A TRANSISTORIZED ELECTRONIC "ACCORDION"

5 MAC

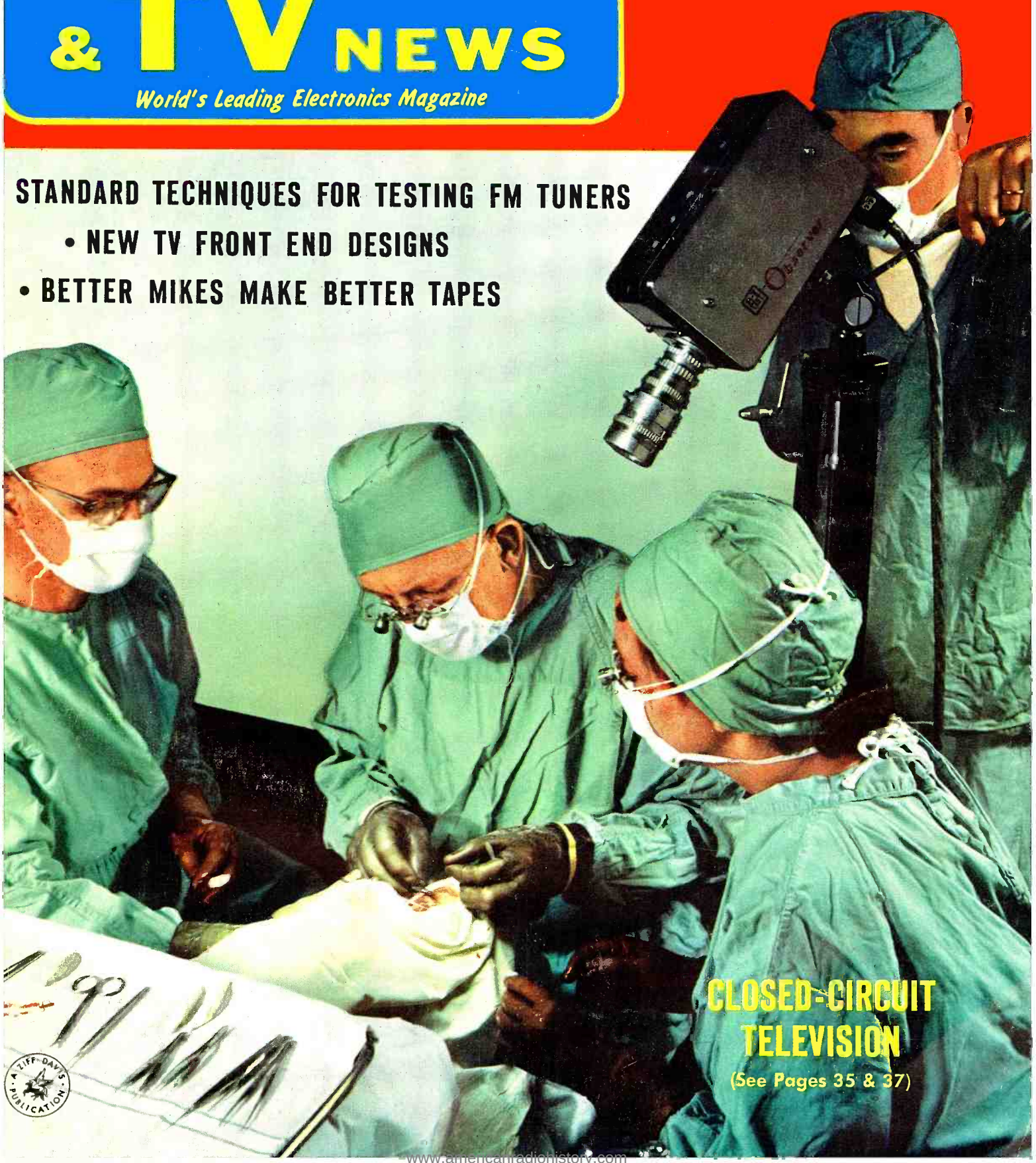
RADIO & TV NEWS

World's Leading Electronics Magazine

MAY
1958
35 CENTS

STANDARD TECHNIQUES FOR TESTING FM TUNERS

- NEW TV FRONT END DESIGNS
- BETTER MIKES MAKE BETTER TAPES



CLOSED-CIRCUIT TELEVISION

(See Pages 35 & 37)

ZIFF-DAVIS PUBLICATION

Mr. Independent Service Dealer:

When you buy tubes are you robbing yourself?

Not when you buy Raytheon TV and Radio Tubes

First of all, Raytheon has no factory TV-radio service organization that competes with you for profitable servicing business — you're not helping a "competitor" when you buy Raytheon Tubes.

Then, too, when you buy Raytheon TV and Radio Tubes you get the finest quality tubes money can buy — tubes designed for top performance in all makes and models of receivers. Raytheon does not manufacture sets and therefore must make tubes that will meet the rigid performance requirements of the many sets produced — tubes ideal for all replacement work.

And last, but by no means least, when you buy Raytheon Tubes you deal with local *independent* tube distributors who are anxious to give you the best in service and technical assistance. They are eager to supply you with the hundreds of helpful shop and sales aids Raytheon makes available for you—helps that make your job easier, more efficient and more profitable.

Make all of your tube dollars work for you — always ask your Tube Distributor for Raytheon quality TV and Radio Tubes.

RAYTHEON MANUFACTURING COMPANY

Receiving Tube and Semiconductor Operations

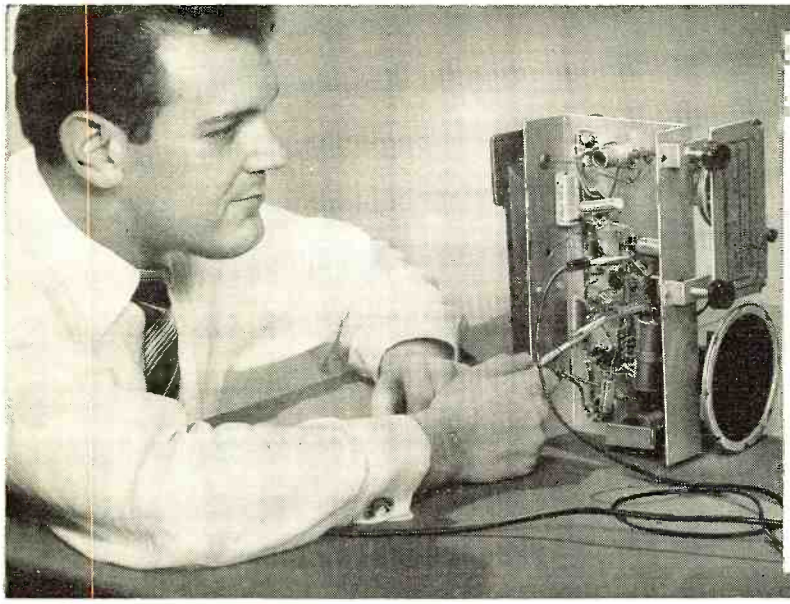
NEWTON 58, MASS.	CHICAGO, ILL.	ATLANTA 6, GA.	LOS ANGELES 7, CALIF.
55 Chapel Street	9501 Grand Ave. (Franklin Park)	1150 Zonolite Rd. N.E.	2419 So. Grand Ave.

Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.

RAYTHEON®

Excellence in Electronics

Fo a Successfu Career n Radio-Television



Train at Home in Spare Time with N. R. I.

OLDEST and LARGEST

Home Study Radio-Television School

N.R.I. Trained These Men

ENGINEER STATION WHPE

"Thanks to NRI, I operated a successful Radio repair shop. Now I am an engineer for WHPE." VAN W. WORKMAN, HIGH POINT, NORTH CAROLINA

QUICK SPARE TIME CASH

"Knew nothing about Radio-TV when I enrolled. After 15 lessons started repairing sets. My future looks bright." DONALD B. ACKERMAN, MINNEAPOLIS, MINNESOTA

HAS OWN TV BUSINESS

"Quit my job to do Television work full time. I love it and do all right financially." WILLIAM F. KLINE, CINCINNATI. OHIO

Prosperous Fast Growing Industry Offers You GOOD PAY-BRIGHT FUTURE-SUCCESS

It's the trained man who gets ahead—gets the better job, drives a better car, lives in a better home, is respected for what he knows and can do. For a job with a future—find out how you can train at home for Radio-Television.

TODAY'S OPPORTUNITY FIELD

Training PLUS OPPORTUNITY is the ideal combination for success. And today's OPPORTUNITY field is Radio-Television. Over 125 million home Radios plus 30 million sets in cars, plus 40 million TV sets mean big money for trained Technicians. More than 4,000 Radio and TV broadcasting stations offer interesting and important positions. Color television, portable TV sets, Hi-Fi, assure future growth. Find out about NRI. Since 1914—for more than 40 years—NRI has been training ambitious men at home in spare time for Radio-TV. With NRI 50-50 method, you study basic principles AND learn by practicing with actual equipment NRI furnishes. You learn with your hands and your head. You get dependable training, backed up by the reputation of the oldest and largest home study Radio-TV school.

ADD TO YOUR INCOME SOON $10-$15 A WEEK IN SPARE TIME

Soon after enrolling many start earning extra money fixing sets. Many open their own full time Radio-TV shops after getting NRI Diploma. MAIL COUPON. Get FREE Sample Lesson and 64-page Catalog showing equipment supplied, outlines of courses, opportunities in Radio-TV. Price is low—terms easy. Address: **NATIONAL RADIO INSTITUTE, Dept. 8EE Washington 16, D. C.**

You Learn Servicing-Broadcasting at Home—By Practicing with Kits N.R.I. Sends

Nothing takes the place of practical experience. That's why NRI training is Learning-by-Doing. With Servicing Course you build Radio shown at top and other equipment. With Communications Course you build Transmitters at left and other equipment. Catalog shows all equipment you get.

Available To VETERANS Under G.I. Bills

SAMPLE LESSON AND CATALOG FREE

MAIL COUPON TODAY

National Radio Institute
Dept. 8EE Washington 16, D. C.

Mail me Sample Lesson and 64-Page Catalog FREE. (No salesman will call. Please write plainly.)

Name_____ Age___

Address_____

City_____ Zone___ State_____

ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

RADIO & TV NEWS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 64 E. Lake Street, Chicago 1, Ill. Entered as second-class matter July 21, 1948, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Authorized by Post Office Department, Ottawa, Canada, as second-class matter. **SUBSCRIPTION RATES:** one year U. S. and possessions, and Canada $4.00; Pan American Union Countries $4.50; all other foreign countries, $5.00.

RADIO & TV NEWS
Reg. U. S. Pat. Off.

First in radio-television-audio-electronics
Average Net Paid Circulation 246,225
Radio & Television News • Radio News • Television News Trademarks Reg. U. S. Pat. Off.

CONTENTS

MAY, 1958 **VOL. 59 ■ NO. 5**

INDUSTRY NEWS

HIGH FIDELITY AND AUDIO

SERVICING

Television-Radio

Test Equipment

AMATEUR

ELECTRONIC CONSTRUCTION

DEPARTMENTS

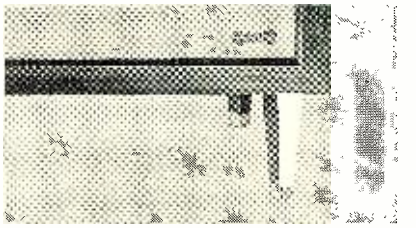
SUBSCRIPTION SERVICE. All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least four weeks for change of address. Include your old address as well as new—enclosing, if possible, an address label from a recent issue of this magazine.

CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

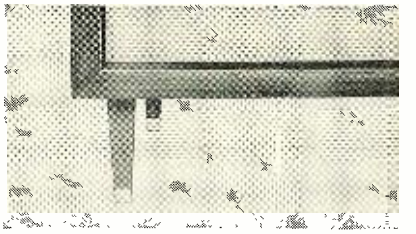
UNIVERSITY INTRODUCES A VERSATILE NEW LOWBOY...

The Debonaire

The smallest lowboy (only 27⅜" wide, 16" deep, 25⅜" high, including legs) for 2- or 3-way systems using 12" or 15" speakers. Designed to complement both traditional and modern decor.



MODERN decor is accommodated by adjustment of the legs to this triangular position.



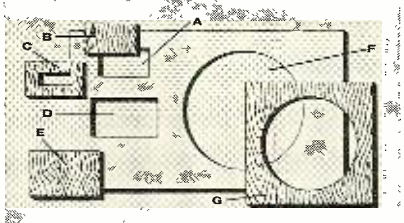
TRADITIONAL decor is accommodated when the legs are set "flat" in this position.

BRILLIANT NEW SYSTEMS AND ENCLOSURE

EN-1215 DEBONAIRE ENCLOSURE Designed for full-range reproduction, the EN-1215 DEBONAIRE enclosure employs the phase inversion principle to augment low frequency response. For versatility, it integrates direct radiation principles to permit using a wide variety of extended range speakers and 2- and 3-way Diffaxials. The versatile baffle board arrangements accommodate the many multi-speaker systems that may be developed with P•S•E—University's Progressive Speaker Expansion plan. P•S•E enables you to start modestly with an extended range speaker for immediate listening satisfaction and build up at your own pace to any one of a number of magnificent sounding speaker systems.

MODEL S-3 DEBONAIRE-12 SYSTEM This system, employing the same 3-way system components so successfully used in the University SENIOR, now makes this highly popular combination available to music lovers in both corner (SENIOR) and lowboy (DEBONAIRE) form. The basic C-12W 12" woofer (less frequency limiter) is ideally suited to the EN-1215 enclosure, reproducing deep bass tones cleanly and efficiently. Mid-range is covered by the new, improved H-600 "reciprocating-flare" horn with T-30 driver; treble range by the UXT-5 Super Tweeter clear out to 17,500 cps. The N-3 Acoustic Baton 3-way network crosses over at 700 cps for mid-range, 5000 cps for treble. PRESENCE and BRILLIANCE balance controls provide optimum adjustment to room acoustics and personal taste.

MODEL S-4 DEBONAIRE-15 SYSTEM An excellent three-element system with a unique approach to mid-range reproduction is achieved in this version of the DEBONAIRE. A 2-way 15" Diffaxial, the Diffusicone-15, is employed together with the new H-600 horn and new Hypersonic T-50 driver. The H-600, with hemispherical diffraction added, complements perfectly the T-50 driver to cover the mid and high ranges from 700 cps crossover to inaudibility. The Diffusicone-15 provides superior bass response to about 1000 cps where its multi-sectional Diffusicone element takes over for mid and high frequency response. With thus both the Diffusicone element *and* the horn/driver combination providing wide-angle response of the mid-range, this three-element system results in an expansion of spatial separation and an exciting blend of reed and woodwind mellowness (from the Diffusicone element) with the brightness of the brass (from the horn/driver). A balance control adjusts the system to room acoustics and personal taste.



EN-1215 BAFFLE BOARD AND ADAPTERS

A—Hole for tweeter Model HF-206 or 4401.
B—Adapter blank to close hole A when tweeter not used.
C—Adapter for Model UXT-5 tweeter.
D—Hole for mid-range (Model H-600 horn).
E—Adapter blank to close hole D when mid-range unit not used.
F—Hole for Diffaxial Models 315-C, 6303, Diffusicone-15; woofer Models C-15W, C-63W.
G—12" adapter (supplied) for Diffaxial Models 312, UXC-123; Coaxial Models 6201, Diffusicone-12, UXC-122 or Model 6200; C-12W woofer.

USER NET PRICES:

Finish	EN-1215	S-3	S-4
Mahogany	$63.00	$196.00	$197.50
Blond	69.00	199.00	200.50
Walnut	69.00	199.00	200.50

LISTEN *University® sounds better*

See your high fidelity dealer . . . or for FREE LITERATURE on University speakers, complete systems, enclosures and kits, write Desk S-3, University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

NRI'S PROFESSIONAL TELEVISION TRAINING

A Fast Way To Reach The Top In TV Servicing

Oldest and Largest Home Study Radio-TV School Trains You to Fix Any Set Easily, Quickly, Correctly

Professional Television Servicing is a field for the *trained* man, for the expert. The man who knows a "little" will soon be left behind. Time wasted in locating defects by "trial and error" methods can cost *you* money; easily made mistakes can mean callbacks, unhappy customers, even parts that cost money to replace.

Take time to get the training you need to get ahead, enjoy the high pay jobs. That is what NRI's Professional Television Training can do for you. *It is not for the beginner.* NRI's Professional Television Training is planned for the man with some knowledge of Television or Radio but who realizes his need to know *more;* so he can make Television repairs more quickly, confidently and accurately.

All-Practice Method

NRI's Professional Television Training is practical, complete. You do more than read about circuits or just build them. NRI is all-practice, guided training. NRI has spent years in developing training equipment you use to conduct Television Servicing experiments, make tests and thoroughly understand the causes and effects of Television problems. You get practical experience, first hand knowledge of Television Receiver defects, learn how to diagnose them and how to service them.

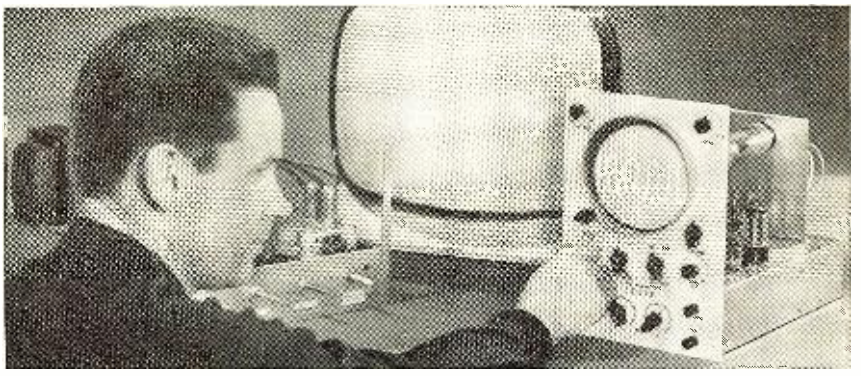
All equipment is yours, to keep. The professional quality 5" Oscilloscope you build will be a valuable part of your Servicing Equipment. You get other kits, developed to speed your knowledge and confidence, including a 17" picture tube and all components for a TV receiver that you build to learn circuitry and make tests; setting up defects just as they might occur in actual servicing.

"The man who learns more... earns more"

The professional TV Serviceman earns good money, enjoys respect and the opportunity of a secure, growing profession. But you can't afford to "guess." You must have training to succeed. NRI can provide it for you.

J. E. Smith
FOUNDER

Scientifically Developed Equipment for Training Makes Learning Fast, Efficient, Practical



Color TV Manuals Early

The day you enroll, NRI sends you special Color TV manuals to give you knowledge of this growing phase of TV. Full color pictures, diagrams help speed your training.

There is no better way to get Professional Television Training than through NRI. NRI is the oldest, largest home study Television-Radio school. For over 40 years, NRI's business has been TRAINING men for success in Television-Radio. NRI graduates hold jobs in every part of the industry. NRI methods are tested, proved. You train at home in spare time, get personal attention from instructors who are specialists in Television techniques.

Not For Beginners

NRI's Professional Television course condenses knowledge and experience that would take years of hit-and-miss learning. You learn how *experts* diagnose and repair TV defects. You are shown *professional* techniques to help you service ANY MAKE, ANY MODEL Television receiver properly and without wasted time and effort. You know the "what" and the "why" of TV Servicing so you can compete with other professionals.

Send For FREE Catalog

Mail the coupon now for free catalog of what you learn, equipment supplied. Cost of entire course, all training equipment, Color TV manuals, etc. is low. Monthly terms if desired. **NATIONAL RADIO INSTITUTE, Dept. 8 EET, Washington 16, D. C.**

National Radio Institute
DEPT. 8 EET, WASHINGTON 16, D. C.

Please send my FREE copy of "How to Reach the Top in TV Servicing." I understand no salesman will call.

Name ---------- Age ----

Address ----------

City ---------- Zone ---- State ----

Accredited Member National Home Study Council

For the RECORD

AN INDUSTRY RESPONSIBILITY

EVERY major city has its problems in crime, fraud, rackets, etc. For the most part, people do not pay too much attention to such conditions but when headlines scream out the fact "Tube Racket in Electronics Industry Exposed," we, as well as everyone in the industry, are deeply concerned.

Judge Samuel Joseph of Bronx County here in New York recently passed sentence on ten individuals and six corporations in an illegal rebranding operation that cost the industry and the public about five million dollars in the period from 1953 to 1957. This isn't the first time this has happened. In 1956 *General Electric Company,* through diligent detective work, brought charges against Joseph Lynch for illegal tube rebranding which resulted in a conviction. They were not alone in their efforts. Other tube manufacturers have been closely scrutinizing their operations and, wherever possible, eliminating similar situations.

RCA was criticized by Judge Joseph, not for any illegal operation, but for not taking remedial action when it became aware of the situation with regards to its products in 1953.

All radio and television tubes, when marketed, have a warranty period during which they can be returned for full credit if they are faulty in any way. Manufacturers simply code their tubes to indicate the date the warranty expires. It has not been a difficult task for illegal operators to pick up vast numbers of faulty tubes whose warranty has expired and simply change the coding, by a rebranding operation, to bring it within the returnable time limit. These tubes are then returned to the manufacturer for full credit. The manufacturers are, in the last analysis, the ones who have been paying through the nose, losing thousands of dollars every year.

There are many aspects to this kind of an operation and, for those who are interested in complete details, we would like to refer them to the article entitled, "The Tube Racket," published in the July, 1956 issue of RADIO & TV NEWS. The details, as exposed in the article, are identical to those in the case just concluded here in New York.

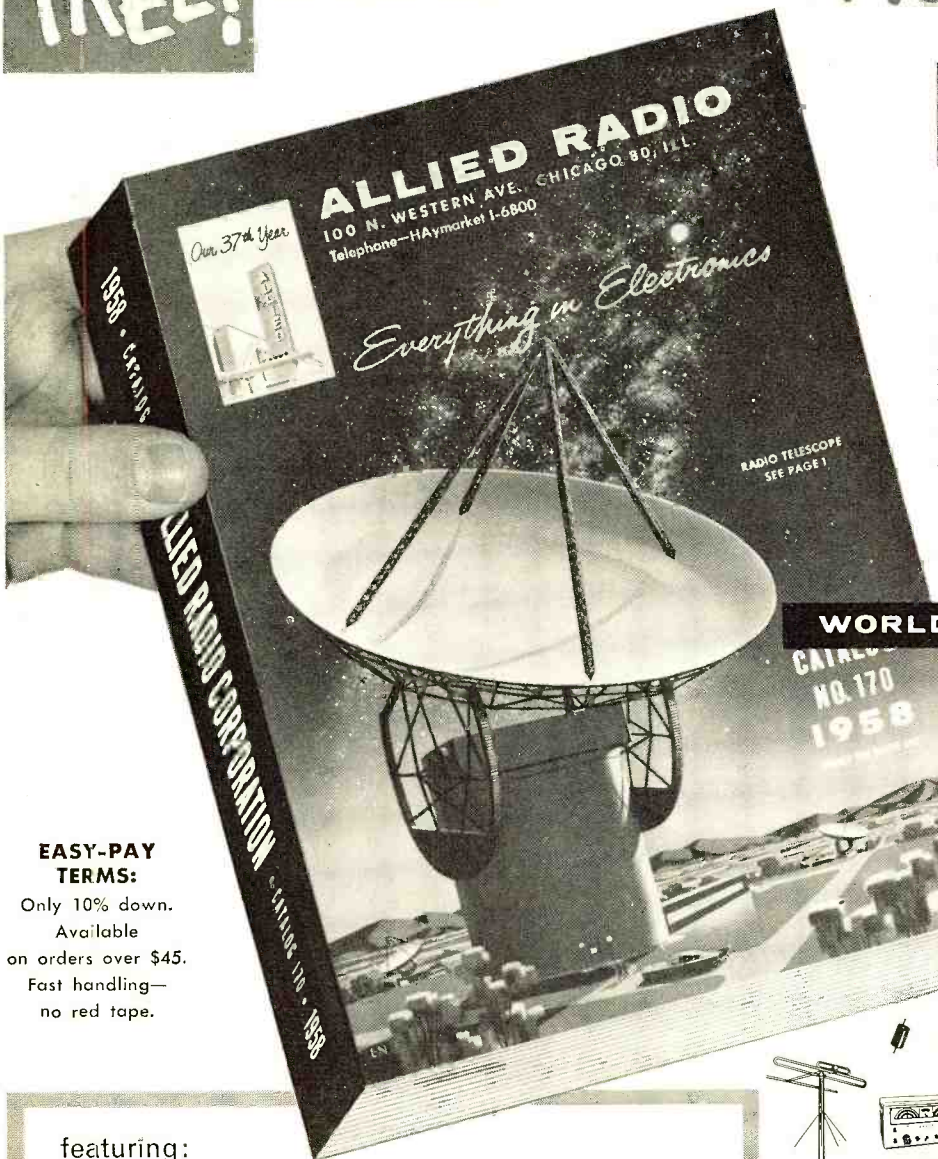
How is the general public affected by such illegal acts? Actually, they are not involved in any way with the rebranding operation, as such. There are, however, a few service shops and individual technicians who make a practice of replacing worn out radio and television tubes with either seconds or used tubes. This practice of installing used tubes is not a crime but it is definitely illegal for anyone to charge the customer the full price of a brand new one in such cases. This practice, unfortunately, reflects on the integrity of every service technician and shop in the industry. Actually, there are only a few who are making it extremely difficult for those who operate their businesses ethically. Our industry is not the only one plagued by such problems. All service-type organizations, whether they be in the automotive or appliance fields, have a few operators that rock the boat of customer confidence, making it extremely difficult for the rest of the industry.

There has been some criticism of organizations which sell used or surplus components. There is certainly nothing illegal in such operations nor do they differ greatly from the used car operation in the automotive industry. Any company or manufacturer has the right to sell used products provided they are clearly designated as such.

A large percentage of the surplus tubes which are sold to dealers for resale to the public are unused tubes obtained from electronic equipment manufacturers who may have gone out of business, changed the design of their equipment, or had an over-run. Although these tubes are technically "unused," they should not be offered to the consumer as brand new items. In all fairness, they should be sold as surplus and all promotional material should so state.

This entire situation, which hardly redounds to the credit of the industry, should not be taken lightly. It is serious and no doubt we have not heard the last of it. Everyone connected with the industry should take every possible step within his means to stop such illegal practices. The consumer, for one, should always make sure when tubes are replaced in his radio or television set that they are actually new ones or, if not, that he is not charged the full price for a surplus item. The service technician or shop owner should report any such illegal practices if he encounters them in the course of his work. If tube manufacturers make every possible effort to prevent recurrence of such tube rebranding, the sheer weight of such suasion would make it difficult for any individual or organization to continue such illegal operations. If the EIA, as spokesmen for our industry, continues its efforts to clean house as it has in the past, it would add impressive weight to this industry-wide campaign. . . . . W.S.

FREE! ALLIED'S 1958 CATALOG



404 value-packed **PAGES**

the only COMPLETE catalog for everything in electronics

Get ALLIED's 1958 Catalog—it's *complete*, up-to-date—404 pages packed with the world's largest selection of quality electronic equipment at lowest, money-saving prices. Get *every* buying advantage at ALLIED: fastest shipment, expert personal help, lowest prices, guaranteed satisfaction...

EASY-PAY TERMS:
Only 10% down. Available on orders over $45. Fast handling—no red tape.

WORLD'S LARGEST STOCKS

- Latest Hi-Fi Systems and Components
- Money-Saving, Build-Your-Own KNIGHT-KITS
- Recorders and Supplies
- Public Address Systems and Accessories
- TV Tubes, Antennas and Accessories
- Amateur Receivers, Transmitters, Station Gear
- Test & Lab Instruments
- Specialized Industrial Electronic Equipment
- Huge Listings of Parts, Tubes, Transistors, Tools, Books

featuring:

ALLIED'S money-saving knight-kits:
Finest electronic equipment in money-saving kit form. Over 50 quality kits available—Hi-Fi amplifier, tuner and speaker kits, Hobby kits, Test Instruments, Ham kits (see our KNIGHT-KIT values elsewhere in this publication). ALLIED KNIGHT-KITS are easiest to build and they SAVE YOU MORE.

EVERYTHING IN HI-FI
World's largest selection of quality Hi-Fi components and complete music systems—available for immediate shipment from stock. Save on exclusive ALLIED-Recommended complete systems. Own the best in Hi-Fi for less!

Our 37th Year

ALLIED RADIO

World's Largest Electronic Supply House

send for the leading electronic supply guide FREE!

ALLIED RADIO CORP., Dept. 1-E8
100 N. Western Ave., Chicago 80, Ill.

☐ Send FREE 404-Page 1958 ALLIED Catalog

*Name*_____

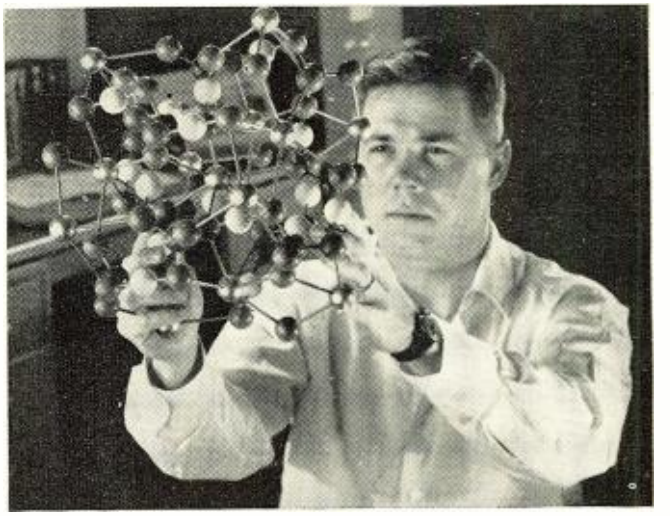
*Address*_____

*City*_____ *Zone*____ *State*_____

SYMBOL OF A POWERFUL FORCE

The question mark symbolizes man's inquiring spirit. And nowhere is this spirit cultivated with more enthusiasm than at Bell Telephone Laboratories where, through vigorous research and development, it constantly works to improve electrical communications and also to help national defense in essential military programs.

More than 3000 professional scientists and engineers at Bell Telephone Laboratories are exploring, inventing and developing in many fields: chemistry, mathematics and physics, metallurgy, mechanical engineering, electronics and others. You see the successful results achieved by this organization of inquisitive and highly trained minds in the nationwide telephone system that serves you.



Dr. Walter Brown, physics graduate of Duke and Harvard Universities, bombards crystalline solids with one-million-volt electrons to study the nature of simple defects in crystals. Objective: new knowledge which may help improve transistors and other solid state devices for new and better telephone and military systems.

Peter Sandsmark, from Polytechnic Institute of Brooklyn, and his fellow electrical engineers develop a new microwave radio relay system able to transmit three times as much information as any existing system. Objective: more and better coast-to-coast transmission for telephone conversations and network television.

Bill Whidden, from Polytechnic Institute of Brooklyn, and George Porter, from Georgetown College, study new experimental telephone instruments designed to explore customer interest and demand. Objective: to make your future telephone ever more convenient and useful.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

RCA INSTITUTES offers you the finest of home study training. The equipment illustrated and text material you get with each course is yours to keep. Practical work with very first lesson. Courses for the beginner and the advanced student. Pay-as-you-learn. You need pay for only one study group at a time.

Send for this FREE Book Now

[RESIDENT SCHOOL courses in New York City offer comprehensive training in Television and Electronics. Day and evening classes start four times each year.
Detailed information on request]

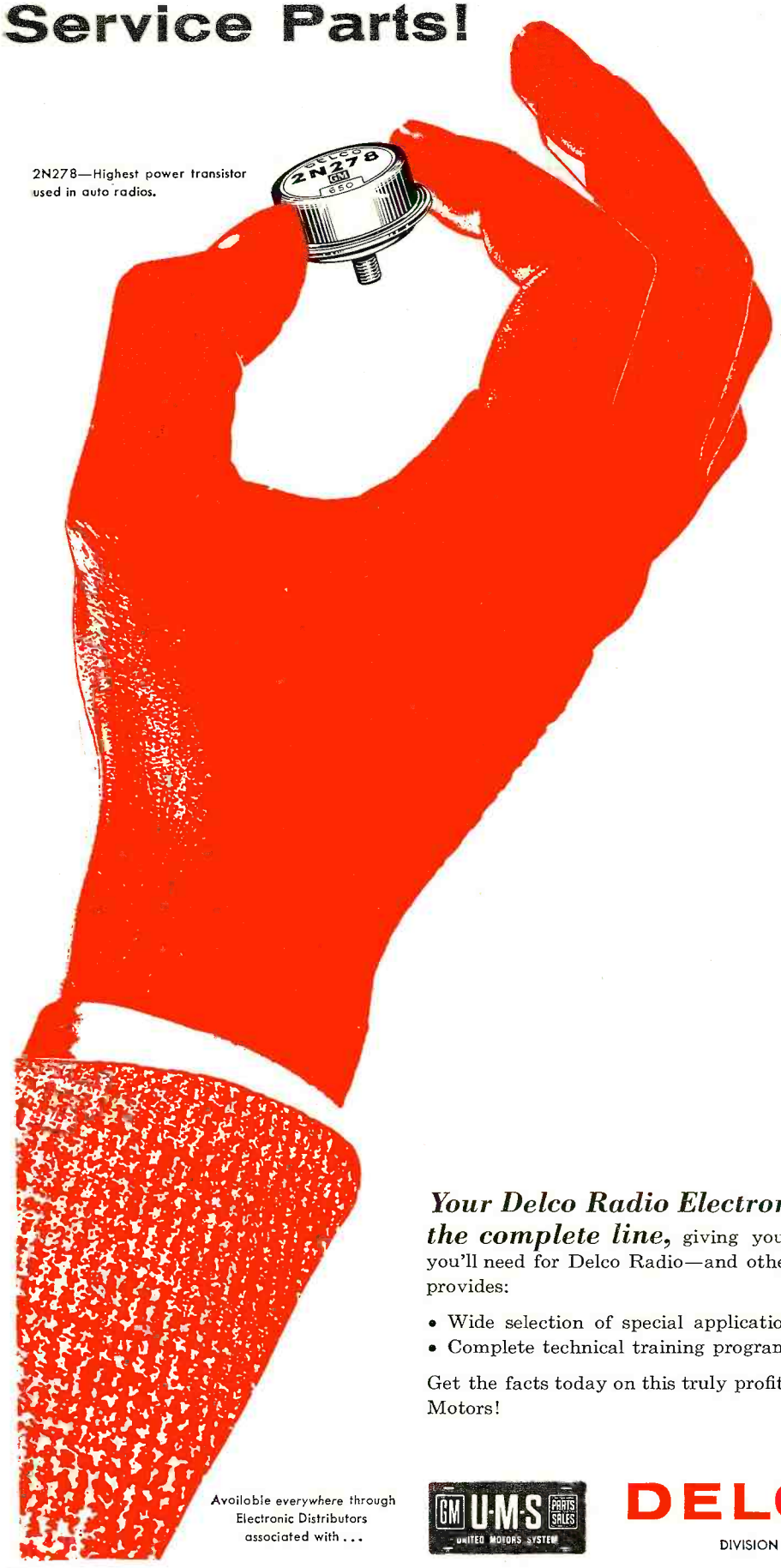
RCA INSTITUTES, Inc. Home Study Dept. RN-58
A Service of Radio Corporation of America
350 West Fourth Street, New York 14, N. Y.

Without obligation, send me FREE 52 page CATALOG on Home Study Courses in Radio, Television and Color TV. No salesman will call.

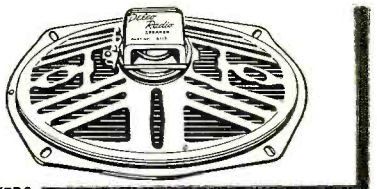
Name .....
please print
Address .....
City ..... Zone ..... State .....
Korean Vets! Enter discharge date .....

In Canada — RCA Victor Co., Ltd.
5001 Cote de Liesse Rd., Montreal 9, Que.
To save time, paste coupon on postcard.

Use Delco Radio Service Parts!



2N278—Highest power transistor used in auto radios.

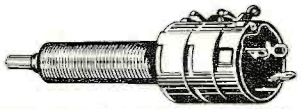


SPEAKERS

IRON CORES

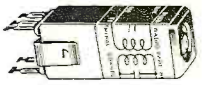
RESISTORS

CAPACITORS



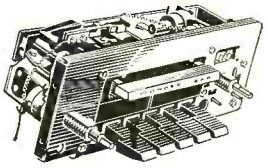
CONTROLS

TUBES

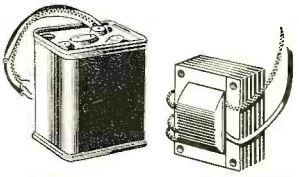


COILS

VIBRATORS



TUNER PARTS



TRANSFORMERS

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

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

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

Available everywhere through Electronic Distributors associated with . . .

GM U-M-S PARTS SALES — UNITED MOTORS SYSTEM

DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

HOW TO PASS Your FCC Commercial LICENSE EXAMS*

Get your FCC license in a hurry!

Get your FCC Commercial License — or your money back

See Free Catalog for complete details

Cleveland Institute training results in success with commercial FCC examinations . . . *easily* . . . *and quickly*

We can train you to pass your License Exams if you've had any practical experience—amateur, military, radio servicing, or other. Our proven plan can help put you on the road to success.

*** Your FCC ticket will be recognized by employers as proof of your technical ability.**

Mail Coupon Now and get both FREE

"License and Good Job . . . Thanks"

"After finishing your Master Course, I passed the FCC exam for the 1st class license. I had my ticket for only one week and I got a job at WOC-TV, AM-FM. Incidentally, WOC is the oldest radio station west of the Mississippi. I sincerely feel that if it weren't for taking your Master Course, I would not have received my 1st class ticket. So I want to take this occasion to again thank you for such a fine, complete and composite study for electronics work."

Francis J. McManus
Davenport, Iowa

Cleveland Institute training results in job offers like these:

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."

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-17 4900 Euclid Bldg. Cleveland 3, Ohio

Accredited by the National Home Study Council

Cleveland Institute of Radio Electronics

Desk RN-17, 4900 Euclid Bldg., Cleveland 3, Ohio

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

- ☐ Military
- ☐ Radio-TV Servicing
- ☐ Manufacturing
- ☐ Amateur Radio
- ☐ Broadcasting
- ☐ Home Experimenting
- ☐ Telephone Company
- ☐ Other_____

In what kind of work are you now engaged?_____

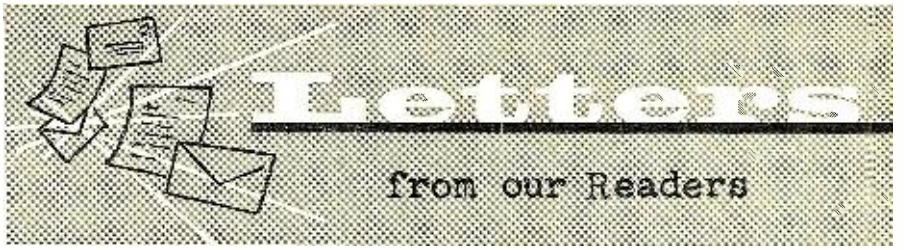
In what branch of Electronics are you interested?_____

Name_____ Age_____

Address_____

City_____ Zone_____ State_____

RN-17



LIGHT OF THE FUTURE

To the Editors:

It is said that Science Fiction is only a step or two ahead of science. Panels similar to the electroluminescent panels described in the January issue of RADIO & TV NEWS have been prominently mentioned in fiction for some time.

Allow me to congratulate you on being among the first to carry an article that covers the real thing so thoroughly.

RICHARD G. BROCKMAN
Oxnard Air Force Base, Calif.

Both we and the author of our lead article for January ("Electroluminescence—Light of the Future") have received many favorable comments from our readers. We're glad you liked the article.—Editor.

* * *

RUSSIAN BROADCAST SET

To the Editors:

I have come into possession of a Russian broadcast receiver which is very unusual in that it is operated by the heat of a kerosene lamp, through the use of a thermocouple. The set is a full superhet using seven 1.2-volt tubes. A vibrator supply is used to deliver 90 volts to the plates of the tubes. The kerosene lamp and thermocouple are quite large. As a matter of fact, the lamp lights and heats the room as well as supplies power for the radio.

The radio has been built for the underprivileged countries of the Middle East. All instructions are printed in Russian; however, the schematic is straightforward and is easily understood.

(Name withheld)
Tripoli, Libya

We are certainly very interested in learning a little more about the receiver. The idea of using a thermocouple that is heated by means of a kerosene lamp strikes us as really trying to tie together the new and the old.—Editor.

* * *

MIDGET RADIO ALIGNMENT

To the Editors:

I have just finished reading "Alignment of Midget Radios" by J. Richard Johnson, which appeared in your January issue. The article is a very informative one containing much useful material. However, I would like to add a few suggestions of my own as a result of almost 15 years experience in servicing:

1. Oscillator alignment should be performed at 1620 kc. and with the tuning capacitor completely open.

2. R.f. and mixer alignment should then be done at 1400 kc. If the trimmer does not align at nearly full capacity, remove one-half to one turn at a time from the loop until it does. If you find there is not enough inductance in the loop to align properly, you might try replacing it with a ferrite-core loop. Follow the instructions that come with this loop carefully. Your customers will thank you for the improvement.

RAY LOEWEN
Ray's TV & Radio Shop
Inola, Oklahoma

A good suggestion that we are glad to pass along.—Editor.

* * *

BUY HI-FI NOW OR LATER

To the Editors:

We recently have been considering the possibility of purchasing a..... packaged hi-fi system. We are wondering whether you have evaluated this particular unit and would you recommend it?

Another problem we have is this. The hi-fi field seems to be moving so fast and there are so many new developments that I don't know whether I should buy anything at all now. Perhaps I should wait for something altogether new before deciding to buy at this particular time. What do you think?

JOHN NICHOLES
Steubenville, Ohio

Just about the very best answers that we can give to the questions outlined above are contained in the article "Which Way to High Fidelity?" in our February issue. This article should be must reading for anyone contemplating the purchase of a hi-fi system.—Editor.

* * *

G-E CARTRIDGE LOAD

To the Editors:

In your December 1957 issue on page 67 you show frequency response curves for the new *General Electric* VR-II phono cartridge. On this same page the article points out "Where interstage record compensation is used, the minimum load across the cartridge should be 100,000 ohms."

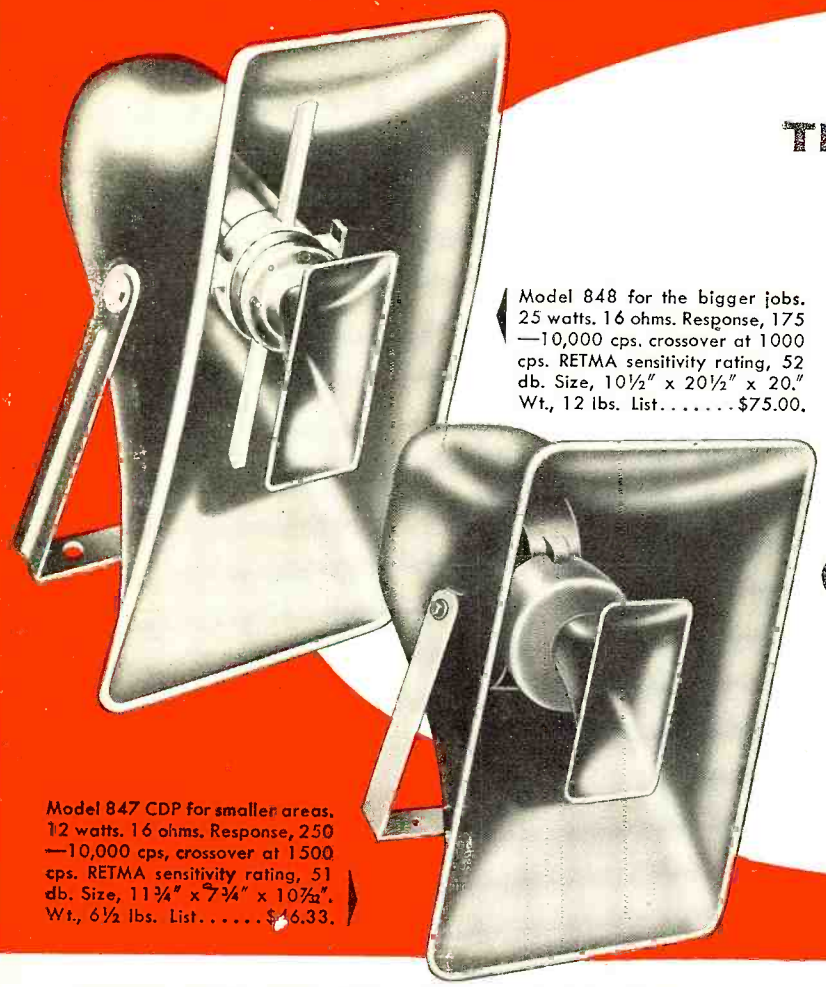
The writer has just built a preamplifier kit having separate turnover and roll-off controls. Would these controls be what the author has referred to as interstage record compensation? The load resistor on my *G-E* VR-II is the value supplied by the kit manufacturer—namely, 22,000 ohms. The author of the article in question mentions that if load resis-

THERE IS A DIFFERENCE IN P. A. SPEAKERS

you get a lot more to sell with

Electro-Voice®

CDP® SPEAKERS



Model 848 for the bigger jobs. 25 watts. 16 ohms. Response, 175 —10,000 cps. crossover at 1000 cps. RETMA sensitivity rating, 52 db. Size, 10½" x 20½" x 20." Wt., 12 lbs. List.....$75.00.

Model 847 CDP for smaller areas. 12 watts. 16 ohms. Response, 250 —10,000 cps, crossover at 1500 cps. RETMA sensitivity rating, 51 db. Size, 11¾" x 7¾" x 10⅞". Wt., 6½ lbs. List.....$46.33.

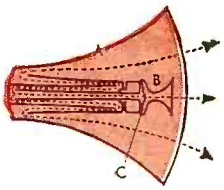
Yes, Electro-Voice gives you more to sell and more help in selling P. A. speakers. Hard-hitting, sales-pulling ads pre-sell architects, buyers in schools, universities, colleges, industry and all your prime P. A. prospects. They are told the CDP story . . . and what a terrific story it is. To tell it is to sell them!

HERE'S WHY CDP SPEAKERS ARE SO SUPERIOR, SO MUCH EASIER TO SELL THAN CONVENTIONAL P. A. HORNS . . .

High frequencies require one throat size and one horn taper rate; low frequencies require a different throat size and a different taper rate. The Electro-Voice CDP gives you a large horn (A), for lows and a second, smaller horn (B), coaxially mounted, for highs working from both sides of a single diaphragm (C). The Electro-Voice CDP gives you 2½ more octaves of sound reproduction . . . frequencies up to 10,000 cps. These 2½ octaves are indispensable for highest intelligibility. See the curve, compare response and efficiency. In addition, Electro-Voice CDP speaker disperses sound through a solid 120° angle for the widest coverage available in P. A. speakers.

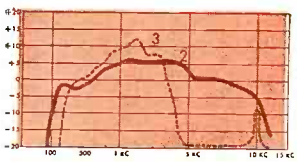
You can *hear* the difference.

1 This is a CDP Speaker with its two coaxially mounted diffraction horns.



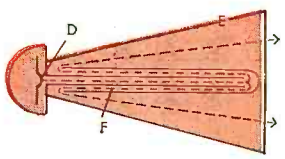
2 This is the frequency response curve of a CDP.

