250 MA & 1250 VDC/250 MA. Size: 23" x 16 x 11". Wt.: 70 lbs. Price, USED: \$49.50 Price Same as above—except, Less Tubes 30.00 DY-12/ART-13 24 V. Dyn. w/Filter & Relays—U: 12.95

**RADAR OSCILLOSCOPE**  
ID-169B/APN-12 INDICATOR: Used with various types of Radar Sets for indication of incoming signals. Can be converted to a monitoring unit or test oscilloscope. Has vertical, horizontal, focus, sweep & intensity controls. Antenna change-over motor using small type coaxial connectors. Tubes: 5/12AU7, 3/5726, 1/6AS6, 1/6AQ5, 1/6X4, & 1/J3PI. Operates from 115 V 400-1000 cycle & 24 DC. Size: 9 x 9 x 16". Wt.: 25 lbs. Complete w/tubes & schematic. Also has 50K ohm Helipot (Similar to BC-929). USED: \$12.95

**POWER SUPPLIES • DYNAMOTORS:**  
PE-120 Power Supply F/BC-659, BC-620. Re-New: \$ 7.95  
AC Power Supply F/BC-603-683 Kit: \$10.00—Wired: 14.95

PE-237 Power Supply F/BC-1306 Used: 14.95  
CD-2045 Vibrator Pac—12 VDC/300 VDC 100 MA N: 7.95

**UHF CONVERTER**  
100 to 225 MC Western Electric FM Converter. Plug in Unit. Covers freq. 100 to 225 MC with 30 MC resultant freq. & tuneable dial. AFC + or - control, using 1/6J4 & 1/5670 tubes. Voltage required 150 VDC 6.3 VAC. Shielded in cast aluminum. Size: 7 1/2" x 6" x 9 1/2" AM-913/TRC New: \$34.95

**LARGEST VARIETY of SURPLUS EVER OFFERED! See CATALOG F-59!**  
Address Dept. RN • All Prices F.O.B., Lima, Ohio. Minimum Order \$5.00, & 25% Deposit on all C.O.D.'s

**FAIR RADIO SALES**  
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**Advance****POWER SUPPLY  
KIT BARGAIN!**

Primary 115V. 60 Cyc. Sec. 400-0-400 V. @ 200 Ma. 6.3 VDC @ 200 Ma. 250 mA. std. mounting plus. Hy 200 Ma. chokes and 200 two 8 Mfd. 600 V all condensers. Kit \$7.50 DC Power Supply Kit 24 VDC-2 amp output. \$3.95

**RELAYS! RELAYS! RELAYS!**

110 V AC DPDT W.L. ....	\$2.95	6 V DC SPDT Advance ... 1.35
110 V AC DPDT Allied ....	3.50	24 V AC SPDT Sigma 41-F... 1.35
110 V AC SPST Allied ....	3.50	w/timer for 110 VAC. 1.65
110 V AC 12PDT Dunco ....	4.15	16,000 Ohm Plate, Sigma SF SPDT - Adi.
110 V AC DPDT Dunco ....	9.75	Will operate on 500
110 V AC DPDT Ceramic-Leach. 3.45	9.75	Mma ..... \$3.95
12 V DC DPDT Allied ....	1.35	
LARGE STOCK AC. DC RELAYS		

★★★★★ Solenoids ★★★★★  
115V 60 Cyc cont. duty, 18 Lb. pull . . . each \$5.50  
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24V & 230V SORENK IN STOCK!