3 This is the frequency response curve of a conventional P. A. horn.



Conventional reentrant horns using single throat (D) and single horn (E) transmit highs along the same circuitous path (F) as required for lows. As a result, the highs become attenuated, sharply decreasing intelligibility. Electro-Voice gives you P. A. speakers with a large horn for lows and a second, smaller horn, coaxially mounted, for highs. **There is a difference and you can hear it.**

4 This is a conventional reentrant-type P. A. horn.



Electro-Voice

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN

EXPORT: 13 East 40th Street, New York 16, U. S. A. CABLES: ARLAB.

CDP speakers are weather-proof, blast-proof and splash-proof, virtually indestructible. They're molded of fiberglass for better acoustical properties and extra strength.

Sell CDP Speakers . . . the speakers that sell because they are clearly superior. See your Electro-Voice Distributor TODAY. Get the facts and start selling the most revolutionary speakers in P. A. history . . . the Electro-Voice CDP.

Send for bulletin 195-N85

tors on the order of 25,000 or 50,000 ohms are used, these produce undesired treble roll-offs at 15 kc. The kit as is sounds terrific; however, where the possibility of improvement exists the writer would gladly roller skate all the way across the Sahara Desert and back again.

SAMUEL J. ROSS
Metairie, Louisiana

Most preamps use the type of record equalization referred to in the article mentioned above. In such cases the cartridge is simply loaded with a sufficiently large resistor to maintain flat high-frequency response, then the required correction is applied later in the preamp circuit. The use of 22,000 or 47,000 ohm resistors directly across the cartridge was quite satisfactory for most of the older cartridges. But in the case of the new G-E unit, as the article pointed out, these values will produce some treble roll-off. Therefore we recommend that the 22,000 ohm resistor supplied by the kit manufacturer be replaced with a 100,000 ohm unit.—Editor.

* * *

DRUG STORE TUBE TESTERS

To the Editors:

You might be interested in an incident that happened in my shop recently. A customer brought in 15 tubes to be tested. Eight of the 15 were burned out. On questioning, he broke down and admitted that he had tested them himself in a drug store. He thought it strange that some of them lit up like flash bulbs. The druggist knew from nothing. I sold him $20 worth of new tubes.

ARTHUR SILVERBERG
Sil-Rad Laboratories
New York, N. Y.

Need we say more?—Editor.

* * *

BROADCAST BAND OSCILLATOR

To the Editors:

Recently I constructed a "Knight-Kit" Wireless Broadcaster sold by *Allied Radio*. The oscillator was of good design but it was extremely low in power and would only send voice modulated signals a short distance. I am writing to you hoping that you could help me find a suitable plan for construction of an oscillator with a much higher output power. Also I would like to know if a phonograph could be connected to such a unit in order to broadcast signals over a greater distance.

DONALD F. DEKOLD
Vero Beach, Florida

We have received a good many letters from our readers along these very lines. We would like to point out that the use of high power broadcast oscillators is prohibited by law unless such units are officially licensed by the FCC as a broadcast station. As a matter of fact, the only reason the wireless oscillator is allowed at all is that it has such a low power that it will not produce harmful interference.

NEW

DEALER

BUSINESS BUILDERS

SALES PROMOTION MATERIAL

TECHNICAL LITERATURE

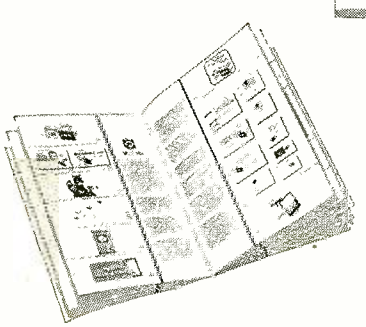
CATALOG

SERVICE TOOLS

CBS-HYTRON SALES CORPORATION
A Subsidiary of Columbia Broadcasting System, Inc.

ELECTRON TUBES
CBS
SEMICONDUCTORS ®

4th Edition



ILLUSTRATES AND DESCRIBES...

. . . service tools • tube caddy • drop cloth • shop coat, shirt, pants • engineer's and technician's handbooks • reference guides, charts, manuals • Tube Tips • Transistor Course • price lists • job tag • repair sticker • doorknob hanger • ad mats • radio and TV scripts • direct-mail postal cards • consumer booklet • stationery • book matches • dealer giveaways • decals • window valance • window streamers • satin banner • giant tube carton • clock • clock-sign • flange and metal hanging signs • illuminated indoor and outdoor signs.

This book can build business for you.

That's a promise! Get a free copy of this new Fourth Edition of the Business Builders Catalog and see for yourself. Check the more than 90 items ranging from new Printed-Circuit Soldering Aids to new Illuminated Outdoor Signs. You'll find that each is designed with you, the independent service-dealer, in mind. Put them to work. Prove to yourself that they can build more service and tube business, more profits for you. Ask your CBS Tube distributor (or us) for your copy of Business Builders Catalog, PA-37 . . . today!

ELECTRON TUBES
CBS
SEMICONDUCTORS ®

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

For the best in entertainment tune to CBS

If the power were to be increased, then interference would be produced. Definite radiation limits on phono oscillators have been set forth by the FCC. If these limits are exceeded, operation becomes illegal.—Editor.

* * *

CALL FOR TAPES

To the Editors:

Every week we have a one hour program, which is tape-recorded, for all the patients here at the Baker San with tuberculosis. It's made up of doctor's talks, news, and music. And here's what we had in mind from your interested readers. A tape, up to about 15 minutes playing time, describing hobbies, sports, occupations, unusual interests would be of interest to the 250 patients here. Tape speed of 3¾ ips is preferred. If you want your tape returned, let us know. Otherwise we will forward the tape to other interested institutions.

ROBERT C. SHELLSKA
Baker San,
Calgary, Alta., Canada

This seems like a worthy cause.—Editor.

* * *

"MUSCLE MOUSE" PRECAUTIONS

To the Editors:

In developing the "Muscle Mouse" a.c.-d.c. 50-watt transmitter (February 1958 issue), I checked the d.c. potential across the key. It ran considerably lower than that which is common in most small transmitters today. However, I did not check for an a.c. component. Subsequent checks with the transmitter show an a.c. leakage of 90 volts between one side of the key and a water pipe ground. This voltage does represent a possible shock hazard and one that should have been brought out in the article.

At the moment I can see two solutions. Easiest is grounding the chassis *through* a .005 μfd., 600-volt ceramic capacitor. This would establish the desirable r.f. ground without passing appreciable current—and would remove any shock hazard from the transmitter chassis itself. However, I am strongly sold on the desirability of having all equipment in a ham station at "earth ground." The obvious answer is to insert a keying relay (the low priced *Advance* GHA-1C6 VAC should do nicely) and at the moment this is the solution I would recommend. Of course, there is also the possibility of a blocked grid keying system. I'm afraid that in this one—with the best of intentions—I shut the front door on the safety problem but failed to lock the basement window.

JAY STANLEY
Denver, Colorado

We hope that all our readers will observe the proper precautions when dealing with "Muscle Mouse." We would also like to point out that the heater pin connections of the 12BY7A used are 4 and 5 and not 4 and 3 as shown.—Editor. —30—

FREE from HOWARD W. SAMS!...valuable all-steel file cabinets with your purchase of PHOTOFACT—

the world's finest TV-Radio Service Data

FREE! FOR REGULAR PHOTOFACT SUBSCRIBERS

You get your File Cabinets FREE if you are a regular subscriber to PHOTOFACT Folders and buy all new Sets as issued each month. Your Folders come to you in special envelopes, each including a "Bonus Certificate." Sixty (60) of these entitle you to a single-drawer File Cabinet ABSOLUTELY FREE...

FREE! FOR PHOTOFACT LIBRARY PURCHASERS

Get FREE File Cabinets as you complete your profit-building PHOTOFACT Library... here's how:

FREE! Single-Drawer File Cabinet with your purchase of 60 Sets of PHOTOFACT Folders. Cabinet Worth $8.95

FREE! Two single-drawer File Cabinets with your purchase of 120 Sets of PHOTOFACT Folders. Cabinets Worth $17.90

FREE! Three single-drawer File Cabinets with your purchase of 180 Sets of PHOTOFACT Folders. Cabinets Worth $26.85

FREE! Four single-drawer File Cabinets with your purchase of 240 Sets of PHOTOFACT Folders. Cabinets Worth $35.80

NEW EASY-BUY PLAN

It's easy to complete your present PHOTOFACT Library or start a PHOTOFACT Library. Use the EASY-BUY PURCHASE PLAN:

- NO INTEREST
- NO CARRYING CHARGE
- AS LITTLE AS $10 DOWN
- UP TO 24 MONTHS TO PAY

Get the world's finest TV-Radio Service Data... get FREE File Cabinets with your PHOTOFACT purchases... take advantage of the Easy-Buy Plan. See your Sams Distributor today, or write to Howard W. Sams for full details.

get the full details of the HOWARD W. SAMS money-saving way to build your complete profit-making PHOTOFACT Library!

HOWARD W. SAMS & CO., INC.
2203 E. 46th St., Indianapolis 5, Indiana

☐ Send details on your FREE File Cabinet offer and EASY-BUY Plan.

☐ I'm a Service Technician: ☐ full time; ☐ part time

My Distributor is: _____

Shop Name: _____

Attn.: _____

Address: _____

City _____ Zone ____ State _____

They're New... Smart... Attract Customers..

A. ILLUMINATED SIGN-A-RAMA. Visible for blocks. Brightly lit with six flashing lamps. Double-faced, large—48" by 24"—gives top identification to your store or shop. Mounting hardware is included.

B. ILLUMINATED SPECIAL-MESSAGE SIGN. Carries your name, or tells any brief message you select. Ideal for windows or interiors. 37" by 14". Uses two 30-watt bulbs. Kit of letters and numerals is included.

C. DISPLAY BACKDROP. Arrange this handy back-up display to meet your advertising needs. Material is flexible, can be curved or will mount flat. For window trim, walls, or counter fronts. Two 36" x 24" designs per strip.

D. GIANT TUBE CARTON. Eye-arresting... indicates the quality components you install and sell.

E. DOOR, WINDOW DECAL. Neat, attractive, new dry-apply type. 12" diameter.

..GENERA E EC RIC'S COLOR-KEYED SHOP SIGNS

Color-keyed to the G-E tube carton—symbol of quality!

Here is your chance to give your shop-front and windows eye-appeal with "sell". Colors of all eleven new General Electric signs and displays match handsomely the famous G-E tube carton. Quality appearance is keyed to high quality of product—a message every passerby is sure to read.

Attractive and modern, General Electric's color-keyed signs and displays also stand for leadership. They identify your shop as a source for television repairwork done to professional standards, backed by up-to-the-minute facilities.

All your display needs are met by smart new G-E designs—from an eye-catching, easy-to-apply door or window decal, to metal and illuminated outdoor and indoor signs...plus colorful utility items like the electric clock and thermometer.

These brand-new signs and displays are waiting for you *now* at your General Electric tube distributor's. Ask him how to obtain them! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

SERVICE CLOTHING, smartly styled, also is available. Garments are color-keyed to new G-E signs and displays—give that professional look. Durable, launder easily.

SERVICE CASES in three useful sizes—small, medium, and large—match color-theme of General Electric displays. Now you can carry with you neatly, compactly, everything you need for making home service calls!

Progress Is Our Most Important Product

GENERAL ELECTRIC

11-11-102

METAL FLANGE SIGN. A display workhorse. Double-faced. Mount it anywhere! Compact—15" by 12"—handy for building corners, delivery entrances, and other side locations.

ILLUMINATED CLOCK, electric. Both useful and advertises your business. Easily read—16" diameter—with long-life bulbs. Hang on a wall, or mount on a counter (easel is provided).

HANGING METAL SIGN. For shop front or service entrance. Message both sides, plus your nameplate. Large—48" by 36"—easily seen. Hanging hardware is included; lights are available.

COUNTER-WALL-WINDOW SIGN. Illuminated. Use it anywhere in your shop! Wrap-around cover has the attractive display on both sides. 15" by 11½" by 5".

OUTDOOR-INDOOR THERMOMETER. Tells temperature accurately. Every viewer will see your advertising message. Replaceable front. 12" diameter.

METAL TACK-ON SIGN. Narrow, smart dimensions—14" by 42". Fasten against building, or mount as a free-standing display.

straight from the shoulder talk...

A TV Picture Tube Warranty is only as good as the manufacturer who issues it...

You can rely on the Picture Tube Warranty of RCA

The manufacturer's warranty is for your protection. An RCA 12-month warranty card is assurance that your replacement picture tube is a genuine RCA Silverama—and that the reputation and integrity of RCA stand behind it.

It's well worth while to insist on an RCA Silverama, the same advanced tube used in many of the new '58 TV sets. Often, it will even produce a picture more brilliant, sharper, clearer than your set gave when new! So, if your picture tube should need replacing, be sure you get what you pay for, the best picture tube made—RCA Silverama. After your service dealer installs it, ask him to complete your copy of the warranty card. One comes with every genuine RCA Silverama Picture Tube.

Super-Aluminized RCA Daylight Clear

RCA Silverama®

PICTURE TUBES

RCA Electron Tube Division, Harrison, N. J.

"Just as good" isn't good enough for your TV!

Let's face it! Nothing lasts forever. When you have to pay out good money for a replacement Picture Tube, you're entitled to the best that modern electronics can produce—that's an RCA SILVERAMA. It stands to reason that RCA, with its great laboratories, facilities, and "know-how"—produces the finest Picture Tubes money can buy. So, don't let "just as good" tempt you. Remember: RCA Silverama Picture Tubes cost no more than other brand-name aluminized tubes ... they are warranted for one full year, too.

Super-Aluminized RCA Daylight Clear

RCA Silverama®

PICTURE TUBES

RCA Electron Tube Division, Harrison, N. J.

...that makes it easy for you to sell the #1 picture tube... RCA Silverama®

Messages like these appear regularly in TV Guide and other publications, telling millions of TV viewers (many of them your customers) the facts about their all-important picture tube.

RADIO CORPORATION OF AMERICA

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

Within the Industry

DON ROSS has been appointed to the newly created post of national field sales manager of *Pilot Radio Corporation.*

In his new position, he will assist the vice-president in charge of sales. Mr. Ross joined the firm as Mid-West sales manager in 1956.

A sales executive with more than fifteen years of experience in sales and sales development, Mr. Ross has been associated with *Bendix Aviation, General Electric Company,* and *Motorola.*

* * *

WESCON has selected William C. Estler, public relations counselor of Palo Alto, Calif. and *General Public Relations, Inc.,* Los Angeles, as public relations counsel for the Western Electronic Show and Convention.

They will work closely with an electronics industry public relations committee chairmanned by Elliot Lewis of the *Ramo-Wooldridge Corp.,* Los Angeles, Calif.

* * *

KENNETH G. BUCKLIN has been appointed manager, engineering, receiving tube operations, *RCA* electron tube division.

Mr. Bucklin joined the division in 1933 after working for two years as an engineer with *De-Forest Radio Company.* In 1939 he became manager, design engineering. Between 1942 and 1953 he served in several merchandising and administrative positions. Mr. Bucklin was appointed manager for receiving tube and transistor marketing in 1953 and a year later was made manager, receiving tube marketing.

In 1952 Mr. Bucklin received the company's "Victor" Award of Merit, the firm's highest citation for salaried employees.

* * *

RCA's first David Sarnoff Outstanding Achievement Awards in Science and Engineering will be presented to Albert Rose of the technical staff of the laboratories, and David K. Barton, engineering staff, defense electronic products.

The two awards, to be made annually to the outstanding scientist and the outstanding engineer of the *Radio Corporation of America,* were established in September, 1956 to commemorate the fiftieth anniversary in radio of Brig. General David Sarnoff, Chairman of the Board of the company. Each award consists of a gold medal and a citation.

Dr. Rose is being cited "for basic contributions to the understanding and utilization of photoelectronic phenomena" and Mr. Barton's citation specifies "for important contributions to precise tracking radars."

* * *

LEWIS J. SHIOLENO has been named general manager of the electronics division, *Erie Resistor Corporation.*

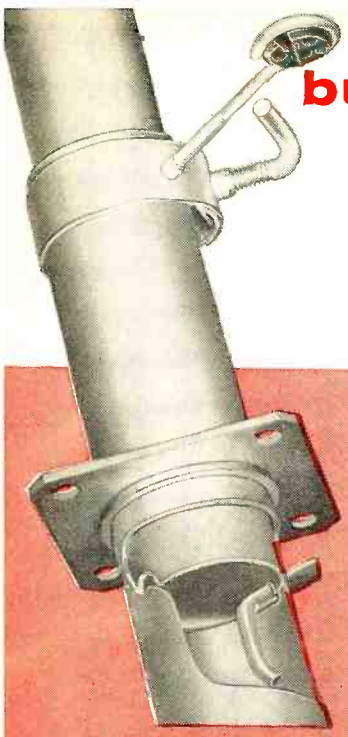
Prior to his appointment, Mr. Shioleno was superintendent of manufacturing for the electro - mechanical division. His new duties encompass all responsibility of sales, engineering, and production for the electronics division.

He is a graduate of the University of Notre Dame and joined the company in May, 1950.

* * *

HEATH COMPANY, a subsidiary of *Daystrom, Inc.,* has moved its entire manufacturing operation to a new 140,000 square foot building. The mailing address remains Benton Harbor, Michigan, but the new phone number is Yukon 3-3961 . . . **CBS-HYTRON,** electron tube division of the *Columbia Broadcasting System,* has made arrangements to sell its plant at Kalamazoo, Michigan, to the **BRUNSWICK-BALKE-COLLENDER COMPANY** . . . Headquarters of the special tube operations of **SYLVANIA ELECTRIC PRODUCTS INC.** have been transferred to Williamsport, Pa., from Woburn, Mass. Concurrently, it was announced that the components laboratories in Mountain View, Calif., will become a part of special tube operations . . . **RADIO INDUSTRIES, INC.** has transferred to its new plant at 666 Garland Place, Des Plaines, Ill. the manufacture of disc capacitors and feedthroughs. The executive and sales offices will be moved later from the Chicago Ravenswood plant to the new, modern, one-story building. The Chicago plant will continue to produce transformers and coils on an expanded basis . . . All manufacturing operations of **SIMPLEX EQUIPMENT CORPORATION,** a subsidiary of *General Precision Laboratory, Inc.,* have been suspended. The parent company's plant in Pleasantville, N. Y., will take over the manufacturing . . . Two more Chicago firms have announced purchase of plant sites in the new Centex Industrial Park, located in Elk Grove Village northwest of Chicago. **SOLA ELECTRIC COMPANY** has

build your PRESTIGE and PROFITS with CHANNEL MASTER ACCESSORIES



Channel Master masting is made of finest quality high carbon steel

CHANNEL MASTER REDUCES ALL MASTING PRICES!

Only Channel Master can bring you top quality masting at the lowest possible prices . . . because *only* Channel Master manufactures telescoping masts in its own steel tubing mill.

- Prices for Channel Master telescoping and straight-length masting are the lowest on the market.
- Telescoping masting line now *fully assembled* — and costs far less than previous non-assembled masts.

Cut your Costs . . . Boost your Profits — Call your Channel Master distributor now.

Cash-In On Channel Master's Consumer Popularity! Feature these top-quality accessories bearing the nationally advertised Channel Master name.

MOUNTS COUPLERS STANDOUT INSULATORS GUY WIRE

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.
WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

Only CHANNEL MASTER offers you this

"SUPERMARKET" VARIETY of TV WIRE

Your choice of 37 models...14 different types...of VHF, UHF, and Rotor Wires

- NEW! JUMBO TRANSMISSION WIRE — extra heavy-duty 170/18 and 155/20 wire.
- NEW! "SUPER FOAM" TRANSMISSION WIRE — superb-quality foam poly insulation.

When you feature Channel Master you have the widest selection of TV wire . . . plus premium quality for longer life and better performance — at no extra cost. That's why . . .

"Live Wire" Dealers use Channel Master Exclusively

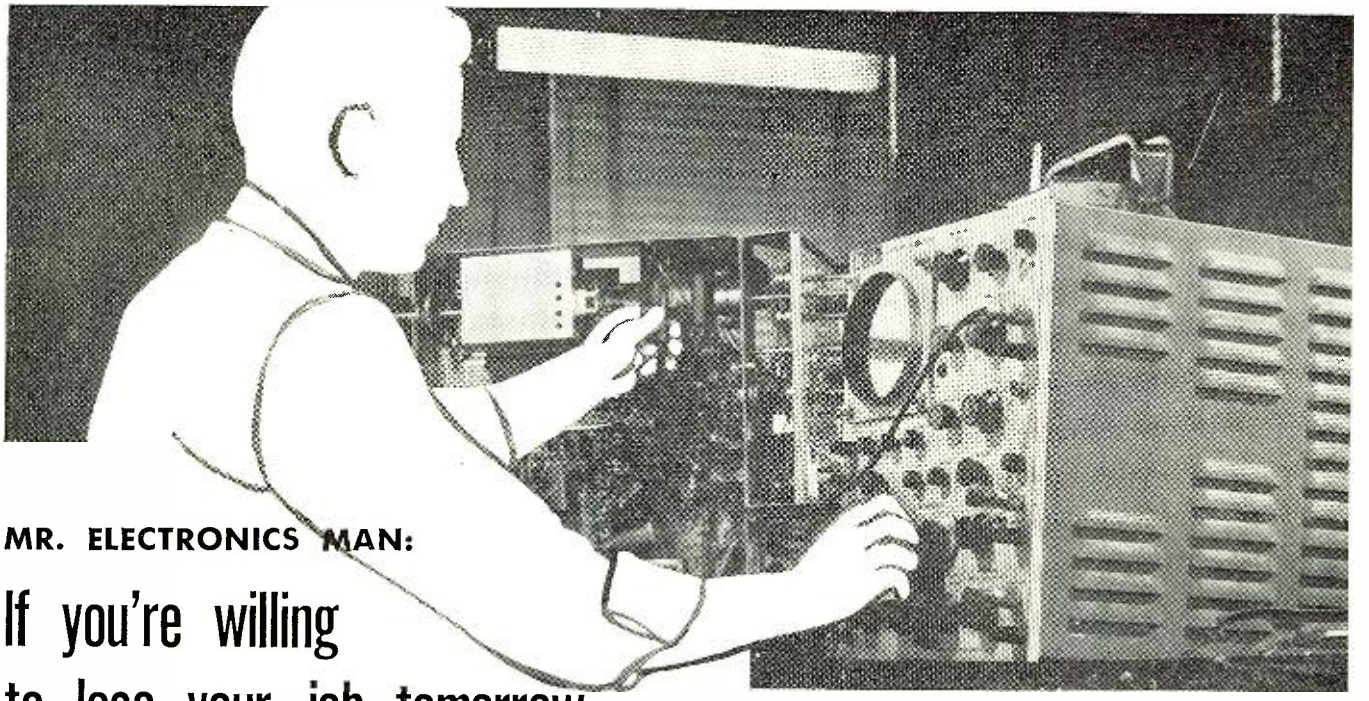
an Metalcraft Inc., chairman; Technical Program—Dr. R. C. Hansen, *Hughes Aircraft Co.,* chairman; Visitors' Housing—J. M. Loge, *J. M. Loge Sound Engineers,* chairman; and Show Advisory—Thomas A. Lynch, *Radio Products Sales, Inc.,* chairman.

Also officiating at the early planning meeting were Walter E. Peterson, director of the electronics division, *Radioplane Co.,* who is convention director, Hugh P. Moore, head of *Lerco Electronics Corp.,* show director, and Don Larson, business manager.

* * *

ERIE RESISTOR CORPORATION has announced the purchase of the assets for cash of **HUPP INSTRUMATION COMPANY,** Los Angeles, Calif. The acquisition includes the assets, designs, patents, trademarks, and the name of the West Coast instrument manufacturer. The firm will be combined with the Hawthorne, California, factory of the parent company's Electro-Mechanical Division which will direct marketing and manufacturing of these electronic instruments . . . **PIC DESIGN CORPORATION** has made known the acquisition of a precision tool component line from **VON INDUSTRIES, INC.,** Mineola, N. Y. . . . A. W. Haydon has started a new enterprise known as **HAYDON INSTRUMENT COMPANY** to design and manufacture new proprietary electromechanical devices. The firm is located at 156 W. Liberty Street, Waterbury 20, Conn. . . . The formation and move of the **DIGITRAN COMPANY** into new headquarters at 45 W. Union St., Pasadena, Calif., has been announced. Formerly known as the *Anatran Division* of *Endevco Corp.,* the new company will continue its development and expansion as a maker of electrical read-out mechanical counters and digital motors for computers, automation, and systems designs . . . Broadcaster Bill Leonard has recently organized the firm of **HANOVER ELECTRONICS, INC.,** 126 E. 37th St., New York, N. Y. The company will publish or manufacture items of special interest to amateur radio operators, short-wave listeners, and experimenters . . . **SYLVANIA ELECTRIC PRODUCTS INC.** announces a change in the title of its radio and television division. Henceforth it will be known as **SYLVANIA HOME ELECTRONICS,** a division of the parent organization. Marion E. Pettegrew, senior vice-president of the company, will continue to have over-all responsibility for the division . . . **PACIFIC MERCURY TELEVISION MANUFACTURING CORP.,** Sepulveda, Calif., has acquired **TELEMETERING CORPORATION OF AMERICA,** Los Angeles, Calif. The company will function as a wholly owned subsidiary of the parent organization . . . Formation of the **MID-SOUTH TECHNICAL INSTITUTE** offering basic and advanced training in the electronics and other fields has been announced. The institute has taken over the facilities and staff of **COMMERCIAL TRADES INSTITUTE** and will operate on a non-profit basis. The

(*Continued on page* 106)



MR. ELECTRONICS MAN:

If you're willing to lose your job tomorrow to a technically-trained man, *turn the page, mister*

But if you're interested in an honest-to-goodness career in the vigorous young electronics industry, here's how you can step ahead of job-competition, move up to a better job, earn more money, and be sure of holding your technical job, even if the brass is firing instead of hiring.

The "how" is advanced, professional home study training in Electronic Engineering Technology including SERVOMECHANISMS; COMPUTERS; RADAR; AUTOMATION; AERONAUTICAL ELECTRONICS; BROADCASTING; COMMUNICATIONS AND MANUFACTURING, and the ELECTRONIC PRINCIPLES ASSOCIATED WITH GUIDED MISSILES, TELEMETERING, ASTRONAUTICS, and INSTRUMENTATION. You don't have to be a college graduate. You *do* have to be willing to study—at home. You can do it while holding down a full-time job. Thousands have. Since 1927 CREI has provided alert young men with the technical knowledge that leads to more responsibility, more job security, more money. And CREI has constantly kept pace with the rapid expansion and progress in electronic achievement.

Remember this: CREI starts with fundamentals and takes you along at your own speed. You are not held back by a class, not pushed to keep up with others. You set your own pace. CREI instructors guide you through the lesson material and *grade* your written work personally. You master the fundamentals, then get into more advanced phases of electronics engineering principles and practice. Finally you may elect training in highly specialized principles of electronic engineering technology as applied to guided missiles, servomechanisms, radar computers, telemetering, automation, instrumentation and other applications.

How good is CREI training? Ask an electronics engineer. Ask a radio station engineer. CREI courses are accredited by the Engineers' Council for Professional Development; CREI is a member of the National Council of Technical Schools.

Look at this partial listing of organizations that recommend CREI training for their own personnel: United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., The Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair Ltd., Federal Electric Corp., and U. S. Information Agency (Voice of America).

What's the next step? *Certainly get more information than we can cram into one page. Fill out and mail the coupon below today, or write Capitol Radio Engineering Institute, Dept. 115-E, 3224 16th St., N.W., Washington 10, D. C.*

CREI ALSO OFFERS RESIDENCE TRAINING at the same high technical level in Washington, D. C. Classes start at regular intervals. Qualified residence school graduates earn degree, "Associate in Applied Science." Check coupon if you prefer residence study.

VETERANS: **If eligible for training under the new G.I. Bill of Rights, check the coupon for full information.**

MAIL THIS COUPON FOR FREE BOOKLET!

CAPITOL RADIO ENGINEERING INSTITUTE

ECPD Accredited Technical Institute Curricula • Founded 1927

Dept. 115E 3224 16th St., N.W., Washington 10, D. C.

Please send me your course outline and FREE illustrated Booklet "Your Future in the New World of Electronics" . . . describing opportunities and CREI home study courses in Electronics Engineering Technology.

CHECK FIELD OF GREATEST INTEREST
- ☐ Radar, Servo and Computer Engineering Technology
- ☐ Electronic Engineering Technology
- ☐ Broadcast (AM, FM, TV) Engineering Technology
- ☐ Television Engineering Technology
- ☐ Aeronautical Electronic Engineering Technology

13

Name.....Age.....

Street.....

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

Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

NOT FOR BEGINNERS. If you have the equivalent of a high school education, and are good at mathematics, if you have *some* electronics experience (advanced amateur, experimenting, military or industrial),—and realize the need of high-level technical knowledge to make good in the better electronic jobs—you can qualify for CREI home study training. (Electronics experience is not required for admission to CREI Residence School.) Please fill in the following information:

EMPLOYED BY .....

TYPE OF PRESENT WORK.....

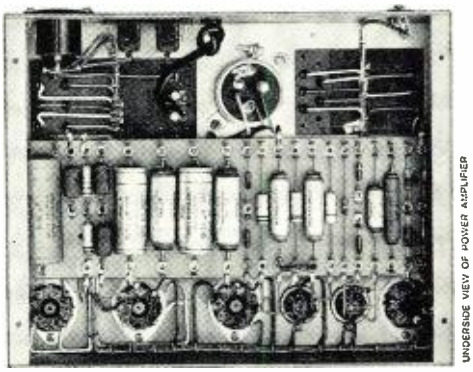
.....

EDUCATION: YEARS HIGH SCHOOL.....

YEARS COLLEGE .....

ELECTRONICS EXPERIENCE .....

Can You Hear



UNDERSIDE VIEW OF POWER AMPLIFIER

A Decimal Point

REMOTE CONTROL PREAMPLIFIER

?

Listen to a Leak "Point One" Amplifier! You will hear more realistic, satisfying music... and enjoy it without fatigue, because the Leak keeps harmonic distortion at the lowest figure ever achieved... 1/10 of one per cent (0.1%) at rated power!

3 NEW HIGH POWER LEAK AMPLIFIERS
... 12, 25, 50 watts ... all at 1/10 of 1% distortion

The aim in producing these amplifiers is to provide the benefits of professional components and workmanship for use in your high fidelity system. All three feature the incomparable Leak triple loop negative feedback circuit, which incorporates the finest components ... and great skill in testing and assembly. All components are utilized well below their maximum ratings to insure great stability and long life. Power ratings are very conservative. In actual fact, each amplifier delivers power far beyond its stated wattage, and still maintains negligible distortion. Leak craftsmanship is traditionally outstanding. *Turn any Leak amplifier upside down* and compare the circuitry and workmanship with that of any other make. Do this at your dealer and judge for yourself.

2 NEW LEAK PREAMPLIFIERS ... "POINT ONE PLUS" & VARISLOPE III
... built specifically and only for the Leak Power Amplifiers!

The handsome, compact look of these new preamplifiers is matched by their exceptional versatility. For example, exclusive tape recording and playback jacks on front *and* rear panels facilitate portable, as well as permanent, tape recorder installations. The new "Point One Plus" features playback characteristics covering all records ever made! The inputs for tuner, tape and phono cartridge each have their own balancing controls. You simply could not buy more preamplifier for the money. The great new Varislope III preamplifier provides all the advanced features of the "Point One Plus" and the exclusive, *infinitely variable* Leak Slope Control. Records which may sound harsh or shrill can be controlled to remove distortion while keeping all the musical content.

LEAK
"POINT ONE"
BRITAIN'S FINEST AMPLIFIERS

*Leak amplifiers are moderately priced. Most fine systems in large homes use the $164.50 (25 watt) combination.**

AMPLIFIERS

TL/12 PLUS An outstanding 12watt 0.1% amplifier built to every superior Leak standard. $89.00.

TL/25 PLUS 25 watts performance more than adequate for average interiors. $109.50.

TL/50 PLUS Full 50 watts output at 1/10 of 1% (0.1%) harmonic distortion. $149.00.

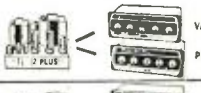
B.I.C. ENDORSED QUALITY

PREAMPLIFIERS

"POINT ONE PLUS" Full complement of controls for records and tone. Inputs for tuner, tape and phono. $55.00.

VARISLOPE III All "Point One" features plus two magnetic inputs, rumble filter, Leak Slope Control. $79.00.

Choose from six Leak combinations:



VARISLOPE $168.00
POINT ONE $144.00

VARISLOPE $188.50
POINT ONE $164.50*

VARISLOPE $228.00
POINT ONE $204.00

For free literature and a list of dealers, write Dept. L. E.-48 BRITISH INDUSTRIES CORP., PORT WASHINGTON, N. Y.

Spot News

Latest Information on the Electronic Industry

By RADIO & TV NEWS' WASHINGTON EDITOR

TOLL-TELEVISION TESTS OFFICIALLY STALLED UNTIL AFTER CONGRESS ADJOURNS—With the solid approval of a resolution by the Senate Interstate and Foreign Commerce Committee asking the FCC not to authorize on-the-air subscription-TV without a definite green light from Congress, the Commission's plan to approve experimental tests in the early Spring found itself stranded . . . As a result, the Commissioners decided that they would not do anything about toll-TV applications until 30 days after Congress goes home . . . Commenting on the Senate resolution, Senator Strom Thurmond (South Carolina) said that the subscription-TV issue involves a broad policy that should be resolved only by Congress and not left to . . . "the whim of a regulatory agency."

RADIO AND TELEVISION CONELRAD ATTENTION SIGNALS ARE TO BE USED FOR EMERGENCY STORM AND FLOOD WARNINGS—Plans are now being pushed by the Weather Bureau to utilize the nationwide emergency alerting system to help minimize the loss of life and property due to unforeseen natural disasters such as hurricanes, tornadoes, and flash floods. Such use of Conelrad was made possible following a recent order issued by the FCC which authorized this special application of existing national defense alerting procedures . . . The Weather Bureau emphasized that the facilities would not be used for forecasts but only in case the weather took an unexpected and unforecast turn for the worse . . . in other words . . . the new service will supplement, not replace, existing methods of disseminating weather information.

WIDE-SCREEN TV PICTURE TECHNIQUE INVENTED—A television system, known as the Scanoscope, in which the aspect ratio can be changed from the conventional 4 x 3 format to an 8 x 3 presentation has been invented. Advantages are said to be analagous to wide-screen motion pictures . . . In the process, a lens squeezes the image on the camera focal plane, from which it is transmitted with the required bandwidth. Then the image is "unsqueezed" electronically in the monitor. It is felt that the new technique will have wide applications in the military and closed-circuit fields, since it provides twice the information with essentially the same equipment. In the documentary and entertainment fields, it is believed, the new approach can provide the same advantages that wide-screen movies afford.

LONG-RANGE MISSILE-DETECTOR RADARS DESIGNED FOR AIR FORCE—Long-range radars required to detect and track enemy ballistic missiles have been developed in the laboratories of the Air Research and Development Command and of universities and industry . . . In one radar, an antenna 178 feet high and 110 feet across is involved . . . Another, the Millstone Hill radar, developed for the Air Force by the Lincoln Labs of MIT, employs klystron tubes that are eleven feet high and a parabolic reflector 84 feet in diameter, mounted on a concrete and steel tower ninety feet high. The rotating portion of the antenna structure weighs ninety tons . . . With a horizontal rotating capability of 360 degrees and a vertical elevating capacity of 90 degrees, the antenna can sweep the sky.

DIGITAL COMPUTERS NOW AVAILABLE TO PROCESS PICTURE INFORMATION—With scanning and display equipment engineered by the Bureau of Standards, it is now possible to use a computer to convert pictures into digital form suitable for input; the information is then processed according to some pre-arranged routine and the results are displayed as a visual output . . . The technique is expected to increase knowledge of the possible applications of high-speed electronic computers for processing information that occurs in the form of pictures, diagrams, or other graphical configurations.

NUMBER OF OPERATING TV STATIONS MOVES TO 507—At press time the FCC announced that there were 507 television stations in operation; 422 on v.h.f., and 85 on u.h.f. . . . New station actions include grants to Carl Bloomquist, Hibbing, Minn., for channel 13 (192-198 mc.) operating on 10.7 kw; Marvin Kratter (Golden State Telecasting Co.), San Francisco, Calif., for channel 38 (614-620 mc.), operating on 16.6 kw; Minneonto TV, Inc., International Falls, Minn., for channel 11 (198-204 mc.), operating on 1.59 kw; and Cache Valley Broadcasting Co., Logan, Utah, for channel 12 (204-210 mc.) on a power of 2.95 kw. —30—

GUIDE

AUTRONIC-EYE®

TRAINING COURSES MEAN MORE BUSINESS FOR YOU!

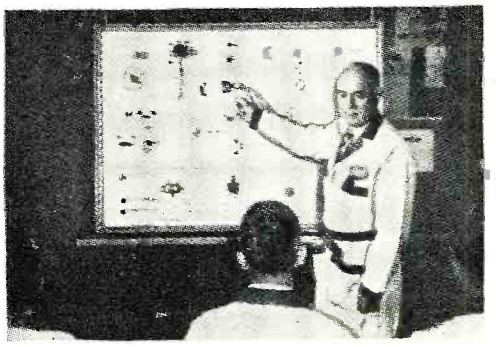
Courses for experienced service technicians provide latest repair information—enable you to do the job faster and more efficiently.

Quick, accurate circuit diagnosis and repair to factory specifications boosts your profits. That's why so many qualified auto technicians attend these Guide training courses at no cost other than transportation and living expenses.

The Guide Lamp diploma, awarded only to those who successfully complete the course, is proof that you're equipped to give more and better service to more people—and that means business.

If you're an auto radio service dealer, come yourself, or send your technicians. There's one of 30 GM Training Centers near you. Apply through your local United Motors Service Division Distributor or write

GUIDE LAMP DIVISION • GENERAL MOTORS CORP. • ANDERSON, INDIANA



Jumbo-size operational panel of Guide's Autronic-Eye Circuit puts all parts out front for better, more efficient instruction.

Thirty modern GM Training Centers offer newest equipment and latest service techniques. There's one nearby . . . no matter where you live.

the experts say... in High Fidelity the best buys are EICO®

EICO KITS and WIRED

BETTER ENGINEERING Since 1945 EICO has pioneered the concept of test instruments in easy-to-build kit form — has become world-famous for laboratory-precision instruments at low cost. Now EICO is applying its vast experience to the creative engineering of *high fidelity*. Result: high praise from such authorities as Canby of AUDIO, Marshall of AUDIOCRAFT, Holt of HIGH FIDELITY, Fantel of POPULAR ELECTRONICS, Stocklin of RADIO TV NEWS, etc. — as well as from the critical professional engineers in the field.†

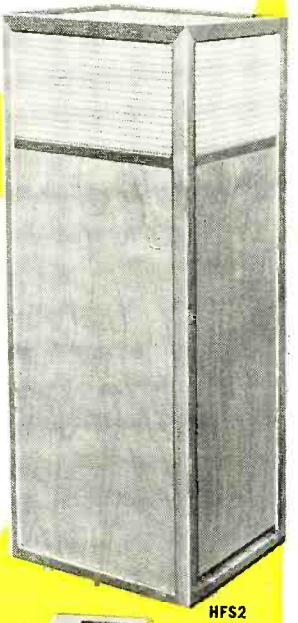
SAVE 50% Mass purchasing, and a price policy deliberately aimed to encourage mass sales, make this possible.

EASY INSTRUCTIONS You need no previous technical or assembly experience to build any EICO kit — the instructions are simple, step-by-step, "beginner-tested."

DOUBLE 5-WAY GUARANTEE Both EICO, and your neighborhood distributor, guarantee the parts, instructions, performance . . . as well as *lifetime* service and calibration at nominal cost . . . for any EICO kit or wired unit.

BEFORE YOU BUY, COMPARE At any of 1200 neighborhood EICO distributors coast to coast, you may examine and listen to any EICO component. Compare *critically* with equipment several times the EICO cost — then *you* judge. You'll see why the experts recommend EICO, kit or wired, as best buy.

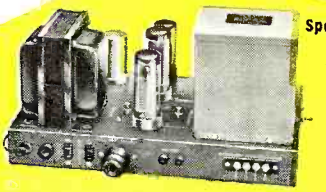
† Thousands of unsolicited testimonials on file.



HFS2 Speaker System

HFT90 FM Tuner with "eye-tronic" tuning

HF61 Preamplifier



HF60, HF50 Power Amplifiers

MEMBER HIGH FIDELITY MANUFACTURERS INC.

HFS2—Speaker System: Uniform loading & natural bass 30-200 cps achieved via slot-loaded split conical bass horn of 12-ft path. Middles & lower highs from front side of 8½" cone, edge-damped & stiffened for smooth uncolored response. Suspensionless, distortionless spike-shaped super-tweeter radiates **omni-directionally.** Flat 45-20,000 cps, useful to 30 cps. 16 ohms. HWD: 36", 15¼", 11½". ". . . rates as excellent . . . unusually musical . . . **really** non-directional" — Canby, AUDIO. "Very impressive" — Marshall (AUDIOCRAFT). **Walnut or Mahogany, $139.95. Blonde, $144.95.**

HFT90 FM Tuner equals or surpasses wired tuners up to 3X its cost. New, pre-wired, pre-aligned, temperature-compensated "front end"—drift-free. Sensitivity, 1.5 uv for 20 db quieting, is 6X that of other kit tuners. DM-70 traveling tuning eye. Response 20-20,000 cps ±1 db. Cathode follower & multiplex outputs. **Kit $39.95*. Wired $65.95*. Cover $3.95.** *Less cover, excise tax incl.

HF61A Preamplifier, providing the most complete control & switching facilities, and the finest design, offered in a kit preamplifier, ". . . rivals the most expensive preamps . . . is an example of high engineering skill which achieves fine performance with simple means and low cost."—Joseph Marshall, AUDIOCRAFT. **HF61A Kit $24.95, Wired $37.95, HF61 (with Power Supply) Kit $29.95. Wired $44.95.**

HF60 60-Watt Ultra Linear Power Amplifier, with Acro TO-330 Output Transformer, provides wide bandwidth, virtually absolute stability and flawless transient response. ". . . is one of the best-performing amplifiers extant; it is obviously an excellent buy." —AUDIOCRAFT Kit Report. **Kit $72.95. Wired $99.95. Matching Cover E-2 $4.50.**

HF50 50-Watt Ultra-Linear Power Amplifier with extremely high quality Chicago Standard Output Transformer. Identical in every other respect to HF60 and same specifications up to 50 watts. **Kit $57.95. Wired $87.95. Matching Cover E-2 $4.50.**

HF30 30-Watt Power Amplifier employs 4-EL84 high power sensitivity output tubes in push-pull parallel, permits Williamson circuit with large feedback & high stability. 2-EZ81 full-wave rectifiers for highly reliable power supply. Unmatched value in medium-power professional amplifiers. **Kit $39.95. Wired $62.95. Matching Cover E-4 $3.95.**

HF-32 30-Watt Integrated Amplifier Kit $57.95. Wired $89.95.

HF52 50-Watt Integrated Amplifier with complete "front end" facilities and Chicago Standard Output Transformer. Ultra-Linear power amplifier essentially identical to HF50. The least expensive means to the highest audio quality resulting from distortion-free high power, virtually absolute stability, flawless transient response and "front end" versatility. **Kit $69.95. Wired $109.95. Matching Cover E-1 $4.50.**

HF20 20-Watt Integrated Amplifier, complete with finest preamp-control facilities, excellent output transformer that handles 34 watts peak power, plus a full Ultra-Linear Williamson power amplifier circuit. Highly praised by purchasers, it is established as the outstanding value in amplifiers of this class. **Kit $49.95. Wired $79.95. Matching Cover E-1 $4.50.**

Prices 5% higher in the West

HF12 12-Watt Integrated Amplifier, absolutely free of "gimmicks", provides complete "front end" facilities & true fidelity performance of such excellence that we can recommend it for any medium-power high fidelity application. Two HF12's are excellent for stereo, each connecting directly to a tape head with no other electronic equipment required. **Kit $34.95. Wired $57.95.**

HFS1 Two-Way Speaker System, complete with factory-built cabinet. Jensen 8" woofer, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass; crisp extended highs. 70-12,000 cps ± 6 db. Capacity 25 w. Impedance 8 ohms. HWD: 11" x 23" x 9". Wiring time 15 min. **Price $39.95.**

THE HI-FI EXPERTS SAY:

"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF20 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis."
William A. Stocklin, Editor, RADIO TV NEWS

"The new EICO 'standard' speaker system . . . produces sound that to my musical ears rates as excellent, from high top to clean low bottom."
Edward Tatnall Canby, AUDIO Magazine

Fill out coupon on other side for FREE CATALOG

HF52, HF20 Integrated Amplifiers

HF12 Integrated Amplifier

HF30 Power Amplifier

HFS1 Speaker System

EICO®

33-00 Northern Boulevard, L. I. C. 1, N. Y.

Over 1 Million EICO instruments in use the world over.

©1958

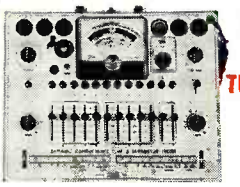
the specs prove it . . your BEST BUY is EICO®

for COLOR & Monochrome TV servicing

FREE CATALOG

shows you HOW TO SAVE 50% on 50 models of top quality professional test equipment.

MAIL COUPON NOW!

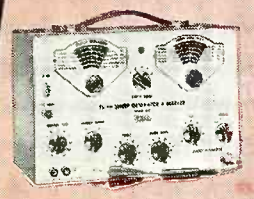


NEW! DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666

KIT $69.95 WIRED $109.95

COMPLETE with steel cover and handle.

SPEED, ease, unexcelled accuracy & thoroughness. **Tests all receiving tubes** (and picture tubes with adapter). **Composite indication of Gm, Gp & peak emission. Simultaneous sel** of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). **New series-string voltages:** for 600, 450, 300 ma types. **Sensitive** 200 ua meter. **5 ranges meter sensitivity** (1% shunts & 5% pot). **10 SIX-position lever switches:** freepoint connection of each tube pin. **10 pushbuttons: rapid** insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. **Direct-reading** of inter-element leakage **in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors:** separate meter readings of **collector leakage current & Beta** using internal dc power supply. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet. **CRA Adapter $4.50**



NEW! TV-FM SWEEP GENERATOR & MARKER #368

KIT $69.95 WIRED $119.95

Entirely electronic sweep circuit (no mechanical devices) with accurately-biased **incroductor** for excellent linearity. **Extremely flat** RF output: **new AGC circuit** automatically adjusts osc. for max. output on each band with min. ampl. variations. **Exceptional tuning accuracy:** edge-lit hairlines eliminate parallax. **Swept Osc. Range** 3-216 mc in **5 fund. bands. Variable Marker Range** 2-75 mc in **3 fund. bands;** 60-225 mc on harmonic band. **4.5 mc Xtal Marker Osc., xtal supplied.** Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

NEW! COLOR and Monochrome DC to 5 MC LAB & TV 5" OSCILLOSCOPE #460

KIT $79.95 WIRED $129.50

• Features DC Amplifiers!

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

NEW! RF SIGNAL GENERATOR #324

KIT $26.95 WIRED $39.95

150 kc to 435 mc with ONE generator! Better value than generators selling at 2 or 3 times its cost! Ideal for IF-RF alignment, signal tracing & trouble-shooting of TV, FM, AM sets; marker gen.; 400 cps audio testing; lab. work. **6 fund. ranges: 150-400 kc, 400-1200 kc, 1.2-3.5 mc, 3.5-11 mc, 11-37 mc, 37-145 mc; 1 harmonic band 111-435 mc. Freq. accurate to ±1.5%;** 6:1 vernier tuning & excellent spread at most important alignment freqs. **Etched tuning dial,** plexiglass windows, **edge-lit hairlines.** Colpitts RF osc. **directly plate-modulated by K-follower for** improved mod. **Variable depth of int. mod. 0-50%** by 400 cps Colpitts osc. **Variable gain ext. amplifier:** only 3.0 v needed for 30% mod. **Turret-mounted coils slug-tuned** for max. accuracy. Fine & Coarse (3-step) RF attenuators. RF output 100,000 uv; AF sine wave output to 10 v. 50-ohm output Z. 5-way jack-top binding posts for AF in/out; coaxial connector & shielded cable for RF out. 12AU7, 12AV7, selenium rectifier; xmfr-operated. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

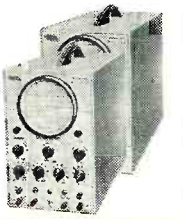
NEW! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)

KIT $29.95 WIRED $49.95

Half-turn of probe tip selects DC or AC-Ohms.

Uni-Probe — exclusive with EICO — only 1 probe performs all functions!

Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't burn-out circuit. **7 non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC Volts, Ohms. Uniform 3 to 1 scale ratio for extreme wide-range accuracy. **Zero center.** One zero-adj. for all functions & ranges. **1% precision** ceramic multiplier resistors. Measure **directly** peak-to-peak voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200. DC/RMS sine volts: 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 v. with HVP probe & 250 mc with PRF probe). Ohms: 0.2 ohms to 1000 megs. 12AU7, 6AL5, selenium rectifier; xfmr-operated. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet.



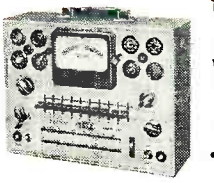
5" PUSH-PULL OSCILLOSCOPE #425

KIT $44.95 Wired $79.95

•

7" PUSH-PULL OSCILLOSCOPE #470

KIT $79.95 Wired $129.50

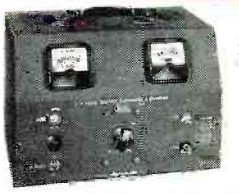


TUBE TESTER #625

KIT $34.95 Wired $49.95

- tests 600 mil series string type tubes
- illuminated roll-chart

Pix Tube Test Adapter **$4.50**



6V & 12V Battery Elim & Charger #1050:

KIT $29.95 Wired $38.95

Extra filtered for transistor eqpt., #1060: Kit $38.95 Wired $47.95

Sep. hi-gain RF & lo-gain audio inputs. Special noise locator. Calibrated wattmeter.

KIT $24.95 Wired $39.95

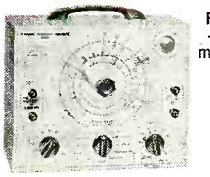
DELUXE MULTI-SIGNAL TRACER #147

20,000 Ohms/Volt MULTIMETER #565

KIT 24.95 Wired $29.95

1000 Ohms/Volt MULTIMETER #536

KIT $12.90 Wired $14.90



Reads 0.5 ohms —500 megs, 10 mmfd—5000 mfd, power factor.

KIT $19.95 Wired $29.95

R-C BRIDGE & R-C-L COMPARATOR #950B

VTVM PROBES	KIT	Wired
Peak-to-Peak	$4.95	$6.95
RF	$3.75	$4.95
High Voltage Probe-1	$6.95	
High Voltage Probe-2	$4.95	
SCOPE PROBES		
Demodulator	$3.75	$5.75
Direct	$2.75	$3.95
Low Capacity	$3.75	$5.75

EICO, 33-00 Northern Blvd., L.I.C. 1, N. Y. R-5

Show me HOW TO SAVE 50% on Test Equipment and Hi-Fi. Send me FREE Catalog and name of neighborhood distributor.

Name.....

Address.....

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

TURN PAGE FOR MORE EICO VALUES

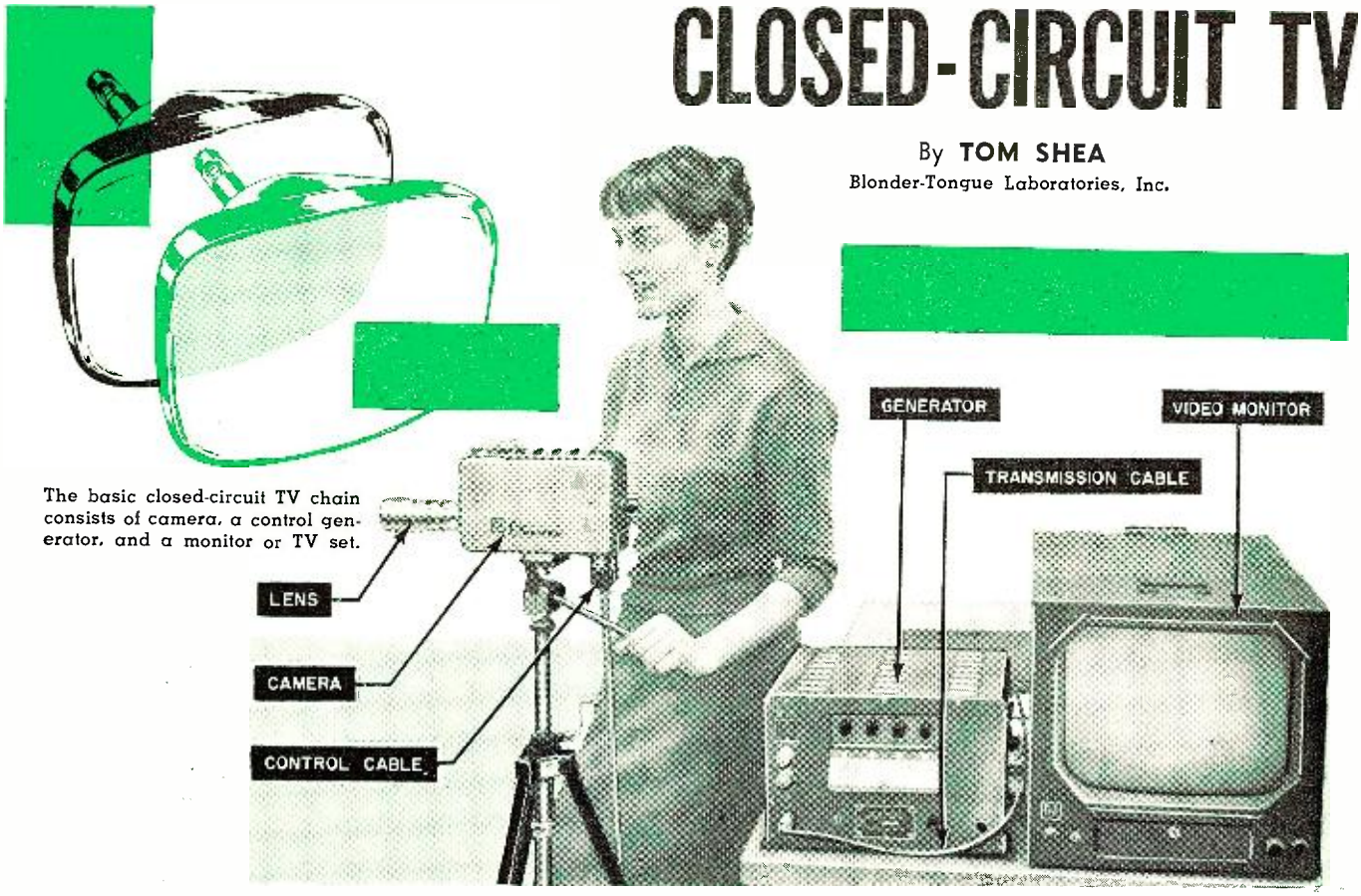
EICO® L.I.C. 1, N.Y.

Send for FREE CATALOG now

Prices 5% higher on West Coast.

CLOSED-CIRCUIT TV

By **TOM SHEA**
Blonder-Tongue Laboratories, Inc.



The basic closed-circuit TV chain consists of camera, a control generator, and a monitor or TV set.

A new industry, still a lusty infant, offers a remarkable tool that's just beginning to be used.

TWENTY-FOUR freshly scrubbed faces were turned intently toward the large television screen on which an amoeba, magnified nearly 1000 times larger than its actual microscopic size, was slowly surrounding and deliberately engulfing another tiny organism. The teacher glanced at the class and realized she had rarely commanded such attentive quiet. A hand went up. The teacher nodded and a girl asked, "What does the amoeba do after it surrounds the food?" From a loudspeaker in the TV set promptly came the answer and two more questions followed in quick succession.

Only a few years ago, each student might have filed up to a microscope, peered in briefly, and passed on to give the next a chance for a glimpse of the microscopic drama. Today, by means of a closed-circuit television system, the science teacher can set up the experiment using one microscope and TV camera and televise it to many classes. Every student can watch the process unfolding on the TV screen and ask the questions that arise fresh at the moment of observation.

That example is but one of many applications being found for closed-circuit television (CCTV). Others are more or less dramatic or spectacular, but all prove that CCTV, although still a lusty infant as a means of communication, offers society a remarkable tool whose potential has just begun to be tapped. As a concept, closed circuit television probably dates back to the invention of television itself. As an actuality, CCTV dates from just after World War II. But the first few demonstrations drew little attention beyond a flurry of publicity and CCTV made little immediate headway, although several electronics firms grasped its possibilities and went into manufacture of equipment. Still, as recently as 1950, closed-circuit television sales did not amount to more than a few thousand dollars, for business men were generally inclined to regard it as a useless toy or, much worse, as a distraction which might even impede production!

Then industrial engineers, safety experts, merchandising people, traffic and materials handling engineers, along with the CCTV sales engineers themselves began showing executives how CCTV could save time, labor, and materials, how it could speed vital communications. Educators soon realized that one teacher before a TV camera could teach as many classes as had TV sets wired to that camera. Rather than being restricted to one limited size class by the age-old traditional method, one teacher could instruct an entire school, or even several schools.

As a result, sharply rising demand produced a growth of the CCTV equipment industry from 3 manufacturers in 1952 to at least 13 in 1957 making complete systems. They include *Blonder-Tongue, Dage, Diamond Power, A. B. Du Mont, Insul-8-Corp., International Tel. & Tel., General Electric, General Precision, Hallamore Electronics, Kin-Tel* (formerly *Kay Lab*), *Philco, RCA*, and *Sarkes Tarzian*. See Table 1. (*Editor's Note: By the end of last year industry sales were variously estimated between $5-million and $9-million.*)

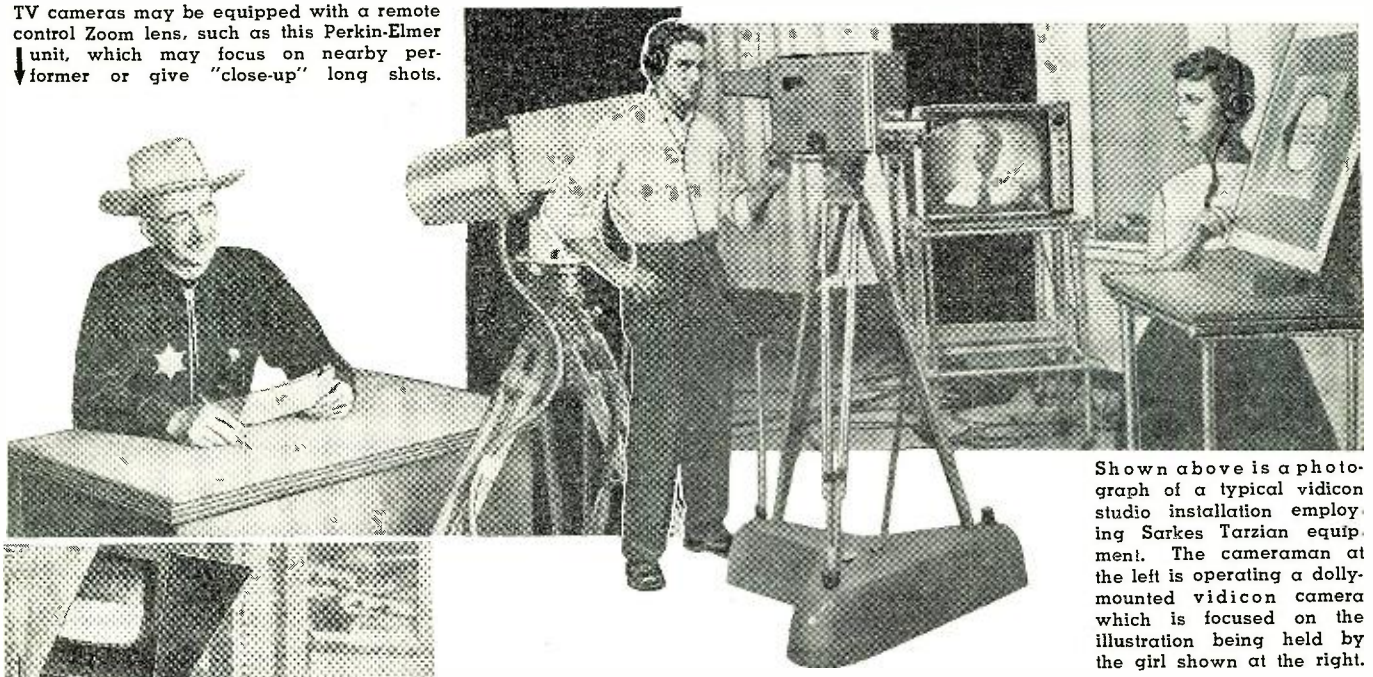
Elements of a CCTV System

A CCTV installation is a complete television transmitting and receiving system with signals transmitted through cables rather than over the air.

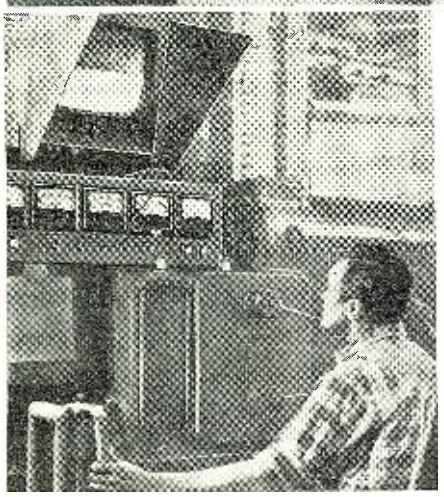
A basic chain (above) consists of a television camera, a control unit which may be integral with camera or separate, and a video monitor or conventional TV set. Transmission line, such as ordinary RG-11/U or RG-59/U coaxial cable, connects the transmission equipment with the video monitor or conventional TV receiver. Many numbers of such basic chains are now in use. Larger, more elaborate systems—where several cameras may supply many receivers, for example—require additional amplifying and distribution equipment. But, in practical terms, there is almost no limit to the number of receivers that can be supplied from one or more cameras.

One of the most promising CCTV system arrangements is the two-way

TV cameras may be equipped with a remote control Zoom lens, such as this Perkin-Elmer unit, which may focus on nearby performer or give "close-up" long shots.



Shown above is a photograph of a typical vidicon studio installation employing Sarkes Tarzian equipment. The cameraman at the left is operating a dolly-mounted vidicon camera which is focused on the illustration being held by the girl shown at the right.



The Diamond Power installation shown above allows the machine operator to check the position of his traveling-housing milling and boring machine by closed-circuit TV.

installation, in which cameras and TV receivers are set up at both ends of the chain. An outstanding example of two-way CCTV is found in educational applications, in which simultaneous two-way sight and sound permits students to ask questions of the instructor who is presenting the course from another classroom or from another school.

In another interesting system now working at the Los Angeles Water and Power Supply Steam Plant, ten cameras are used to coordinate control of furnace flames and steam pressure. Cameras installed at specially designed ports in the furnace walls equipped with constant cooling means, observe flame character. Other cameras are trained on boiler pressure gauges. Extremely detailed images of flames and gauges are required.

Video monitors are installed in the steam plant's main operations control board where one operator can watch several flames and make adjustments to maintain proper combustion. The system saves fuel: previously the inability of the operators to observe flames directly often produced incomplete burning and appreciable fuel waste. The system also prevents excessive escape of smoke, an important aspect of smog prevention in Los Angeles.

St. Mary's Hospital in San Francisco is now using a very versatile closed circuit system. Permanent transmission line outlets are located in the chapel and also four floors down in the auditorium, which is used for social functions. Camera pick-ups from other areas of the hospital are cabled to either of these outlets.

CCTV output on channel 2 is fed to the hospital's master antenna system, which also receives commercial over-the-air programs on other channels. Output from the "head-end" of

TABLE 1 CLOSED-CIRCUIT TV EQUIPMENT MANUFACTURERS

COMPLETE SYSTEMS AND EQUIPMENT

Blonder-Tongue Labs., Inc.
9 Alling Street
Newark 2, New Jersey

Dage Television Division
Thompson Products, Inc.
West 10th Street
Michigan City, Indiana

Diamond Power Specialty Corp.
Electronics Department
Lancaster, Ohio

Allen B. Du Mont Laboratories, Inc.
760 Bloomfield Avenue
Clifton, New Jersey

General Electric Company
Technical Products Department
Electronics Park
Syracuse, New York

General Precision Laboratory, Inc.
63 Bedford Road
Pleasantville, New York

Hallamore Electronics Co. Div.
The Siegler Corp.
8352 Brookhurst Ave.
Anaheim, California

Insul-8-Corporation
1369 Industrial Road
San Carlos, California

International Telephone & Telegraph Co.
Industrial Products Division
15191 Bledsoe Street
San Fernando, California

Kin Tel
P.O. Box 623
5725 Kearny Villa Road
San Diego, California

Philco Corporation
Government & Industrial Division
4700 Wissahickon Ave.
Philadelphia 44, Pa.

Radio Corporation of America
Engineering Products Division
Camden, New Jersey

Sarkes Tarzian Inc., 415 N. College Avenue, Bloomington, Indiana

COMPONENTS AND ACCESSORIES

Ampli-Vision Division
International Telemeter Corp.
200 Stoner Avenue
Los Angeles 25, California

B & K Manufacturing Co.
3726 N. Southport Ave.
Chicago 13, Illinois

Conrac, Inc.
Glendora, California

Entron, Inc.
4902 Lawrence St.
Bladensburg, Maryland

Foto-Video Laboratories, Inc.
36 Commerce Road
Cedar Grove, New Jersey

Hoffman Electronics Corp.
3761 S. Hill Street
Los Angeles 7, California

Telechrome Mfg. Corp.
28 Ranick Drive
Amityville, New York

Jerrold Electronics Corp.
23rd & Chestnut Streets
Philadelphia 3, Pa.

Miratel Inc.
1080 Dionne St.
St. Paul, Minn.

Perkin-Elmer Corp.
Main Avenue
Norwalk, Conn.

Polarad Electronics Corp.
43-20 34th St.
Long Island City 1, N. Y.

Setchell-Carlson, Inc.
330 Fifth Avenue
New Brighton, Minn.

Tarc Electronics, Inc.
48 Urban Avenue
Westbury, New York

Transvision Inc.
460 North Avenue
New Rochelle, New York

Zoomar, Inc.
Glen Cove, Long Island, New York

the antenna system is distributed to 170 TV sets throughout the hospital, with broadband amplifiers placed strategically to maintain signal strength at each television receiver's antenna terminals.

The St. Mary's Hospital system was installed originally to improve bedridden patients' morale by enabling them to view hospital chapel services on TV. But each month finds new uses for the system—televising an operation to more doctors than could group around the operating table; unusual opportunities in psychiatric work where behavior of disturbed patients can be observed at a distance by the doctor; training of hospital personnel; allowing bed-ridden patients to "visit" with underage relatives not permitted to go to patients' rooms. The hospital's CCTV system has proven so valuable that plans are underway to install 70 more sets in a new wing now under construction.

Other Case Histories

The uses which CCTV is already serving could fill—and already have filled—entire books. They range from simple chains, such as where a camera is installed to survey a machine operation in a factory and wired to a monitor at an observer's position; to multi-camera installations with complex switching facilities; to the tremendous commercial cable networks used to transmit a televised championship prizefight to participating theaters. Also in the nuclear energy and military missile fields, the use of CCTV is very widespread. New uses are discovered every week. Here are a few more specific applications.

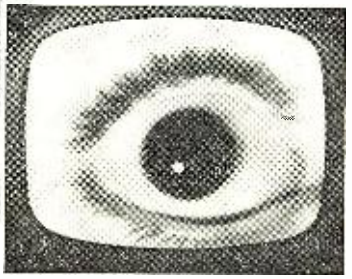
Last spring Bankers Trust Company in New York took stockholders on a 25-minute "seated tour" of the bank *via* a CCTV installation setup. More than 300 viewed the tour on an 8 x 10 foot projection-type television screen. The noted sports announcer Red Barber MC'ed the tour, discussing banking operations with department heads on four floors and providing the stockholders with a real inside view of the bank's business plant. The success of the demonstration prompted Bankers Trust to install coaxial cable on a permanent basis. Future use of CCTV is planned to link the personal loan department with the records department in order to transmit immediate visual data on customers' past records.

A large and very elaborate CCTV system for data transmission is now in operation at Pennsylvania Station in New York City. Ticket sales and reservations to points all over the country are expedited through the use of 100 TV cameras trained on the station's reservation board. The CCTV system has cut ticket sales time from 8 minutes average per passenger down to a mere 2 minutes.

Security and crime detection are also fields in which CCTV has proved its worth. In industrial plants (and especially in national defense plants) CCTV enables a guard to survey an

COVER STORY

Use of telephoto lens on TV camera permits image enlargement 18 times normal size.



AN EYE FOR AN EYE

Closed-circuit TV has given the medical profession a new diagnostic and teaching tool of great value.

THIS month's cover photograph was made during an actual eye operation performed at Hempstead General Hospital, Hempstead, Long Island, New York. This modern hospital—it is only two years old—offers the most completely equipped and staffed facilities for eye treatment and surgery on Long Island.

Very often these days the operating room staff at the hospital is augmented by one new member—the TV cameraman. Many eye operations at Hempstead General are transmitted via closed-circuit television to an adjoining room where physicians and other staff personnel can watch every phase of the operation as easily and close-up as if they were standing over the operating table!

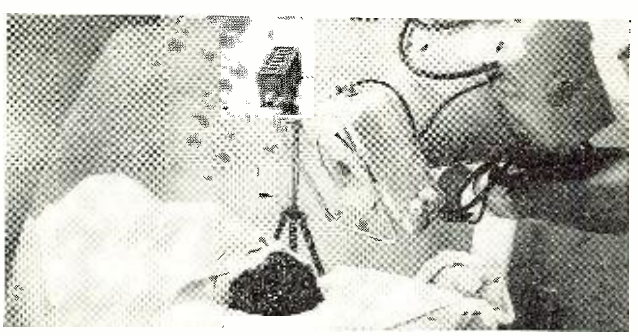
Equipped with a 3-inch telephoto lens, the Blonder-Tongue "Observer TVC-1A" closed-circuit television camera reproduces an image of the eye under surgery on the screen of the video monitor which is 18 times larger than life-size. Every muscle and blood vessel in the eye appears sharp and with excellent contrast as surgery proceeds. Physicians queried about their attitude toward televising surgery said that they would rather watch techniques on a TV screen than sit in an amphitheater.

Medical applications of closed-circuit TV are numerous. Both hospitals and pharmaceutical companies are turning more and more to this new visual medium of communication for instruction, for operational use in x-ray and other radiation treatment, and for medical advertising and promotion. At the University of Kansas Medical Center, the use of closed-circuit TV began seven years ago with the transmission of daily programs of instruction from the operating room of the hospital; expanded to a multitude of uses with color TV pickups made in laboratories, delivery rooms, and other areas in the Center; and now includes classroom use to present each student with a close-up vantage point in any demonstration.

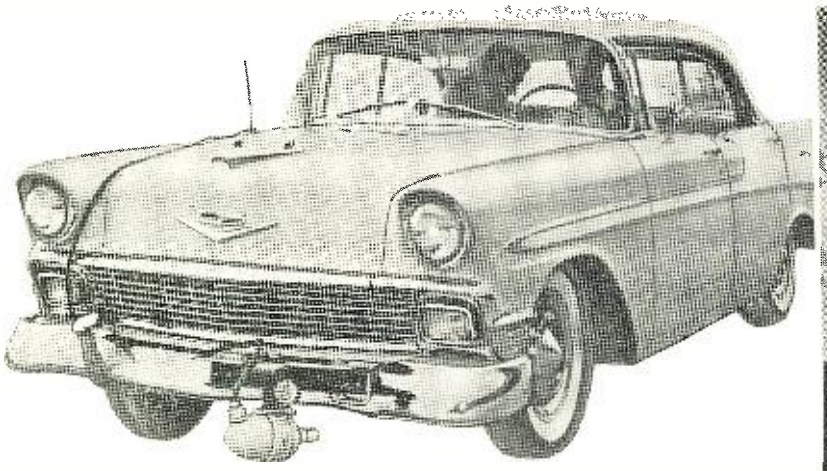
At the Nebraska Psychiatric Institute in Omaha, a closed-circuit TV system is now being used to observe patients under psychiatric care from a remote spot; a projection system in the Institute's auditorium permits several hundred students to view the patient simultaneously during lecture-demonstration sessions.

Color television is especially valuable in medical applications. The General Electric Company now has a color TV chain designed for closed-circuit applications and institutions that can afford its $25,000 cost have found it invaluable in instruction and diagnostic work.

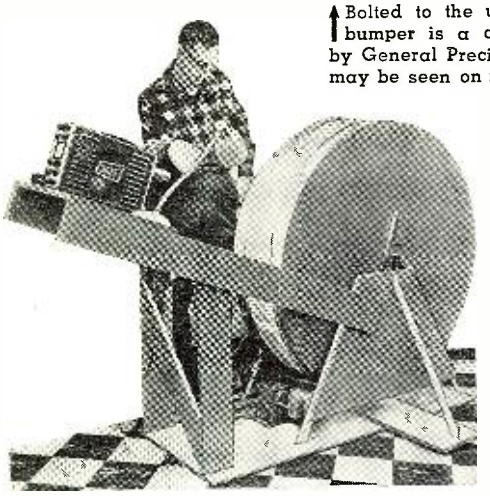
Monochrome closed-circuit television has been reduced in cost to the point where it is well within the budgets of today's hard pressed hospitals. Many are adopting such black-and-white gear as an essential tool of modern hospital operation and medical education. (Cover by Elkin Photography)



Technicians can now administer radiation to patients without danger to themselves. A closed-circuit TV monitor keeps track of treatment in a radiation-shielded control room. This photograph was taken at the Albert Einstein Memorial Hospital.



↑Bolted to the underside of a test car's front bumper is a closed-circuit TV camera made by General Precision. Suspension system action may be seen on monitor in back seat of the car.



TV cameras enable men at the control pulpit to watch movements of large steel slab, and help line up the slab for the maximum shearing accuracy. The closed-circuit TV equipment that is employed here is Radio Corp. of America gear. Industrial type applications such as this make up a rather large amount of present-day CCTV business.

← In the news room of the "Berkshire Eagle," Berkshire, Massachusetts, news bulletins are placed on the huge revolving drum and are transmitted to the street by the Dage television camera shown to the left. Pedestrians on the street may then read the news stories as they are transmitted by the CCTV system.

entire floor, or several entry gates, or a hazardous or restricted area. Cameras spotted around a warehouse discourage pilfering. At the Bambergers Department Store in Newark, N. J., a CCTV system using three cameras trained on small articles counters has cut down shoplifting, not only because of the actual surveillance it makes possible, but because news of the installation has been widely spread to the public. No self-respecting shoplifter feels safe anymore in Bambergers knowing that a lens may be trained on his face anywhere in the store!

CCTV systems have proved invaluable in preventing uncontrolled exposure to radioactivity. The Alfred Einstein Memorial Hospital in Philadelphia uses a CCTV chain which enables an X-ray technician in another room to view a patient who is undergoing radioactive cobalt treatment without danger of overexposure to himself. At several atomic reactor installations CCTV permits surveillance of the reactor from a safe, remote observation position.

CCTV is in very wide industrial use. At the Southwestern Portland Cement Company in Fairborn, Ohio, a CCTV camera perched at the lip of a slurry (mixing) kiln eliminates the hazardous climb up a long ladder formerly required to check slurry flow and spot any signs of congestion. At the Ketchikan Pulp Mill in Alaska, one of the most modern in the world, a CCTV camera is trained on the main 400-ton surge bins to guard against costly overflows—a job formerly done by a man who was in a dangerous position.

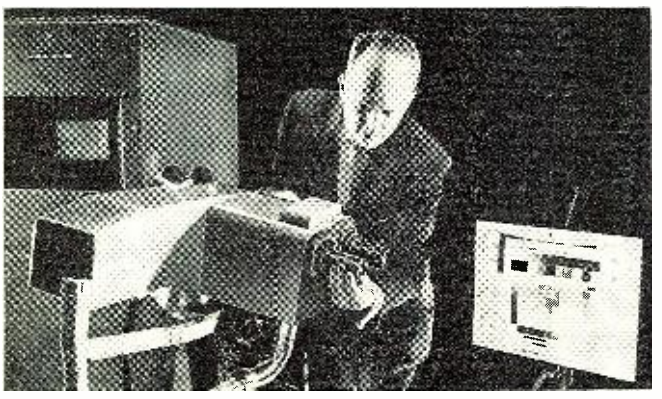
At *Blonder-Tongue Laboratories*, equipment response curves displayed on an oscilloscope at the final production test position are picked up by camera and transmitted to a video monitor placed before the quality control technician seated 120 feet away. By glancing at the screen he can quickly check response quality and maintain production quality.

Education is perhaps the most challenging—and the most controversial—field for CCTV. Educators and congressmen have hailed CCTV as a revolutionary tool that can bring education into step with the nuclear age. Others have condemned it as the first step in the "dehumanization" of the educational process. The controversy rages, but notable experiments with CCTV are already in process.

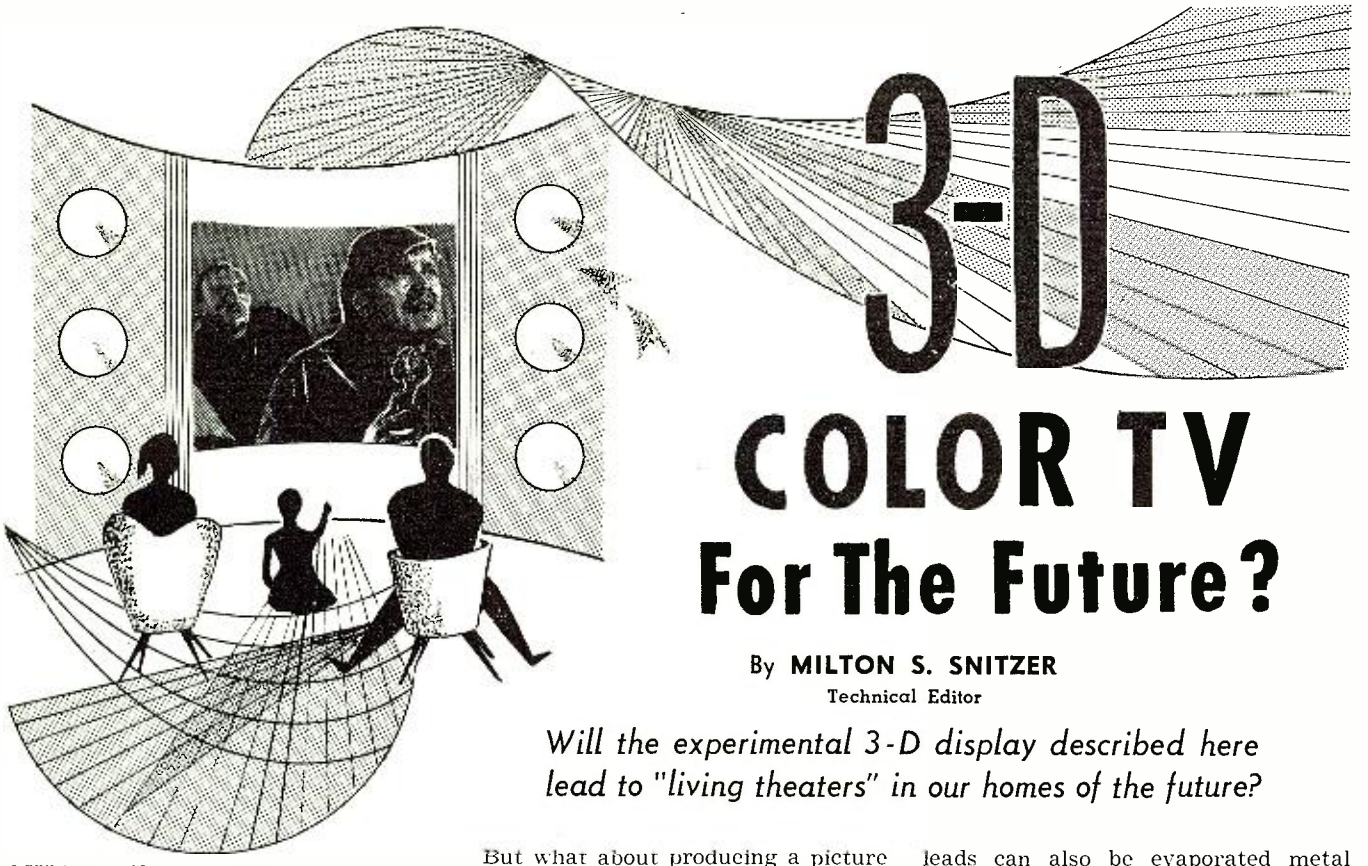
In Hagerstown, Maryland, a five-year pilot project linking 23 schools in a CCTV system went into operation in September 1956. Now a highly competent science teacher performs basic science experiments before a camera while 554 children throughout the system watch their classroom screens with, it is hoped, rapt attention. Simultaneously, a skilled mathematics specialist explains the intricacies of elementary arithmetic to over 500 second-graders *via* the CCTV network. Altogether, instructional programs originate at four different locations simultaneously. The project is sponsored by the Fund for the Advancement of Education, and the Electronic Industries Association (formerly RETMA), with equipment donated by CCTV manufacturers.

The Hagerstown experiment is one of many: in a Phoenix, Arizona high school, biology experiments are transmitted by CCTV to other school rooms; non-English speaking residents of the Chelsea district of New York City are learning English *via* CCTV; at the Dental School of the University of Texas, students watch dental surgery close-up *via* CCTV and ask questions of the instructor at any time by means of a two-way audio

(*Continued on page* 144)



World's first closed-circuit 3-D color TV system was developed by General Electric for AEC. Polarizing glasses, shown here atop special dual-lens color camera, must be worn by the viewer to get the 3-D effect. The new system will provide closeup vision for workers who are remotely servicing nuclear reactors.



3-D COLOR TV For The Future?

By **MILTON S. SNITZER**
Technical Editor

Will the experimental 3-D display described here lead to "living theaters" in our homes of the future?

WHAT will our TV sets of the future be like? Surely we should not have to keep our eyes glued to a rather small flat screen with tiny flat figures on it. Just imagine what depth and realism could come from a large three-dimensional colored image —just like a real-life play right in our own living rooms. This would not be an optical illusion but real 3-D.

Some 3-D Methods

The movie industry has experimented with two methods that can give the illusion of depth. In one, two differently colored images are superimposed on the flat screen. If the viewer then sees these through special glasses whose lenses match the colors of the images, he will see one image with one eye and another image with the other eye. The two separate pictures are combined in the mind of the viewer to produce a 3-D picture.

Another idea is to project one image with light that is polarized in one direction, and project the other image with light polarized in another direction. Again, special glasses made up of polarized light filters could be used to produce the two separate pictures needed for 3-D. With this second method, full-color pictures can be given depth and realism.

Recently, *General Electric* has developed the world's first 3-D color television system for remote servicing of nuclear reactors. This system is strictly a closed-circuit setup that is not currently feasible for the living room. The technician who will view the picture will use special polarizing glasses like those used for 3-D movies.

But what about producing a picture that has true depth and does not require special glasses or other illusion techniques? The 3-D display device to be described may provide the answer.

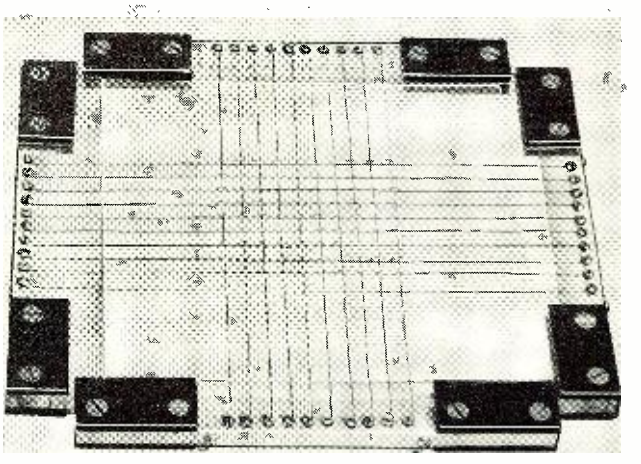
3-D Electroflor

Electroflors are certain new materials that can store electrical energy. When an indicating material is added, the combination will give off light if electrically stimulated by fairly low voltages. Normally the material is crystal-clear. About 50 electroflors are available from such companies as *Shannon Luminous Materials Co.*, Hollywood, Calif. with a variety of colors and storage times.

In practice, a flat glass or plastic plate with a series of tiny holes may be used. A gridwork of fine wires criss-cross each hole, which is filled with the electroflor and sealed. The leads can also be evaporated metal coatings, thin enough to remain transparent. With 500 leads on a side and a 25-inch square, definition about equal to a conventional TV picture tube may be had. The plates may be made as large as needed.

By the use of 3 thin plates sandwiched together, each of which glows with a primary color, it is possible to produce a full-color display. Then by stacking a number of such plates together to any desired thickness a true 3-D display is produced. Experimental versions of such displays have already been made. Of course special scanning signals would have to be used to produce a TV-like raster.

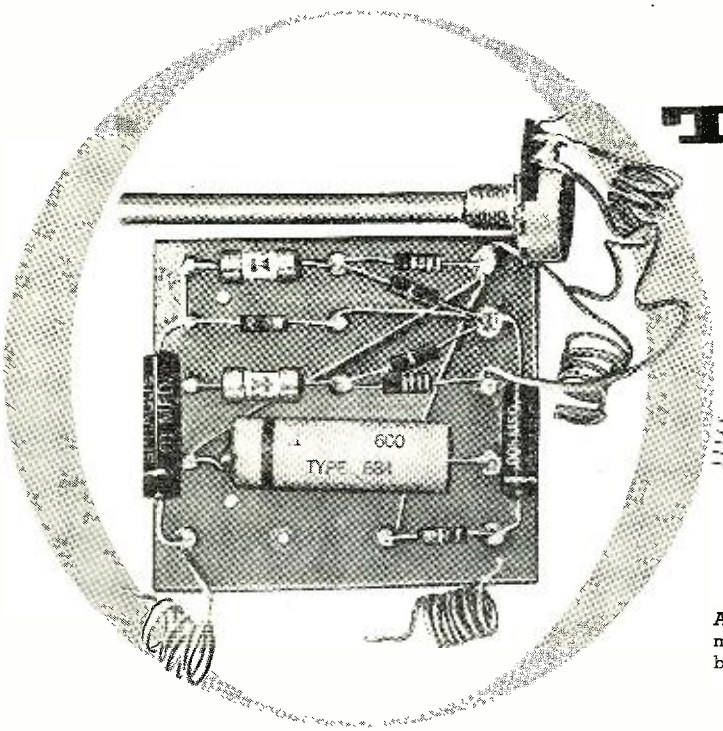
Perhaps after we have added color and depth to our TV of the future, we may want to make the display even more real by adding odors. Can't you smell that sizzling steak now? —30—

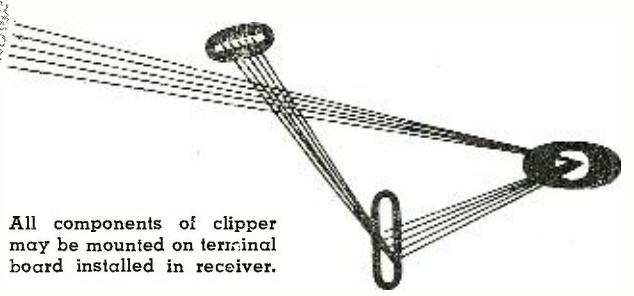


Experimental unit made up of two sets of wire electrodes at right angles to each other supported and insulated on a glass plate. Tiny holes at the intersections of the wires are filled with a transparent electroflor and the assembly is sealed. The electroflor will fluoresce and give off light of various colors when electrically stimulated. Any number of these flat plates may be stacked together to produce a true 3-D display device.

The Zero Clipper

By HECTOR E. FRENCH, W1JKZ





All components of clipper may be mounted on terminal board installed in receiver.

Simple dual crystal noise clipper may be added to receiver for improved ham phone or s.w. listening.

BACKGROUND noise is always a problem in short-wave communication. It always seems that the station you want to hear is just loud enough to be tantalizing. A word or two comes through now and then, but not enough of them to be useful. And even when the words are all understandable, the background noise is often loud enough to be objectionable on a rather large percentage of the stations.

This problem differs at the different frequencies. At the lower communication frequencies, which are usually more crowded, the problem is more apt to be interference from other stations. It's at the higher frequencies that the background noise really gets enthusiastic. You'll find spots on the dial where the galaxy itself—our own Milky Way—adds its own contribution of background noise in your receiver, just to make your job of picking out weak signals a little bit harder.

In fact, a certain amount of background noise seems to be built right into the universe. Physicists tell us that every body hotter than absolute zero will radiate energy. And since the cathodes of the vacuum tubes are much hotter than anything else in a receiver, you can expect the tubes to contribute to this background noise energy. Some of this background noise is even caused by individual electrons trying to make up their minds whether to stop at the screen or whether to keep on going all the way to the plate!

There are a number of ways to improve the signal-to-noise ratio for small signals, at your receiver. One way is to use a conventional tone control. Much of the noise usually appears to be in the 1000 to 3000 cycle range of frequencies, where the human ear is the most sensitive. Unfortunately, this is also the range of frequencies that carry most of the information in a speech signal. By the time the tone control has been turned up far enough to cut off some of the background noise, it has also cut off some of the signal. Instead of a tone control, then, you might use a sharp filter, to cut off any noise components outside of this speech range of frequencies.

Another trick which helps cut down the apparent background noise uses an audio system which is as free as possible from resonant peaks. With such peaks, some sharp noise pulse, as from automobile ignition or a syllable of speech, will throw some part of the system into a train of damped oscillations and make the noise sound louder than it really is.

Another common way to improve the signal-to-noise ratio is to use a peak clipper circuit. This circuit is based on a rectifier which lets ordinary audio signals through without affecting them but which clips off any sharp pulse-type interference (as from automobile ignition) that is higher than the signal. This keeps the audio system from being shocked into a damped oscillation with every sharp pulse of interference. However, this kind of circuit doesn't help cut down background noise, because the noise peaks don't stick up far enough above the signal so the rectifier circuit can have something to work on.

In order to cut down on the background noise, let's first look into the characteristics of a speech signal, in comparison with the background noise. If this were done on an oscilloscope, there is one important difference that would become apparent right away: the speech signal looks like a series of pulses of audio energy, while the background noise is continuous. Communication by speech is apparently carried out by these bursts of audio energy, with each burst being a syllable. These syllables are shown, along with background noise, in the first waveform of Fig. 4.

This difference—between the "pulse-modulation" communication of speech and the steady interference of the background noise—is the clue toward a method of improving the apparent signal-to-noise ratio. If the actual communication is carried out by the pulses, it should be possible to design a circuit to let the pulses through and hold back the steady background noise. This should not only improve the signal-to-noise ratio but should also trick the ear into thinking there's even less noise left than there really is, since the ear won't have to strain so hard to try hearing every word as it comes popping up out of the noise.

Fig. 1 shows the first circuit designed to check out this method of improving the apparent signal-to-noise ratio. This circuit uses a pair of shunt diodes, which act like a pair of normally closed switches. Each diode "switch" across the audio circuit stays closed until the signal is higher than a certain "trigger" value, which is determined by the setting of the 2-megohm control. As soon as the signal is above this "trigger" value, the diode switch opens (because each diode plate is then negative with re-

spect to its cathode) and allows the signal to pass through. In this way, each time a syllable comes along as a burst, or pulse, of audio energy, the diode switch opens and allows the signal to pass through. As soon as the syllable is through, the diode switch closes and shorts out the background noise. This circuit would be called a "zero clipper," because it eliminates everything from zero volts *up* to a certain "trigger" value, while the peak clipper eliminates everything from a peak value *down* to a similar "trigger" value.

In operation, this circuit was a definite help in improving the apparent signal-to-noise ratio, especially when the background noise seemed to be just about as loud as the signal. Listening tests, both with experienced phone operators and with people who had never heard short-wave signals, showed that the zero clipper would make the difference between getting the information and not getting it.

However, this circuit does have definite disadvantages. It requires a vacuum-tube dual-diode (a 6AL5 was used here), a heater supply, a tube socket, and space on the chassis to mount the tube. In addition, this circuit required a change in the output stage cathode circuit, to take care of the d.c. component at the output of the clipper circuit.

Most of these problems are overcome in the series circuit of Fig. 2, which uses a pair of 1N34 semiconductor diodes in place of a pair of thermionic vacuum-tube diodes. This eliminates the tube and tube socket, uses fewer parts, takes up less space, requires no heater current, radiates no heat, and is easier to install in existing equipment. Just as was the case in the preceding circuit, the rectifiers here act as switches. However, with this circuit, the switches are in series with the audio line, rather than across the audio line. Because of this, the diode "switches" must remain open for all voltages between zero and the "trigger" value and close for voltages above this value. With the switches open, the circuit reduces to a straightforward resistance attenuator circuit, which lets only a small percentage of the signal through. The attenuation of between-syllable noise is theoretically around 20 db.

With this circuit, when a syllable sends the input voltage to the zero clipper higher than the "trigger" value, which is set by the 2-megohm control, the diode switch closes and the signal passes through. After the syllable is finished, the between-syllable noise is not high enough to pass through the diodes and, instead, must pass through the resistances. Or, expressed in another way, the background noise has to go *through* a 1-megohm resistor, while the signals go *around* the resistor.

This circuit works even better than the shunt-diode circuit. One very important improvement, in addition to the ones outlined a few paragraphs ago, is that this circuit causes much less signal loss than the earlier shunt circuit using vacuum tubes. Also, with this circuit using semiconductors, the transition from "switch open" to "switch closed" is not as abrupt as with a thermionic diode, which results in less audio distortion. This is given in Fig. 3, which shows a sine-wave signal and its appearance after passing through the zero clipper circuit. If the diodes were theoretically perfect switches, the output from a sine-wave input would be an approximate sine wave having a sharp irregularity near the zero voltage axis. However, since the diodes in this circuit are not perfect diodes, the distortion is not as bad as the figure would show. Instead, the zero clipper output will have a moderate amount of third and fifth harmonic distortion caused by the square-law rectification of these diodes at small signal levels.

Fig. 4 shows what happens to a phone signal which is unfortunate enough to sound at about the same level as the background noise. The first example, Fig. 4A, shows how the syllables are actually higher than the noise, but that the noise sounds just as loud as the signal because the noise is present all the time, while the signal is intermittent. The psychological effect is to make the noise sound louder than it really is. The second example, in Fig. 4B, shows the "trigger" level at which the zero clipper is to operate; signals between this level and zero are to be wiped out, while the voltages more positive or more negative than the trigger levels are to pass through. Fig. 4C shows what the signal looks like after the zero clipper has operated on the signal. Here, each syllable comes through with its own share of noise plus added distortion—but the noise between syllables is wiped out.