STEPPING RELAYS  
Resettable type. 3 deck, 10  
pos. 24 VDC . . . ea. \$6.95  
2 deck, 44 pos. no reset  
ea. \$6.95  
5 deck, 23 Pos. ea. \$7.50  
16 deck, 22 Pos. \$22.50

**McELROY**  
**TAPE PULLER**  
115V  
AC-DC... \$8.95

CHOKES  
FULLY CASED  
6 hy. 100 Ma. \$1.09  
8 hy. 100 Ma. 1.49  
8 hy. 200 Ma. 1.89  
10 hy. 150 Ma. 2.19  
20 hy. 300 Ma. 8.95  
22 hy. 100 Ma. 2.59

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Earphones  
Hi-Impedance Dual  
Headset, complete w/  
headband & Cord. Used  
-teristic Value  
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6.3 V. .... SEC.	10 V SEC. 15 Amp. .... \$4.45
1 Amp. .... \$1.25	12 V SEC. 2 Amp. .... 1.19
3 Amp. .... 1.85	12 V SEC. 25 Amp. .... 5.95
12 Amp. .... 3.25	24 V SEC. 1 Amp. .... 1.25
20 Amp. .... 3.50	24 V SEC. 3 Amp. .... 1.95
25 Amp. .... 3.95	5 V SEC. 10 KV-INS .. 3.95
35 Amp. .... 5.75	10 KV-INS .. 3.95

SCOOP! RG-8/U CO-AX CABLE  
52-ohm impedance, 100-ft. length. .... \$6.75  
RG-59A/U (72-ohm) with male and female  
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SPECIAL!!	1x8 mfd 500 VDC	\$2.95
2 Mfd	500 VDC	.45
4 Mfd	600 VDC	.75
6 Mfd	600 VDC	.95
10 Mfd	600 VDC	1.00
12 Mfd	600 VDC	1.35
20 Mfd	650 VDC	2.75
1 Mfd	1000 VDC	.60
2 Mfd	1000 VDC	.75
4 Mfd	1000 VDC	1.25
8 Mfd	1000 VDC	1.60
10 Mfd	1000 VDC	2.50
15 Mfd	1000 VDC	2.45
4 Mfd	1500 VDC	1.75
8 Mfd	1500 VDC	2.95
10 Mfd	1500 VDC	3.25
12 Mfd	1500 VDC	3.75
20 Mfd	1500 VDC	5.95
35 Mfd	1500 VDC	7.75

SPECIAL!! PANEL METERS

1" METERS	3" METERS
0-1 Ma. .... \$3.50	0-20 Micro-amps. 4.95
0-200 Micro-amps. 3.50	0-100 Micro-amps. 4.95
0-500 Micro-amps. 3.50	0-200 Micro-amps. 4.95
2" METERS	
0-1 Ma. RF. .... 3.25	0-50 V AC. .... 3.45
0-5 Amps. RF. .... 2.95	0-500 V AC. .... 3.45
0-200 Micro-amps. 2.95	0-1 Mill. .... 4.45
0-30 Milli-amps. 2.95	0-5 Mills. .... 4.45
0-300 V AC. .... 3.25	0-100 Mills. .... 3.45
10.0 to 100.0 DB. 3.95	200-2000 V DC. .... 3.45
75 Micro-amps. null indicator. 5.75	0-300 Amps DC. .... 3.45
0-7.5 V DC. .... 2.95	w/shunt. .... 5.45
0-150 V DC. .... 2.95	S-Meter used in Hallicrafter. .... 3.45

SELENIUM RECTIFIERS

FULL WAVE BRIDGE	
130 110 VAC input 150 mills. .... \$1.25	57/48 VAC input 100-110 VAC input. 6.75
200 mills. .... 1.55	30/24 VAC input
300 mills. .... 2.50	1/2 amp. .... 1.15
500 mills. .... 3.50	2 amp. .... 2.15
1 1/2 amps. .... 5.25	7 amp. .... 5.25
	10 amp. .... 6.75

SPERTI-VACUUM SWITCH.... 2.95  
same as used in ART-13

4 WIRE TELEPHONE  
COILED CORDS ..... 89c ea.  
6 for \$5.00

POWER SUPPLY Special!!  
ALL WIRED-READY TO USE  
BC-1086 PRI-115V AC  
SEC. 300V @ 200 Ma.  
105V SEC. Reg. supply @ 20 Ma.  
1 Meter 0-15 Ma; 5 Tubes (6SK7, VR105,  
6H6, SU4, GSN7) ONLY..... \$19.75

NAR POWER SUPPLY  
115 V. 60 Cyc. input 12-14 VDC, 3 Amp. \$8.95  
output filtered and fully housed.....