The photograph shows one of the series-type zero clipper circuits, built on a punched board taken from a piece of experimental commercial

(*Continued on page* 118)

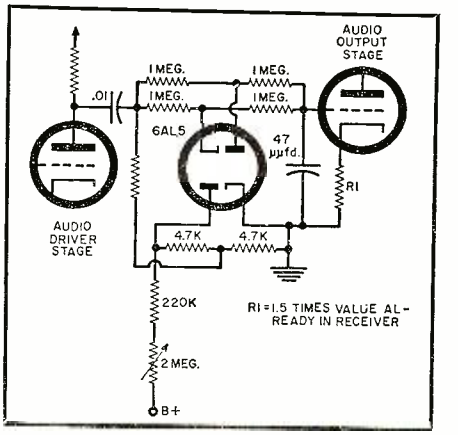


Fig. 1. Shunt type zero clipper requires vacuum tube and changes in output circuit.

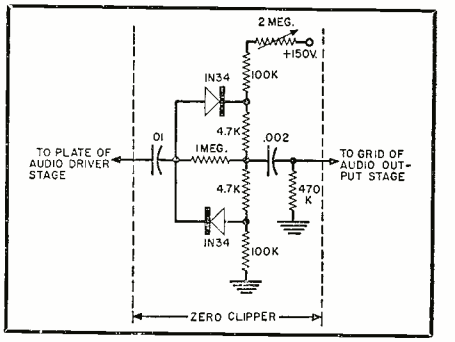


Fig. 2. Series type zero clipper using crystal diodes. No circuit changes needed.

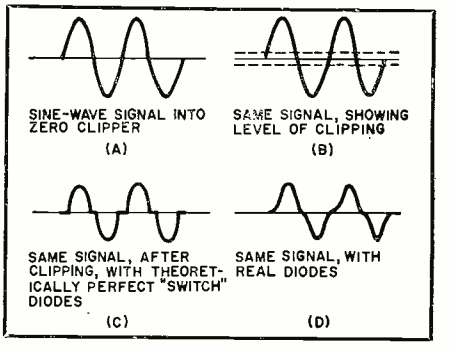


Fig. 3. Operation of zero clipper on a sine-wave signal is shown in this figure.

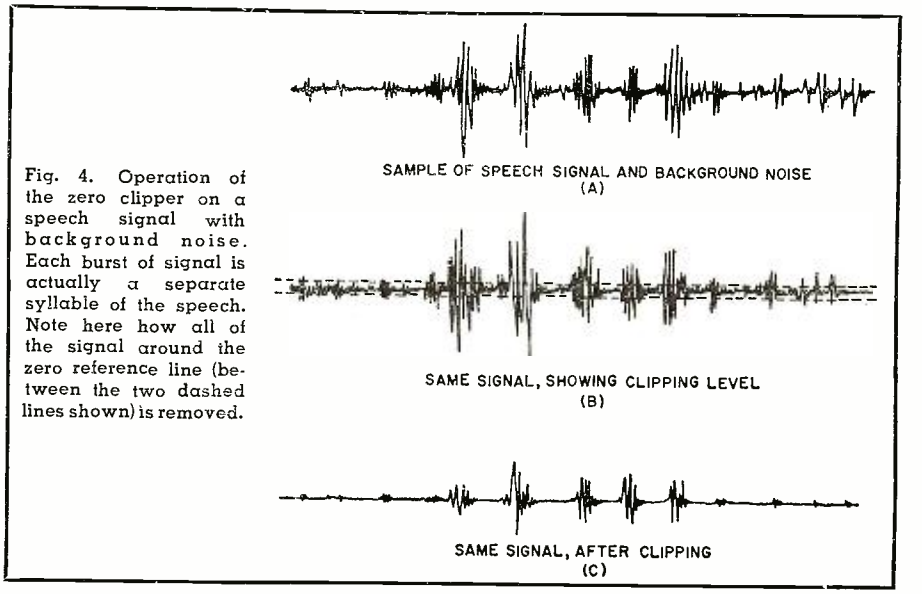


Fig. 4. Operation of the zero clipper on a speech signal with background noise. Each burst of signal is actually a separate syllable of the speech. Note here how all of the signal around the zero reference line (between the two dashed lines shown) is removed.

The Cable Tracer-Checker

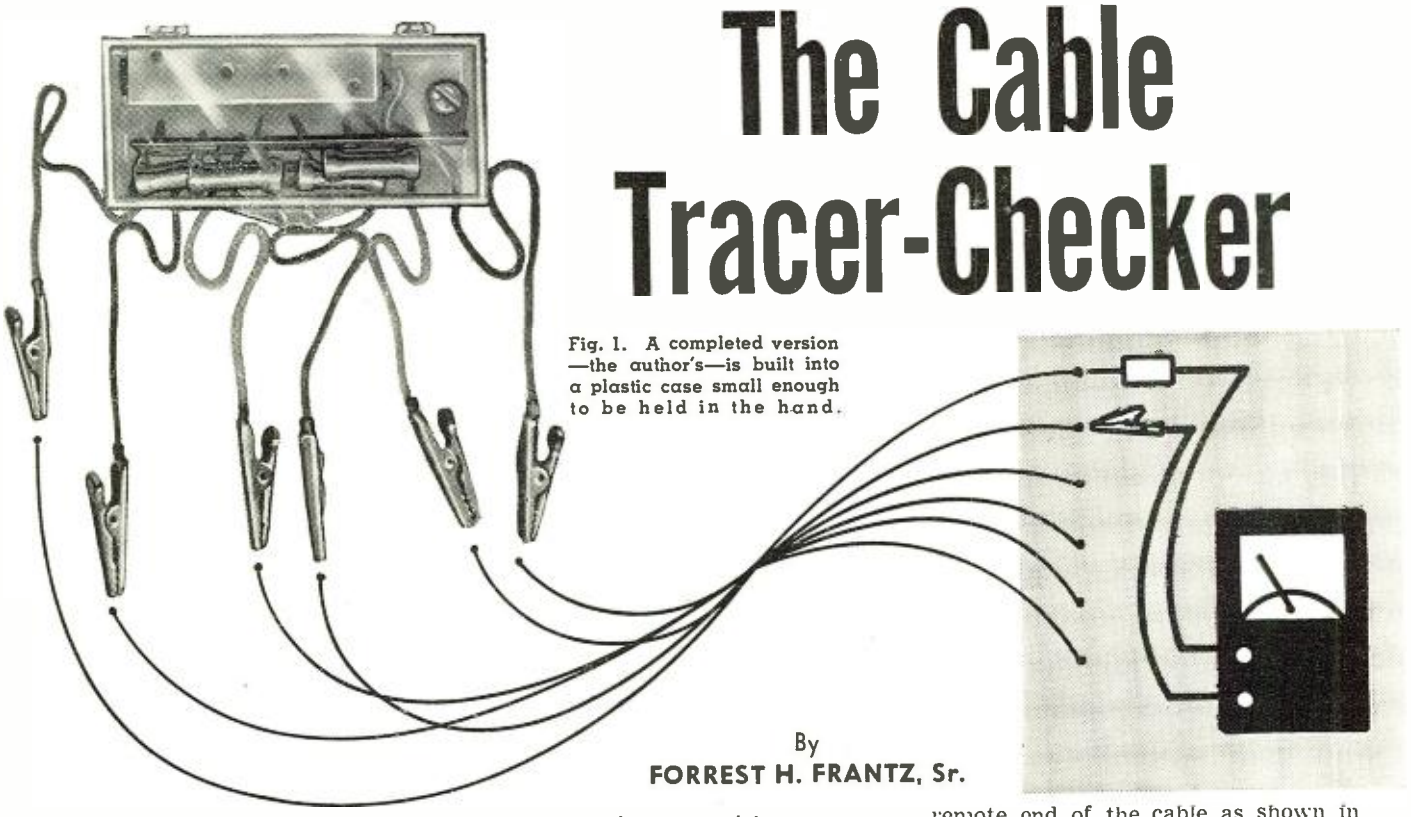


Fig. 1. A completed version —the author's—is built into a plastic case small enough to be held in the hand.

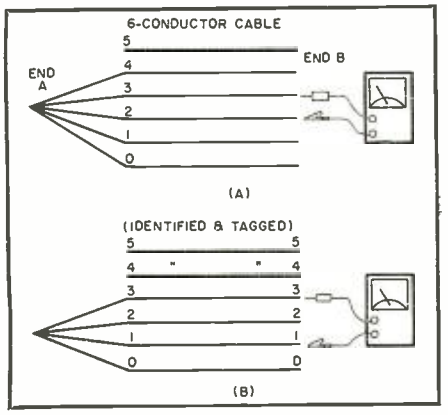
By
FORREST H. FRANTZ, Sr.

Does lead identification in multi-conductor cables annoy you? Try this sure-fire, rapid technique.

WHEREVER the electronic technician encounters multi-conductor cables, whether it be in industrial work, intercommunication-system service, or any other branch of the field, he is likely to run into an exasperating situation. The problem arises whenever the conductors in a cable are not color coded or when someone has switched the colored leads at a splice. The trouble is more likely to be met in older installations or amateur installations. The question: how to identify the uncoded or mis-coded conductors? This problem is also occasionally encountered within the chassis of a single piece of electronic gear or in inter-chassis cabling.

One way to solve the problem is to connect all but one of the conductors together at one end of the cable (end *A*) and look at the other end (*B*) for the conductor that is free with an ohmmeter, as shown in Fig. 2A. When this conductor is located and tagged, a second conductor may be disconnected from the common connection, as shown in Fig. 2B. This conductor may then be located and tagged and the process may be repeated until all of the conductors have been identified.

Fig. 2. Steps in the basic method for identifying conductors in a cable.



This procedure is tedious. If the distance between the ends of the cable is great, the job can consume a good bit of time and energy. There are ways in which this basic procedure may be simplified, but they're hardly worth exploiting. Why? Because an extremely inexpensive and simple accessory can be built to make cable tracing a snap. This accessory reduces cable tracing to a pat procedure and makes it possible to identify conductors in a matter of minutes. Furthermore, this accessory may be used to find shorts and opens in a multi-conductor cable rapidly.

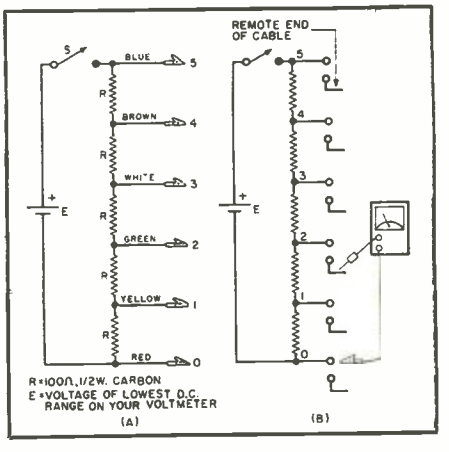
The accessory is the "Cable Tracer-Checker," shown in Fig. 1. It consists of a penlite battery voltage source and a voltage divider made up of five 100-ohm resistors. The tracer-checker is used with a voltmeter. The type of voltmeter you use will generally determine the battery voltage. The accessory described is good for checking six lines at a time, but, by increasing the number of resistors, you can increase the line handling capacity. The schematic is shown in Fig. 3A.

To use the unit, connect it to the remote end of the cable as shown in Fig. 3B. Assume conductor number 0 to be an additional wire external to the cable for the moment. Connect the negative terminal of the voltmeter to it. The battery voltage *E* should be equal to the voltage of a convenient scale on your voltmeter.

The author's meter has a 1.5-volt range, so he used a 1.5-volt battery. This meter, it so happens, also has a 5-volt range. Thus, when the positive meter lead is connected to conductor number 1, the meter conveniently reads "1" on the *5-volt* meter scale. This conductor is then tagged. When the unknown conductor which the positive meter lead touches is number 3, the meter will read 3 on the 5-volt scale. When number 4 is touched, the meter reads 4. Thus, any cable with six or fewer wires can be checked and identified quickly. While not all me-

(*Continued on page* 137)

Fig. 3. Schematic (A) for the cable tracer-checker. In practice, it is used in conjunction with a voltmeter (B).



Microphones for Tape Recorders

By **NORMAN H. CROWHURST**

Tina Robin, recording star for Coral Records, makes a tape on the Tandberg recorder.

Get more fun and greater use from your present tape recorder by adding a better microphone.

A HOME tape recorder is probably one of the most versatile possessions one can have, both in providing entertainment or in doing many useful jobs. You may have bought it in the first place for the purpose of recording your own voice and that of your friends but it has many other uses. For example, this article is being dictated into a home recorder. The author also uses the same recorder quite frequently for "writing" letters to friends in different parts of the world.

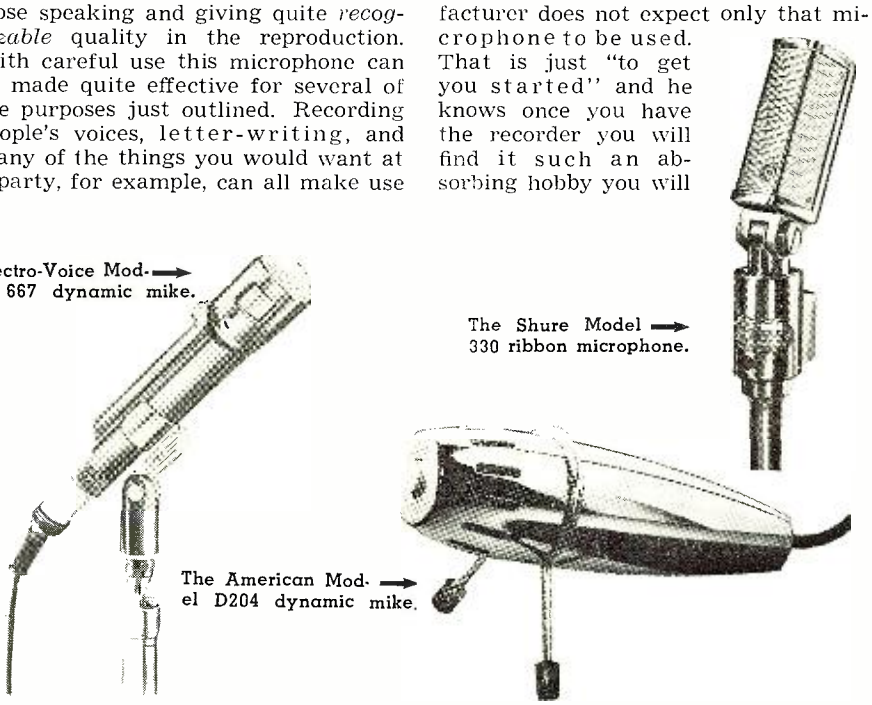
Real fun can be had with a tape recorder at a party, either playing deliberate games built around the tape recorder or just leaving the recorder on to pick up random conversation. If you have some friends or members of the family who are musical, making recordings of their efforts can be an extremely interesting hobby. Recording junior's school graduation or, when friends or relatives get married, making a recording of the wedding ceremony as a present to the newlyweds will be much appreciated, both now and in the years to come.

The recording of local concerts, musical groups, or other functions, is something that will always be appreciated in the community. If you are a home movie fan, another thing you can do with your tape recorder is to make a recorded commentary as a "sound track" for your movies. This does not need accurate synchronization as a rule, if the commentary merely relates the events or background of the scenes being seen at the moment.

There are applications, such as recording programs off the air, which do not require a microphone. But notice that all the uses we've just mentioned require the use of a microphone and proper technique in the use of the microphone is necessary if you are to get the maximum enjoyment from your home recorder.

All home recorders come with a small microphone, usually intended for close speaking and giving quite *recognizable* quality in the reproduction. With careful use this microphone can be made quite effective for several of the purposes just outlined. Recording people's voices, letter-writing, and many of the things you would want at a party, for example, can all make use of the microphone that comes with the machine.

In a pinch it can probably be used for some of the other jobs too, but better results can be obtained by using a better microphone. The one that comes with the recorder is usually a low-cost unit, so the recorder can be sold at a competitive price. The recorder manufacturer does not expect only that microphone to be used. That is just "to get you started" and he knows once you have the recorder you will find it such an absorbing hobby you will



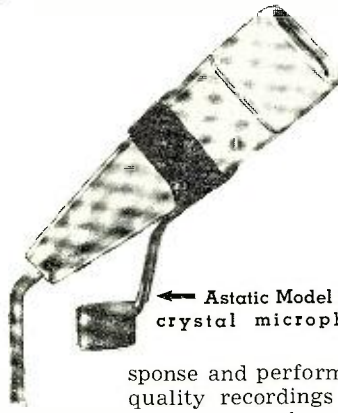
Electro-Voice Model 667 dynamic mike.

The Shure Model 330 ribbon microphone.

The American Model D204 dynamic mike.

Altec Lansing Model 680A dynamic mike.

The Fen-tone "Ribbonette" microphone.



Astatic Model M-332 crystal microphone.

Telefunken Model ELA M410 dynamic mike.

probably go for a better microphone.

Home recorders do not come with better microphones for two reasons: (1) The extra cost would add to the price tag and make the buy uncompetitive. (2) Choice of a better microphone should be up to the user, for reasons we shall presently see. And when you buy a better microphone, the one you already have is not necessarily a dead loss. It still has its uses.

Usually the type of microphone that comes with the recorder has been chosen because of its good intelligibility. It may still be the best unit to use for letter writing, dictating, or recording people's voices close to. The better microphones are usually of more use in picking up at longer range, because it is in this sphere that the low-cost microphone does not perform so well (because of its usually irregular peaky response that causes it to be frequency selective in reverberation pickup). They may also have improved response and performance so that better quality recordings may be made. So you want to know how to choose a satisfactory microphone for the other jobs that the original microphone does not serve so well.

Mounting the Microphone

Probably the first thing to decide is the kind of mounting your microphone should have. Most professional microphones, and many of the lower cost ones suitable for the home user, come as a separate "head" that may be attached to any kind of mounting, such as a handle to hold in the hand, a table stand, desk stand, or floor stand, according to the use desired. Other microphones come complete with their mounting, such as a desk stand, a table stand, a hand mounting, or the lavalier type microphone that can be hung around the neck and worn on the chest, or complete with a floor stand.

Some come with a complete interchangeable arrangement, adaptable to two or three of these methods. The best thing to do is to figure out how many ways you want to use the microphone based on where you plan to use it and then buy one that will serve all of these purposes reasonably well. It can be very exasperating to take the tape recorder and microphone along with you somewhere to make a recording and then find you have nowhere to put the microphone, no convenient "sky hooks" to hang it on!

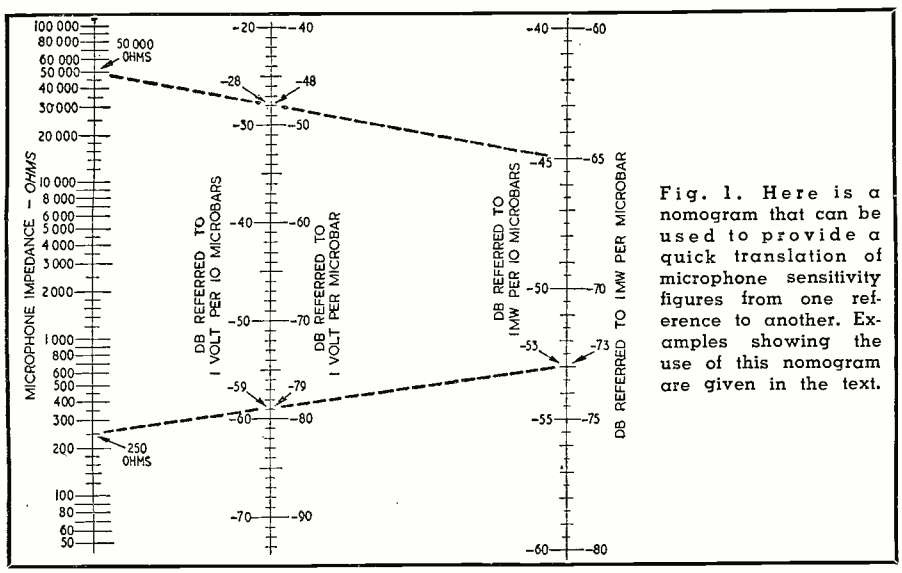


Fig. 1. Here is a nomogram that can be used to provide a quick translation of microphone sensitivity figures from one reference to another. Examples showing the use of this nomogram are given in the text.

Mike Technique

The microphone that comes with the recorder usually works best when a person speaks quite closely into it, at a distance of not more than 6 inches, for example. If you put the microphone down in a room somewhere, on a table or stand, and try to pick up sounds from all over the room, you will find you need to turn the volume of the recorder all the way up. Then sounds from all over the room may be audible when you play the tape back at the same level.

There may also be considerable hum because the recorder does not work as well when all the gain is used for both record and playback. It really means, too, that you are not getting enough onto the tape, to get background noise and hum reasonably below the sounds to which you want to listen.

But there is another thing you will probably notice if you use the microphone that came with the recorder in this way. The sounds all over the room are accompanied by a lot of echo that you don't notice listening to the sound in the ordinary way. This is because the listening faculty in our brain is able, by the use of our two ears, to differentiate the sounds picked up, and "listen" specifically to sounds you want to hear while rejecting others.

This means that, in normal listening, we subconsciously reject the reverberation of the room, the echo around the walls, and act as if it were not there. We can only do this because of our two-eared listening faculty that enables the brain to differentiate between the original sound we want to hear and its echo after having traveled around the room.

No microphone can discriminate in this way. It picks up the original sound together with its echo and, when recorded together on the tape, our listening faculty has lost the capability of separating. This is because, when played back, both groups of sound come out of the same loudspeaker *together*. The original sound no longer comes directly from the voices of the people, or the musical instruments, or whatever it may be, while the reverberation comes from different walls of the room. All of it comes from the loudspeaker.

This is why we need some "microphone technique" to make the best use of the sound in recording. We need to get a realistic impression which requires that we pick up a "balanced" mixture of sound, so it plays back as near as possible a resemblance of the original sound. To do this with many microphones we either have to speak more closely to the microphone or have the microphone closer to the source of sound, the musical instrument or whatever it is.

The alternative is to use a microphone with a directional characteristic that "listens" more in the direction of the sound we want to pick up than in

the various directions from which the echo may come.

Frequency Response

There is another difference between the low-cost microphone that came with the recorder and the high-quality one you should use for making recordings of music, or even other kinds of sound, where the microphone is at a greater distance from the source of sound. This is in the frequency characteristic of the microphone. For the small close-talking microphones, the design is usually made somewhat "peaky" or with resonances.

Skillful design in this way can give speech a "crisp" reproduction that makes it rather pleasant to listen to and gives a satisfactory and recognizable characterization of the person's voice. When the same microphone is used at a greater distance, with more amplification, the resonance of the microphone interacts with the echo from the room to produce a most unpleasant effect. That added crispness and a pleasant tone for picking up voice close to, now produces a hollow ringing sound to the echo components that are recorded along with the sounds you really want to hear.

To avoid this, the higher quality microphones have a much smoother frequency response and avoid the peaky method of gaining sensitivity as well as providing some discrimination in what they pick up.

Sensitivity and Impedance

There are two more important characteristics you need to know in buying a microphone to use with your tape recorder. These are its sensitivity and its impedance. Microphones differ widely in the sensitivity, that is, the amount of electrical output they provide for a given sound input. A less *sensitive* microphone may not give sufficient electrical output to work satisfactorily with your recorder.

The other thing—*impedance*—has to be right in order to make proper use of the electrical output that the microphone gives. If your recorder is designed to work with a high-impedance microphone, which is the usual arrangement, a low-impedance microphone will be almost "dead," even though it is sensitive enough with the right recorder input connections. If your recorder comes with a low-impedance input then a low-impedance microphone would be satisfactory.

Low-impedance microphones are used for professional work because they enable longer leads to be used between the microphone and the amplifier or recorder than are possible with high-impedance microphones. But for home recording use, the distance between the microphone and the recorder can usually be kept to not more than, say, 10 or 12 feet which is satisfactory for many high-impedance microphone applications.

Let's see what difference in sensitivity can mean. The standard microphone sensitivity, used for broadcasting purposes, gives an output rated at −55 db. This can mean two things according to whether the microphone is low or high impedance. For a high-impedance microphone −55 db means the output voltage for a sound pressure of 1 microbar is −55 db (about 2 mv.) relative to 1 volt electrical output.

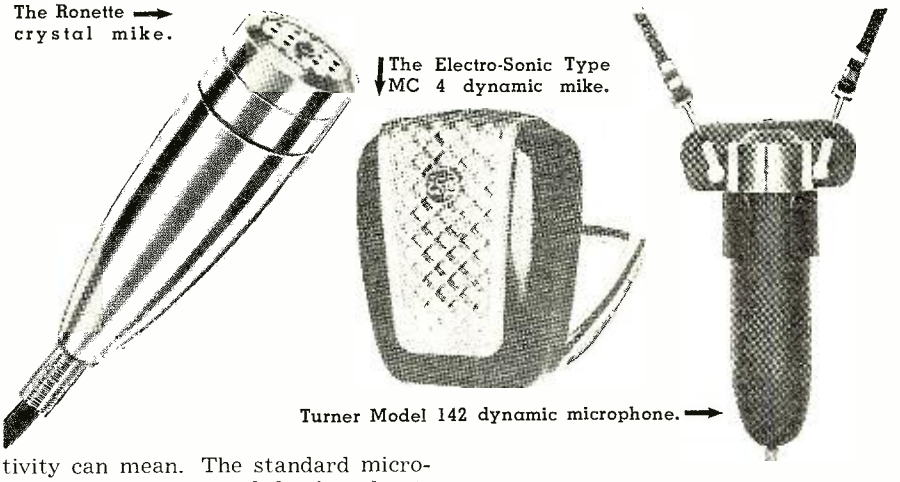
A sound level of 1 microbar is quite a small sound—nothing like close-talking, so some manufacturers will list instead the output level for 10 microbars. If the same microphone, rated at −55 db for 1 microbar, is rated for 10 microbars, the rating becomes −35 db.

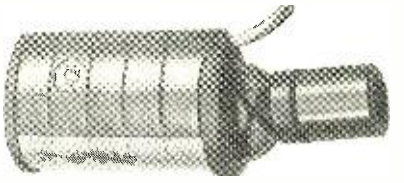
For a low-impedance microphone, the reference, instead of being 1 volt for a microbar of sound, is 1 milliwatt for 10 microbars. This is almost universal and the level corresponding to a sensitivity of −55 db, after an appropriate input transformer has been used in the recorder, comes out pretty much the same as −55 db referred to 1 volt per microbar from the high-impedance microphone.

The important thing in comparing sensitivity is to make sure of the reference level. A specification which merely says that the microphone has a sensitivity of −43 db means nothing unless you can find somewhere what the reference level is. Even then, of course, the use of so many different reference levels can make things quite confusing. So to aid in making transfers from one method of reference to another, the chart of Fig. 1 can be a great help.

If a low-impedance microphone is rated in reference to 1 volt per microbar (as some are), its output with reference to 1 milliwatt per 10 microbars can be obtained by aligning its impedance on the left scale with the volt-per-microbar reading on the center scale and reading off the milliwatts-per-10-microbar rating on the right scale.

When looking for a new microphone you will need one at least as sensitive as the one that came with the recorder or else you will need a preamplifier to get sufficient amplification for the long distance pickup you intend to use with the better microphone. (*Editor's Note: Most home recorders require micro-*





RCA Type SK-45B dynamic microphone.

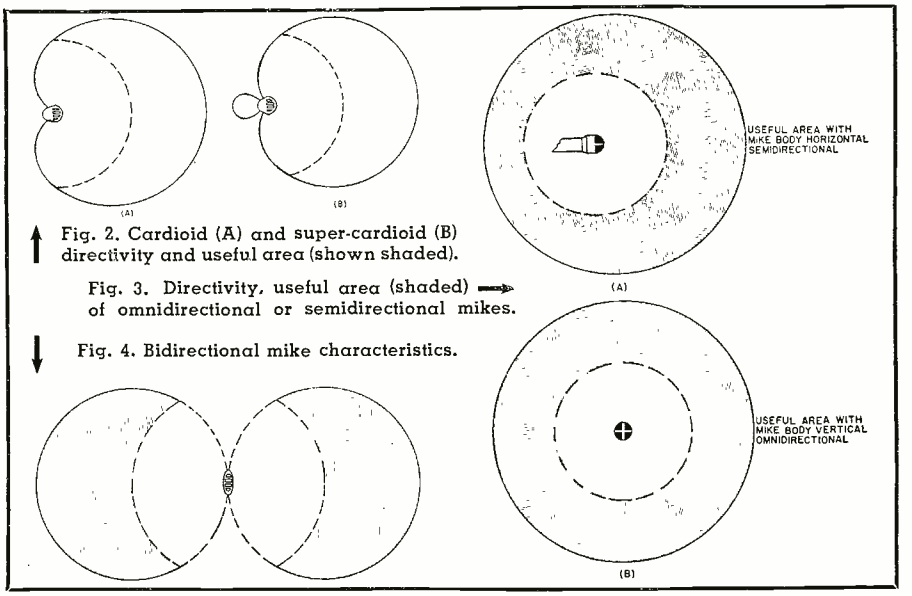


Fig. 2. Cardioid (A) and super-cardioid (B) directivity and useful area (shown shaded).

Fig. 3. Directivity, useful area (shaded) of omnidirectional or semidirectional mikes.

Fig. 4. Bidirectional mike characteristics.

phone sensitivites of −55 db or better in order that hum does not become a problem. With professional-type recorders a less sensitive microphone, −60 db or better, may usually be used.) The first thing to do is to find out the sensitivity of the microphone you already have. This you can do by finding out whose microphone it is and then looking it up in the maker's catalogue.

You may find the microphone has a sensitivity of about −53 db (some even have a sensitivity as high as −45 db). If you have one of these high-sensitivity microphones (usually crystal), the only way to get better performance will be to use a preamplifier with a somewhat lower-sensitivity, long-range microphone. The best suggestion here is a small microphone preamplifier, transistor operated. A few of these have already become available and it is expected in the near future that many more of this type of preamplifier will appear on the market.

The transistor type is particularly good because it can be battery-operated. The drain on the battery is very low and the battery will last a long time. It is easy to make these preamplifiers hum free and of good, low distortion. Consequently transistorized microphone preamplifiers are simple and inexpensive items to manufacture.

But once again you will need to make sure the input and output impedance are suitable for the microphone and the recorder input respectively. As a good many lower priced microphones come either in alternative impedance ratings or with an adjustment to make the same unit adaptable to both, this would be no problem as long as you make sure you have the right impedance.

Dynamic Types

Microphones are usually typed by the kind of transducer element—the thing that converts sound waves into electrical currents—that the microphone uses. A dynamic microphone uses a moving coil and is like a moving coil loudspeaker, only very much smaller. It has a low-impedance basic element which may be stepped up by means of a built-in transformer. The simplest type of dynamic microphone has what is known as an omnidirectional response—it picks up sounds coming from all directions almost uniformly, as shown in Fig. 3.

A good dynamic microphone, even of relatively low cost, has a fairly smooth frequency response and is better than the average microphone that comes with the tape recorder. From this viewpoint, however, because of its usually being omnidirectional, the sounds should never be more than about two feet away from the microphone otherwise it will tend to exaggerate echo effects from the room.

A small musical group could use one of these microphones by having the musicians arranged around the microphone so that all of them are fairly close to it. This is an unconventional arrangement for an orchestral group, but one that probably your friends may be prepared to adopt as a compromise in the interest of getting a good quality recording.

Dynamic microphones are also made in cardioid and other directional patterns. A cardioid response picks up principally from the front, with a fairly wide "fringe" at the sides, represented by the pattern of Fig. 2A. Some directional microphones have a super- or ultra-cardioid pattern in which the compensation is re-adjusted so as to get a narrower frontal response, as shown in Fig. 2B.

These pickup patterns are more useful for most work where you do not want to have the microphone too close to the source of sound—the musical group or the people speaking. Just point the microphone in their general direction and this will automatically reduce the amount of pickup from other directions.

Crystal and Ceramic Types

Crystal and ceramic type microphones always come in high impedance only. So, if your recorder has only a low impedance input, do not consider this type. However, as most home recorders do have high-impedance inputs, crystal or ceramic microphones can be employed. Their response is not quite as uniform, as a rule, as the dynamic type, but a good crystal or ceramic type microphone can give very good results in combination with a home tape recorder and because of their inherently higher sensitivity any necessity for a preamplifier can often be avoided.

Crystal microphones have a higher sensitivity than the same model using ceramic, but for this loss in sensitivity with the newer type (about 5 to 8 db difference) ceramics *can* be designed with better response than crystals, and also ceramics are not so susceptible to excessive humidity and temperature extremes as are most crystals. Otherwise their properties are very similar.

Some of these microphones are produced with a cardioid response, which enables them to be directional and give the advantage of this particular characteristic. The cardioid construction with a crystal or ceramic device loses some of its inherent sensitivity, but a unit with "variable-D," or what the experts call constant-phase difference, achieves a sensitivity in the normal range. For some tape recorders these mikes will require a preamplifier.

Magnetic and Carbon Mikes

Controlled reluctance or magnetic microphones come pretty much in the same category as the lower cost crystal microphones and are used almost interchangeably with the low-cost microphones that come with the recorder. Their principal usefulness is for close talking as we have already mentioned. Carbon microphones, which are generally the least expensive type, probably have the lowest fidelity of response and may be troubled with carbon "hiss" or "packing." For this reason this type is not generally used as a recording microphone despite the fact that its output sensitivity is the highest of all the types.

Condenser Types

Condenser microphones fall into the "high-cost" bracket and have a performance that is usually much better than warranted with a home recorder. After all, there is no point in buying a very expensive microphone that pro-

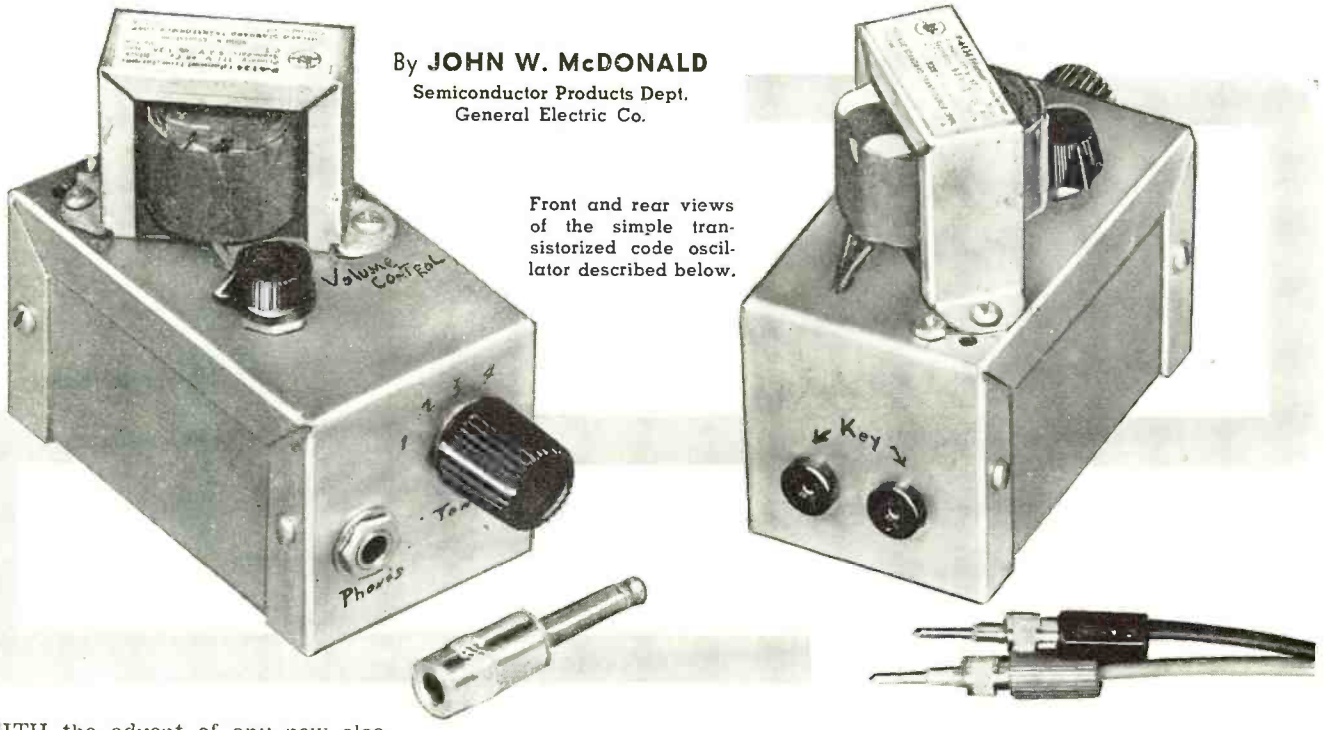
(*Continued on page* 129)

Table 1. Summary of a number of important comparative characteristics of the general types of microphones discussed.

TYPE	PRICE RANGE	DIRECTIONALITY	SENSITIVITY	IMPEDANCE	FREQUENCY RANGE	FREQUENCY SMOOTHNESS	APPLICATION
Dynamic	Low-medium	Omni- or semi-	Medium-high	Any	Fair	Peaky	General purpose, medium quality
	Medium	Omni- or semi-	Medium	Any	Good	Good	General purpose, better quality
	Medium	Cardioid	Low-medium	Any	Good	Good	General purpose, more amplification needed
	High	Omni- or cardioid	Uses associated preamp		Excellent	Excellent	Broadcast, general purpose, high-level output
Crystal or Ceramic (see text)	Low	Omni- or semi-	Very high	High	Fair	Peaky	Voice and announcements
	Medium	Omni- or semi-	Medium-high	High	Good	Fair	General purpose, lower cost
	Medium	Cardioid	Medium	High	Good	Fair	General purpose, medium quality
Condenser	Expensive	Omni- or semi-	Uses a built-in preamplifier		Excellent	Excellent	Professional top quality, all-purpose, needs polarizing
Ribbon	Medium	Bidirectional	Low-medium	Any	Excellent	Excellent	High quality music and dialogue
	High	Cardioid	Low	Any	Excellent	Excellent	High quality music and dialogue
Magnetic	Very low	Omni- or semi-	High	High	Fair	Peaky	Voice and announcements
Carbon	Very low	Omni- or semi-	Very high	Low	Limited	Peaky	Mobile announcements—needs polarizing

Transistorized Code Oscillator

By **JOHN W. McDONALD**
Semiconductor Products Dept.
General Electric Co.



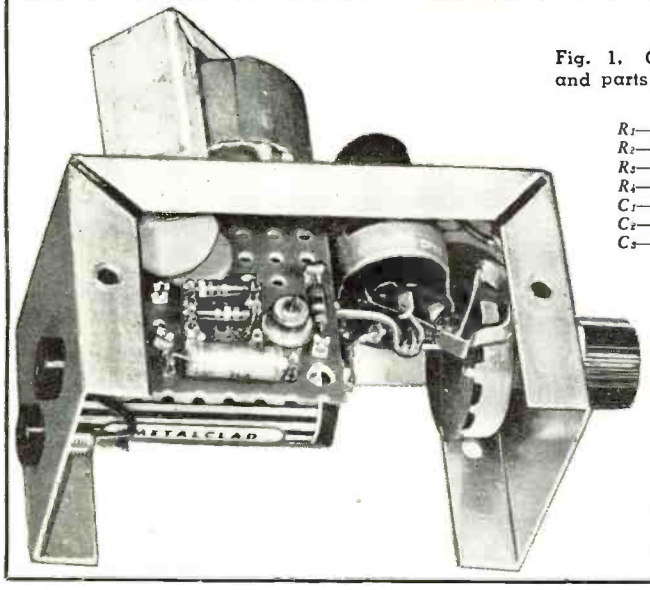
Front and rear views of the simple transistorized code oscillator described below.

Simple one-transistor circuit may be used for code practice or as basic audio signal source.

WITH the advent of any new electronic device, such as transistors, it's to the advantage of those who will be affected to familiarize themselves with the unit before it's commercialized. The usual procedure is to breadboard circuits similar to proven devices already in use (such as the vacuum tube) and evaluate the results. The oscillator is a basic circuit and can be readily transistorized.

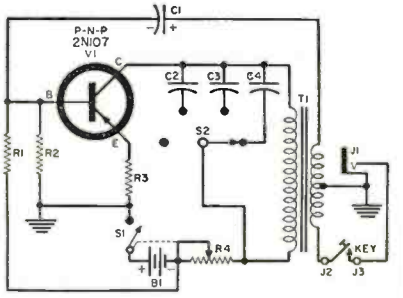
The transistorized code oscillator to be described is a neat, compact unit. It can be built from standard, readily available parts. Both Old Timers and Novice ham operators can increase their speed and gain experience with transistors in the process. This unit is easy to construct. The major parts are often available in the "junk box" and the wiring and layout are not critical. The oscillator is mounted in a 2¼" x 4½" x 2¼" "Minibox." The transistor is mounted inside the chassis to protect it from loss or damage during storage. The schematic diagram of the unit is given in Fig. 1. The 2N107 was chosen because of its availability and low cost. Several different types of junction transistors were tried with success. By reversing the polarity of the battery, an *n-p-n* will work as well as the *p-n-p*.

The primary of a 6.3-volt, center-tapped, filament transformer is used as the collector load. When switch S_1 is closed, surge current passing through the transistor and primary starts oscillation. The induced signal is fed back to the base through C_1 to continue oscillation. The unit oscillates continuously and the signal is fed into the earphones by means of the key. (*Continued on page* 124)



Bottom view of the simple one-transistor code oscillator is shown here. Tone control switch S_2 is at the right while the volume control R_4 is mounted on top of the little chassis. Small components, including transistor, are mounted on the board as shown.

Fig. 1. Complete schematic diagram and parts listing for the code oscillator.



R_1—20,000 ohm, ½ w. res.
R_2—25,000 ohm, ½ w. res.
R_3—470 ohm, ½ w. res.
R_4—10,000 ohm pot (with switch S_1)
C_1—5 μfd., 6 v. elec. capacitor
C_2—.006 μfd., 200 v. capacitor
C_3—.004 μfd., 200 v. capacitor
C_4—.02 μfd., 200 v. capacitor
S_1—S.p.s.t. switch (on R_4)
S_2—S.p. 4-pos., non-shorting switch (Mallory 3215J)
J_1—Phone jack (Mallory "Infant," open-circuit type, 41H-054)
J_2, J_3—Pin jack
B_1—3-volt battery
T_1—Fil. trans. 6.3 v., c.t. @ 1.2 amp. (Stancor P-6134)
Chassis—2¼" x 4½" x 2¼" "Minibox"
V_1—"p-n-p" junction transistor (2N107 or equiv., see text)

By **ED BUKSTEIN**
Northwestern Television & Electronics Institute

BASIC

Binary Counting Circuits

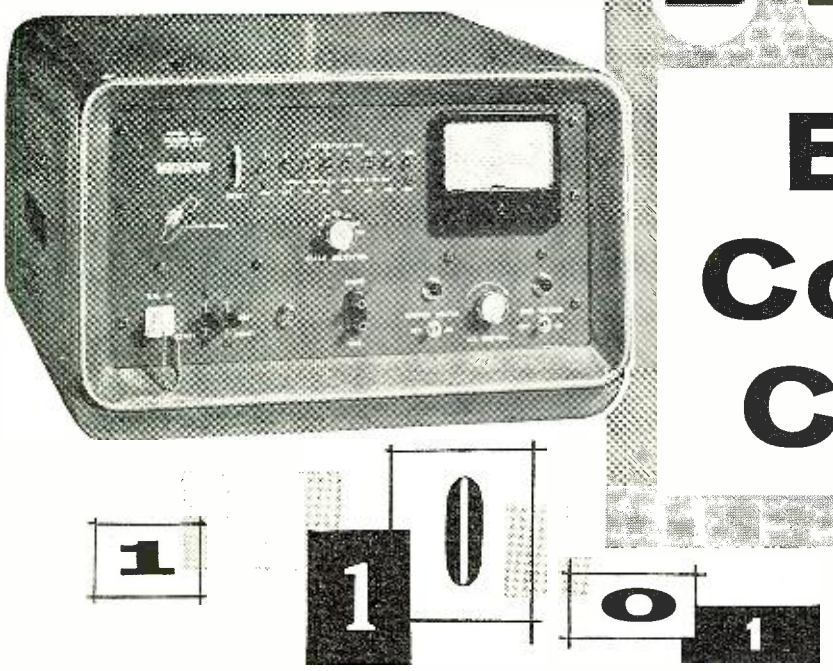


Fig. 1. Used for counting the pulses of a Geiger counter, this Nuclear-Chicago scaling unit includes 8 flip-flop stages and indicates by 8 neon lamps plus a mechanical counter (top left).

An appraisal for technicians of the fundamental, binary-counting flip-flop and how it is applied.

MUCH of the usefulness of a flip-flop stage derives from its ability to produce one output pulse for every two pulses applied to its input. When an input pulse is applied to a twin-stage flip-flop, the tube which was previously conducting becomes cut off and the tube which was cut off becomes conductive. A second pulse applied to the input will again reverse the circuit, restoring it to its original condition. Since one complete cycle of operation requires two input pulses, an output taken from the circuit may be said to have a frequency only half as great as the frequency of the input pulses.

A flip-flop stage and its input and output waveforms are shown in Fig. 2. Assuming that the circuit starts in the *zero* condition (left-hand tube cut off and right-hand tube conducting), the following changes will occur when the first negative pulse is applied to the input: The negative input pulse (waveform *A*) is fed to both grids but has no effect at the left-hand grid, since this tube is already cut off. Arrival of the negative pulse at the right-hand grid drives this tube toward cut-off. The resultant increase of voltage at the right-hand plate is coupled to the grid of the left-hand tube and causes this latter stage to conduct.

EDITOR'S NOTE: *This straightforward presentation takes no previous knowledge for granted of the circuitry that has become fundamental to modern electronic counting and computing equipment. The method of counting by "ones" and "zeros"—the binary counting technique—is used in preference to the more familiar decimal system because the former is better suited to available circuits. For a discussion of binary notation itself, see "Basic Electronic Counting" in our issue of March, 1958.*

When the left-hand tube conducts, its plate voltage decreases. This decrease is coupled to the right-hand grid, which is, in turn, thus driven to cut-off. The first input pulse therefore switches the circuit to the *one* condition (left-hand tube conducting and right-hand tube cut off.) As the right-hand tube cuts off, its plate voltage increases as shown in waveform *B*.

When the second negative input pulse is applied to the circuit, it cuts off the left-hand tube and the increasing plate voltage of this stage causes the right-hand tube to conduct. The circuit is now back to the *zero* condition. When the right-hand tube conducts, its plate voltage decreases as shown in waveform *B*.

The output signal of this stage is coupled through a small capacitor from the plate of this right-hand tube. This small capacitor, in conjunction with the input resistance of a following stage, provides differentiating action due to the short *RC* time constant. As a result, waveform *B* becomes peaked as shown in waveform *C*. A comparison of waveform *A* and *C* reveals that two negative pulses applied to the input will produce only one negative pulse at the output. It is for this reason that the flip-flop stage is often referred to as a 2-to-1 frequency divider.

When the input to a flip-flop is applied to the grids in the manner shown in Fig. 2, negative input pulses are used to trigger the circuit. Positive pulses may be used instead, but a greater amplitude is required. One of the reasons for this is that some of the amplitude of the positive pulse is wasted in bringing the tube from below cut-off up to the cut-off level, and

PULSE	CONDITION OF FLIP-FLOPS 4th stage	3rd stage	2nd stage	1st stage	LIGHTS ON
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	1+2
4	0	1	0	0	4
5	0	1	0	1	1+4
6	0	1	1	0	2+4
7	0	1	1	1	1+2+4
8	1	0	0	0	8
9	1	0	0	1	1+8
10	1	0	1	0	2+8
11	1	0	1	1	1+2+8
12	1	1	0	0	4+8
13	1	1	0	1	1+4+8
14	1	1	1	0	2+4+8
15	1	1	1	1	1+2+4+8
16	0	0	0	0	0

Table 1. The conditions of the flip-flop stages indicate the number of pulses stored in the circuit. For example, after the 13th pulse is applied, the binary number 1101 is recorded. This is the equivalent of decimal number 13.

the switching action does not begin until the tube is brought above cut-off.

Fig. 3 illustrates several other commonly used methods of applying triggering pulses to a flip-flop stage. When the input pulses are applied to the cathodes as shown in Fig. 3A, the circuit will respond only to positive input pulses. This positive input to the cathode cuts off the tube that was previously conducting. As the tube cuts off, its plate voltage increases and drives the opposite grid more positive. The use of diodes for coupling the input pulses is shown at Fig. 3B. Since the input pulses are applied to the cathodes of the diodes, the circuit will respond only to negative triggering pulses.

The coupling diodes automatically channel the negative input pulse to the grid of the conducting triode. This happens because, for any given condition of the flip-flop, one of the diodes will be cut off. For example, when the left-hand triode is conducting, its plate voltage will be low. This makes the plate of the associated (lower) diode less positive than its cathode, which is connected to "B+". The input pulse therefore cannot pass through this diode. The other (upper) diode, however, couples the input pulse to the plate of the right-hand triode—and consequently to the left-hand grid.

In the triggering method illustrated in Fig. 3C the input pulses are applied to the junction of the plate-load resistors and an additional resistor connected in the "B+" line. This circuit, which responds only to negative input pulses, provides a high input impedance to reduce loading of the preceding circuit.

A single flip-flop stage produces a 2-to-1 ratio of frequency division. If *two* flip-flop stages are connected in cascade (the output of the first stage providing the input for the second), the second stage will produce an output pulse after *four* pulses have been applied to the first circuit. Three flip-flops in cascade will divide the input frequency by 8, four stages will have a ratio of 16, five stages 32, etc. Since each additional stage *doubles* the ratio of frequency division, the total ratio of division for any number of stages will be 2^n where n is the number of stages.

Fig. 4 shows four flip-flop stages in cascade. The reset switch is used to

(*Continued on page* 136)

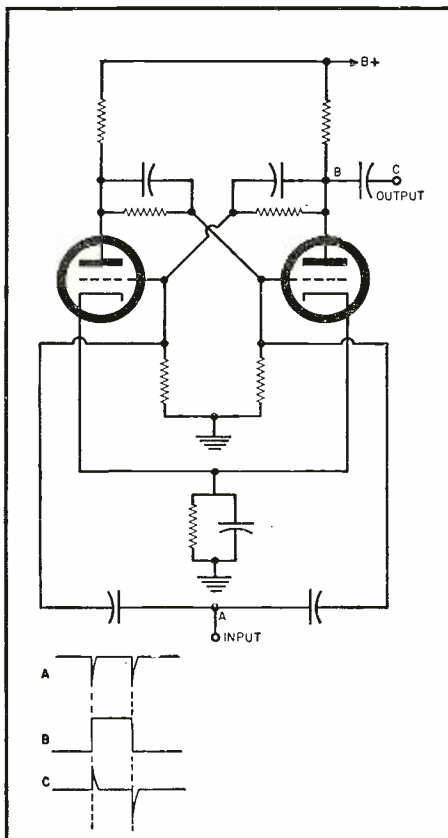


Fig. 2. A flip-flop stage with its input and output waveforms. Two input pulses result in a single output pulse.

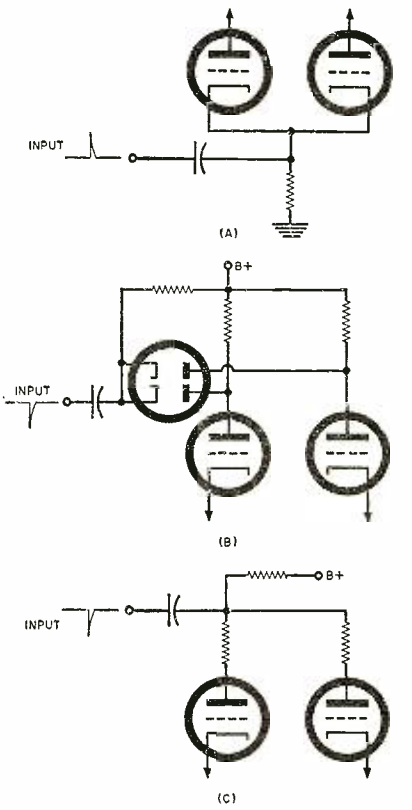
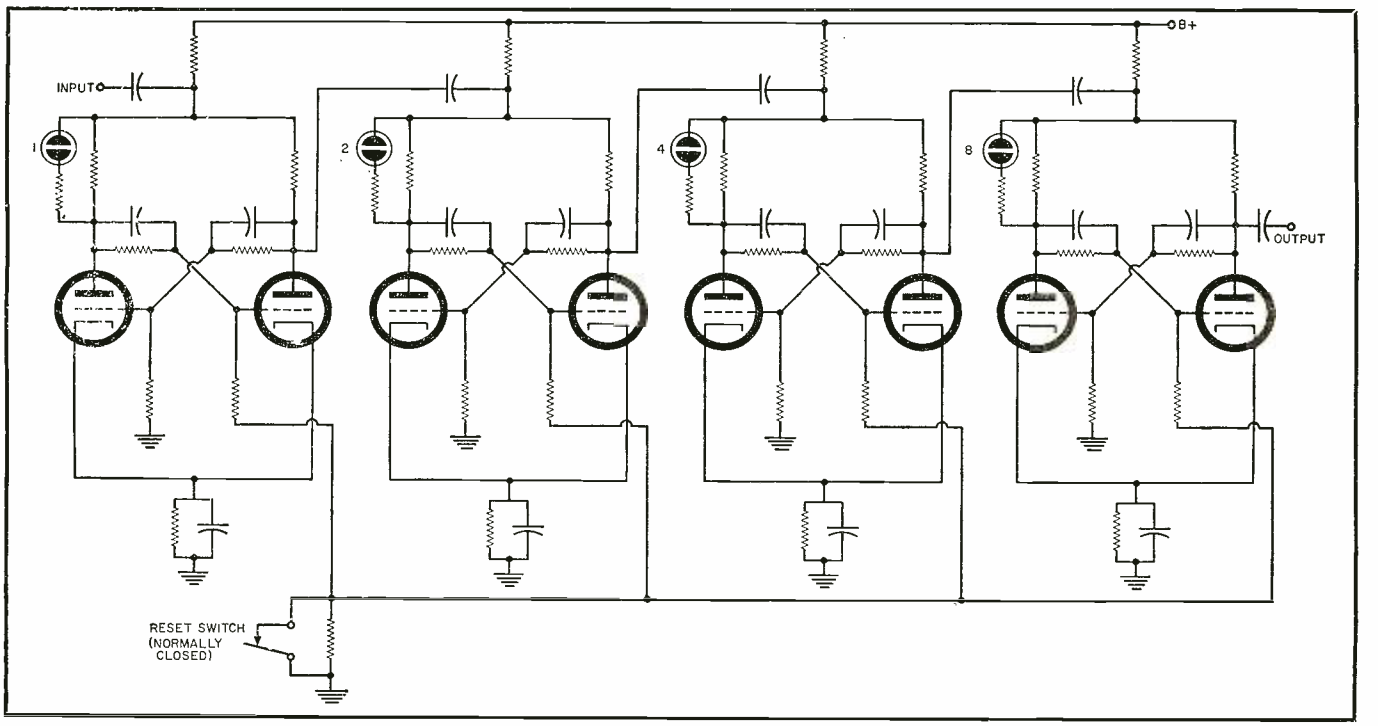
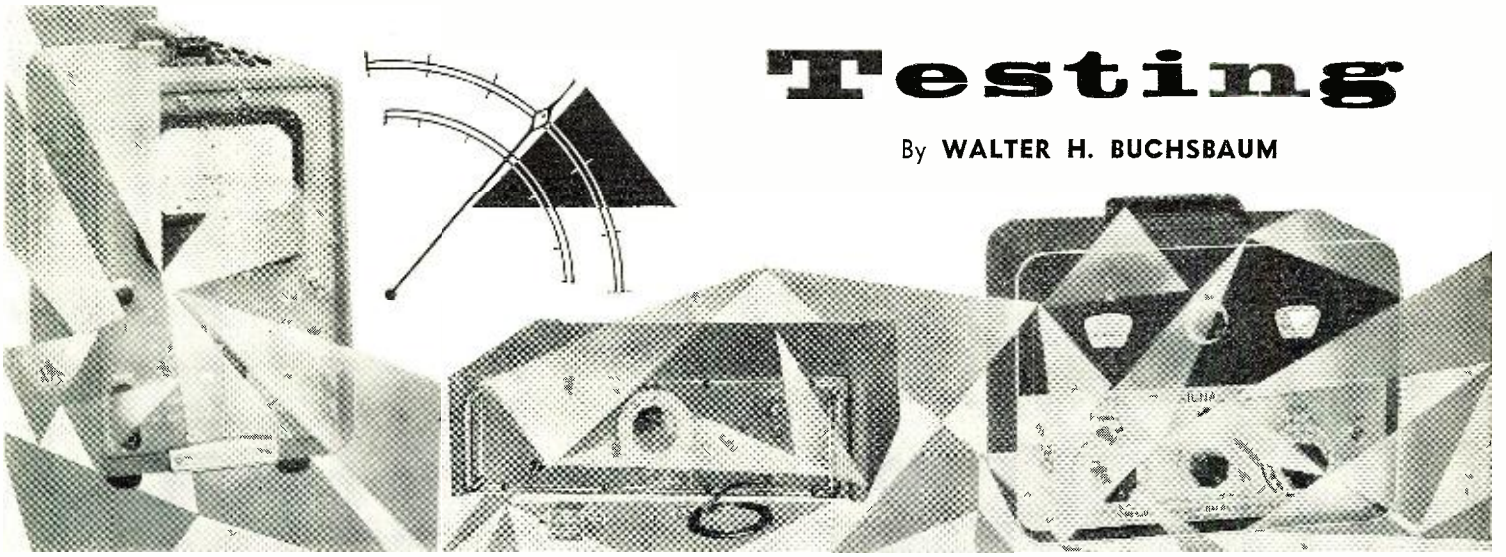


Fig. 3. Commonly used methods for applying negative or positive triggering pulses to conventional flip-flop stages.

Fig. 4. With four cascaded flip-flop stages, 16 input pulses must be applied to produce a single output pulse.





Testing

By **WALTER H. BUCHSBAUM**

A review of the standard laboratory procedures that should be used to measure and check tuner specifications.

THERE are many FM tuners on the market today, in both kit and assembled form and each is offered with a set of electrical specifications which should determine its performance. These specifications are sometimes based on tests devised by the manufacturer but usually the published figures are obtained by standard test methods.

The Institute of Radio Engineers (IRE) publishes the findings of various groups, coordinated by the Standards Committee, and the reference on FM receivers is the publication "Methods of Testing Frequency Modulation Broadcast Receivers," 1947. In this standard all applicable tests are described and agreed methods for performing them are presented. Many of these tests deal with the acoustical portion of the FM set and therefore do not apply to FM tuners. Other tests, such as the one on masking interference or local oscillator radiation, are not important enough to the set owner to warrant specifications.

The technically minded purchaser of an FM tuner may wonder at the meaning of some of the specifications the manufacturer publishes or he might try to duplicate these results in his own performance tests. Conflicting claims of excellence may often be due more to varying test methods than actual electrical differences. This article describes twelve tests, listed in the IRE standards and usually performed in evaluating FM tuners. The reader must be warned, however, that the equipment required for most of these tests is usually available only in well equipped development or testing labs.

Standard Values

For FM tuners there are certain standard values which will be referred to many times and which are commonly used in all performance tests. The most important of these are: the standard input impedance which is 300 ohms; standard test frequencies which are 88, 98, and 108 mc.; and standard input voltages. These range from 11, 110, and 1100 microvolts up to 1.1 volts. The standard test modulation of the input signal is 400 cycles at 30% which means that the r.f. signal varies in frequency ± 22.5 kc.

Test Equipment

The most important piece of test equipment is the signal generator. In addition to being stable and having an accurately calibrated frequency dial, this generator must also have a number of other features. It must cover the 88 to 108 mc. frequency band and the adjacent ranges. To cover the 10.7 mc. i.f. band a second generator is usually used. A metered output attenuator, calibrated from 0.1 microvolt to 1.1 volts as well as frequency modulation, metered from zero to 100%, should be part of the generator. Either external or internal modulation from 30 to 15,000 cps should be possible and the modulator should contain the standard 75 microsecond pre-emphasis network, including a disabling switch for it.

To match the 300-ohm tuner input, the generator should either have a balanced 300-ohm output or else a cable and termination must be used to change the 50-ohm output to a 300-ohm balanced system. The loss in this conversion must be accounted for in all output readings.

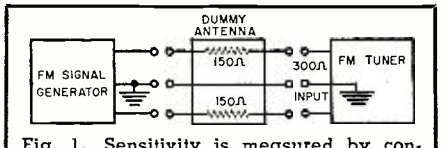
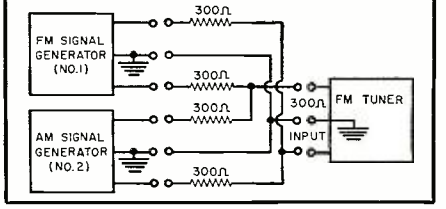


Fig. 1. Sensitivity is measured by connecting generator and turner as shown.

Fig. 2. The AM suppression test described in the text may be made with this setup.



To check the output of the FM tuner a v.t.v.m. and an oscilloscope will be required. Since the IRE standards were written for complete FM receivers, all output measurements were made at the loudspeaker, hence the conventional audio distortion analyzers, power output meters, and dummy loads were used. In this respect some modification of the standards is necessary. Distortion will have to be measured either by analyzers or by eye on the oscilloscope and, in place of power output, the usual cathode-follower output signal will be metered.

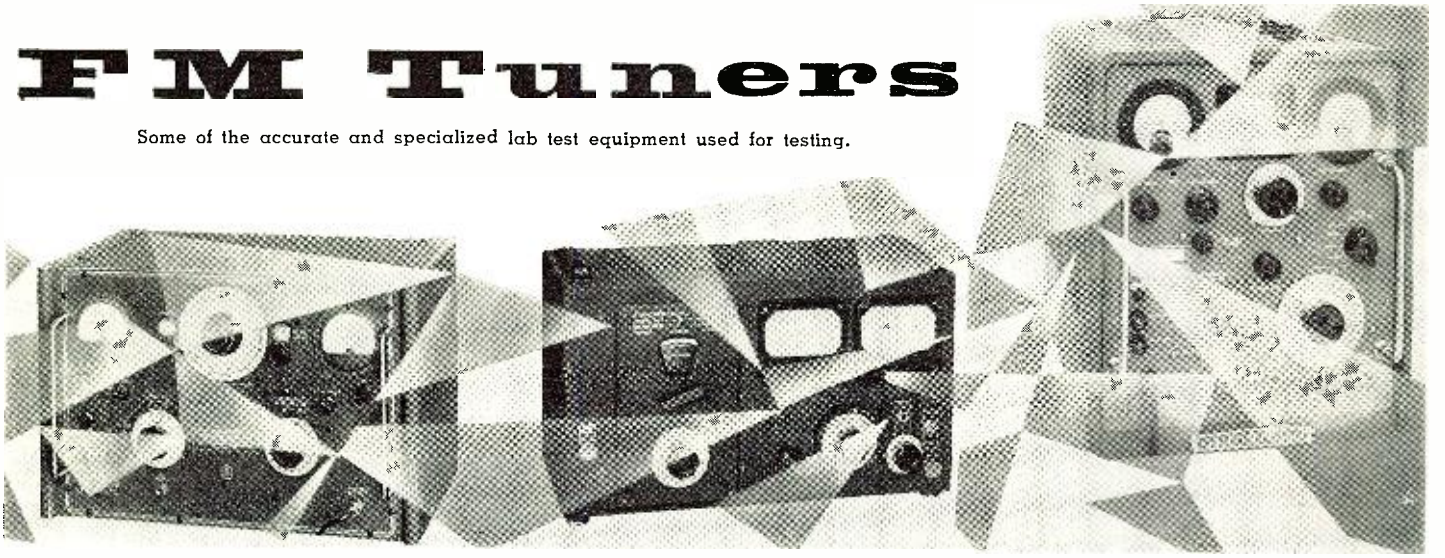
One of the important items in measuring tuner performance is a dummy antenna. Fig. 1 shows the typical circuit of such a network as connected to the 300-ohm balanced generator. The resistors used should all be of the ½ watt, 5% carbon type and all leads should be as short as possible.

Practically all FM tuners use 117-volt a.c. power and, in testing them, the line voltage should be measured and set to 117 volts at all times. Use of a metered *Variac* makes this convenient to arrange, otherwise the line voltage must be checked several times during each test.

Before proceeding with any of the following performance tests the tuner should be carefully aligned and tracked at several points in the band, but at least at the standard test frequencies already listed. For this alignment check it will be necessary to remove the tuner from the cabinet and all further tests will be done on the open chassis. Only if all tubes are in place and the set is working properly with the regular antenna,

FM Tuners

Some of the accurate and specialized lab test equipment used for testing.



can these tests be readily performed.

1. Tuning Range Test: First the tuner frequency control is checked for smooth operation over the band. Then connect the signal generator to the tuner through the dummy antenna as shown in Fig. 1 and set the tuner to the highest frequency. Connect the v.t.v.m. to the FM detector output and, with the generator at c.w. (unmodulated), tune the generator until the v.t.v.m. goes through zero. In the same way check the frequency at the low end of the tuner dial. All FM tuners should cover at least from 88 to 108 mc. preferably with a few megacycles at either end. If the FM tuner has a calibrated tuning dial, the dial reading should be compared to the generator reading at least at the standard test frequencies of 88, 98, and 108 mc.

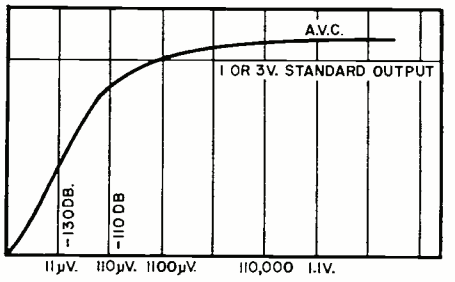
2. Sensitivity Test: Three different sensitivity values can be considered as giving an indication of FM tuner performance and a fourth measurement is taken to give an indication of the audio stage limitations on the i.f. system.

(*a*). Maximum sensitivity is measured by connecting the generator and tuner as shown in Fig. 1 and connecting the v.t.v.m. to the audio output jack. To make the measurements exact, the oscilloscope or a distortion analyzer should also be connected to the tuner output. All tuner controls are set for maximum gain and then the tuner and generator are tuned, in turn, to each of the three test frequencies. The generator output should be set to the standard test modulation which is 400 cps at 30%, or 22.5 kc. deviation. In FM receivers the output is standard at 0.5 watt of audio power into a dummy load and for FM tuners the most widely used value is either 1 or 3 volts r.m.s. at the output jack, depending on the manufacturer's data. The purpose of the scope or analyzer is to make sure that the 400-cps signal is free from distortion. The signal generator attenuator is adjusted to produce either 1 or 3 volts r.m.s. at the output jack and the microvolts thus supplied constitute the maximum sensitivity. Needless to say, correct tuning is essential. It may happen that receiver noise is so great at maximum gain that it obscures the signal. This should be noted and another reading can be taken for the generator setting where the received signal is twice as large as the noise. Usually the tuning position for minimum noise and minimum distortion coincides, but if two different spots on the frequency scale are involved, this should be noted.

(*b*). Maximum deviation sensitivity is measured with the signal generator set to 100% or ±75 kc., but otherwise in the same manner as just described. The generator output is adjusted at each test frequency to give 10% distortion at the tuner output jack, as measured on the oscilloscope or distortion analyzer. Vary the generator output attentuator until the output is either 1 or 3 volts or until only 10% distortion is apparent, whichever is the higher generator output reading. This reading, in db below 1 watt or in microvolts, is the maximum deviation sensitivity.

(*c*). For the deviation sensitivity test the generator is set only to 98 mc., the output is set for 90 db below one watt or to 1100 microvolts and the deviation is varied from 0 up to that value which produces 1 or 3 volts r.m.s. at the tuner. The value obtained is expressed either in kilocycles or per-cent.

Fig. 3. Typical a.v.c. characteristic.



(*d*). "Quieting signal sensitivity" gives an indication of the degree of internal receiver noise during moments when the received signal is not modulated. The generator is tuned, in turn, to the three test frequencies and, with 400 cps, 30% modulation, the attenuator is set for 1100 μv. output. The modulation is then turned off and the tuner output reading is noted. With standard test modulation on again, set the attenuator to a minimum value so that the tuner output reading is about 30 times (30 db to be exact) the reading with unmodulated input. This attentuator setting, in microvolts or db below one watt, is then the quieting signal sensitivity for 30 db quieting.

3. AM Suppression Test: This important test measures the degree to which a tuner can reject AM interference appearing together with the desired FM signal. Either a generator having simultaneous AM and FM available or two separate signal generators are required. In the latter instance connections should be made as shown in Fig. 2 and the output signals, as measured at the generator, will be half of the actual applied signal. At 98 mc. an FM signal, 1000 cps at 30% modulation, is fed through the dummy antenna at 1100 μv. If the circuit of Fig. 2 is used, the generator should deliver twice the output voltage. Then the FM tuner volume control is adjusted to produce 1 or 3 volts r.m.s. output at the jack. Next the AM signal is introduced having a 400 cps, 30% amplitude modulation and the same generator output voltage. If two generators are used they must be tuned very precisely to avoid beat notes. The AM signal should be free from any FM content. Now it is necessary to insert a 1000-cps rejection filter at the tuner output jack. In many instances where a suitable filter is not available the 400-cps output can be measured on the scope, if the scope is synchronized at 400 cps. The ratio of the undesired 400-cps output to the 1 or 3 volts standard

FM output is the AM suppression in db. To indicate how the suppression characteristic varies with input level the measurement can be repeated at the other standard input signal levels such as, 11, 110 μv., etc. Typical values of AM suppression with 1100 μv. input are between 30 and 40 db.

4. Harmonic Distortion Test: With the FM tuner set at 98 mc. and the signal generator connected through the dummy antenna as shown in Fig. 1 several different indications of distortion can be obtained. Precise distortion measurements can best be made by means of a distortion analyzer, but for approximate readings visual observation on the scope may be enough.

(*a*). Output variation. With the signal generator set at 400 cps 30% modulation and 1100 μv., vary the volume control to produce different output levels. Different degrees of distortion will be observed and they indicate the audio distortion due to the audio section.

(*b*). Modulation distortion is measured as previously described but the volume control is set for 1 or 3 volts r.m.s. output and the modulation percentage is varied at the generator from 10 to 100%. This measurement gives an indication of the r.f. and i.f. bandwidth and the linear response of the detector.

(*c*). Input signal variation from 11 μv. up to 1.1 volts, with both 30 and 100% modulation, indicates the action of the a.v.c. and bandpass response. The output signal is kept constant at either 1 or 3 volts r.m.s. by adjusting the volume control.

(*d*). Modulation frequency distortion is best checked with a generator having external modulation which is supplied by an audio oscillator. This test can be performed by repeating the tests of (*a*) and (*b*), but with different audio frequencies ranging from 30 to 20,000 cps, at 30% modulation and standard input and output signal values.

5. Maximum Undistorted Output: This test has generally more meaning for complete FM and audio systems since in FM tuners the audio output voltage is not critical. The test for harmonic distortion listed in paragraph (4*a*) is simply modified by setting the volume control to that output level where the total harmonic distortion is just 10% (r.m.s. voltage) of the output signal. This signal voltage is then the maximum undistorted output.

6. Maximum Output: Again this test is useful mostly in evaluating a complete FM receiver and all it tells about the FM tuner is what the maximum output voltage of the cathode follower is, irrespective of distortion.

7. A.V.C. Characteristics: This is determined by setting the volume control to produce half the maximum possible output with each of the following generator settings: 11, 110, 1100, 11,000, 110,000 μv. and 1.1 volts output, at 400 cps, 30% modulation at 98 mc. By plotting the values of output signal, in each instance, against the input voltage, a curve like the one of Fig. 3 is obtained and this represents the a.v.c. characteristic. Note that with increasing input signals the output of the FM tuner tends to remain constant, which is due to both a.v.c. and the limiting action of the limiter stage.

8. Spurious Responses: This test consists simply of tuning the signal generator over a wide frequency band to see if the FM tuner will pick up undesired frequencies. Certain known spurious responses are unavoidable, but their signal strength would have to be quite large to interfere. Each spurious frequency is noted first and then the test described in paragraph (2*a*), the maximum sensitivity test, is performed for each spurious frequency. Normally, all such undesired frequencies should have sensitivity readings at least 60 db below the desired response. There is one particular response that is inherent in the superheterodyne system and that is the image response. This occurs at a frequency 21.4 mc. above the desired signal and is due to the beat of the local oscillator with a signal 10.7 mc. higher. For most FM tuners the image response should be better than 45 db below the desired response. If, for example, the maximum sensitivity of the tuner is 11 μv., the image sensitivity should be less than 3300 μv.

Another undesired frequency which will always be received is the i.f. itself. To check the receiver sensitivity for the 10.7 mc. i.f. a generator supplying this signal must be used. This generator is connected through the standard dummy antenna and the maximum sensitivity test is performed. Results should be better than the image response sensitivity.

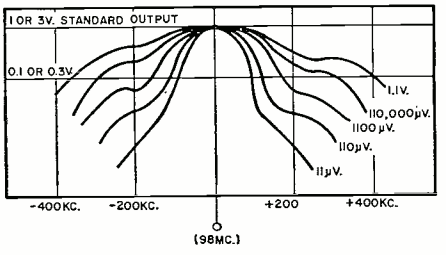
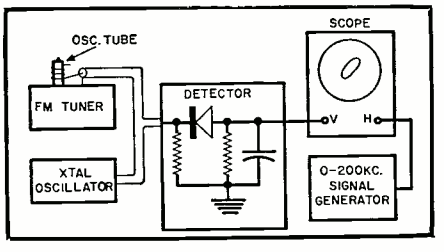


Fig. 4. Curves showing the over-all frequency response of an FM tuner at various signal levels. Note the wider over-all response at higher inputs.

Fig. 5. Method employed to check the drift of the oscillator in the FM tuner being checked. A crystal diode scope probe is used to detect the beat.



9. Measurement of Hum: For complete FM receivers, the hum measurement provides an indication of the audio system quality as well as the tuner performance. When the audio section alone is tested for hum, the simplest way to check is to use the oscilloscope as an indicating device. The scope should be sensitive enough to show at least 0.01 volt peak at measurable amplitude. First, short the tuner antenna terminals together, set the volume control to minimum and the tone control for maximum hum. The scope is connected to the audio output jack and the horizontal sweep synchronized to the 60-cps power line. Hum voltages observed are peak values but, in specifications, hum is usually stated in r.m.s. so that the actual peak-to-peak reading has to be divided by 2.8. A second test which will check the entire tuner can be made with the tuner connected to the signal generator and tuned exactly for the 98 mc. test frequency with 1100 μv. input. With the standard 30% modulation on, adjust the volume control for the standard 1 or 3 volts output. Then turn the modulation off and measure the hum signal on the scope. In this way the ratio of hum to signal can be determined. Most FM tuners will have less than .05 volt peak hum output.

10. Tuning Characteristic Test: This test gives some indication of the over-all frequency response of the FM tuner at different signal input levels. At the 98 mc. test frequency the tuner volume control is set for standard 1 or 3 volts output and the generator for one of the standard input levels, 11, 110, 1100 μv., etc. Then the generator is detuned in 25 kc. steps above and below the 98 mc. center frequency. The output amplitude is then plotted on a graph against frequency, as shown in Fig. 4. A separate curve is taken for each level of input. As the input signal increases it is natural for the apparent bandwidth to incease as well.

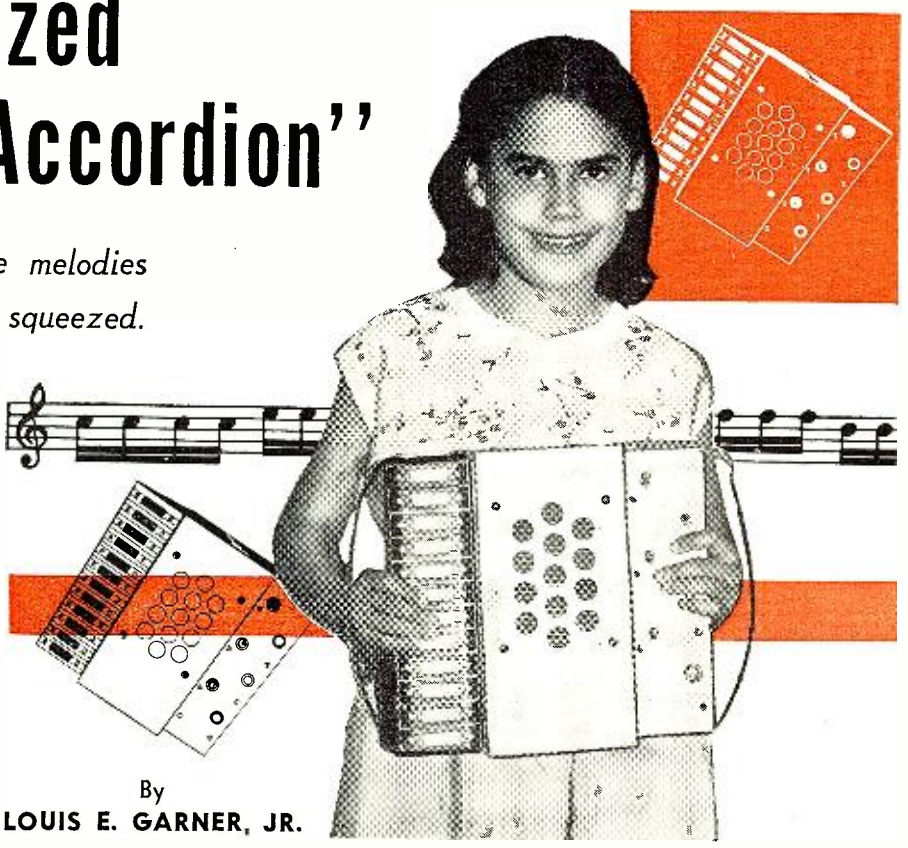
11. Tuning Indicator Test: Many of the more expensive FM tuners have some type of tuning indicator. Where a tuning eye tube is used, the percentage of non-illuminated area is an indication of the error in tuning. When a meter is used, the needle deflection gives the same information. To test the accuracy of these devices the same test as in paragraph (10) is performed, but instead of recording the output signal variation the action of the tuning indicator is noted. The point where the tuning indicator shows completely "off station" should coincide with the 100 kc. above and below center points for accurate tuning.

12. Frequency Drift Test: The local oscillator drift can be ascribed to two major causes. First is the inevitable warm-up drift and second is due to variations in line voltage and subsequent "B+" and filament changes.

(*Continued on page* 131)

A Transistorized Electronic "Accordion"

Can be used to play simple melodies and doesn't even have to be squeezed.



By
LOUIS E. GARNER, JR.

IN MANY respects, electronics and music are compatible fields. Electronic audio equipment is used to amplify the voices of singers and the efforts of musicians; electronic radio and television equipment makes it possible to distribute the renditions of famous orchestras, instrumental groups, and singers to immense numbers of listeners; and, finally, electronic sound recording and reproduction equipment can preserve original musical performances for years while, at the same time, permitting an almost unlimited number of "encores."

Many different types of electronic musical instruments have been devised in the past. Relatively few of these have "caught on" with the general public or with professional musicians, however. It would not be too difficult to count the really popular instruments on the fingers of one hand. The electric guitar, the electric organ, and the Theremin are probably the best known electronic instruments and, of these, the Theremin is used primarily for special concerts and for background music or unusual sound effects on radio and TV programs and in the theater.

Thus, while electronic equipment has been used extensively to amplify, to distribute, and to record music, specialized electronic music-making instruments have never achieved really widespread popularity.

That electronic instruments can remain so "unpopular" in a gadget-conscious atomic age is rather surprising, especially since advanced electronic instruments, in theory at least, are capable of producing a much wider range of frequencies, of tonal shadings, and of amplitude and pitch variations than can conventional instruments.

The explanation for this situation probably lies in the essentially "personal" quality of music. Except for the piano, organ, and a few of the larger units, a musician using a conventional instrument can literally take his "music" with him wherever he goes. He can play his cornet, trumpet, accordion, piccolo, ocarina, saxophone, harmonica, trombone, violin, clarinet, or oboe wherever he pleases . . . on picnics, at church outings, in his room at night, at a jam session with his cronies, on a concert stage, or in a conservatory classroom. He needn't worry about finding a "convenient" source of line power nor need he be concerned with dangling cables and cords which might limit his freedom of movement. And he doesn't have to check on whether d.c. or a.c. (or the frequency of a.c.) power is available before accepting a playing engagement.

Essentially, then, since most conventional musical instruments are fully self-contained and, in this sense, are completely portable, they are really "personal" instruments. On the other hand, electronic instruments, in the past at least, have required an external source of electric power, plus, in some cases, external loudspeaker and amplifier units and bothersome cables and wires.

Self-contained portable vacuum-tube operated instruments can be designed, of course, but they generally require heavy, short-lived, expensive battery power packs. In most cases, the power pack may actually weigh more than the instrument itself.

When low-power transistors were first introduced, they offered real possibilities—lightweight, physically small, rugged, and requiring relatively little current at low voltages, these seemed ideal for portable instrument applications. But it soon became apparent that such transistors could not deliver adequate audio power levels. To be practicable for general use, an electronic musical instrument should deliver its output at good room volume.

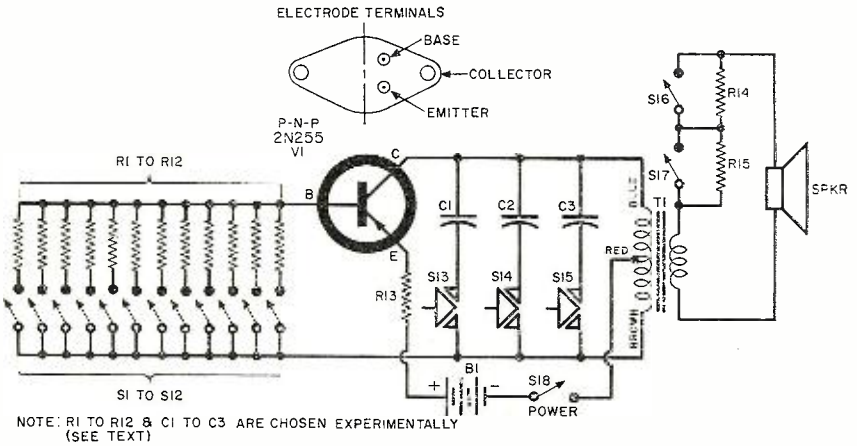
Today, however, with the mass commercial production and ready availability of low-cost power transistors, it becomes feasible to design a truly self-contained electronic musical instrument, that is, one which can be used to play genuine tunes, which will deliver good volume, which is not excessively heavy, and which has adequate battery life. The electronic "accordion" shown in the photographs represents a basic step in the design of such instruments.

Although designed primarily to demonstrate the possible use of power transistors in the construction of electronic instruments, the "accordion" is an effective basic instrument and can be used to play popular tunes and melodies. With a special tonal quality of its own which distinguishes it from its similar appearing "cousin," the conventional reed accordion, the instrument is held and operated in much the same manner as the conventional instrument, with an important exception—no "squeezing" is necessary.

Using readily available parts, the electronic "accordion" is inexpensive and easy to assemble and not only makes an interesting construction project for the experimenter, gadgeteer, or home builder but also makes an excellent "toy" for an older boy or girl. Youngsters as young as five or six years can have a lot of fun playing with it, even if they don't produce recognizable tunes.

Circuit Description

The schematic wiring diagram for the instrument is given in Fig. 1. Referring to this diagram, we see that the "accordion" uses a single *CBS-*



R_1-R_{12}—See text for details on determining values (1 w.)
R_{13}—3.9 ohm, 2 w. res.
R_{14}—10 ohm, 1 w. res.
R_{15}—22 ohm, 1 w. res.
C_1-C_3—See text for details on determining values (200 v.)
S_1-S_{12}—Piano-type s.p.s.t. push-button switches
S_{13}, S_{14}, S_{15}—S.p.s.t. push-button switch
S_{16}, S_{17}, S_{18}—S.p.s.t. toggle switch
T_1—Transistor, output trans. 48 ohms to 3.2 ohms (Argonne AR-503)
B_1—6-volt battery (Burgess F4P1 or RCA VS009)
Spkr.—PM loudspeaker, oval type. 3-4 ohm voice coil
V_1—"p-n-p" power transistor (CBS-Hytron 2N255)

Fig. 1. Schematic wiring diagram of unit.

Hytron type 2N255 *p-n-p* power transistor in a common-emitter audio oscillator circuit.

In operation, center-tapped power output transformer T_1 serves a dual function; it matches the collector-emitter impedance to the low impedance of the PM loudspeaker's voice coil and also serves to provide the feedback necessary to start and sustain oscillation. Operating power is supplied by a single 6-volt battery, B_1, controlled by a s.p.s.t. power switch, S_{18}. Unbypassed emitter resistor R_{13} helps to stabilize circuit operation and prevents collector current "runaway" when the instrument is used at moderately high ambient temperatures.

Since the oscillator transformer (T_1) is center-tapped, it provides considerably more feedback between collector and base circuits than the "minimum" required to insure oscillation and the circuit functions as an overdriven oscillator. This results in several operating characteristics which are desirable in an instrument of this type.

First, instead of a monotonous sounding sine-wave, the unit delivers a signal rich in harmonics which has a unique musical quality. In addition, the oscillator's operating frequency (pitch or tone) can be varied either by changing the circuit's *LC* characteristics or by changing the loading on the oscillator. In practice, both are varied to obtain desired notes and tonal variations. Finally, the signal level (or volume) remains essentially constant as different notes are played.

The oscillator's operating frequency can be varied in either of two ways. As any of the "piano-key" s.p.s.t. switches S_1 to S_{12} are closed, different values of fixed resistance (R_1 to R_{12}) are connected in series with the transistor's base electrode. This varies both the base bias current and the loading on transformer T_1. In addition, since base bias current variations cause corresponding changes in collector current levels, but of greater magnitude, the d.c. through T_1's primary winding changes and the inductance of this component varies. The net result is that the frequency of the oscillator drops as lower values of base resistance are used.

The instrument's frequency can also be varied by changing the circuit's *LC* characteristics. In practice, this is accomplished by using s.p.s.t. push-button switches S_{13} to S_{15} to shunt different values of fixed capacitance (C_1 to C_3) across T_1's primary winding. As larger capacitor values are used, the operating frequency becomes lower.

For special effects, both the base bias resistor and the shunt capacitor can be changed together simply by closing one of the resistor switches (S_1 to S_{12}) and one or more of the capacitor switches (S_{13} to S_{15}) simultaneously. Since the transistor requires some base bias current to operate, the circuit will not oscillate (or produce a signal) unless at least one of the base resistor switches is depressed, even if the power switch (S_{18}) is closed.

Two fixed resistors, R_{11} and R_{15}, are connected in series with the loudspeaker's voice coil. Generally these are shorted out of the circuit by shunt switches S_{16} and S_{17}, which remain "closed" during normal operation of the instrument. When either switch is opened, its corresponding resistor is automatically connected in series with the voice coil, reducing the signal delivered to the loudspeaker and thus output "volume." These "volume" or "loudness" switches are used to reduce signal level for solitary practice or for special effects. A slight change in tone may occur as these switches are operated.

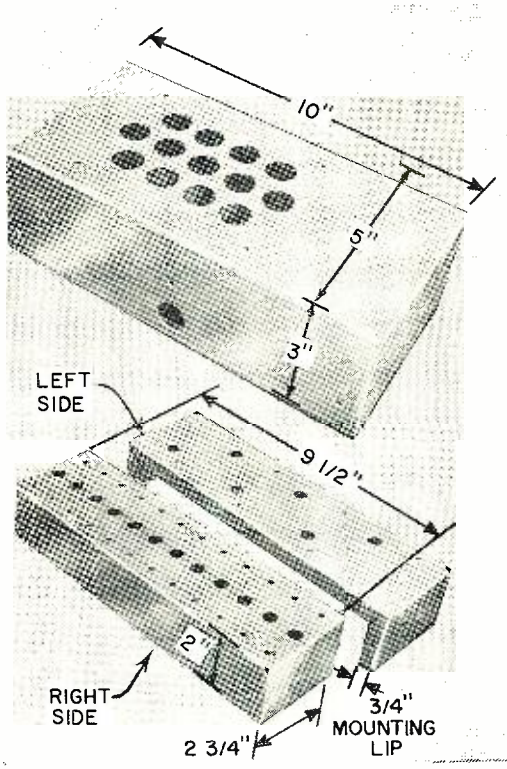
Construction Hints

With neither component layout nor circuit lead dress critical, a prospective builder of the "accordion" can either follow the general layout of the author's model, as shown in the photographs, or can make up a new layout to suit his own inclinations. Irrespective of the layout chosen, care should be taken that resistors R_1 to R_{12} and capacitors C_1 to C_3 are readily accessible and that the power supply battery B_1 can be removed and replaced without difficulty.

The "accordion-like" appearance of the author's instrument was achieved by using piano-key push-button switches for S_1 to S_{12} (available at local hardware stores) and by making up a special case with a large control "body" and two smaller "wings." A single 3" deep aluminum chassis was used for the "body," with a pattern of large holes punched in it to form a grille for the oval loudspeaker. The slightly shorter "wings" were made by cutting a 2" deep chassis in half lengthwise and forming mounting lips along the cut edges. All three chassis were assembled together using standard machine screws, hex nuts, and lockwashers.

Although hand-made, the finished case will look professionally built if properly finished. Two coats of enamel or clear acrylic plastic should be applied to the case after all machine work and case assembly is finished, but before parts are mounted or wiring started. For a finishing touch, leather strap handgrips can be added,

Main chassis and two side (keyboard) chassis. Dimensions are not critical.



with a neck strap provided if desired.

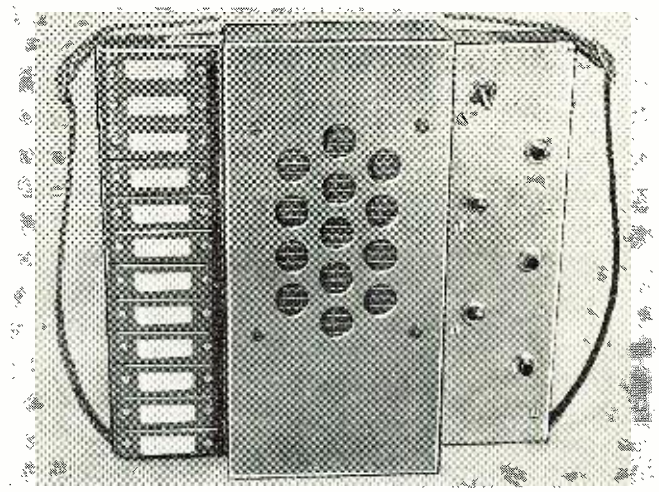
The 2N255 power transistor is mounted on a small piece of aluminum which serves as an effective heat sink for its collector electrode. This "subchassis" must be electrically insulated with respect to circuit ground and other wiring to prevent accidental shorts. In the model, this was accomplished by mounting the heat sink chassis on a strip of perforated Masonite. The insulating strip, in turn, was mounted to the main chassis by means of small "L" brackets.

Since the values of resistors R_1 to R_{12} and capacitors C_1 to C_3 are determined experimentally after all wiring is finished and the instrument is ready for test, it is best to provide terminal strip or individual "tie-point" mounting for these components.

Once the wiring is completed, all connections should be rechecked for errors and "cold-soldered" joints. Particular attention should be given to the polarity of battery connections, to transistor terminal connections, and to the color coding of transformer (T_1) leads.

Parts substitutions: The components used in assembling the author's model are specified in the parts list. A builder with a well-stocked laboratory or workshop may prefer to use parts he already has on hand where possible in order to save on "out-of-pocket" cost when assembling his own instrument.

Quite a number of substitutions are possible: the "piano-key" push-button switches (S_1 to S_{12}) may be replaced by conventional push-buttons; the toggle switches (S_{16}, S_{17}, S_{18}) may be replaced by rotary or slide switches; the 2N255 power transistor may be replaced by type 2N256; the power supply battery (B_1) may be replaced by any similar 6-volt battery of the same (or greater) capacity, or even by four standard flashlight cells connected in series. Finally, the oval PM loudspeaker specified in the parts list (and used in the model) may be replaced by



Here is a close-up over-all view of the electronic "accordion." The 12-note keyboard is at the left. At the right are the 2 loudness toggle switches and the power switch along with the 3 frequency buttons.

a *round* speaker or even two smaller round speakers connected in parallel. (Two 8-ohm speakers may be connected in parallel to provide a total impedance of 4 ohms and to match T_1's secondary winding.)

Circuit modifications: In addition to making straight substitutions for specified parts as outlined, the individual builder may actually change the basic circuit to meet his special operating requirements, to simplify the operation of the completed instrument, or to reduce the costs and the wiring complexity.

For example, capacitors C_1 to C_3 and switches S_{13} to S_{15} may be omitted entirely if the builder does not wish the added versatility of these tone controls. Similarly, if a fixed volume level is satisfactory, R_{14}, R_{15}, S_{16}, and S_{17} may be omitted and the loudspeaker's voice coil may be connected directly to T_1's secondary leads.

On the other hand, if the builder prefers a continuously variable "volume" control which has no effect on tone, these components (R_{14}, R_{15}, S_{16}, S_{17}) may be replaced by a fixed impedance "T" pad attenuator (such as a *Mallory* T2 control).

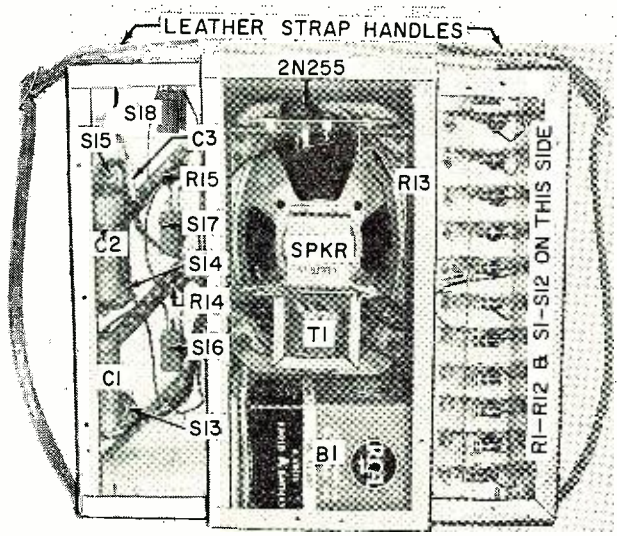
Additional (or fewer) base bias resistors (R_1 to R_{12}) and corresponding switches (S_1 to S_{12}) may be used to change the operating range of the instrument. With twelve "keys," somewhat better than a single octave is covered, but the instrument itself can cover several octaves, provided enough "keys" are added. Similarly, additional (or fewer) capacitors (C_1 to C_3) may be used.