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# FCC Information on the Citizens Radio Service

The following is from the FCC's Safety and  
Special Radio Services Bureau bulletin 1001.

**General.** The Citizens Radio Service is intended for personal or business short-distance radio communication, signalling, and radio control of objects and devices such as model airplanes. Any citizen of the United States who is 18 or more years of age (or 12 years for a Class C station) may obtain a station license in this service if his application meets the requirements of Part 19 (as revised) of the Commission's Rules governing the Citizens Radio Service. Partnerships, associations, trusts, or corporations meeting the citizenship requirements of the Communications Act of 1934, including any state, territorial, or local government entity, or any organization or association, including Civil Defense organizations, operating by authority of such governmental entities, may also be licensed in this service.

Part 19 (be sure to specify the edition effective September 11, 1958 when ordering) may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for 10 cents in coin. If you desire to obtain future amendments, use the form provided in the booklet for that purpose. It is emphasized that Part 19 should be consulted before filing an application, and that station licensees should read and understand it. This item contains information of a general nature and is not a substitute for the actual rules governing the service.

Frequencies available to stations in this service are shared among licensees. During periods of normal operation no protection can be afforded to the communications of any station in this service, even when involving the safety of life or property, from interference which may be caused by the proper operation of other authorized Citizens Radio stations or from stations in other radio services properly operating on frequencies shared with the Citizens Radio Service.

**General restrictions on use.** Citizens Radio stations may not be used for any purpose contrary to any law or for broadcasting to the public in any way. They likewise may not be used as links in the physical circuits of other radio services although they may be used for the mechanical control or turning on and off of stations in other services. No charge may be made for messages carried over Citizens Radio stations or for any other types of communications transmitted by such stations, or for the use of licensed equipment by persons other than the licensee. The licensee is responsible at all times for the operation of stations licensed to him.

**Interference.** Citizens Radio station users must expect and tolerate interference not only from other legally operating Citizens Radio stations but sometimes from stations legally operating in other radio services. Licensees of class A stations must apply for a new authorization before shifting frequencies to avoid interference; licensees of class B, C, or D stations may shift to any of the frequencies available to stations in their respective classes without any further authorization.

**Licenses required.** A station license must be obtained from the Federal Communications Commission at Washington (Field Offices no longer issue any class of Citizens Radio license) for operation of a Citizens Radio station. FCC Form 505 is used to apply for a new, renewed, re-instated, or modified license. A commercial radio operator's license of the proper grade is also required for manually operated telegraphy and for any adjustments to a Citizens Radio transmitter during installation, testing, or servicing which may cause the transmitter to operate off-frequency or otherwise in a manner which would violate the rules. FCC Form 505 must also be used for a change of address, or for a change in the number of transmitters, or any other information shown on the license, or for authority to transfer control of the licensee corporation. If a license is lost, a duplicate may be obtained by applying on FCC Form 505 with a statement as to how it was lost.

**Obtaining Application Forms 505.** All of the Commission's Engineering Field Offices stock Form 505, and it may be obtained without charge from any such office, or from the Commission at Washington. Since this form is relatively expensive, requests for an unusual quantity must explain why such a quantity is needed.

**Renewal of license.** FCC Form 505 is used to apply for a new license to replace an expiring license. In such a case, the form should be filed at least 30 days prior to expiration of the current license. Be sure to fill out the form so that it will show the station details exactly as they are to appear on the new license.

**Applications and correspondence.** Applications and correspondence about applications for all classes of Citizens Radio Service stations must be sent to the Federal Communications Commission, Washington 25, D. C. (Commission Field Offices no longer issue Citizens Radio Service authorizations.)

**Classes of stations, frequencies, and**

CLASS	USE	FREQ.	MAX. POWER	EMISSION
		(mc.)	(input)	
A	Voice*	460.05-460.95 462.55-463.20 464.75-466.45	60 w. 40F2, 40F3	8A2, 8A3,
B	Voice & Control	465**	5 w.	See Rules
C	Control	26.995-27.255 on 27.255 mc. only)	5 w. (30 w.)	8A2
D	Voice	26.965-27.225	5 w.	8A3

\*Other emissions may be authorized upon a showing of need.  
\*\*Any class A frequency in the range 462.55-463.20 mc. or 464.75-466.45 mc. may be used if equipment meets class A standards. Power is still limited to 5 watts, however.

Table 1. Stations in Citizens Service.

**Emissions.** Table 1 is intended as a general guide. See Subpart C, Part 19 of the Rules for specific information.

**Antenna structures.** Class A station antennas are not limited as to height unless they are hazards to air navigation. However, to avoid unnecessary interference, antennas of class A stations should be kept as low as possible in view of the areas to be covered. Antennas for class B, C, and D stations may not extend more than 20 feet above the surface (building roof or ground) on which the antenna supporting structure is mounted.

**Transmitters.** To keep interference down as much as practicable, the Commission has set up certain standards for transmitters in the Citizens Radio Service. These standards are set out in Part 19, Subpart C, of the Rules. Provision is made for advance acceptance of transmitters, and licensees may interchange such accepted transmitters to suit their own convenience if the substitute transmitters are listed in the Commission's "Radio Equipment List, Part C" (available for inspection at the Commission's Field Engineering Offices), as being satisfactory for stations licensed under Rules Part 19. The listed specifications will indicate the class of Citizens Radio station for which the equipment is suitable. Transmitters which do not appear on this list may be licensed provided sufficient data is submitted to show that they meet the standards. In the case of class C and class D transmitters which are crystal-controlled, it is only necessary to indicate that fact on the application form to secure approval of the equipment to be used in a particular station.

**Engineering advice.** Since the subject matter covered is technical in nature, Part 19 of the Rules, Form 505 and its instruction sheet, and even this item may contain terms and expressions which are not readily understood by the average layman. The Commission will advise applicants and others on specific points, but lacks the facilities for giving engineering advice on a very general basis. Engineering advice relating to specific radio systems often requires a knowledge of local conditions which can be obtained only by an on-the-spot survey, and the Commission is unable to provide such a service. Equipment dealers usually provide engineering advice to their customers.

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**B ... Buy**  
**C ... Columbia**

**BC-348 COMMUNICATIONS RECEIVER**  
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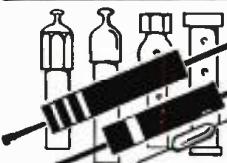
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# What's



## New in Radio

### RADIO-INTERCOM KIT

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois has just added a radio-intercom to its "Knight-Kit" line of electronic gear.

The "Ranger" incorporates a master



and remote unit which functions as a combination AM receiver and two-way intercom. Two additional remote units may be added should the user wish to expand the system.

Both the master and remote can originate calls. Radio broadcasts, automatically received by the remote, are silenced during conversation on the intercom. The master unit has two separate volume controls—one for radio and the other for the intercom. The units are housed in ivory plastic cases with brown mesh grille insert. Only the master station need be connected to an a.c. or d.c. power source.

### DELCO GARAGE DOOR CONTROL

Delco Radio Division, Kokomo, Indiana is now marketing a transistorized garage door control which operates in the v.l.f. range between 5 and 10 kc. Unique circuitry allows the use of 50 channels in this frequency range averaging 100 cycles in width.