Final adjustment: Due to tolerances in the characteristics of the transistor, the transformer, and other circuit components, the final values of the base bias resistors R_1 to R_{12} (as well as capacitors C_1 to C_3) must be chosen experimentally to produce the individual musical notes desired. In general, the values for these resistors will fall between 22 and 320 ohms, depending on the range desired. For a single range of somewhat over an octave, there will be about a 2 or 3 to one variation in resistance from the "minimum" to "maximum" values. In the author's model, for example, the values range from 22 to slightly over 45 ohms.

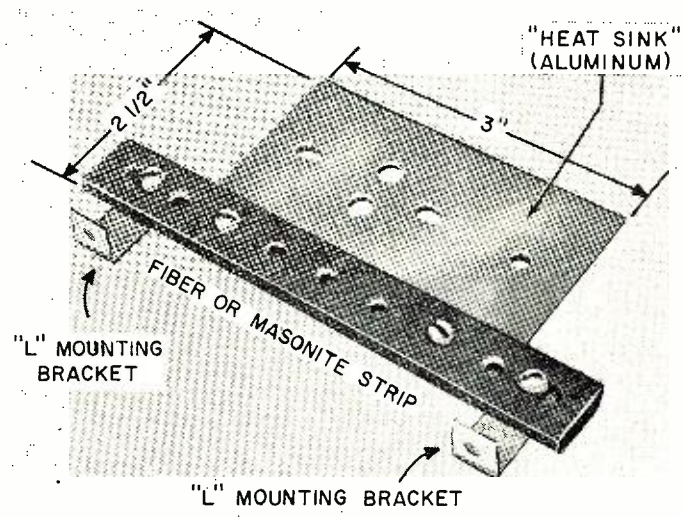
The exact resistance value needed to sound a particular musical note is determined by connecting an adjust-

(*Continued on page* 141)

Rear view of the wired instrument is shown here with the back panel removed. The major components are identified and correspond to circuit on the facing page. Wiring is not critical.



Here is a view of the power transistor mounting plate, the edge of which can be seen (with the transistor already mounted) in the view to the left. A piece of aluminum is used as heat sink.



Service Business Budgets

By **WILLIAM LEONARD**

Realistically planned operation can keep service dealers from spending themselves out of business.

IN THE COURSE of any year the average TV service dealer passes through at least one serious financial crisis during which he is forced to harbor doubts whether he will be able to stay in business. The annual cycles of boom and bust in TV servicing come around with such relentless regularity, it would seem that all dealers would lay aside some reserves during the fat days to tide them over the lean ones. But most dealers wear blinders when business is good and they are handling a lot of money. They overspend for stock, for equipment, and for their personal use. They dig financial holes that are hard to climb out of.

Many service dealers, under the guidance of competent accountants, have adopted the one sure plan for keeping the brakes on their spending when business is good. That plan is the use of a monthly budget based upon anticipated gross profit and set up on an annual basis. As one dealer who uses such a plan said, "Any well regulated business budgets its money. It is too easy to over-buy for stock and to take too much money out of the business for your personal use when business is good—if you do not have definite, pre-determined spending limits."

It is extremely unfortunate that TV service dealers do not have available to them the same type of business operating statistics that have been compiled for other industries. These statistical analyses, grouped by businesses of various sizes in the activity, provide a yardstick with which the individual dealer can measure the weaknesses and strong points of his own business. As an example, a recently issued *Dun & Bradstreet* "Cost of Doing Business" Report covering the operating results in 1956 for paint and wallpaper stores provides a wealth of useful, comparative information for every dealer in that field.

TV service dealers themselves are largely responsible for the lack of similar operating information on electronic service businesses. All attempts that have been made to compile average operating figures from the combined reports of numerous individual businesses have failed because of the lack of cooperation in supplying the information on the part of dealers.

A step in the direction of gathering this extremely necessary and useful information on electronic service businesses was recently taken in Missouri. A committee made up of representatives of the manufacturers, distributors, and service dealers mailed a questionnaire to a list of 635 service dealers in that state. This questionnaire sought the opinions of dealers on how to improve relations between manufacturers, distributors, and the independent service industry. The only question relating to business operating included in this survey was the request for each dealer who answered it to include the gross annual volume of business handled by his shop.

The dealers who cooperated in this survey reported annual volumes ranging from $200 to $250,000. The average for the 142 dealers who completed the questionnaires was $27,835 per year. On the basis of other available information, it is probable that this annual volume is ten thousand dollars or more above the national average of shops in the electronic service business.

There are three types of income that must be analyzed separately in a service business in determining the gross profit and its use, percentage-wise, in the operation of the business. First, of course, there is the income developed from the sale of service; second, the profits realized from the sale of tubes and parts; and third, the profits from the sale of new sets. Where the dealer has one-hundred per-cent of the income from the sale of service to use in paying his operating expenses, his average gross on tubes and parts is possibly forty per-cent. On new set sales he is fortunate if he can realize a gross profit of twenty-five per-cent.

The relationship of gross profit to gross income was discussed at some length at a recent meeting of service dealers in the Midwest. In explaining his approach to setting up an annual budget, one dealer said:

"For the sake of discussion, let's say that a service business is doing an average of three thousand dollars gross volume per month. This is an average on an annual basis. The business may do as much as five thousand dollars per month in October and November and drop to only twelve hundred dollars a month in May and June.

"Let us further assume that the three thousand dollars gross per month includes one thousand dollars from the sale of labor and time and two thousand dollars from the sale of parts, tubes, accessories, and perhaps a few new sets.

"I selected the figure of one thousand dollars per month as the income from the sale of labor because that would average out eight calls per day, six days per week at five dollars per call.

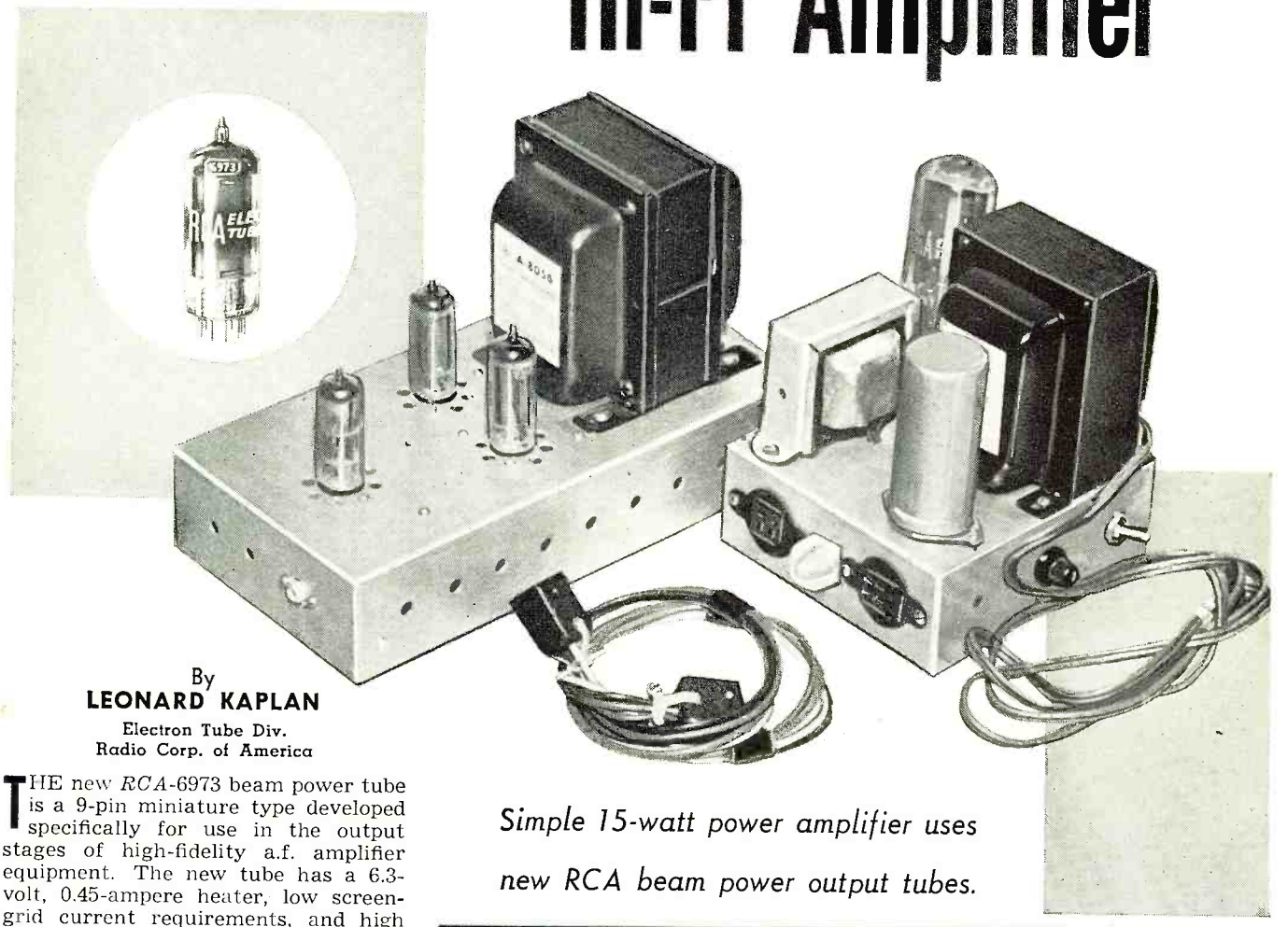
"Now let's further assume that the fixed operating expenses of this business run $1500 per month. This includes the salary or draw of the owner. With a gross of three thousand and fixed operating expenses of $1500, there would be $1500 per month available, over and above operating expenses, to pay what? So let us examine the gross income closely.

"The business had one thousand

(*Continued on page* 143)

A Low-Cost Hi-Fi Amplifier

Over-all views of the low-cost hi-fi amplifier along with its separate power supply. The new miniature beam power tube used is shown directly below.



Simple 15-watt power amplifier uses new RCA beam power output tubes.

By
LEONARD KAPLAN
Electron Tube Div.
Radio Corp. of America

THE new *RCA*-6973 beam power tube is a 9-pin miniature type developed specifically for use in the output stages of high-fidelity a.f. amplifier equipment. The new tube has a 6.3-volt, 0.45-ampere heater, low screen-grid current requirements, and high plate and screen-grid voltage ratings which allow it to operate very efficiently in a variety of output circuits. It is provided with specially designed grid structures and a basing arrangement which assure cool grid operation and freedom from grid emission. This feature permits the use of much higher values of grid-No. 1 circuit resistance than are generally permissible for beam power tubes and gives the 6973 exceptionally high power sensitivity. Two 6973's, pentode connected, in a conventional push-pull class AB_1 output circuit can deliver as much as 24 watts of output power with very low harmonic distortion.

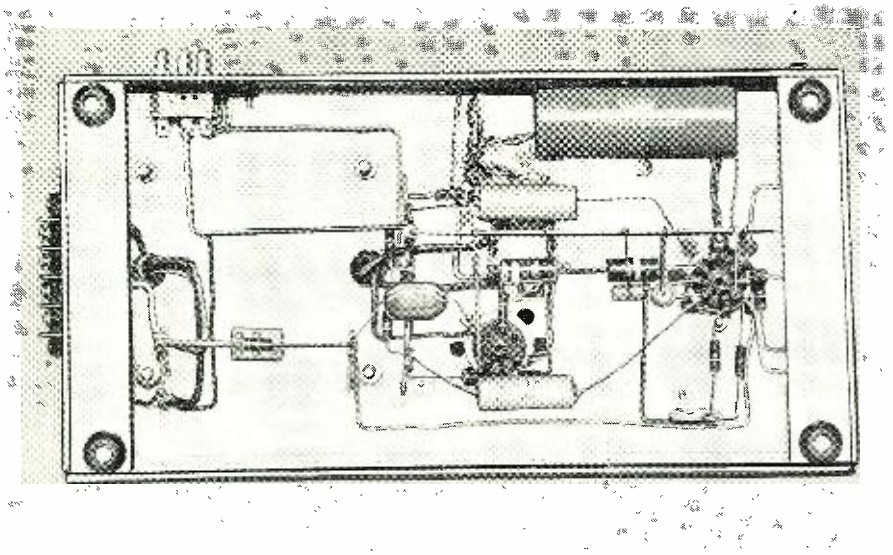
The characteristics of the 6973 have made it possible to design a simple, low-cost high-fidelity amplifier using only three tubes and having performance characteristics indistinguishable from those of amplifiers having much more complex circuits, using more tubes, and costing many times as much. The new amplifier employs only standard, non-critical components, and does not contain any circuits, balancing adjustments, or other controls which might require the use of test equipment. Anyone with a soldering iron and a modicum of construction experience should be able to assemble the unit and duplicate the results obtained in the laboratory.

Power Output:	15 watts continuous; 19 watts for short bursts
Sensitivity:	.98 volt for 15 watts output
Frequency Response:	17 to 60,000 cps ± 1 db
Output Impedance:	.65 ohm at 60 cps on 8-ohm tap
Total Harmonic Distortion at 1000 cps:	.17% @ 1 watt output; .19% @ 4 watts; .2% @ 8 watts; .4% @ 15 watts
Hum and Noise:	90 db below 15 watts (input shorted) 75 db below 15 watts (input open)

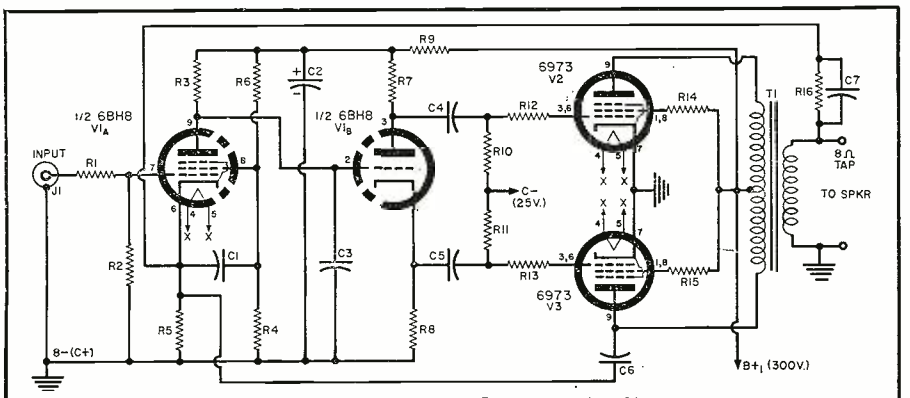
Table 1. The performance characteristics of the amplifier described below.

Design Consideration

The initial specifications for the amplifier were: (1) It should be capable of reproducing everything the human ear can detect and, therefore, should have a frequency response flat within ± 1 db from 20 to 20,000 cps. (2) Total harmonic distortion at full output should be less than 0.5% so as to be virtually undetectable to even the most discriminating listener.[1] (3) Because most authorities agree that a dynamic range of approximately 70 db is necessary for high-fidelity reproduction it should have a power output of at least 15 watts so as to be capable of reproducing a range of 75 db when used with speakers of average efficiency.[1, 2] (4) To assure good loudspeaker damping and permit operation with any type of loudspeaker system, including the new electrostatic types, it should have the lowest possible terminal impedance and the highest



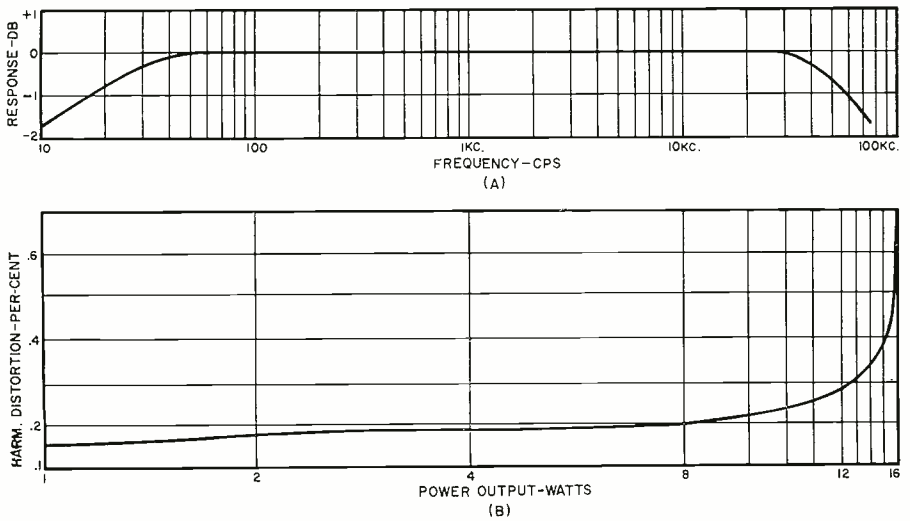
Bottom view of the amplifier itself is shown here. Note the simplicity of the wiring and the absence of any crowding. Note also the use of the ground bus.



R_1—10,000 ohm, ½ w. res. ± 10%
R_2—470,000 ohm, ½ w. res. ± 10%
R_3—220,000 ohm, ½ w. res. ± 10%
R_4—2.7 megohm, ½ w. res. ± 10%
R_5—680 ohm, ½ w. res. ± 10%
R_6—1.5 megohm, ½ w. res. ± 10%
R_7, R_8—15,000 ohm, 2 w. res. ± 5%
R_9—3900 ohm, 2 w. res. ± 10%
R_{10}, R_{11}—220,000 ohm, ½ w. res. ± 10%
R_{12}, R_{13}—1000 ohm, ½ w. res. ± 10%
R_{14}, R_{15}—100 ohm, ½ w. res. ± 10%
R_{16}—6800 ohm, ½ w. res. ± 10%
C_1—.25μfd., 400 v. capacitor
C_2—40 μfd., 450 v. elec. capacitor
C_3—15 μμfd., 400 v. capacitor
C_4, C_5—.1 μfd., 400 v. capacitor
C_6—6.8 μμfd., 600 v. capacitor
C_7—180 μμfd., 400 v. capacitor
J_1—Input jack
T_1—Output trans. 6600 ohms plate-to-plate to v.c. (Stancor A8056)
V_1—6BH8 tube
V_2, V_3—6973 tube

Fig. 1. Complete schematic of the low-cost amplifier. This unit is not available in kit form but must be built by the home constructor from this circuit and parts.

Fig. 2. (A) Frequency response of the power amplifier taken at a reference level of 1.25 watts output. (B) Total harmonic distortion at various output powers.



possible margin of stability. (Margin of stability is a term used to describe the ability of an amplifier to refrain from bursting into oscillation when used with a reactive load or when excited by signals having steep wavefronts.)

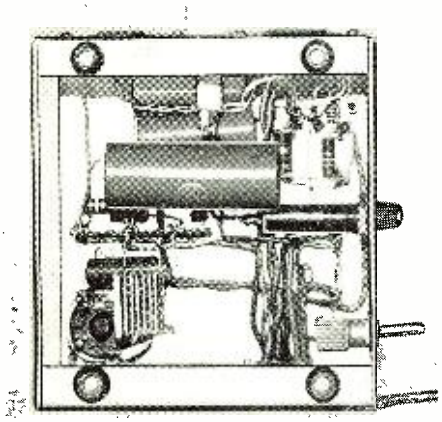
Circuit Design

The circuit of the amplifier is shown in Fig. 1. The amplifier employs a pentode input stage, direct-coupled to a triode split-load-type phase inverter which, in turn, drives a pair of 6973's in push-pull class AB_1. The 6973's are pentode connected and are operated with fixed bias. The input and phase-inverter stages use the recently introduced *RCA* 6BH8, which contains a high-gain pentode and a medium-mu triode in one envelope.

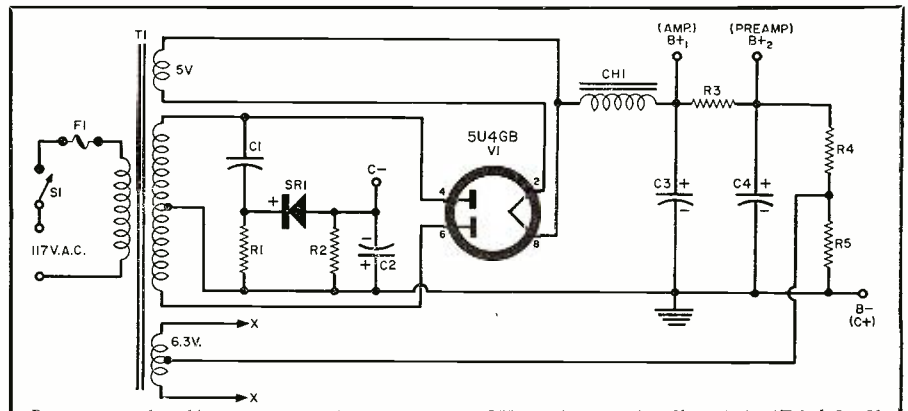
The use of direct coupling between the input and phase-splitter stages minimizes phase shift at low frequencies and consequently increases the amount of inverse feedback that may be used without danger of low-frequency instability. Because the plate voltage of the input stage determines the bias on the phase splitter the use of direct coupling can introduce certain difficulties, particularly in a high-gain, high-impedance circuit such as this one; that is, normal variations in the characteristics of the input pentode can produce wide variations in the operating point of the following triode. This difficulty has been substantially overcome by obtaining the screen-grid voltage for the pentode from a high-impedance voltage divider. This voltage divider serves two purposes: (1) it prevents excessive screen-grid voltage from being applied to the tube during the warm-up period; (2) the large *IR* drop in the 1.5 megohm resistor tends to stabilize the screen-grid voltage against the effects of changes in tube characteristics. Since the plate current and plate voltage of the pentode are highly dependent on the screen-grid voltage, the plate voltage also tends to stabilize from tube to tube so that any 6BH8 will perform well in the circuit.

One of the difficulties sometimes experienced with the split-load-type phase inverter is unequal high-frequency response in the two sections of the circuit due to the fact that the plate section has higher impedance to ground than the cathode section. This difficulty has been minimized to a large degree in the new amplifier by use of a low-value load resistance (15,000 ohms) for each of the sections. The resulting high-frequency unbalance is negligible within the audio-frequency range and is less than 2 db at 100,000 cps.

A class AB amplifier delivers highest efficiency and lowest distortion when operated with fixed bias[3]. This method of operation has several advantages: (1) The quiescent currents are low and heavy currents are drawn only when power is being delivered to the load. Tube dissipation at normal signal



Underside view of the separate power supply used with the amplifier. Selenium rectifier supplies fixed bias used.



R1—15,000 ohm, ½ w. res. ± 10%
R2—68,000 ohm, ½ w. res. ± 10%
R3—4700 ohm, 2 w. res. ± 10%
R4—270,000 ohm, 1 w. res. ± 10%
R5—47,000 ohm, ½ w. res. ± 10%
C1—.02 μfd., 600 v. capacitor
C2—100 μfd., 50 v. elec. capacitor
C3—80 μfd., 450 v. elec. capacitor
C4—40 μfd., 450 v. elec. capacitor
CH1—3 hy., 75 ohm filter choke (Triad C13X or equiv.)
S1—S.p.s.t. switch
F1—2 amp fuse
T1—Power trans. 360-0-360 v. @ 120 ma.; 5 v. @ 3 amps; 6.3 v. @ 3.5 amps. (Stancor PC-8410 or equiv.)
SR1—20 ma., 130 v. selenium rectifier
V1—5U4GB tube

Fig. 3. Diagram and parts list for separate power supply unit. A 6.3-volt pilot lamp may be wired to points "XX."

levels is very small and, therefore, is favorable for long tube life. (2) The reactance of the cathode bypass capacitor normally used in a self-biased stage is eliminated. Practical sizes of cathode-bypass capacitors seldom provide adequate bypassing at very low audio frequencies. Their reactance increases rapidly as the frequency is lowered and causes a corresponding increase in output impedance which is detrimental to the stability of the amplifier when large amounts of feedback are employed[1]. (3) The elimination of the self-bias resistor allows the bias to be independent of signal level and allows optimization of bias for lowest distortion.

Negative voltage feedback of 19.5 db is applied around the entire amplifier to assure very low output impedance and minimize distortion. The small capacitors connected from the grid of the 6BH8 triode to ground and from the plate of one output tube (the lower one on the schematic) to the cathode of the input pentode increase the margin of stability substantially, as a glance at the photographs of the square-wave response in Fig. 4 will show.

Power Supply

Fixed-bias operation of the output stage requires that the plate supply have very good voltage regulation because the plate current varies considerably with the signal level. The circuit of the power supply is shown in Fig. 3. It is a conventional choke-input system, and provides excellent regulation at low cost. The fixed bias voltage for the output stage is obtained from one-half of the high-voltage winding of the power transformer through a capacitance-resistance voltage divider and a 20-ma. selenium rectifier. The voltage divider allows the use of a selenium rectifier having a rating of only 130 volts r.m.s. The center tap of the heater-supply winding is connected to a resistive voltage divider across the output of the power-supply. The resulting 50-volt positive heater bias minimizes heater-cathode leakage and eliminates the need for hum-balancing adjustments[5].

Conclusion

The extent to which the original objectives have been achieved may be seen from the performance data shown in Figs. 2 and 4 and in Table 1. It can be seen that in every respect the amplifier exceeds the original specifications.

REFERENCES

1. *Langford-Smith, F., ed.: "RCA Radiotron Designer's Handbook," Chapters 13, 14, 21*
2. *Olson, H. F.: "Elements of Acoustical Engineering," D. Van Nostrand Co., First Edition, 1947, pgs. 483-487*
3. *Schade, O. H.: "Beam Power Tubes," Proceedings of the IRE, February 1938*
4. *Williamson, D. T. N.: "Design of a High-Quality Amplifier," Wireless World, April-May 1947 and August 1949*
5. *Heacock, D. P. & Wissolik, R. A.: "Low-Noise Miniature Pentode for Audio-Amplifier Service," Tele-Tech, February, 1951*

-30-

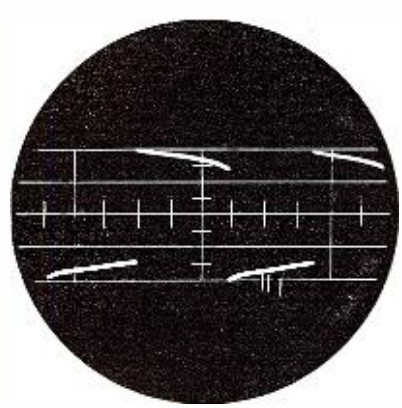


Fig. 4. (A) Square-wave response at 20 cps. Some waveform tilt is shown.

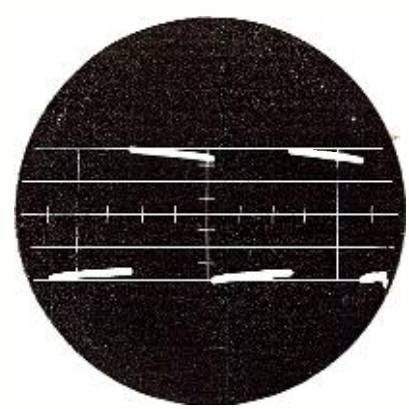


Fig. 4. (B) Square-wave response at 50 cps. A very slight tilt still remains.

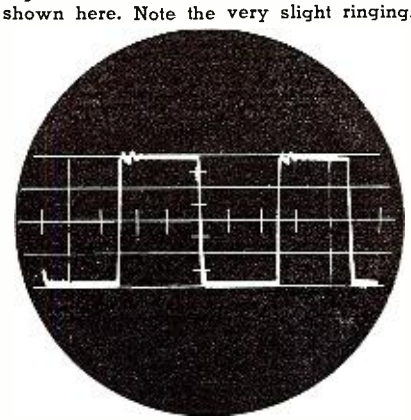


Fig. 4. (C) A 5000 cps square wave is shown here. Note the very slight ringing.

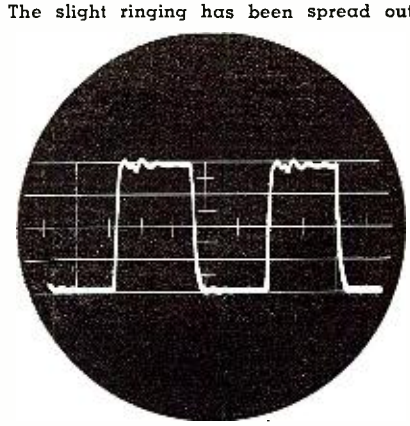
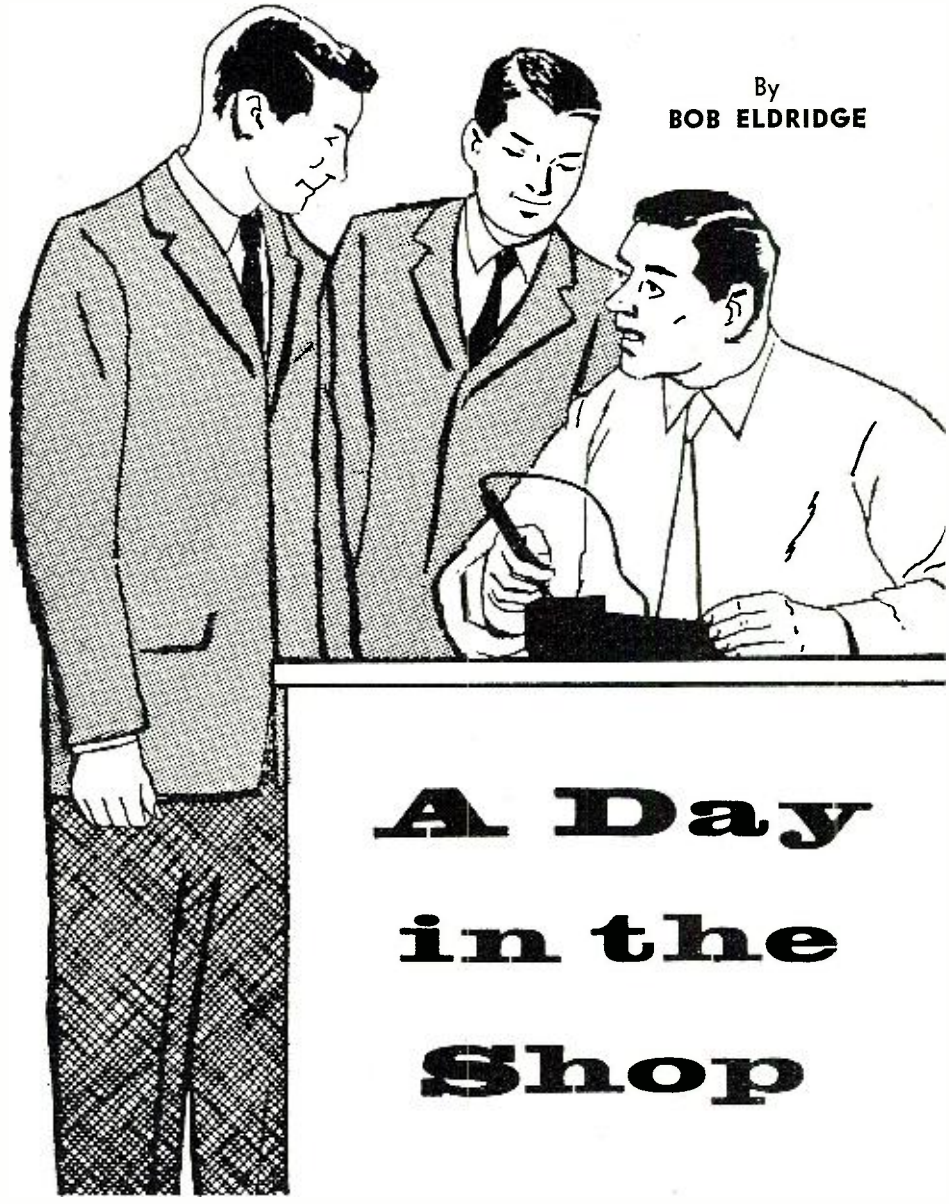


Fig. 4. (D) This is a 10,000 cps square wave. The slight ringing has been spread out.

By
BOB ELDRIDGE



A Day in the Shop

Wisdom from an experienced bench man illuminates practical problems for two electronics students.

THE author's shop is often host, for a day, to a couple of students of electronics. These individuals, who entertain the ambition of some day joining the profession, have become partners in an amicable arrangement: in return for the time spent in explaining what we do to sets under repair—and why—they do such things as making routine checks of tubes and cleaning up chassis. This arrangement provides another benefit. It gives the bench men an appreciative audience and a chance to talk shop. A running commentary of what goes on during a typical day will give you an idea:

There are three sets awaiting service and one more due in later in the day. Each of the chassis bears a brief note on the job sheet containing any information the outside technicians think may help the bench man. We insist on factual information, *not* an attempt at diagnosis. An exception is the case where the outside man knows for sure what the trouble is but, for some reason, was unable to fix it in the home. Sometimes the notes are so detailed that an immediate lead is given; sometimes the information is no more helpful than, "Mrs. Johnson says the picture is still too far back!"

The job sheet on the first one says "Touchy horizontal hold—phase coil adjustment very critical." The tubes have already been checked, so we can get to work on the set, an *Emerson,* right away. Fired up and connected to the antenna, the set shows a good picture, but just a touch one way or the other on the horizontal-hold control will throw the picture out of sync. The slightest movement of the slug in the phasing coil moves the picture across the screen and half a turn either way will also throw the picture out.

"What do you think that is?" asks Jack. "Missing sync pulse, I guess," answers the bench man, and reaches for the scope low-capacity probe. However, on attaching the probe to the input grid of the Synchroguide stage (see Fig. 1), there is displayed on the scope a perfect waveform with a good high sync pulse sitting smugly up on the saw-tooth. More as a matter of habit than anything else, he transfers the probe to the junction of the phasing coil and oscillator coil and glumly surveys another perfect waveform. This one is the familiar "sine-wave-plus-spike" which is said to be engraved on the heart of every technician after a lifetime of fighting mode-hopping (or squegging, if that's your local term) oscillators.

"According to the scope, the set should work fine," says the bench man. "Now we'll have a look at the grid with a v.t.v.m. and check for bias variation."

He attaches the d.c. probe of the v.t.v.m., sets the pointer at center-zero, and slowly turns the horizontal-hold control while watching the pointer: "See that voltage on the grid? That should vary smoothly in either direction, depending on which way I turn the hold control. As I try to increase the frequency of the oscillator by turning the control, the voltage should change on the grid to maintain oscillator speed at 15,750 cps. As you see, the voltage doesn't change much until suddenly it jumps up as the picture goes out of lock. This is our first clue. Now we must check to see whether there is a leak to ground from the grid, which would short the correction voltage."

He turns the set off, waits a minute or so for the heaters to cool, and then measures from grid to ground with the ohmmeter. He finds over 1 megohm, which is normal and explains "I had to let the tube cool off, otherwise the small positive voltage on the ohmmeter probe might cause conduction between cathode and grid of the tube and give me a false reading." He then checks each of the resistors in the grid and cathode circuits of the control section to the left. (A glance at Fig. 1 will show that there are no parallel paths here, so provided that none of the capacitors have leakage, it is not necessary to disconnect any of the resistors to measure them.)

Each of the capacitors is then disconnected at one end and tested on a checker for capacitance and leakage. The .047 and the .022 check normal but the .47 shows definite leakage at 250 volts and up. "This capacitor is rated at 150 volts," says the bench man, "but we can't take chances in a Synchroguide circuit. Let's replace this one before going any further. If we are lucky, this may be the trouble anyway." Sure enough, when the capacitors are reconnected and the new .47-μfd. unit is in place, the set reacts in a perfectly normal manner. After setting up the oscillator and

checking on the scope for correct waveform (spike slightly higher than the hump) all that remains is to check the sound adjustments, a routine in the shop, and check operation on each of the channels available. The set is put aside on the running-up bench for a test run before being finally put aside for delivery to the customer.

Multivibrator Woes

The next set in line also has horizontal troubles—no raster at all in fact—and the note says "No high voltage, but oscillator working." A quick check with the v.t.v.m. at the grid of the 6BQ6 shows some negative voltage, but only about 10 volts, whereas normal on this set is about 25. Cathode voltage is plus 13 volts (normal across the 100-ohm cathode resistor is about 10 volts, indicating 100 milliamperes normal current through the tube). Screen voltage is about normal at 160 volts.

"What does that tell you?" asks Jack. "Well, first the oscillator is working, producing some grid drive to the output tube and, second, the output tube is passing a bit too much current—but almost any fault in the output stage has something of that same effect. Let's look at the boost voltage."

He checks the width coil, using the 1500-volt range of the v.t.v.m. but finds just the same 300 volts that exists on the "B+" line, so there is no boost. "Well," says the bench man, "on this set that usually means a short in the yoke or in the width coil or in the flyback or—most likely of all—a shorted .1-μfd. boost filter capacitor. Let's clip on the substitution box in place of the .1-μfd. capacitor."

"This set makes a louder squeal than usual, doesn't it?" asks John, the second student. "Hey! That's a point," says the bench man, "it's not only louder, but it's *lower!* That's only 5000 or 6000 cycles. Let's think about that a bit. There's a fault that happens on the *G-E* 'J' chassis that causes just that kind of effect when the 20-μfd. filter in the oscillator 'B+' supply goes open."

He takes the substitute electrolytic from under the bench, clips the negative wire to the chassis, the positive end to the "B+" side of the ringing coil (Fig. 2) and bingo! Up comes the raster. "Let's go and have coffee on that one!"

While in the coffee shop for a 15-minute break, the bench man explains that, when the filter capacitor in the plate "B+" supply is good, the cold end of the ringing coil is effectively grounded as far as the r.f. is concerned. However, when the filter goes open, the grounded point becomes "hot" to r.f. The plate impedance of the oscillator is effectively raised so much that it cannot operate at the correct frequency. Thus the oscillator is working and is driving the output stage, but *not* at 15,750 cps.

"I remember," he muses, "the first time I came across that fault. Charlie

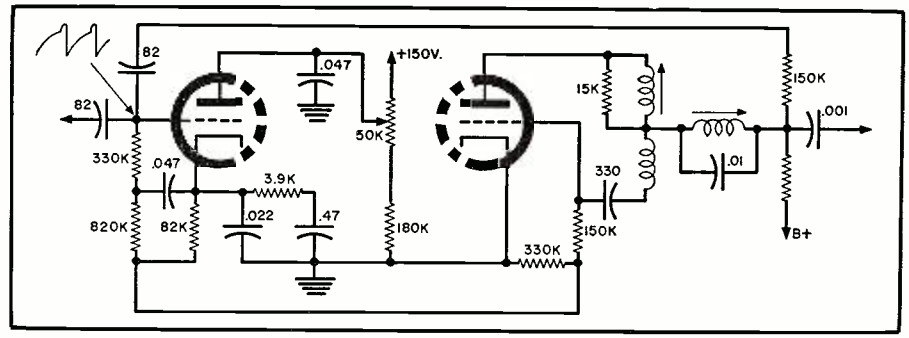


Fig. 1. Pulse-width (Synchroguide) horizontal oscillator with a.f.c. triode.

was working on an old *Stewart-Warner* that had no raster and it was emitting such a whistle that, even with the speaker disconnected, the audio-output transformer was sending out enough noise to irritate everyone in the shop. We all asked Chuck at least to stop the whistle before he went on with the job, but he didn't bother to do so—maybe he has a built-in filter in his ear. Anyway, when he slipped out for lunch without having got the set going, we had a quick look at the job. We found the noise was due to modulation at the screen of the 6AQ5 audio tube, so we hooked in a 40-μfd. capacitor to remove the modulation. To our surprise the raster fired up and the set worked like a charm. We wired in the capacitor, professional-like, and switched the set off.

"When Chuck came back from lunch and switched it on, he erupted so violently the air almost turned blue around him: 'The blankety-blank set has started up on its own now!' We soothed him by explaining what had happened. Sure enough, when he checked into the set, he found the 80-μfd. filter in the power supply was open, causing exactly the same effect we had in the set there on our bench except that, in his case of course, the screen of the audio tube came off the same 'B+' point. I remember so vividly 'the Case of Chuck and the *Stewart-Warner*' that I feel ashamed of myself for not noticing the symptoms on this set more quickly. The coffee's on me."

Back in the shop, the bench man wires in a 10-μfd. capacitor in place of the defective 10-μfd. section shown in Fig. 2, makes a careful check of the rest of the set, adjusts the sound, and the chassis joins the *Emerson* over on the running-up bench.

Another Missing Raster

The next one up, a 1953 *Admiral* with somewhat similar circuitry to Fig. 2, also has no raster and has nothing helpful on the job sheet at all. The plate resistor of the first section of the oscillator has obviously been overheated, which usually means there is positive bias on the grid. The bench man withdraws the 6BQ6 before switching on the set—there is no point in over-running the output tube while the oscillator is being investigated. Attaching the d.c. probe of the v.t.v.m. to the grid of the 6SN7, he switches on the set—and overswings the needle past the 100-volt mark before the tubes have even warmed up.

"There's a definite clue," says the bench man, "where do you think that voltage comes from?" Both students look at the circuit diagram on the bench. "One of those .001-μfd. units from the separator shorted?" asks Jack. "Look more carefully and you can see *which* one," says the bench man. "Oh, yes," says Jack, "the one from the plate circuit because the cathode has no voltage until the tube starts to conduct." "Dead right," approves the bench man. "If the voltage only appears after the tubes have warmed up, it may be the capacitor coming from the cathode of the sync separator or it may be due to a short in the 6AL5 phase discriminator. Sometimes if that .01-μfd. capacitor at the 6AL5 cathode goes open, you get a thumping big spike coming in from

(*Continued on page* 134)

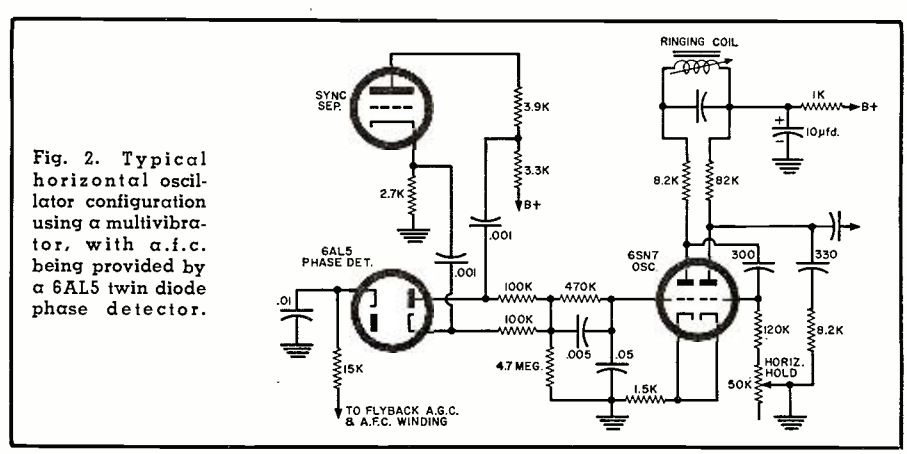


Fig. 2. Typical horizontal oscillator configuration using a multivibrator, with a.f.c. being provided by a 6AL5 twin diode phase detector.

How The G-Y Signal is Used

By **ROBERT G. MIDDLETON**
Radio Electronic Television Schools

R-Y, G-Y, B-Y, I, Q—has the "alphabet soup" of color-TV terminology been causing you confusion? Here is a readable clarification of key points.

IF YOU have started to service color-TV receivers, and even if you haven't, you know that many of the present-day chassis are using *G-Y* chrominance detectors. The basic difference between the newest receivers and the earlier ones is shown in Fig. 1. The configuration of Fig. 1A is called *R-Y/B-Y* detection and represents a slightly older design practice. The arrangement of Fig. 1B is called *R-Y/G-Y* detection which is now becoming more popular.

The chief advantage in using the *R-Y/G-Y* detection system is realization of improved signal-to-noise ratio or improved weak-signal reception. This improvement is possible because the *G-Y* signal is transmitted at a higher level than the *B-Y* signal.

At this point many of you are saying: "Now wait just a minute—we know very well that color-TV signals are transmitted *along the I and Q axes;* so how can you talk about transmitting a *G-Y* signal?"

This is quite true—as far as it goes. And there is the point: the simple statement that transmission is made along the *I* and *Q* axes *does not go far enough.* There is considerably more to a color-TV signal than meets the eye (at least at first sight!).

Let us consider for a moment what *I* and *Q* mean. These are initials which signify "in phase" and "quadrature phase." Why should these particular designations be used? They are used principally because it is easier and quicker to speak of a transmission primary as the "*I* phase," rather than as the "orange-cyan axis." Likewise, it is easier to speak of the "*Q* phase" rather than the "green-magenta" axis.

If you inspect the reproduction of a color-bar signal on the screen of a color-TV receiver (see Fig. 3) you will observe indeed that the *I* signal produces an orange or a cyan hue, depending upon whether it is positive or negative. Likewise, the *Q* signal produces a green or magenta hue, depending upon whether it is positive or negative. (You may argue that the hue is slightly off-green or off-magenta, but this is beside the point.)

But why *I* and *Q*, rather than some other letters? Just what do we mean by "in phase" and "quadrature phase"? The answer to this question lies in the fact that color-TV transmission originally was made along the *R-Y* and *B-Y* axes. The *B-Y* (blue minus luminance) axis is *in phase* with the 3.58-mc. subcarrier burst and the *R-Y* (red minus luminance) axis is in quadrature phase with this burst, as we see in Fig. 2.

Now, it was found that the best color characteristics could be transmitted by shifting the transmission axes 33 degrees from their *R-Y* and *B-Y* positions, as depicted in Fig. 4. These axes are no longer in phase with anything in particular, except perhaps subjective human reaction to color. But we need a shorthand designation for them, and it was convenient to dub these axes *I* and *Q*. And there you are.

When transmission axes were changed to *I* and *Q*, it became possible to use wide-band transmission along the *I* axis for high-fidelity color reproduction (optimum chroma-circuit response). This shift of transmission axes, however, had no effect whatsoever upon the proportions of *R-Y* and *B-Y* contained in red, or green, or any other color because these proportions remain fixed. This fact is illustrated in Fig. 6, which shows that the red chrominance signal "stays the same" whether transmitted by *I* and *Q* components or by *R-Y* and *B-Y* components.

It then follows that a red signal, although transmitted along the *I* and *Q* axes, can be demodulated along the *R-Y* and *B-Y* axes at the receiver. To take another step, how about the *G-Y* axis shown in broken lines in Fig. 2? A red signal, for example, also exists with respect to the *G-Y* axis, as depicted (*O-C*) in Fig. 8. Likewise, a green signal has a component (*O-F*) along the *G-Y* axis, as seen in Fig. 5.

Since it is thus quite possible to demodulate a chrominance signal along *R-Y* and *G-Y* axes, instead of *R-Y* and *B-Y* axes, we may ask "What advantage can be gained by *R-Y/G-Y* demodulation?" The advantage comes about principally from the fact that

chrominance values are re-adjusted prior to transmission, to avoid overmodulation of the transmitter. Compare Figs. 7A (before re-adjustment) and 7B. In the re-adjustment process, *R-Y* is reduced to .877 of its original value. *B-Y* is reduced to .493 of its original value. But, in this process, *G-Y* is *increased* to 1.423 of its original value.

Of course, these values must be restored finally at the receiver, by suitable adjustments of gain in the three chrominance channels, but this is no problem. In any case, the incoming chrominance signal contains *G-Y* at a level much in excess of *B-Y*. That is, the *G-Y* signal is better able to compete with noise than is the *B-Y* signal. Hence, dictates of good receiver design, other things being equal, call for the use of *R-Y/G-Y* detection rather than *R-Y/B-Y* detection. After *R-Y* and *G-Y* signals have been recovered in the synchronous detectors, it is a simple matter to matrix these signals to obtain a relatively noise-free *B-Y* signal.