The receiver in the garage operates all the time and, under these conditions, the very long life of the transistors provides reliable maintenance-free service. The receiver uses five transistors, two crystal diodes, and a semiconductor rectifier. The single tuned



antenna is a ferrite rod designed with coils positioned on the rod to resonate with a fixed capacitor at the desired channel. The first two stages are

straight audio amplifier circuits. The third amplifier stage (driver) feeds a selective circuit which helps select the correct frequency and reject all extraneous signals.

The signal from the transmitter in the automobile is an unmodulated carrier at a frequency matching the receiver in the garage. The transmitter uses two transistors, a low-power audio type as an oscillator and a power transistor as a power amplifier to drive a ferrite-rod tuned antenna. With about 5 watts of power, a predictable range of 60 to 100 feet is obtained.

### 8-INCH LONG-NOSE PLIER

Mathias Klein & Sons, 7200 McCormick Road, Chicago 45, Ill. has announced the development of a new long-nose plier which has been especially designed to reach into confined places.

The new slender design and 8-inch length makes this plier practical in applications where other pliers cannot reach. The knurled ends grasp the wire firmly.

For additional information on this and other tools in the firm's line, write the manufacturer direct.

### NEW TYPE GEIGER TUBES

Amperex Electronic Corporation of Hicksville, N. Y. has announced the development of two new Geiger counter tubes, the Types 18515 and 18517.

Using two of these new tubes, an ultrasensitive Geiger counter can be built weighing only 400 pounds as compared to over 4000 pounds for the conventional units now being used in laboratories, hospitals, and medical installations. According to the company, only two of the new tubes are needed as against as many as 30 in conventional installations.

The betau detector tube, Amperex 18515, has a betau detecting efficiency greatly in excess of any similar tube on the market, according to the firm. The quenching agent is bromine gas. The cosmic-ray guard tube, 18517, also uses bromine as the quenching agent. The two tubes are wired in an anti-coincidence circuit.

The two tubes are now available in production quantities. For further in-

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formation, write the company's Special Tube Division at 230 Duffy Ave., Hicksville, N. Y.

#### U.H.F. REPEATER

Kaar Engineering Corporation, 2995 Middlefield Road, Palo Alto, Calif. is now marketing a low-cost repeater unit for two-way radio systems.

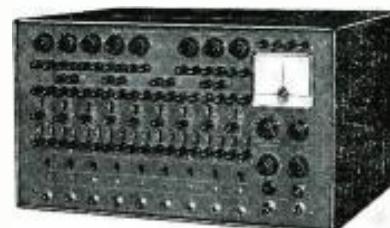
The TR502A can be used as a repeater for mobile services, as a base station repeater, as a mobile relay station, and as a combination base-mobile relay station. The equipment may be used with the firm's own u.h.f. units as well as any existing 450-470 mc. FM system.

The company will supply complete engineering specifications, prices, and other pertinent details to those requesting them from Dept. 500.

#### ANALOG COMPUTER KIT

Heath Company of Benton Harbor, Mich. is now offering an inexpensive educational electronic analog computer in kit form, the EC-1.

Developed especially for schools and colleges for teaching and demonstration in engineering, physics, and mathematics classes, for laboratory use, and for small industrial laboratories, the new unit is completely self-contained. The instrument includes nine d.c. operational amplifiers, three initial-condition power supplies, five coefficient



potentiometers, four sets of relay contacts, an electronically regulated power supply, and a repetitive oscillator for automatic operation. Also included with the kit is an assortment of precision resistors, Mylar capacitors, special silicon diodes, and patch cords for setting up scores of complex problems.

All components are mounted on plugs for convenient and rapid insertion in problem-board sockets. All markings and symbols are of the standard computer type. Problem results are read directly from the meter supplied with the kit.

The EC-1 is housed in a steel case with a convenient access hatch. The kit comes complete with step-by-step assembly and operating instructions.

#### NEW ELECTRONIC V.O.M.

The Hickok Electrical Instrument Co., 10524 Dupont Ave., Cleveland 8, Ohio is now offering its Model 470 electronic voltmeter which has been designed for both field and bench service work.

Featuring a 7-inch meter for increased readability, a new, high-sensitivity 0-5 volt d.c. range has been incorporated specifically for use in transistor bias tests. The new "a.c.-ohms-d.c." single unit probe eliminates the inconvenience of individual leads. The

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Pri. 115V. Secs. 320-0-320V. @ 150 Ma. 5V. @ 2 Amps 6.3V. @ 3 Amps..... \$2.95  
Pri. 115V. or 230V. Secs. 450-0-450V. @ 250 Ma. 5V. @ 3 Amps 6.3V. 8 Amps..... \$5.95  
Write for quantity prices

**FILAMENT TRANSFORMERS**

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Pri. 115V. or 230V. Secs. 6.3V. @ 3 Amps. @ 5 Amps..... \$1.50  
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10 MFD 600 VDC 1.15	1 MFD 3000 VDC 1.85
12 MFD 600 VDC 1.50	2 MFD 3000 VDC 3.50
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600 VDC .....	2.50
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12 MFD 1000 VDC 2.50	1 MFD 15,000 VDC 34.50
15 MFD 1000 VDC .50	.02 MFD 15,000 VDC 3.50
1 MFD 1200 VDC .45	2 MFD 25,000 VDC 49.00
1 MFD 1500 VDC .75	4 MFD 30,000 VDC .85
2 MFD 1500 VDC 1.10	10 MFD 330 AC. 1.95
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G.E. Relay control, contacts 8000 ohm relay sensitivity 2 mils. 10 for \$9.25. ea. \$1.10

**MINIATURE MICROAMMETER**

1 1/2" Square 0-100 Micro. Suitable for grid dip. Field strength, 5 meter.  
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1 1/2" Square. 0-1 Milli..... ea. \$2.95

**PANEL METERS**

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**2" METERS**  
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0-50 Micro (0-5 scale)..... 4.95  
0-500 Micro DC..... 4.95  
0-300 Milli DC..... 2.95  
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18-36 Volts DC..... 1.99  
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3-12 MMF Eric Ceramic Trimmers..... 21c  
Replacement 6" phone cord for Standard Headsets..... 35c  
UTC DUNCER TRANS. Pri. 100 ohm. Sec. 125,000 ohm. Ideal for mike CUTLER-HAMMER TOGGLE SWITCH SPDT (ST42D) for \$1.00..... ea. 29c  
Write for quantity prices on all special items

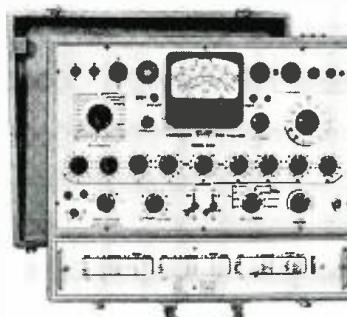
All merchandise sold on a 10 day money back guarantee basis  
Min. Order \$3.00—25% with Order—F.O.B. New York

# PEAK

ELECTRONICS COMPANY  
66 W. Broadway, New York 7, N.Y., WO-2-5439

microammeter. Plate impedance is 33 ohms for best correlation.

The instrument provides four direct-reading  $G_{\mu}$  ranges: 0-1000  $\mu$ mhos.



0-3000  $\mu$ mhos, 0-10,000  $\mu$ mhos, and 0-30,000  $\mu$ mhos. The d.c. filtered leakage measures 0-10 megohms at 85 volts.

The analyzer is housed in a gray leatherette-covered portable case which measures 15 $\frac{1}{2}$ " x 18 $\frac{1}{16}$ " x 7 $\frac{3}{4}$ ".

**INTERCOM KITS**

The Mark Simpson Manufacturing Company, Inc., 32-28 Forty-Ninth St., Long Island City 3, N.Y. has released five new intercoms in kit form for the "do-it-yourself" enthusiast.