The question may well be asked: "Why do all modern color receivers use *R-Y*, *B-Y*, and *G-Y* channels in one arrangement or another? Why not

(*Continued on page* 149)

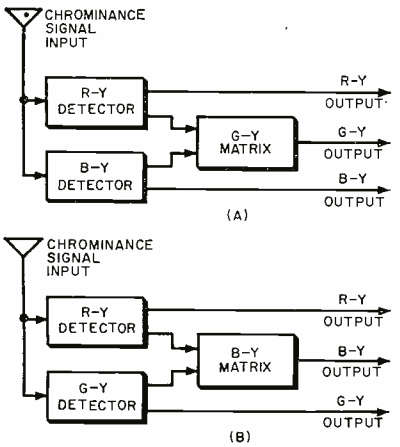


Fig. 1. A receiver chrominance channel set up (A) for R-Y/B-Y detection and another (B) set up for R-Y/G-Y detection.

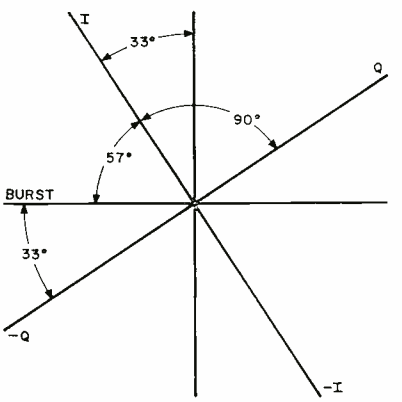


Fig. 4. The phase relationship between the arbitrary I and Q axes and the 3.58-mc. burst, which coincides with —(B-Y).

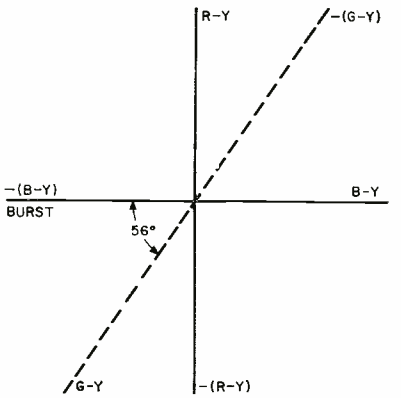


Fig. 2. The B-Y axis is "in phase" with 3.53-mc. burst, but "in quadrature phase" with the R-Y axis; i.e., 90 degrees away.

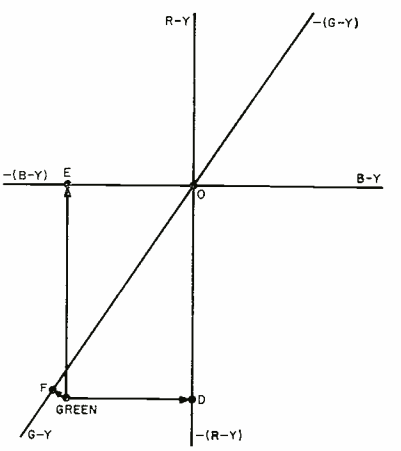


Fig. 5. Location of a fixed green signal with respect to R-Y (line O-D), G-Y (line O-F), and B-Y (line O-E) axes.

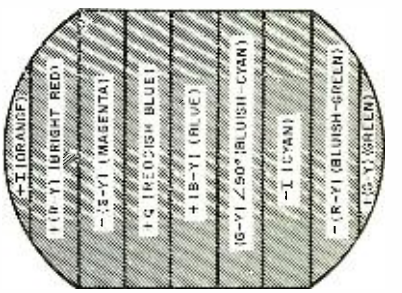


Fig. 3. Standard color-bar pattern.

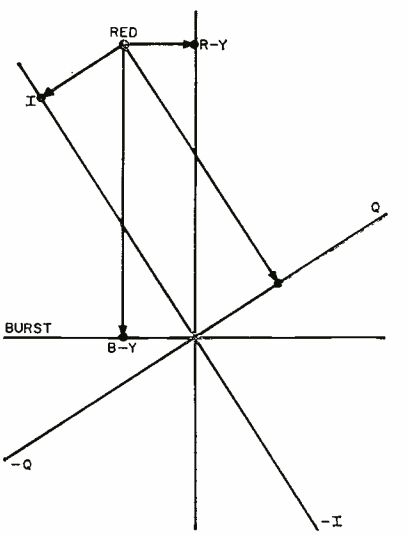


Fig. 6. Any color signal (such as red) "stays in the same place" regardless of which axes are used for transmission.

Fig. 8. A red signal as it exists with reference to R-Y and G-Y axes.

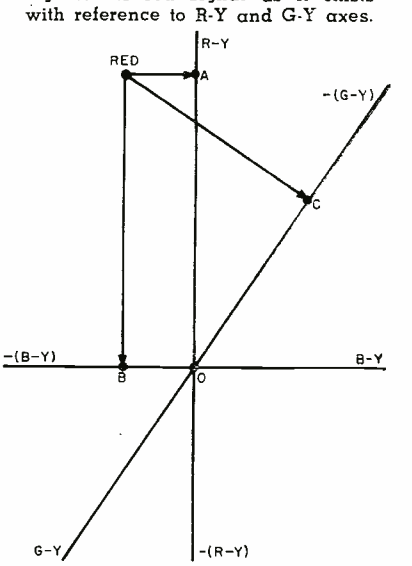
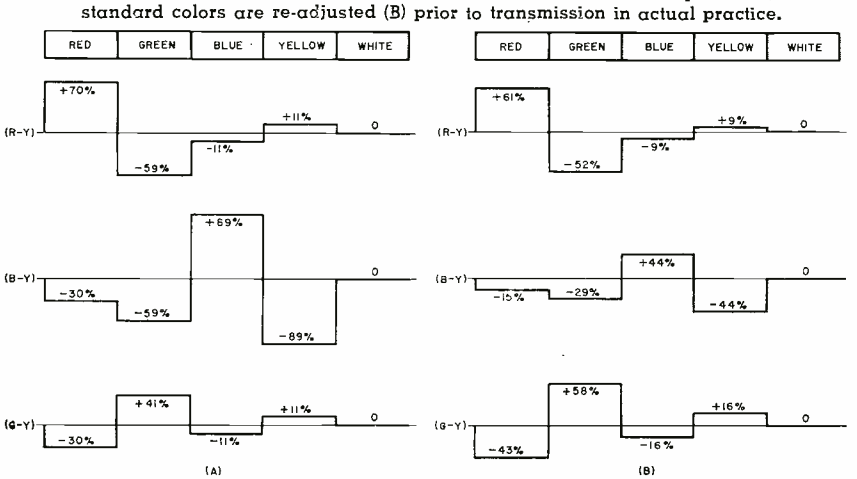
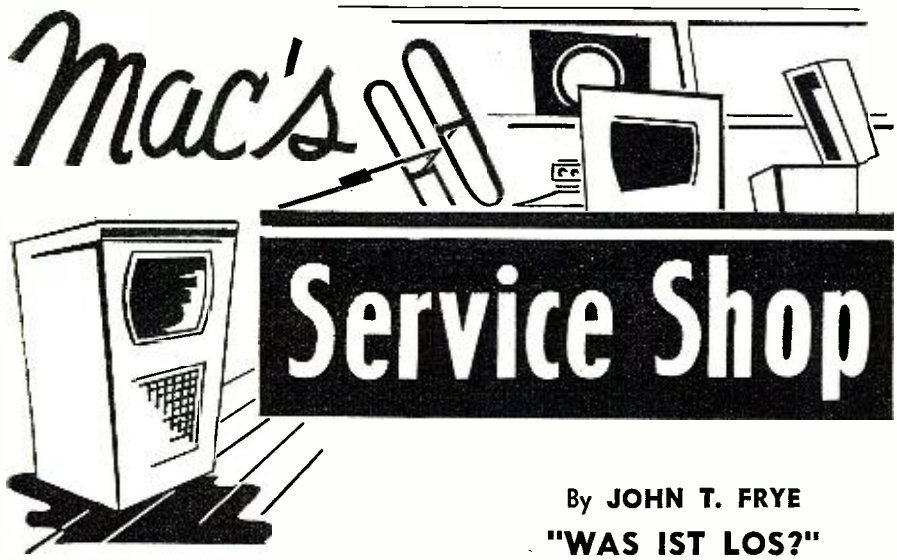


Fig. 7. The normal levels (A) for the various chrominance components of standard colors are re-adjusted (B) prior to transmission in actual practice.





By **JOHN T. FRYE**

"WAS IST LOS?"

SPRING had been a long time coming, but finally made it. A warm breeze was wafting in the wide-open door of Mac's Service Shop this sunny morning and shortly after eight o'clock Barney himself wafted through that door. His blue eyes had a dreamy, far-away look in them that promised little in the solder-slinging line for this day.

Mac, the owner of the shop, was already at work at the bench. A large cream-colored, gold-trimmed portable was in front of him and he was frowning at a small crumpled diagram spread out on the bench. At his elbow was a German-English dictionary.

"Hey," Barney exclaimed as his eyes focused on the receiver; "what you got there? That's a pretty gaudy portable, isn't it?"

"Yep," Mac said without looking up. "It's a *Metz* 'Babyphon' 56 receiver made in Germany. An Air Force fellow stationed in England bought it there and had it shipped home. It has some pretty unusual features."

"Looks as though it might have," Barney agreed. "Do those two little folding doors in front cover the speaker grille? And what does that 'Babyphon' name mean?"

"The speaker grille is in the end," Mac pointed out as he placed the receiver on its back; "but take a look in here," he suggested as he lifted the outside edge of the right-hand door. Inside was a turntable and a little ivory-colored pickup arm.

"Well I'll be!" Barney exclaimed. "A combination two-way portable and a baby phono player! Does that thing really work?"

"It certainly does. It plays any 45 rpm record. The motor is d.c. and this rheostat adjusts the speed. The pickup has a genuine sapphire needle. When the set is plugged into the 'mains' as the instruction book has it, power for the motor is furnished by rectified a.c. from a transformer. When you must operate the set away from the power lines, the tiny motor is run by four medium-sized flashlight batteries connected in series. The instruction book says one set of these batteries will play eight hundred sides."

Barney had the back off the receiver by this time and was peering inside.

"What's that little square doohickey back in the corner?" he asked.

"That's a built-in, gas-tight, lifetime, nickel-cadmium storage battery that never requires any servicing except recharging. It has a rating of 1.2 volts and 3.5 ampere-hours and heats the filaments of the eight tubes that are connected in parallel. Not only does this save dry cells, but floating the battery across the filament supply when the set is operating on a.c. keeps down ripple and holds the filament voltage constant. That prolongs the life of the tubes. The battery is charging at a reduced rate when the set is operating on a.c. and you can charge the battery more rapidly with the set turned off if you like. A full charge will keep the set going for fifteen hours. On top of that, if the battery becomes discharged away from the power lines, you can just slip a standard flashlight cell into this space in the battery holder and run the filaments off it until you have a chance to recharge the battery."

"They've thought of everything," Barney remarked. "I see the 'B' battery is a standard 90-volt unit. What do all those five piano-key push-buttons do?"

"One turns the set off; one turns on the phono player; and each of the three remaining ones turns the set on and selects a different band. The long-wave band tunes from 150 to 350 kilocycles; the medium band, from 510 to 1640 kilocycles; and the short-wave band from 6 to 15.5 megacycles. When the phono button is pushed, all r.f. and i.f. tubes have their filament voltage cut off. A jack in the back enables you to run the output of the phono player into an external amplifier. When you plug into this jack, all filaments are automatically turned off and power is furnished just to the phono motor. The boys who designed this didn't intend to waste a single electron!"

"Well, let's hear it play."

"That's the joker; get a load of this."

Mac pushed the medium-band key and the set broke into a loud motorboating. Manipulating the bass or treble tone controls or the volume control would change the frequency of the plopping sound, but no setting of any of them would stop it entirely.

"Since when did motorboating become a tough service problem?" Barney scoffed. "Chances are the set has an open output filter capacitor."

"Chances are it hasn't; I tried that," Mac said with a grin.

"Open grid in one of the stages?" Barney offered hopefully.

"Nope; neither can I find any open bypass capacitors, loose shields, or resistors with radically changed values. I decided to quit guessing and study the diagram a bit; but I ran into a headache there, too. This diagram is in German."

"Gwan!" Barney hooted. "Quit trying to pull my leg. A diagram is a diagram in any language."

"Is that so!" Mac retorted. "Suppose you take a good long gander at this little diagram that came with the set and explain some things to me."

"Son-of-a-gun," Barney exclaimed; "it *does* look kind of funny. Do you have it figured out yet?'

"Not all of it, but I've discovered a few things. This is the power transformer here. The thick dark lines indicate transformer windings and the light line between them stands for the core. These little rectangles are resistors. The plain ones are ⅓ watt. If lines bisect the rectangle both lengthways and across, the resistor is ¼ watt. Two dots inside the rectangle mean the resistor is $\frac{1}{10}$ to $\frac{1}{20}$ watt.

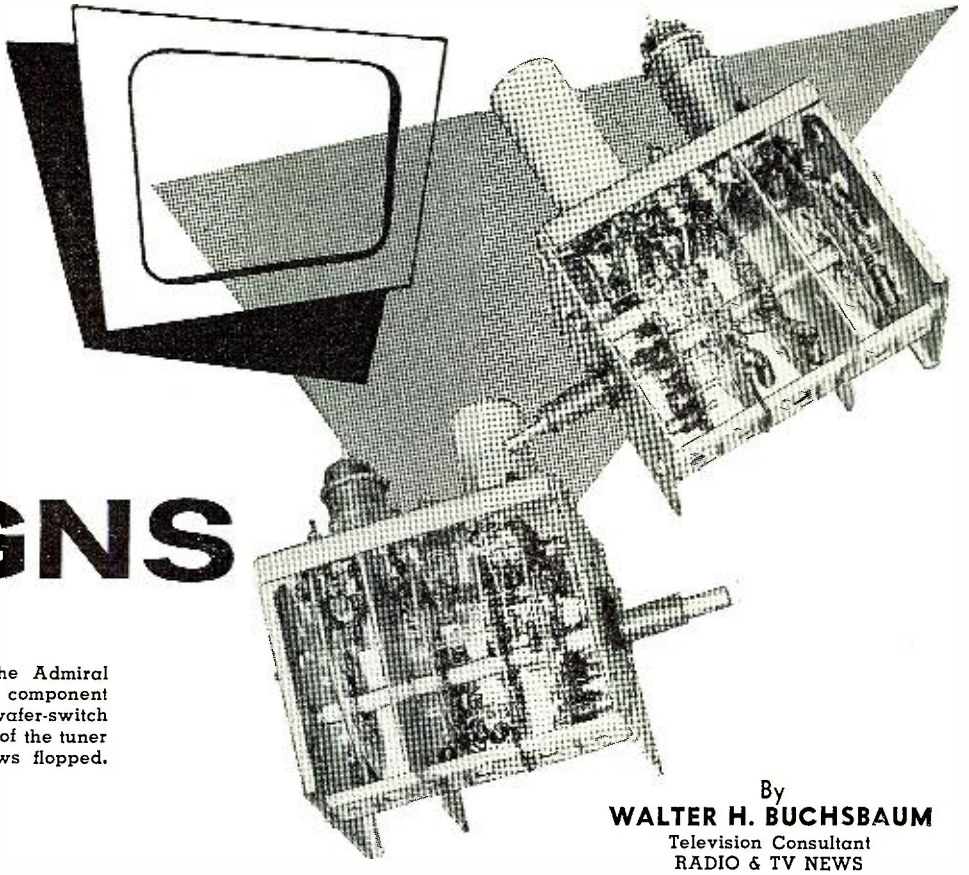
"Capacitors are shown by the usual symbol of two small rectangles side by side representing the two plates. In a polarized capacitor, the negative connection is shown by a blocked-in rectangle, while the positive one is left unshaded. Paper bypasses have both rectangles blocked in. Such a symbol by itself indicates a unit with a working voltage of 125 volts. A dot beside the symbol means 250 working volts. Notice this capacitor in series with the resistor from plate to plate of the push-pull output stage has a little tilde beside it. I'm not sure, but I think that means a special capacitor for use across a high-potential alternating source.

"The capacity values beside the capacitors on the diagram bothered me for a while, but I think I have them figured out. The letter 'u' means microfarads. The letter 'p' apparently means micromicrofarads. The letter 'n' must mean 'thousands of micromicrofarads.' At least a capacitor that is marked .047 is shown on the diagram as '47n.' "

"What's this thing that looks like a

(*Continued on page* 132)

NEW TV Front End DESIGNS



Figs. 1 & 2. Two views of the Admiral Model 94D128-1 TV tuner. This component is typical of the latest crop of wafer-switch TV tuner assemblies. Both sides of the tuner are shown here, with the views flopped.

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TV NEWS

There are changing trends in preferred types, size, mechanical arrangement, and circuitry.

AN OBSERVER focusing his attention on the tuners used in today's TV receivers might react with surprise on noting that they differ considerably from those current a few years ago. Since there have been relatively few changes in tuner design during recent years, and none of them has, by itself, represented a dramatic advance, the surprise would be justified. Yet the sum total of change has resulted in tuners that are noticeably different, featuring better performance and also affecting troubleshooting and service requirements.

New, improved tubes have been developed with increased gain, lower noise figures, and more rugged construction. Because the growth of u.h.f. has not been rapid, there have been few advances in this range and most manufacturers continue to provide an optional auxiliary type of tuner that works in conjunction with a conventional v.h.f. circuit, rather than making available full 82-channel tuners or independent u.h.f.-only types. Although newer u.h.f. amplifier tubes have been developed, it would increase tuner cost to use them. Apparently the limited u.h.f. market does not warrant a concentration on improved design. Accordingly, most u.h.f. tuners incorporate only an oscillator and mixer crystal, feeding into the v.h.f. tuner and relying on the latter for gain and noise characteristics.

Basic v.h.f. circuitry still embraces the pentode r.f. amplifier, the resurrected Neutrode and the well known, low-noise-figure, cascode circuit. Oscillator-mixer tubes are now frequently a combination pentode and triode. The latest TV tuners have a number of features not previously found together, but the increased gain and better noise figure have also made the entire tuner more subject to various troubles. Because of the increased gain, microphonics, regeneration and spurious oscillation as well as pickup of image, i.f., and other interference, are more easily caused by mechanical deficiencies. Alignment and all mechanical adjustments are more critical and require more care. In addition, most recent tuner designs are intended for modern compact receivers and are, therefore, limited as to available space. This makes servicing more difficult.

The very existence of remote control devices has also had its impact on the design of tuners. Mechanical remote fine tuning is a rather complicated thing to set up. Variable-capacitor tuning from a remote position is also difficult to arrange, what with the uncertain capacitance of leads between the remote device and the tuner tending to introduce undesired tuning —and detuning—effects.

The result has been the elimination of the traditional fine-tuning variable capacitor on some new front ends, with an electronic means of automatic fine-tuning control—some form of a.f.c.—taking its place instead. Such an arrangement is discussed in "New *Westinghouse* TV Circuits," starting on page 54 of our January 1958 issue.

The well-known turret tuner, with its easily removable segments, is less widely used in many of the larger manufacturers' sets; in its place we often find the switch tuner using a version of the "tuned line" circuit. Service technicians who remember the first *RCA* switch-type tuner, the KRK-2, may not be delighted with the thought of working with that type of circuit again; however, the new switch tuners are not at all as difficult to align and repair as their earliest prototypes. Above all, the circuit is much improved over the original push-pull version and recent examples are more rugged mechanically. Many of these new tuners are used with some kind of power or remote-control tuning device, which eliminates some of the abuse and tampering to which owners of earlier models often subjected sets.

Wafer-Switch Tuners

The basic principle of the wafer-switch tuner, the series-connected coils, will be well known to many. Tuned circuits are adjusted from lower to higher channels by shorting out individual sections. At the lowest channel, all coil sections are in the circuit and, at the highest, only one or two coils are part of the resonant tuning circuit.

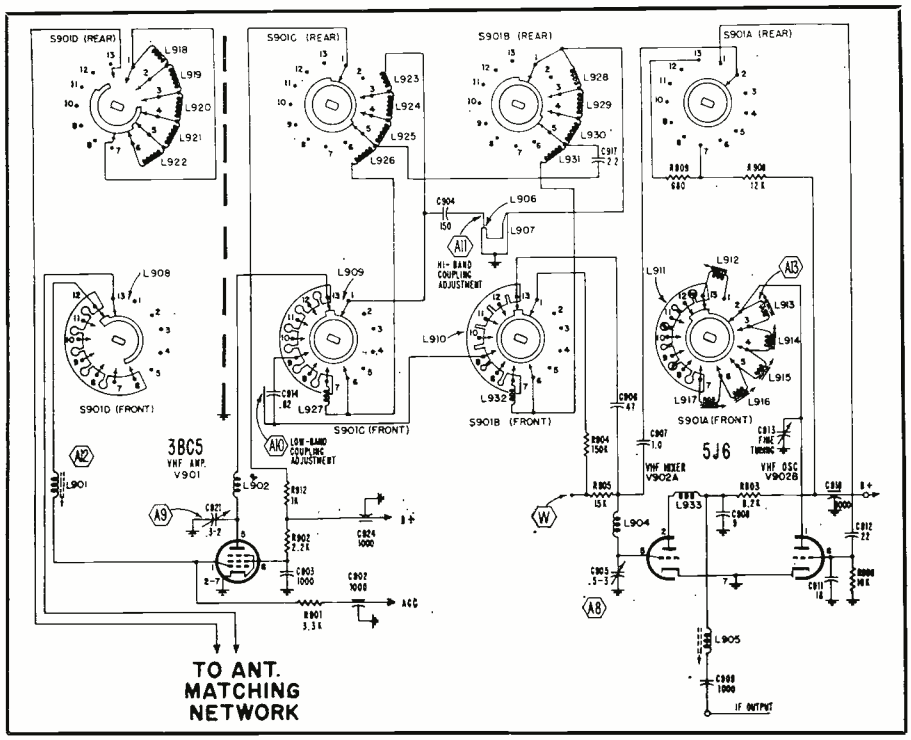


Fig. 3. Schematic for Admiral 94D128-1, using 4 switch-tuned circuits.

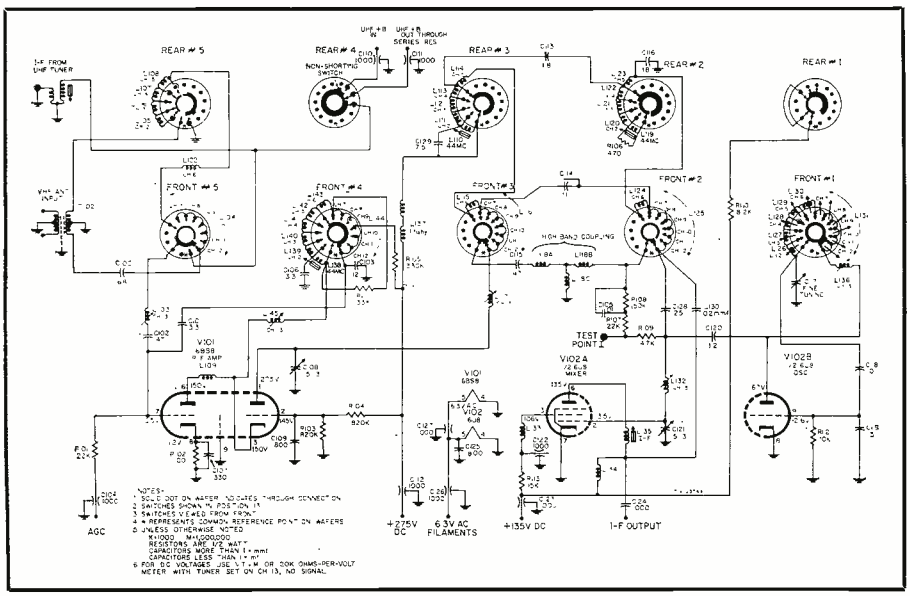


Fig. 4. This G-E switch-type cascode tuner uses a fifth switch deck.

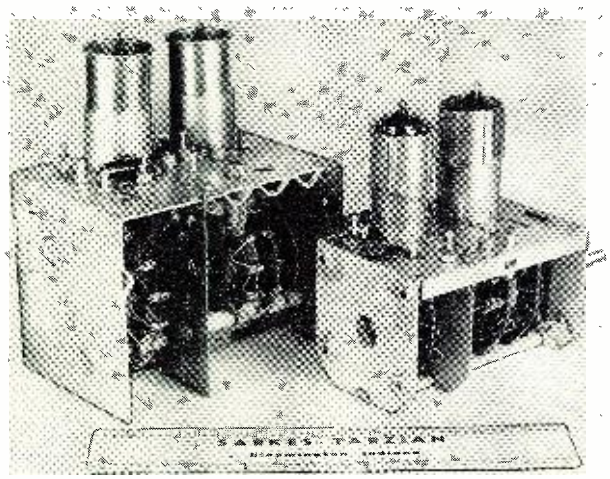


Fig. 5. The Sarkes Tarzian tuner to the right is the latest compact unit available. To its left is an earlier, electrically similar switch tuner, shown for size comparison.

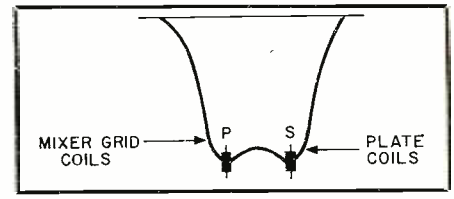


Fig. 6. One string of coils is tuned to affect one side of the response curve, with another set being used to shape the other side of the curve.

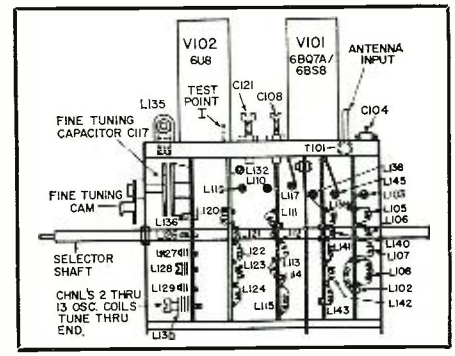


Fig. 7. Mechanical arrangement of the G-E switch-type tuner. The shield plate, right of center, goes between the switch deck for the neutralizing circuits and the r.f. switch deck.

Typical of the circuitry of the new switch-type tuners is the *Admiral* 94D128-1, shown in Figs. 1 and 2. This same tuner, with minor modifications, is manufactured for other companies by *Sarkes Tarzian* and found in other well-known TV sets. The circuit diagram of Fig. 3 shows how each of the four tuned circuits employed is switched for the various channels. Note that only the oscillator resonant circuit has adjustments for each low-band v.h.f. channel and for every other high-band channel. In Figs. 1 and 2, the switch deck closest to the knob end of the shaft is the oscillator deck, which can be adjusted from the front of the tuner by inserting an insulated screwdriver through the various holes provided for this purpose. At the rear of the tuner is the input tuning switch deck, separated from the rest of the tuner by a grounded shield.

One of the interesting features of this tuner is the construction of the high v.h.f. channel-tuning circuit. It consists of a solid strip of silver-plated brass with punched-out circles providing the small incremental inductances needed to tune from one channel to the next. There is no adjustment possible in the r.f. and mixer tuned circuit except for the coils which are in series with each string of punched-out inductances.

Alignment of this tuner is done by adjusting all tuned circuits first at Channel 13, then at Channel 12, and so on down to Channel 2. Oscillator coils can be adjusted by regular tuning screws, but most other coils have to be adjusted by compressing or spreading them apart, a process which requires a little talent and judgment. To adjust the bandpass characteristic of the network coupling the r.f. amplifier

plate and the mixer grid, the coupling between the two is controlled to give the desired slight dip in response characteristic. As shown in Fig. 6, one string of coils is tuned for each side of the response curve and the two coupling circuits are adjusted for the high- and the low-band coupling as separate steps. The latter is simply a wire "gimmick" depending on the capacity of a short length of hook-up wire. To set the coupling at the high v.h.f. band, a *U*-shaped punched piece serves as a *T*-network.

The type of tuner just described will be found primarily in low-priced receivers where extreme fringe area performance cannot be expected. The pentode r.f. amplifier used here, in conjunction with the triode mixer, does not provide the ultimate in low noise figure or sensitivity, but performs well in fairly strong signal areas.

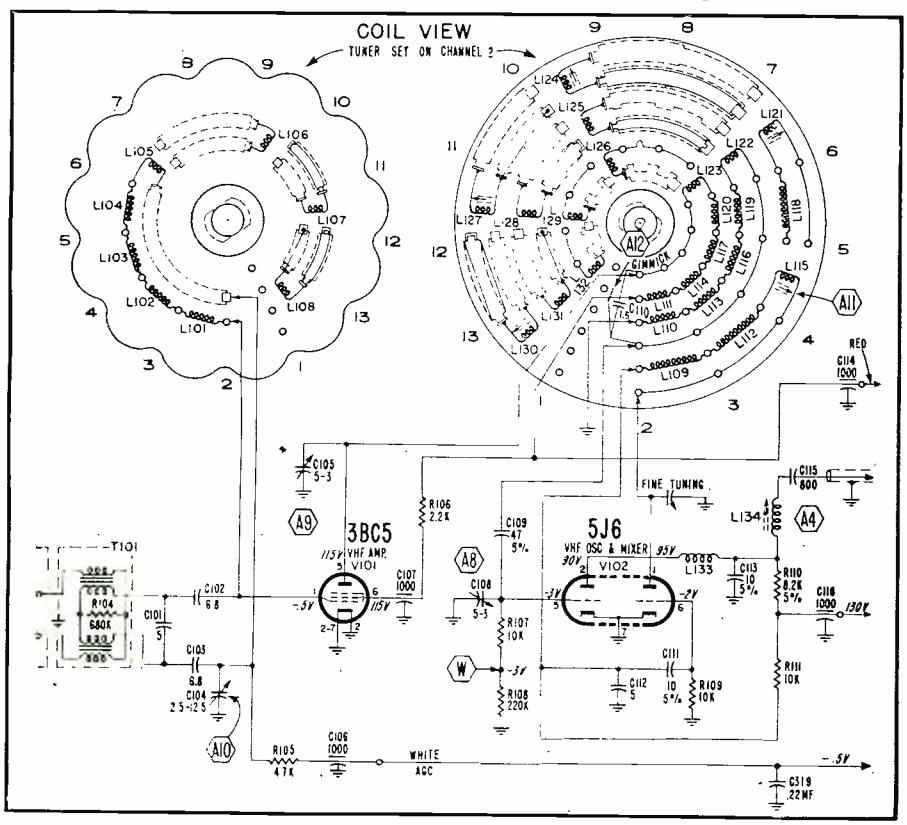
In construction, this tuner will be found to be more adaptable to mass production techniques than to simple servicing. Disassembly requires unsoldering some brackets and re-assembly is also quite tricky. Only where the service technician has difficulty getting a replacement tuner should he attempt such major mechanical repairs as replacing individual switch wafers or rewiring tube sockets. If simple defects occur, such as a broken detent spring, open or shorted capacitors or resistors, replacement is not too difficult. Some typical tuner problems such as microphonics, regeneration, and oscillation are harder to handle, since their cause is usually something not too obvious, such as a poorly soldered chassis ground point or a capacitor leaning too tightly against a switch deck.

The tuner circuit whose schematic is shown in Fig. 4 is mechanically very similar to the one just discussed. The only obvious difference is the addition of a fifth switch deck in Fig. 4 and, of course, the use of a cascode r.f. amplifier and a pentode-triode combination for the oscillator and mixer. The basic circuitry has been in use for several years, but some of the specific features are unusual.

Starting at the center-tapped input transformer, note that one side of the secondary goes to the series of low-channel coils while the other side goes to the high-band channels. For reception through the high band, one portion of the secondary is shorted out, optimizing the impedance match for the antenna input.

Note also how the neutralizing-circuit switch is wired. To reduce the "*Q*" of the tuner section for the low channels, a resistor (R_{111}) is connected across those coils, while the "B+" voltage for that plate goes through a 320,000-ohm resistor to the tap for Channel 10. To control the dip in the response curve, the coupling between the plate of the r.f. amplifier and the mixer grid is varied. For the low channels, a wire "gimmick" is shunted across a coupling capacitor (C_{111}). Note that another coupling capacitor (C_{113}) goes across at the Channel 5 tap. This gives more uniform bandpass at the lower channels without excess dip at Channel 6. The high-

Fig. 8. The schematic of the pentode version of the disc-type tuner shows that it uses a combination of series coils and sectional tuning elements.



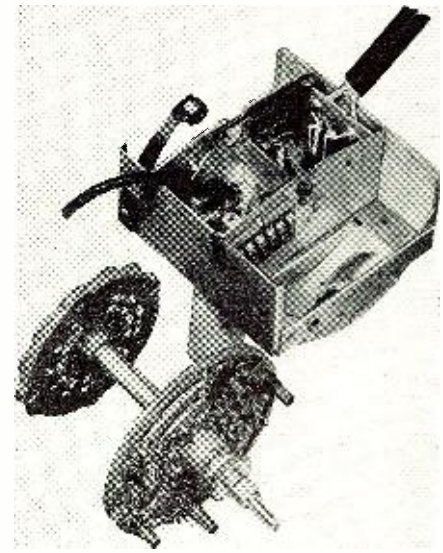


Fig. 9. The disc-type tuner, shown here partially disassembled, could be described as a cross between the more familiar switch and turret types.

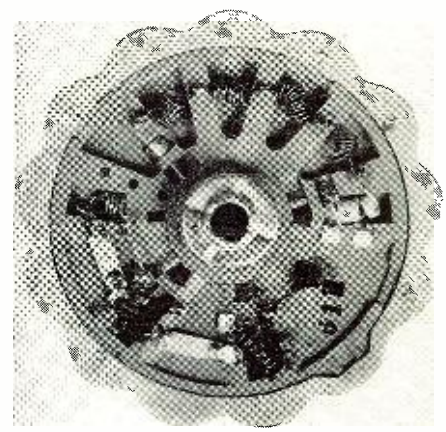
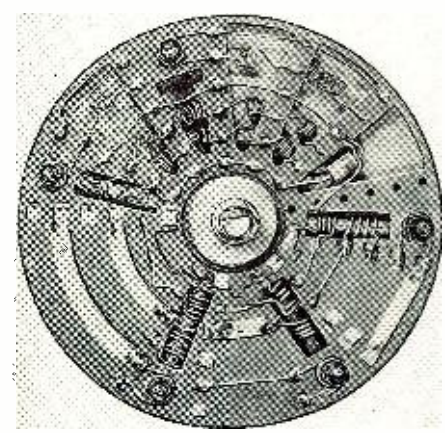


Fig. 10. The dual-contact coil arrangement shown on this disc segment (contacts are on the reverse side) rotates against points on the switch.

Fig. 11. This larger disc, mounted at the front of the disc tuner, carries the tuned circuits for the r.f. amplifier plate and for the mixer grid.



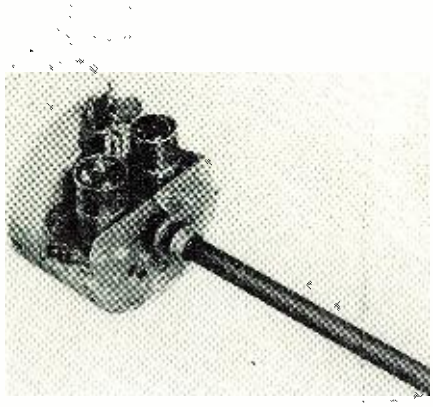


Fig. 12. The Standard Coil "Fireball" tuner features mechanical compactness.

band coupling is achieved through a *T*-network and must be adjusted by squeezing or spreading the coils. Another unusual feature is the series coil and capacitor filter network at the screen of the mixer tube. Its purpose apparently is to avoid regeneration.

The tuner just described is used in the latest *G-E* receivers and has 13 switch positions, which include a separate u.h.f. setting for use with an additional u.h.f. tuner. When in the u.h.f. position, the v.h.f. tuner operates at 44 mc., the i.f. of the receiver, and connects the u.h.f. tuner "B+" which is otherwise shut off. When the tuner is switched to any v.h.f. station, the u.h.f. signal is bypassed to ground through the #4 rear switch deck, avoiding spurious pickup.

The mechanical arrangement of this tuner is shown in Fig. 7. The shield plate here goes between the neutralizing switch deck and the plate circuit of the cascode tube. As in all switch tuners, the oscillator coil deck is in front, and this particular switch tuner has adjustments for each channel. Typically, they must be adjusted in sequence, starting with Channel 13 and going down to Channel 2.

The switch tuners described here are made by various TV set makers, as well as by *Sarkes Tarzian, Oak,* and other tuner manufacturers for the set makers. Both in servicing and alignment, all switch tuners have many similarities. Once the service technician has become familiar with them, minor variations in individual manufacturers' models will scarcely be noticed.

Highlighting the trend toward reduced size in the TV receiver, and thus in the tuner as well, is the *Sarkes Tarzian* unit shown to the right in Fig. 5. It is compared to an earlier and electrically similar assembly to the left.

The Disc-Type Tuner

If it were possible to cross-breed a switch-type tuner with the well-known turret tuner, like those made by *Standard Coil,* the resulting hybrid would doubtless look much like the disc tuner shown partially disassembled in Fig. 9. It has the advantage of kidney spring contacts that are self-wiping. Its coils move around stationary contacts and yet two switch wafers are involved. It makes easy repair and alignment possible, and yet is inexpensive to manufacture. Mechanically the input circuit, on a single disc, is automatically separated from other tuned circuits.

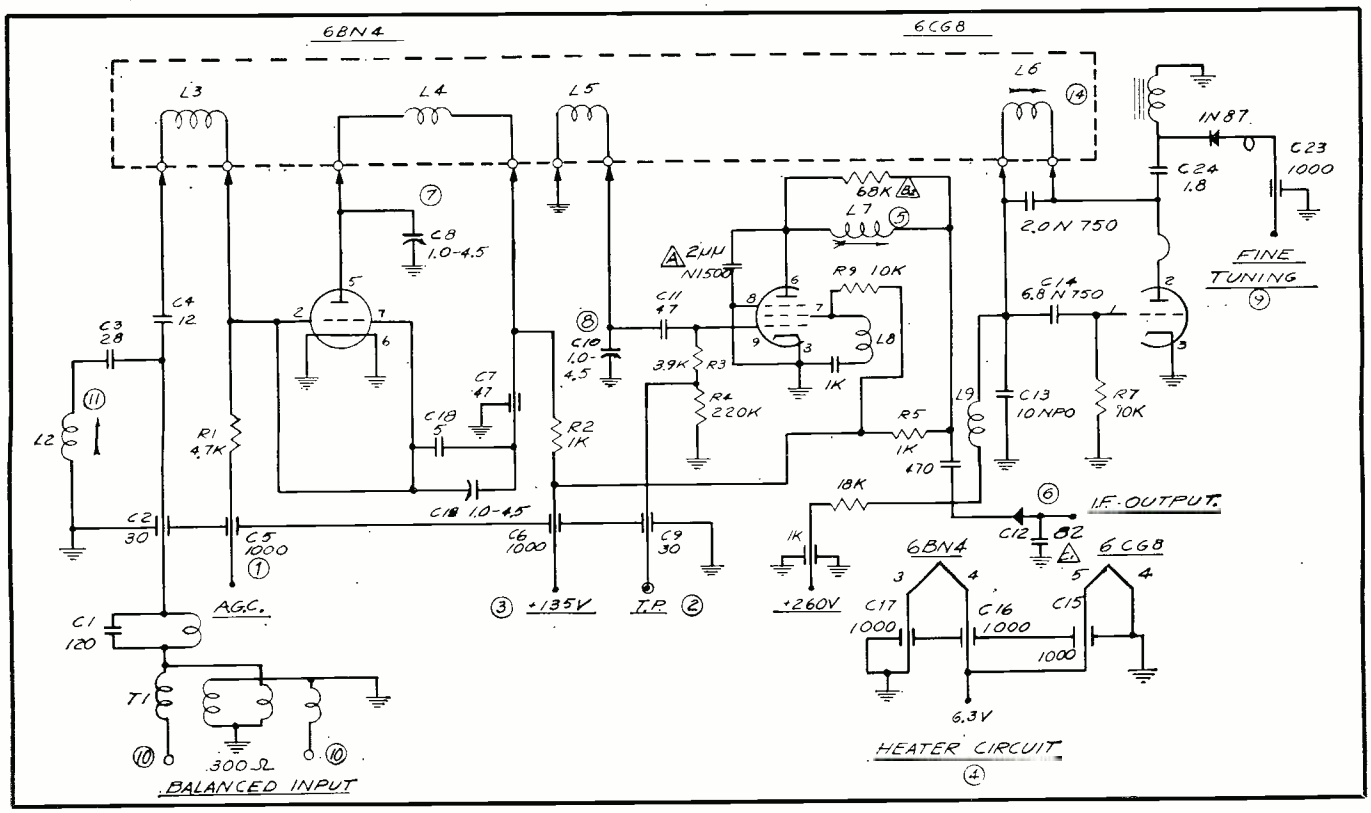
The circuit diagram of Fig. 8 demonstrates the differences and features of this new arrangement, which here uses a pentode r.f. amplifier and dual-triode mixer-oscillator. The same type of disc tuner is also made with a neutralized-triode input, or with a pentode r.f. stage and a triode oscillator and mixer. In Figs. 8 and 9, the hybrid nature of this tuner is clearly shown by the combination of series coils and sectional tuning. In the r.f. input disc, for example, between Channels 2 and 6, a series of coils is used just as in a switch-type tuner; but then a completely different coil is switched in for Channels 7, 8, and 9. For Channels 10 and 11 a still different set is connected into the circuit. Again, Channels 12 and 13 have their own coil. This is made possible by the use of dual switch points, mounted stationary, while the dual-contact coil arrangement shown in Fig. 10 rotates against the switch points.

In a similar manner, all tuned circuits are switched. The r.f. amplifier plate and mixer grid circuits are mounted on the larger disc at the front of the tuner, which is shown in detail in Fig. 11. The outer ring is occupied by the oscillator circuits and can, as usual, be tuned from the front of the set. Adjustable coils are only provided for groups of channels, but again the tuned-line concept does not cover the entire v.h.f. band.

Coupling between the r.f. amplifier

(*Continued on page* 122)

Fig. 13. The latest Neutrode version of the ever-popular Standard Coil turret tuner, as used in a Packard-Bell receiver.

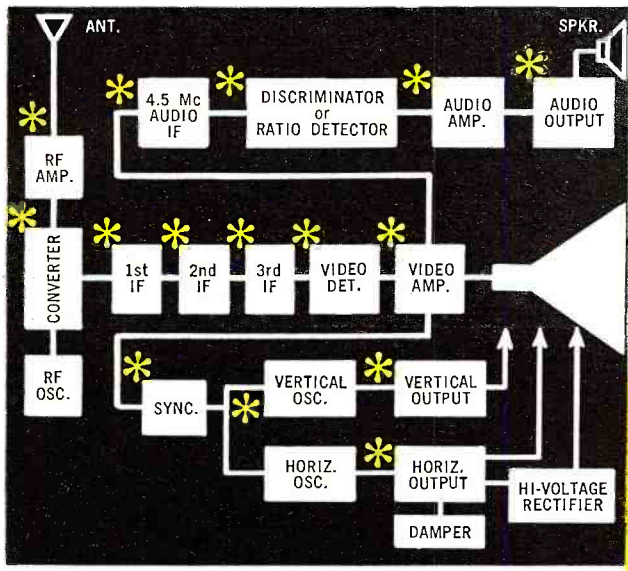


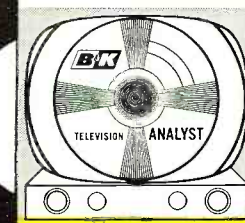
NEW
COMPLETE

DIRECT VIEWING

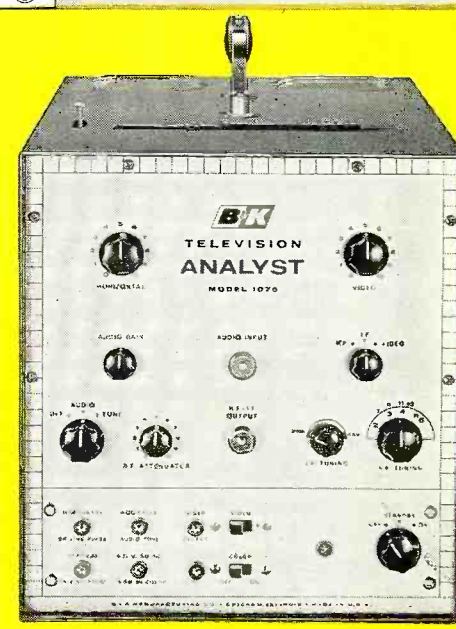
E EV S ON ANALYST

test each stage SEPARATELY





and watch the ← result on the TV set itself



NEW
B&K
MODEL 1075

UNIQUE NEW SIGNAL-INJECTION TECHNIQUE
Saves TV Trouble-Shooting Time and Work

R.F. **I.F.** Supplies complete r.f. and i.f. signals with video and audio modulation to quickly trouble-shoot each stage in each of the sections of the TV receiver. Enables you to check the r.f. sensitivity and AGC settings of TV receivers.

VIDEO Reproduces a complete test pattern on the screen of the TV picture tube and injects signals into each video stage of the TV receiver for fast, visual trouble-shooting and correction—anywhere, anytime. Makes it easy to check bandwidth, resolution, shading and contrast capabilities of the TV set.

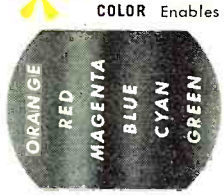
SYNC Provides composite signal, sync positive and negative.

SWEEP CIRCUIT DRIVING PULSES Provides separate vertical and horizontal driving pulses for trouble-shooting deflection circuits.

INTERMITTENTS Test signal injection also aids in locating intermittent troubles.

AUDIO Provides a 4.5 mc sound channel, FM modulated with approximately 25 kc deviation. (This audio carrier is modulated either from a built-in 400 cycle tone generator, or from your own external audio source.) Injection of the 400 cycle tone signal simplifies trouble-shooting of the audio section.

COLOR Enables you to trouble-shoot and signal trace color circuits in color TV sets.



Generates white dot and crosshatch patterns on the TV screen for color TV convergence adjustments.

Generates full color rainbow pattern of orange, red, magenta, blue, cyan, green to test color sync circuits, check range of hue control, align color demodulators, etc.

SET ADJUSTMENT Enables you to check and adjust the vertical and horizontal linearity, size and aspect ratio of television receivers.

QUICK, DIRECT, COMPLETE TV TROUBLE-SHOOTING

Now, by point-to-point signal injection and test pattern reproduction, you can easily trouble-shoot and signal trace *any stage throughout the video, audio and sweep sections* of black & white and color TV receivers. With the remarkable new Model 1075 B&K TELEVISION ANALYST, you can quickly isolate and diagnose TV troubles (including intermittents). By use of the generated test pattern, you can *actually see* the condition directly on the picture tube of the television set itself. No external scope is needed. The TELEVISION ANALYST is practically a *complete* TV service shop *in one instrument!* Net, **$259.95**

See your B&K Distributor or write for Bulletin 1075-N

B&K

B & K MANUFACTURING CO.
3726 N. Southport Ave. • Chicago 13, Illinois

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont.