The "Baby Tender" kit is a one-station intercom system which operates through any AM radio in the home. The "Quick Talk" and "Big Talk" are two-station units while the "Wireless Watcher" is of the carrier-current type. The "Thrifty Talk" is a six-station system. Remote units are available for use with the various basic systems.

Each kit comes complete with all parts including the metal housing and step-by-step instructions and schematics. Write the manufacturer direct for additional details and prices.

**ENGINE ANALYZER CLIP**

Mueller Electric Company, 1583H East 31st St., Cleveland 14, Ohio has developed a new and special clip connector for use with oscilloscope engine analyzers.

The No. 27-ITO clip is clamped to the outside of the insulated ignition cable and transmits information to the



"enginescope." The clip acts as a capacitor plate when clamped around the high-tension lead and by picking up differences in potential at a point or points on the ignition cable or spark-plug wires, allows the scope to depict various capacitance effects.

When closed, the long semi-circular jaws form a snug-fitting tube around the insulated wire. The jaws are available in lengths from 1 $\frac{1}{2}$ " to 3" so that

an instrument designer can select the jaw length providing capacitance in balance with the circuit of his analyzer.

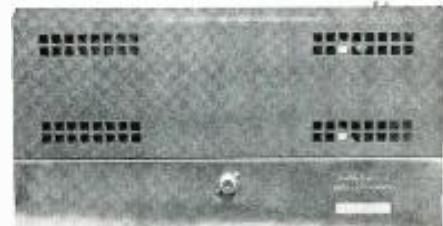
Flexible, high-dielectric slip-over vinyl insulators for the clip are available in six different colors for coding purposes.

**V.H.F. CHANNEL AMPLIFIERS**

SEG Electronics Co., Inc., 1778 Flatbush Ave., Brooklyn, N.Y. is now in production on a series of super-powered, single-channel amplifiers for v.h.f. television service.

The SPA series deliver at least 20 volts into a 75-ohm load which is in excess of 5 watts. They are designed to follow the usual 1-volt output final amplifier used in community TV service and deliver an additional 26 db gain to enable the signal to be driven over long distances.

The circuit consists of a grounded-grid amplifier which drives a push-pull twin-tetrode transmitting tube. The final amplifier is double-shielded to



eliminate stray radiation. Operation is class A linear with a 6-8 mc. bandwidth.

For additional information on this equipment, including complete specs and price, write the manufacturer direct.

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- T-126/ARC-5. 100-156 Mcs VHF Xmtr. W/all tubes. New.....\$14.95
- Dumont 241 Lab Scopes in excellent condition.....\$75.00
- Hickok Model 695 TV-FM Signal Alignment Generator.....\$250.00
- Precision Model 98 VTVM (new).....\$80.00
- TS-173 (90 to 450 Mcs.) Excellent. Lab checked.....\$150.00
- Federal Type 104A Mobile Signal Generator. (New).....\$49.50
- T-61/AXT-2 TV Transmitter. Excellent condition w/MTG.....\$39.50
- Bolometer w/GE 3½" rd Standing-Wave Ratio Meter. New w/tubes.....\$7.95
- Hewlett-Packard Model 430A. Microwave Power Meter. Good condition.....\$100.00
- EP-298 Power Supply for BC348-Q (new) original package.....\$14.95
- Precision ES-500A Deluxe Scope. (Like-new).....\$120.00
- Hickok Model 620 TV Linearity Pattern Generator. Excellent.....\$57.50
- RCA Audio Frequency Meter (0-50,000 CPS) Good condition.....\$70.00
- Precision Model 954 Tube and Set Tester. Good.....\$45.00
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- Hickok Model 547 Dynamic Mutual Conductance Tube Checker.....\$55.00 (Very good condition, lab certified O.K. with roll chart.)
- I-177A Mutual Conductance Tube Checker. Checks Radio & TV tubes. 115VAC @ 60 Cy. W/orig. tube chart manual & instructions. Lab checked out O.K. Very good.....\$24.50
- Burlington 3" round 115 VAC 60 Cy. Elapsed Running-Time Meters. Brand new in original mfr's cartons.....\$8.50
- Running Time Meters. 10-12 VAC 60 Cy. 3" round. Mfd. by GE and others. Orig. boxed.....\$7.50
- Ling Spectator Camera for closed circuit and professional Ham TV use (write for details).
- TS-35AP Signal Generator and Power Meter (8700 to 9500 Mcs.) In good, used condition.....\$45.00
- Hammarlund Super-Pro Power Transformer. Herm. sealed. Pri: 115 or 230 Volts @ 60 CPS. Sec: 435-0-435 @ 160 Ma. R.M.S. (Bias tap: 315 Volts @ 11 Ma.) Filament Secondaries:  
(1) 6.3 Volts @ 7 Amps.  
(2) 5.0 Volts @ 2 Amps  
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- Super-Pro Choke to match—25 Hly. @ 160 Ma.....\$2.50
- Drake I-A SSB Receiver. Brand new \$299.00
- Glas-Line.....\$2.89 per hundred feet
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- 5LPI. New surplus tested O.K. ....\$7.00
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- Many other types in stock.

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Send 25¢ for latest Summer 1959 "GREEN SHEET" CATALOG.

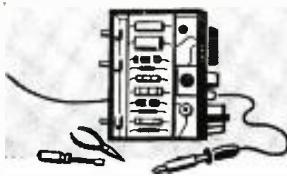
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**TUBES Wanted:** Receiving, transmitting, special purpose, any type, make, quantity. Must be clean. Highest prices paid. Write, wire, or phone J.S.H. Electronics Co., 1108 Venice Blvd., Los Angeles 15, Calif. Richmond 9-7644.

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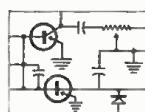
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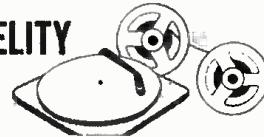
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**ELECTRONICS WORLD**

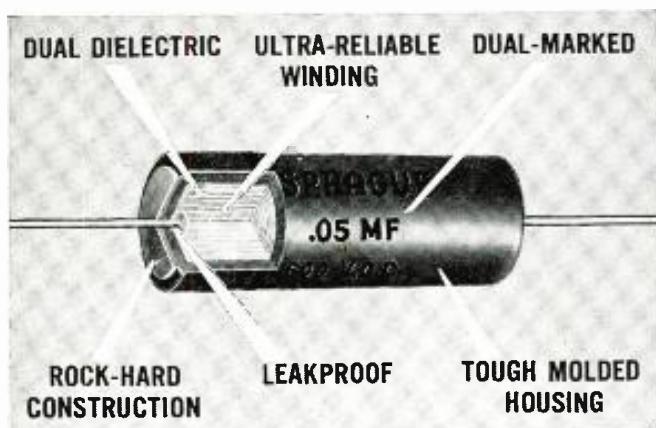
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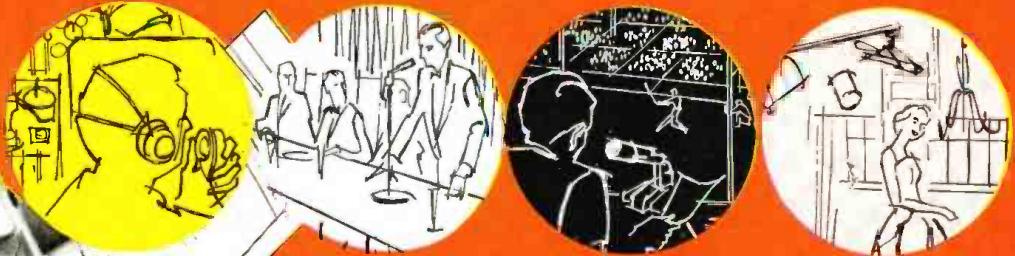
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