Export: Empire Exporters, 458 Broadway, New York 13, U. S. A.

here we grow again

With this issue we introduce our new building—over 140,000 sq. ft. of modern plant equipment under one roof, the largest in the nation devoted to direct mail selling of electronic kits. To you, in the field, goes the credit for the tremendous growth of the electronic industry over recent years. Your imagination, courage and resourcefulness have moved America into the electronic age at a breath-taking pace. A pioneer in "do-it-yourself" electronic kits, Heath Co. has always endeavored to stay out in front. As a result we have grown too—from one small building to a point where we occupied seven buildings in the local area. Our new plant is your assurance of more and better HEATHKITS to come!

here's what it means to you-

Faster, more efficient handling of orders to speed HEATHKITS to your doorstep.

More for your purchasing dollar through increased efficiency and lower handling costs.

Faster research and development projects bringing you the latest electronic equipment in step with ever-expanding fields.

Better and faster service facilities to help you with any problems and questions you may have.

a subsidiary of Daystrom, Inc.

HEATHKIT

HEATH COMPANY, Benton Harbor 15, Mich.

TIME PAYMENTS . . .

The Heath Time Payment Plan was designed for your convenience. Now, you can order the kits of your choice, and pay for them in small monthly installments. Write for full details.

HEATHKIT EXTRA PERFORMANCE 70-WATT AMPLIFIER KIT

For really high performance, with plenty of reserve power, the W-6M is a natural. The full 70-watts output will seldom, if ever, be required. However, this reserve insures distortion-less sound on power peaks. The W-6M will loaf along at normal listening levels and yet is always ready to extend itself when program material demands it, without the least amount of strain. The output circuit employs 6550 tubes with a special-design Peerless output transformer for maximum stability at all power levels. A quick-change plug selects 4, 8 and 16 ohms or 70-volt output and the correct feedback resistance. A variable damping control is also provided for optimum performance with any speaker system. Extremely good power supply regulation is possible through the use of a heavy-duty transformer along with silicon-diode rectifiers, which are noted for their very long life, and yet are smaller than a house fuse. Frequency response at 1 watt is ±1 db from 5 cps to 80 kc with controlled hf rolloff above 100 kc. At 70 watts output harmonic distortion is below 2%, 20 to 20,000 cps and IM distortion below 1%, 60 and 6,000 cps. Hum and noise 88 db below full output. In addition to high performance, its fine appearance makes it a pleasure to display in your living room. Proper layout of chassis insures ease of assembly by eliminating those cramped and difficult places to get at. Clear instructions—and top-quality components. Get started now and make this amplifier the heart of your hi-fi system. Shipped express only. Shpg. Wt. 50 lbs.

MODEL W-6M

$109.95

MODEL W-6: Consists of W-6M kit, plus WA-P2 preamplifier. Express only. Shpg. Wt. 59 lbs. $129.70

HEATHKIT HIGH FIDELITY FM TUNER KIT

This tuner can bring you a rich store of FM programming, your least expensive source of high fidelity material. It covers the complete FM band from 88 to 108 mc. Stabilized, temperature-compensated oscillator assures negligible drift after initial warmup. Features broadbanded circuits for full fidelity, and better than 10 uv sensitivity for 20 db of quieting, to pull in stations with clarity and full volume. Employs a high gain, cascode RF amplifier, and has AGC. A ratio detector provides high-efficiency demodulation without sacrificing hi-fi performance. IF and ratio transformers are prealigned, as is the front end tuning unit. Special alignment equipment is not necessary. Edge-lighted glass dial for easy tuning. Here is FM for your home at a price you can afford. Shpg. Wt. 8 lbs.

MODEL FM-3A

$25.95 (with cabinet)

HEATHKIT BROADBAND AM TUNER KIT

This AM tuner was designed especially for high fidelity applications. It incorporates a special detector using crystal diodes, and the IF circuits feature broad band-width, to insure low signal distortion. Audio response is ±1 db from 20 cps to 9 kc, with 5 db of preemphasis at 10 kc to compensate for station rolloff. Sensitivity and selectivity are excellent, and tuner covers complete broadcast band from 550 to 1600 kc. Quiet performance is assured by 6 db signal-to-noise ratio at 2.5 UV. Prealigned RF and IF coils eliminate the need for special alignment equipment. Incorporates AVC, two outputs, two antenna inputs, and built-in power supply. Edge-lighted glass slide-rule dial for easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 8 lbs.

MODEL BC-1A

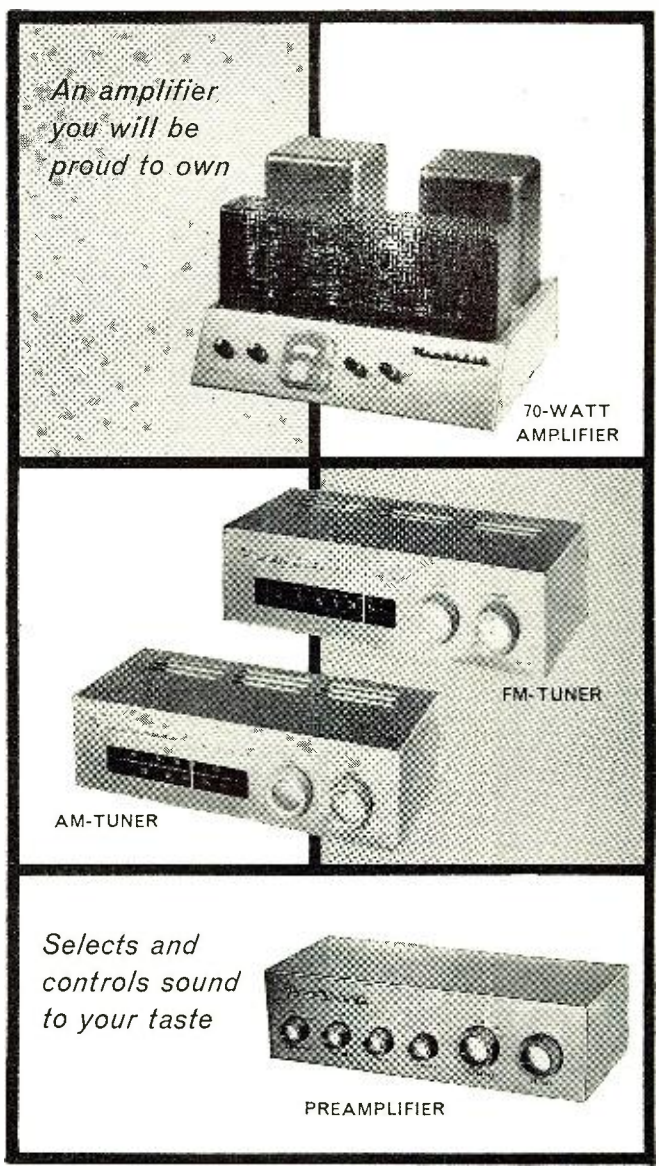
$25.95 (with cabinet)

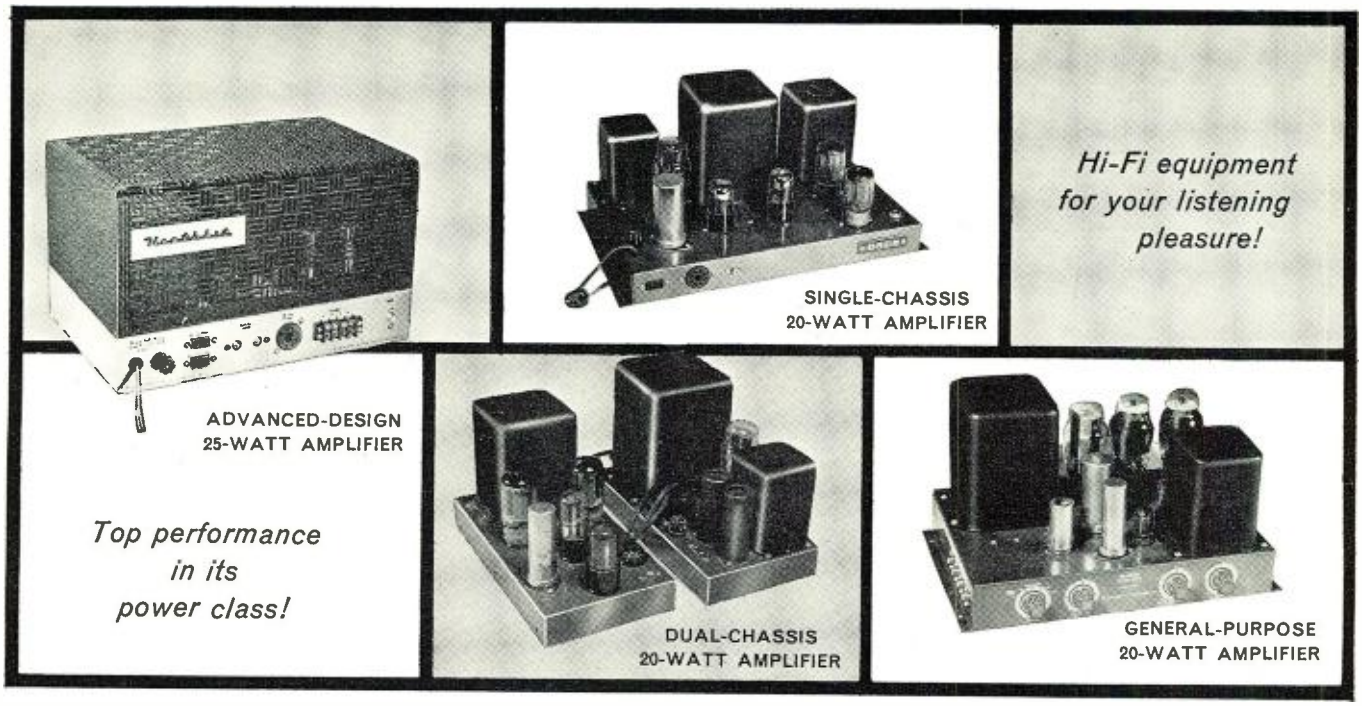
HEATHKIT MASTER CONTROL PREAMPLIFIER KIT

Designed for use with any of the Williamson-type amplifiers, the WA-P2 has five switch-selected inputs, each having its own level control to eliminate blasting or fading while switching through the various inputs, plus a tape recorder output. A hum control allows setting for minimum hum level. Frequency response is within ±1½ db from 15 to 35,000 cps. Equalization provided for LP, RIAA, AES, and early 78's. Separate bass and treble controls. Low impedance cathode follower output circuit. All components were specially selected for their high quality. Includes many features which will eventually be desired. Shpg. Wt. 7 lbs.

MODEL WA-P2

$19.75 (with cabinet)





HEATHKIT ADVANCED-DESIGN 25-WATT HIGH FIDELITY AMPLIFIER KIT

Designed especially to satisfy critical audio requirements, the W-5M incorporates the extra features needed to compliment the finest in program sources and speaker systems. Faithful sound reproduction is assured with a frequency response of ±1 db from 5 to 160,000 cps at 1 watt, and harmonic distortion is less than 1% at 25 watts, with IM distortion less than 1% at 20 watts. Hum and noise are a full 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8 and 16 ohms. Exclusive Heathkit features include the "tweeter saver", and the "bas-bal" balancing circuit, requiring only a voltmeter for indication. Years of reliable service are guaranteed through the use of conservatively rated, high quality components. KT66 tubes and Peerless output transformer are typical. Shipped express only. Shpg. Wt. 31 lbs.

MODEL W-5M
$59.75

MODEL W-5: Consists of W-5M kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 38 lbs. $79.50

HEATHKIT SINGLE-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W4-AM Williamson-type amplifier will amaze you with its outstanding performance. A true Williamson circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can provide you with many hours of listening enjoyment with only a minimum investment compared to other units on the market. 5881 tubes and a special Chicago-standard output transformer are employed to give you full fidelity at minimum cost. Frequency response extending from 10 cps to 100 kc within ±1 db at 1 watt assures you of full coverage of the audio range, and clean clear sound amplification takes place in circuits that hold harmonic distortion at 1.5% and IM distortion below 2.7% at full 20 watt output. Hum and noise are 95 db below full output. Taps on the output transformer are at 4, 8 or 16 ohms. Shipped express only. Shpg. Wt. 28 lbs.

MODEL W4-AM
$39.75

MODEL W-4A: Consists of W-4AM kit above, plus model WA-P2 preamplifier. Express only. Shpg. Wt. 35 lbs. $59.50.

HEATHKIT DUAL-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W3-AM is a Williamson-type amplifier built on two separate chassis. The power supply is on one chassis, and the amplifier stages are on the other chassis. Using two separate chassis provides additional flexibility in installation. Features include the famous acrosound model TO-300 "ultralinear" output transformer and 5881 tubes for broad frequency response, low distortion, and low hum level. The result is exceptionally fine overall tone quality. Frequency response is ±1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion is less than 1% and IM distortion is less than 1.3% at 20 watts. Hum and noise are 88 db below 20 watts. Designed to match the speaker system of your choice, with taps for 4, 8 or 16 ohms impedance. A very popular high fidelity unit employing top quality components throughout. Shipped express only. Shpg. Wt. 29 lbs.

MODEL W-3AM
$49.75

MODEL W-3A: Consists of W-3AM kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 37 lbs. $69.50

Heathkits...

By DAYSTROM

bring you the lasting satisfaction of personal accomplishment

HEATHKIT GENERAL-PURPOSE 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model A-9C will provide you with high quality sound at low cost. Features a built-in preamplifier with four separate inputs, and individual volume, bass and treble controls. Frequency response covers 20 to 20,000 cps within ±1 db. Total harmonic distortion is less than 1% at 3 db below rated output. Push-pull 6L6 tubes are used, with output transformer tapped at 4, 8, 16 and 500 ohms. A true hi-fi unit using high-quality components throughout, including heavy-duty "potted" transformers. Shpg. Wt. 23 lbs.

MODEL A-9C
$35.50

HEATHKIT "BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

The extremely popular Heathkit model SS-1 Speaker System provides amazing high fidelity performance for its size. Features two high-quality Jensen speakers, an 8" mid-range woofer and compression-type tweeter with flared horn. Covers from 50 to 12,000 CPS within ±5 db, in a special-design ducted-port, bass reflex enclosure. Impedance is 16 ohms. Cabinet measures 11½" H x 23" W x 11¾" D. Constructed of veneer-surfaced plywood, ½" thick, suitable for light or dark finish. All wood parts are precut and predrilled for easy, quick assembly. Shpg. Wt. 30 lbs.

MODEL SS-1

$39.95

HEATHKIT "RANGE EXTENDING" HI-FI SPEAKER SYSTEM KIT

Extends the range of the SS-1 to ±5 db from 35 to 16,000 CPS. Uses 15" woofer and super-tweeter both by Jensen. Kit includes crossover circuit. Impedance is 16 ohms and power rating is 35 watts. Measures 29" H x 23" W x 17½" D. Constructed of veneer-surfaced plywood ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

MODEL SS-1B

$99.95

Heathkits...

By DAYSTROM

let you save up to ½ or more on all types of electronic equipment.

HEATHKIT SINE-SQUARE GENERATOR

The new AG-10 provides high quality, sine and square waves over a wide range, for countless applications. Some of these are; radio and TV repair work, checking scope performance, as a variable trigger source for telemetering and pulse work, and checking audio, video and hi-fi amplifier response. Frequency response is ±1.5 db from 20 CPS to 1 MC on both sine and square waves, with less than .25% sine wave distortion, 20 to 20,000 CPS. Sine wave output impedance 600 ohms, square wave output impedance 50 ohms, (except on 10v ranges). Square wave rise time less than .15 usec. Five-position band switch—continuously variable tuning—shielded oscillator circuit—separate step and variable output attenuators in ranges of 10, 1, and .1 volts for both sine and square wave, with extra range of .01 volt on sine wave. Both sine and square wave can be used at the same time without affecting either wave form. Power supply uses silicon-diode rectifiers. Shpg. Wt. 12 lbs.

MODEL AG-10

$49.95

HEATHKIT AUDIO ANALYZER KIT

The AA-1 is actually three instruments in one compact package. It combines the functions of an AC VTVM, an audio wattmeter, and an intermodulation analyzer. Input and output terminals are combined, and high and low frequency oscillators are built in. VTVM ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts (RMS). Wattmeter ranges are .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w and 150 w. IM scales are 1%, 3%, 10%, 30% and 100%. Provides internal load resistors of 4, 8, 16 or 600 ohms. A tremendous dollar value. Shpg. Wt. 13 lbs.

MODEL AA-1

$49.95

HEATHKIT "LEGATO" HIGH FIDELITY SPEAKER SYSTEM KIT

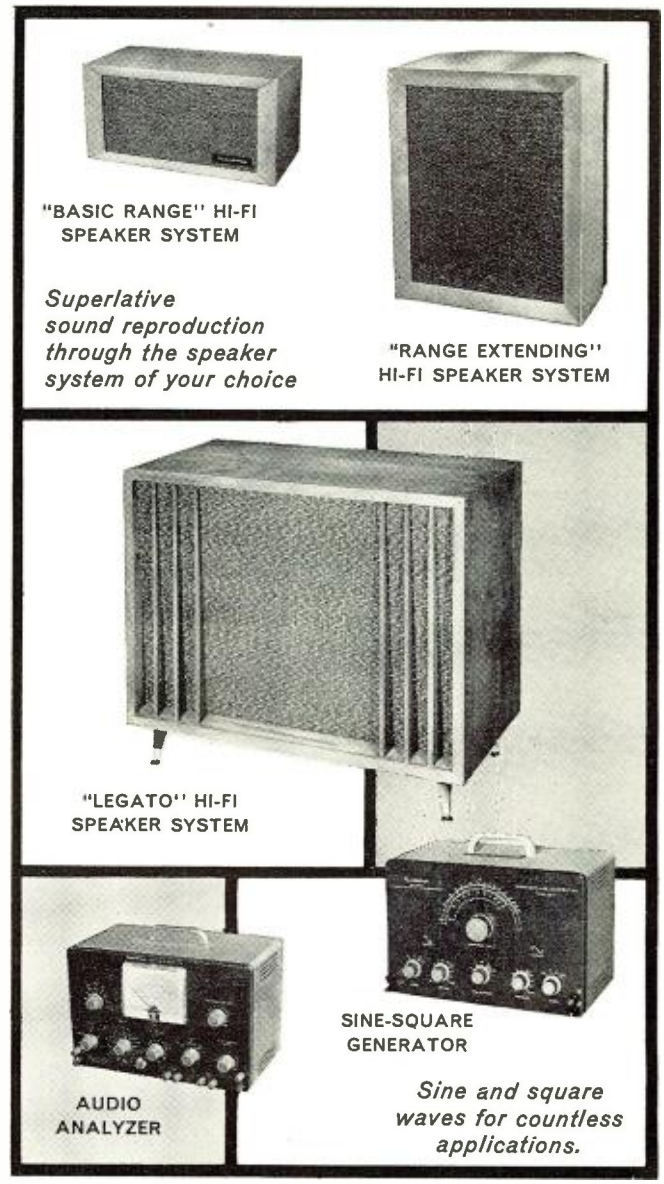
The quality of the Legato, in terms of the engineering that went into the initial design, and in terms of the materials used in its construction, is matched in only the most expensive speaker systems available today. The listening experience it provides approaches the ultimate in esthetic satisfaction. Two 15" theater-type Altec Lansing speakers cover 25 to 500 CPS, and an Altec Lansing high-frequency driver with sectoral horn covers 500 to 20,000 CPS. A precise amount of phase shift in the crossover network brings the high frequency channel into phase with the low frequency channel to eliminate peaks or valleys at the crossover point, by equalizing the acoustical centers of the speakers. The enclosure is a modified infinite baffle type, especially designed for these speakers. Cabinet is constructed of veneer-surfaced plywood, ¾" thick, precut and predrilled for easy assembly. Frequency response 25 to 20,000 CPS. Power rating, 50 watts program material. Impedance is 16 ohms. Cabinet dimensions 41" L x 22¼" D x 34" H.

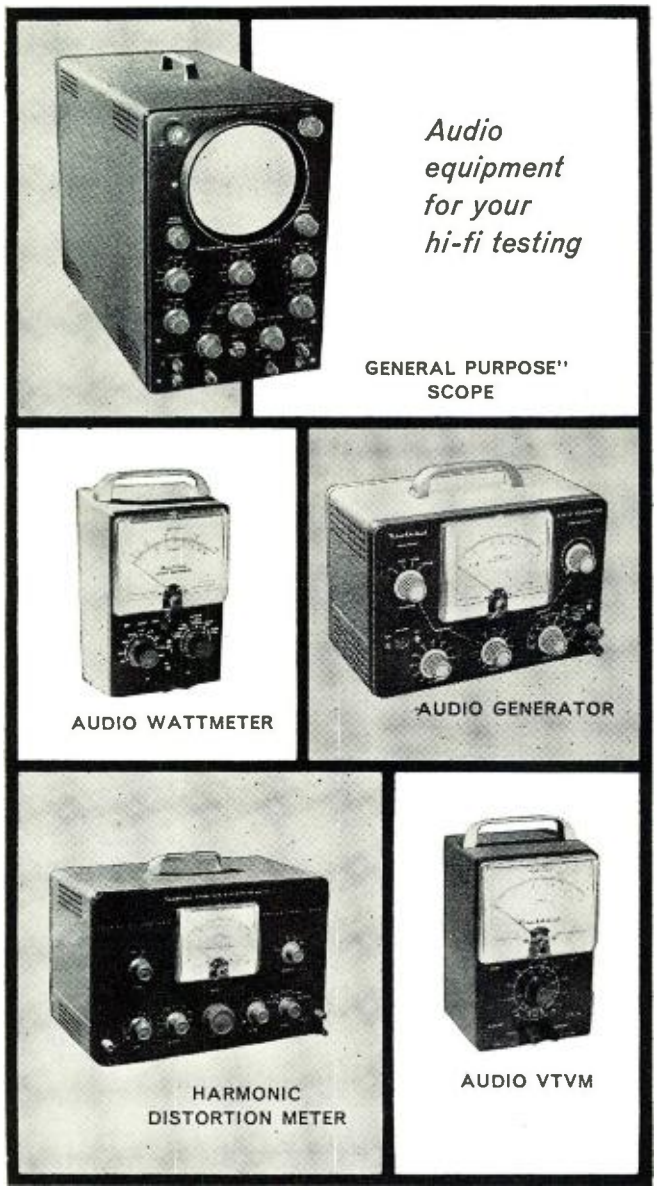
Choice of two beautiful cabinets. Model HH-1-C in imported white birch for light finishes, and HH-1-CM in African mahogany for dark finishes. Shpg. Wt. 195 lbs.

MODEL HH-1-C
MODEL HH-1-CM

$299.95

EACH





HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

The model OM-2 Oscilloscope is especially popular with part-time service technicians, students, and high fidelity enthusiasts. It features good vertical frequency response ±3 db from 4 cps to over 1.2 mc. A full five-inch crt. and sweep generator operation from 20 cps to over 150 kc. Stability is excellent and calibrated grid screen allows precise signal observation. Extra features include external or internal sweep and sync, 1-volt peak-to-peak calibrating reference, 3-position step-attenuated input, adjustable spot shape control, push-pull horizontal and vertical amplifiers, and modern etched-metal circuits. Easy to build and a pleasure to use. Ideal for use with other audio equipment for checking amplifiers. Shpg. Wt. 21 lbs.

MODEL OM-3

$39.95

HEATHKIT AUDIO WATTMETER KIT

The AW-1 Audio Wattmeter can be used in any application where audio power output is to be measured. Non-inductive LOAD resistors are built in for 4, 8, 16 or 600 ohms impedance. Five power ranges cover 0-5 mw, 50 mw, 500 mw, 5 w, and 50 w full scale. Five switch-selected db ranges cover −10 db to +30 db. All indications are read directly on a large 4½" 200 microampere meter. Frequency response is ±1 db from 10 cps to 250 kc. Precision type multiplier resistors used for high accuracy, and crystal diode bridge for wide-range frequency response. This meter is used in many recording studios and broadcast stations as a monitor as well as servicing. A fine meter to help supply the answers to your audio operating or power output problems. Shpg. Wt. 6 lbs.

MODEL AW-1

$29.50

HEATHKIT AUDIO SIGNAL GENERATOR KIT

The model AG-9A is "made to order" for high fidelity applications, and provides quick and accurate selection of low-distortion signals throughout the audio range. Three rotary switches select two significant figures and a multiplier to determine audio frequency. Incorporates step-type and a continuously variable output attenuator. Output indicated on large 4½" panel meter, calibrated in volts and db. Attenuator system operates in 10 db steps, corresponding to meter calibration, in ranges of 0-.003, .01, .03, .1, .3, 1,3 and 10 volts RMS. "Load" switch permits use of built-in 600-ohm load, or external load of different impedance. Output and frequency indicators accurate to within ±5%. Distortion less than .1 of 1% between 20 and 20,000 cps. Total range is 10 cps to 100 kc. Shpg. Wt. 8 lbs.

MODEL AG-9A

$34.50

HEATHKIT HARMONIC DISTORTION METER KIT

All sounds consist of dominant tones plus harmonics (overtones). These harmonics enrich the quality and brightness of the music. However, additional harmonics which originate in the audio equipment, represent distortion. Used with an audio signal generator, the HD-1 will accurately measure this harmonic distortion at any or all frequencies between 20 and 20,000 cps. Distortion is read directly on the panel meter in ranges of 0-1, 3, 10, 30 and 100% full scale. Voltage ranges of 0-1, 3, 10 and 30 volts are provided for the initial reference settings. Signal-to-noise ratio measurements are also permitted through the use of a separate meter scale calibrated in db. High quality components insure years of outstanding performance. Full instructions are provided. Shpg. Wt. 13 lbs.

MODEL HD-1

$49.50

Heathkits..

By DAYSTROM

are well known for their high quality and reliability.

HEATHKIT AUDIO VTVM KIT

This new and improved AC Vacuum Tube Voltmeter is designed especially for audio measurements and low-level AC measurements in power supply filters, etc. Employs an entirely new circuit featuring a cascode amplifier with cathode-follower isolation between the input and the amplifier, and between the output stage and the preceding stages. It emphasizes stability, broad frequency response, and sensitivity. Frequency response is essentially flat from 10 cps to 200 kc. Input impedance is 1 megohm at 1000 cps. AC (RMS) voltage ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts. Db ranges cover −52 db to +52 db. Features large 4½" 200 microampere meter, with increased damping in meter circuit for stability in low frequency tests. 1% precision resistors employed for maximum accuracy. Stable, reliable performance in all applications. Shpg. Wt. 5 lbs.

MODEL AV-3

$29.95

HEATHKIT COLOR BAR AND DOT GENERATOR

The CD-1 combines the two basic color service instruments, a Color Bar Generator and White Dot Generator in one versatile portable unit, which has crystal-controlled accuracy and stability (no external sync lead required). Produces white dots, cross hatch, horizontal and vertical bars, 10 vertical color bars, and a new shading bar pattern for screen and background adjustments. Variable RF output on any channel from 2 to 6. Positive or negative video output, variable from 0 to 10 volts peak-to-peak. Crystal controlled sound carrier with off-on switch. Voltage regulated power supply using long-life silicon rectifiers. Gain knowledge of a new and profitable field by constructing this kit. Shpg. Wt. 12 lbs.

MODEL CD-1

$59.95

Heathkits...

By DAYSTROM

are guaranteed to meet or exceed advertised specifications

HEATHKIT TV ALIGNMENT GENERATOR KIT

This fine TV alignment generator offers stability and flexibility difficult to obtain even in instruments costing several times this low Heathkit price. It covers 3.6 mc to 220 mc in four bands. Sweep deviation is controllable from 0 to 42 mc. The all-electronic sweep circuit insures stability Crystal marker and variable marker oscillators are built in. Crystal (included with kit) provides output at 4.5 mc and multiples thereof. Variable marker provides output from 19 to 60 mc on fundamentals and from 57 to 180 mc on harmonics. Effective two-way blanking to eliminate return trace. Phasing control. Kit is complete, including three output cables. Shpg. Wt. 16 lbs.

MODEL TS-4A

$49.50

HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT

This fine oscilloscope compares favorably to other scopes costing twice its price. It contains the extra performance so necessary for monochrome and color-TV servicing. Features push-pull horizontal and vertical output amplifiers, a 5UP1 CRT, built in peak-to-peak calibration source, a fully compensated 3-position step-type input attenuator, retrace blanking, phasing control, and provision for Z-axis modulation. Vertical amplifier frequency response is within +1.5 and −5 db from 3 CPS to 5 MC. Response at 3.58 MC down only 2.2 db. Sensitivity is 0.025 volts RMS/inch at 1 kc. Sweep generator covers 20 CPS to 500 kc in five steps, five times the usual sweep obtained in other scopes through the use of the patented Heath sweep circuit. Etched-metal circuit boards reduce assembly time and minimize errors in assembly, and more importantly, permit a level of circuit stability never before achieved in an oscilloscope of this type. Shpg. Wt. 21 lbs.

MODEL O-12

$64.95

HEATHKIT ELECTRONIC SWITCH KIT

A valuable accessory for any oscilloscope owner. It allows simultaneous oscilloscope observation of two signals by producing both signals, alternately, at its output. Four switching rates. Provides gain for input signals. Frequency response ±1 db, 0 to 100 kc. A sync output is provided to control and stabilize scope sweep. Ideal for observing input and output of amplifiers simultaneously. Shpg. Wt. 8 lbs.

MODEL S-3

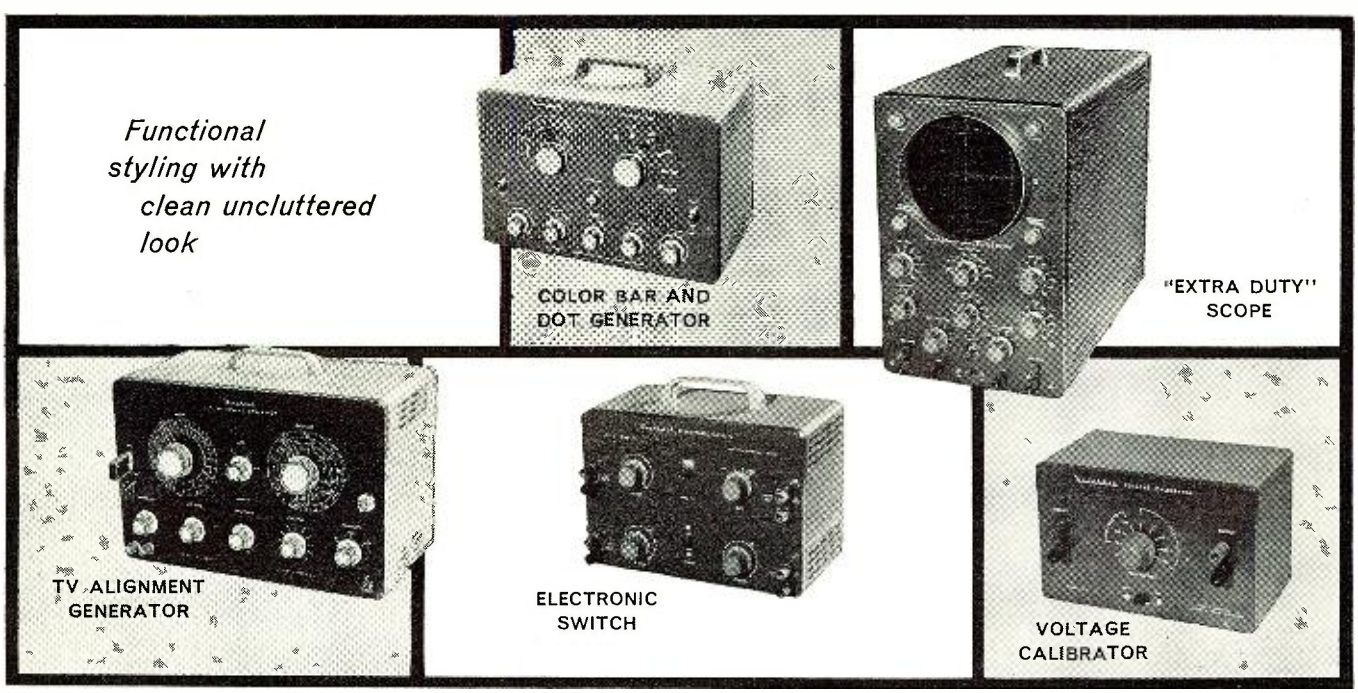
$21.95

HEATHKIT VOLTAGE CALIBRATOR KIT

This unit is an excellent companion for your oscilloscope. Used as a source of calibrating voltage, it produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors insure accurate output amplitude, and multivibrator circuit guarantees good sharp square waves. Output frequency is approximately 1000 CPS. Fixed outputs selected by panel switches are; .03, 0.1, 0.3, 1.0, 3.0, 10, 30 and 100 volts peak-to-peak. Allows measurment of unknown signal amplitude by comparing it to the known output of the VC-3 on oscilloscope. Shpg. Wt. 4 lbs.

MODEL VC-3

$12.50



HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT TUBE CHECKER KIT

Eliminate guesswork, and save time in servicing or experimenting. The TC-2 tests tubes for shorted elements, open elements, filament continuity, and operating quality on the basis of total emission. It tests all tube types encountered in radio and TV service work. Sockets are provided for 4, 5, 6 and 7-pin, octal, and loctal tubes, 7 and 9 pin miniature tubes, 5 pin hytron miniatures, and pilot lamps. Tube condition indicated on 4½" meter with multicolor "good-bad" scale. Illuminated roll chart with all test data built in. Switch selection of 14 different filament voltages from .75 to 117 volts. Color-coded cable harness allows neat professional wiring and simplifies construction. Very easy to build, even for a beginner. Shpg. Wt. 12 lbs.

MODEL TC-2

$29.50

HEATHKIT HANDITESTER KIT

The small size and rugged construction of this tester makes it perfect for any portable application. The combination function-range switch simplifies operations. Measures AC or DC voltage at 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 (30 ohm center scale) and 0-300,000 (3000 ohm center scale). Very popular with home experimenters, electricians, and appliance repairmen. Slips easily into your tool box, glove compartment, coat pocket, or desk drawer. Shpg. Wt. 3 lbs.

MODEL M-1

$17.95

HEATHKIT PICTURE TUBE CHECKER KIT

The CC-1 can be taken with you on service calls so that you can clearly demonstrate the quality of a customer's picture tube in his own home. Tubes can be tested without removing them from the receiver or cartons if desired. Checks cathode emission, beam current, shorted elements, and leakage between elements in electromagnetic picture tube types. Self-contained power supply, and large 4½" meter. CRT condition indicated on "good-bad" scale. Relative condition of tubes fluorescent coating is shown in "shadowgraph" test. Permanent test cable with CRT socket and anode connector. No tubes to burn out, designed to last a lifetime. Luggage-type portable case. Shpg. Wt. 10 lbs.

MODEL CC-1

$24.95

HEATHKIT ETCHED-CIRCUIT VTVM KIT

This multi-purpose VTVM is the world's largest selling instrument of its type—and is especially popular in laboratories, service shops, home workshops and schools. It employs a large 4½" panel meter, precision 1% resistors, etched metal circuit board, and many other "extras" to insure top quality and top performance. It's easy to build, and you may rely on its accuracy and dependability. The V7-A will measure AC (RMS) and DC voltages in ranges of 0-1.5, 5, 15, 50, 150, 500 and 1500. It measures peak-to-peak AC voltage in ranges of 0-4, 14, 40, 140, 400, 1400 and 4000. Resistance ranges provide multiplying factors of X 1, X 10, X 100, X 1000, X 10k, X 100k, and X 1 megohm. Center-scale resistance readings are 10, 100, 1000, 10k, 100k, 1 megohm and 10 megohms. A db scale is also provided. The precision and quality of this VTVM cannot be duplicated at this price. Shpg. Wt. 7 lbs.

MODEL V7-A

$24.50

Heathkits...

By DAYSTROM

let you fill your exact needs from a wide variety of instruments

HEATHKIT 20,000 OHMS/VOLT VOM KIT

This fine instrument provides a total of 25 meter ranges on its two-color scale. It employs a 50 ua 4½" meter, and features 1% precision multiplier resistors. Requires no external power. Ideal for portable applications. Sensitivity is 20,000 ohms-per-volt DC and 5000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5000 volts, AC and DC. Measures direct current in ranges of 0-150 ua, 15 ma, 150 ma, 500 ma and 15 a. Resistance multipliers are X 1, X 100 and X 10,000, with center-scale readings of 15, 1500 and 150,000 ohms. Covers −10 db to +65 db. Easy to build and fun to use. Attractive bakelite case with plastic carrying handle. Shpg. Wt. 6 lbs.

MODEL MM-1

$29.95

HEATHKIT RF SIGNAL GENERATOR KIT

Even a beginner can build this prealigned signal generator, designed especially for use in service work. Produces RF signals from 160 kc to 110 mc on fundamentals in five bands. Covers 110 mc to 220 mc on calibrated harmonics. Low impedance RF output in excess of 100,000 microvolts, is controllable with a step-type and continuously variable attenuator. Selection of unmodulated RF, modulated RF, or audio at 400 CPS. Ideal for fast and easy alignment of radio receivers, and finds application in FM and TV work as well. Thousands of these units are in use in service shops all over the country. Easy to build and a real time saver, even for the part-time service technician or hobbyist. Shpg. Wt. 8 lbs.

MODEL SG-8

$19.50

HEATHKIT LABORATORY RF GENERATOR KIT

Tackle all kinds of laboratory alignment jobs with confidence by employing the LG-1. It features voltage-regulated B+, double shielding of oscillator circuits, copper-plated chassis, variable modulation level, metered output, and many other "extras" for critical alignment work. Generates RF signals from 100 kc to 30 mc on fundamentals in five bands. Meter reads RF output in microvolts or modulation level in percentage. RF output available up to 100,000 microvolts, controlled by a fixed-step and a variable attenuator. Provision for external modulation where necessary. Buy and use this high-quality RF signal generator that may be depended upon for stability and accuracy. Shpg. Wt. 16 lbs.

MODEL LG-1

$48.95

HEATHKIT DIRECT-READING CAPACITY METER KIT

Here's a fast, simple capacity meter. A capacitor to be checked is merely connected to the terminals, the proper range selected, and the value read directly on the large 4½" panel meter calibrated in mmf and mfd. Ranges are 0 to 100 mmf, 1,000 mmf, .01 mfd, .1 mfd full scale. Not affected by hand capacity. Shpg. Wt. 7 lbs.

MODEL CM-1

$29.50

Heathkits...

By DAYSTROM

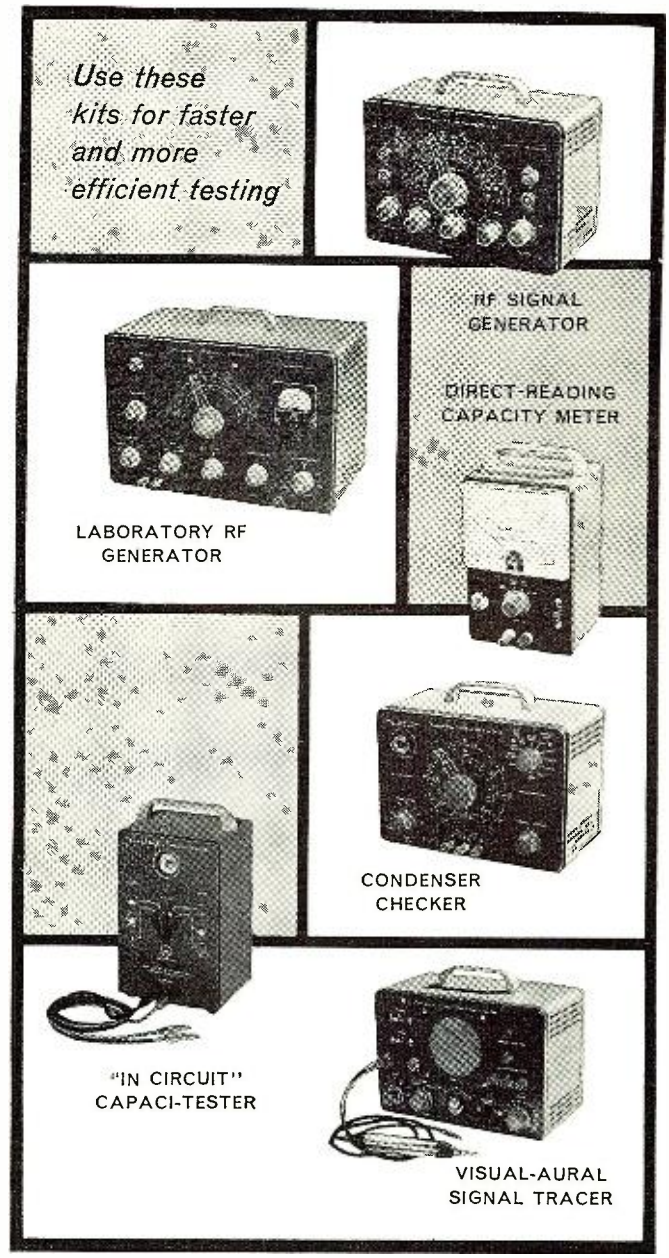
are educational
as well as functional

HEATHKIT "IN-CIRCUIT" CAPACI-TESTER KIT

With the CT-1 it is no longer necessary to disconnect one capacitor lead to check the part, you can check most capacitors for "open" or "short" right in the circuit. Fast and easy—to save your valuable time in the service shop or lab. Detects open capacitors from about 50 mmf up, so long as the capacitor is not shunted by excessively low resistance value. Will detect shorted capacitors up to 20 mfd (not shunted by less than 10 ohms). (Does not detect leakage.) Employs 60 cycles and 19 megacycle test frequencies. Electron beam "eye" tube used as indicator. Compact, easy-to-build, and inexpensive. Test leads included. Shpg. Wt. 5 lbs.

MODEL CT-1

$7.95



HEATHKIT CONDENSER CHECKER KIT

This handy instrument uses an electron beam "eye" tube as an indicator to measure capacity in ranges of .00001 to .005 mfd, .5 mfd, 50 mfd and 1000 mfd. Also measures resistance from 100 ohms to 5 megohms in two ranges. Checks paper, mica, ceramic and electrolytic capacitors. Selection of five polarizing voltages. Shpg. Wt. 7 lbs.

MODEL C-3

$19.50

HEATHKIT VISUAL-AURAL SIGNAL TRACER KIT

Although designed originally for radio receiver work, the T-3 finds application in FM and TV servicing as well. Features high-gain channel with demodulator probe, and low-gain channel with audio probe. Traces signals in all sections of radio receivers and in many sections of FM and TV receivers. Built-in speaker and electron beam eye tube indicate relative gain, etc. Also features built-in noise locator circuit. Provision for patching speaker and /or output transformer to external set. Shpg. Wt. 9 lbs.

MODEL T-3

$23.50

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT IMPEDANCE BRIDGE KIT

The model IB-2A employs a Wheatstone Bridge, a Capacity Comparison Bridge, a Maxwell Bridge, and a Hay Bridge in one compact package. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 100 mmf to 100 mfd, inductance from 0.1 mh to 100 h, dissipation factor (D) from 0.002 to 1, and storage factor (Q) from 0.1 to 1000. A 100-0-100 ua meter provides for null indications. The decade resistors employed are of 1% tolerance for maximum accuracy. Completely self-contained. Has built in power supply, 1000-cycle generator, and vacuum-tube detector. Special two-section CRL dial insures convenient operation. Instruction manual has entirely new schematic that clarifies circuit functions in various switch positions. A true laboratory instrument, that will provide you with many years of fine performance. Shpg. Wt. 12 lbs.

MODEL IB-2A

$59.50

HEATHKIT "LOW RIPPLE" BATTERY ELIMINATOR KIT

This modern battery eliminator incorporates an extra low-ripple filter circuit so that it can be used to power all the newest transistor-type circuits requiring 0 to 12 volts DC, and the new "hybrid" automobile radios using both transistors and vacuum tubes. Its DC output, at either 6 or 12 volts, contains less than .3% AC ripple. Separate output terminals are provided for low-ripple or normal filtering. Supplies up to 15 amps on 6 volt range or up to 7 amps on 12 volt range. Output is variable from 0 to 8 or 0 to 16 volts. Two meters constantly monitor output voltage and current. Will also double as a battery charger. Shpg. Wt. 23 lbs.

MODEL BE-5

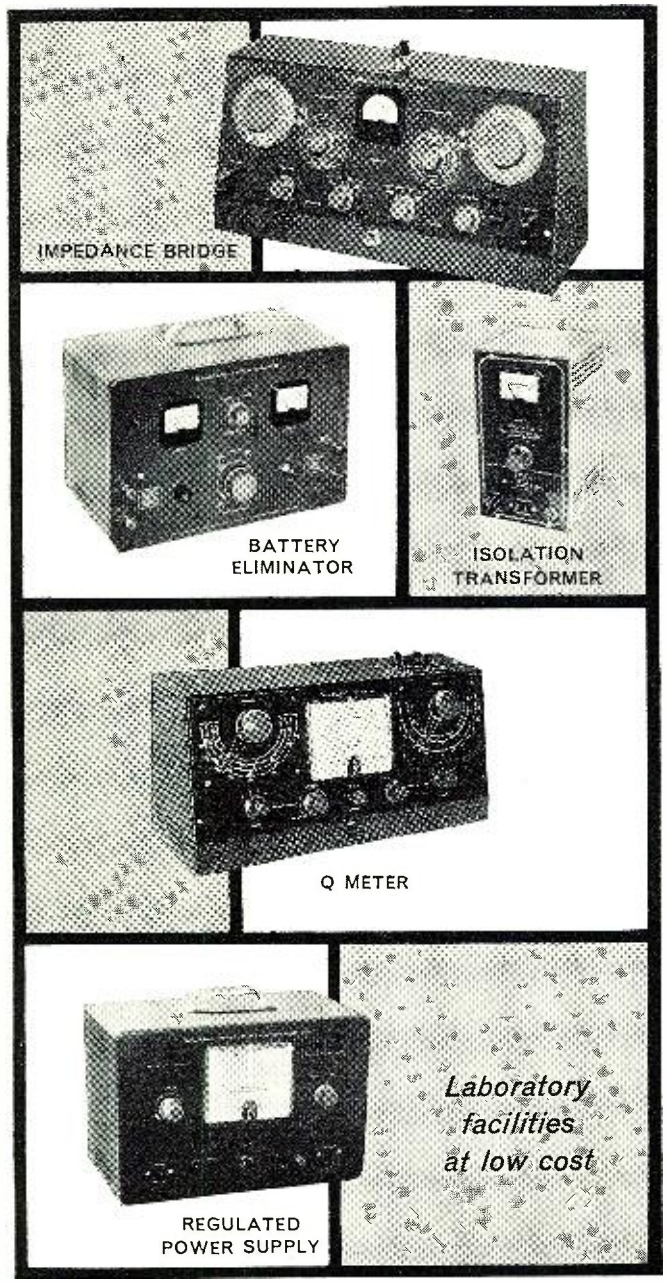
$39.95

HEATHKIT ISOLATION TRANSFORMER KIT

The model IT-1 is one of the handiest units for the service shop, home workshop or laboratory. Provides complete isolation from the power line. AC-DC sets may be plugged directly into the IT-1 without the chassis becoming "hot". Output voltage is variable from 90 volts to 130 volts allowing checks of equipment under adverse conditions such as low line voltage. Rated for 100 volt amperes continuously or 200 volt amperes intermittently. Panel meter monitors output voltage. Shpg. Wt. 9 lbs.

MODEL IT-1

$16.50



Heathkits...

By DAYSTROM

are designed with high-quality, name-brand components to insure long service life

HEATHKIT "Q" METER KIT

At this price the laboratory facilities of a Q Meter may be had by the average service technician or home experimenter. The Q Meter permits measurement of inductance from 1 microhenry to 10 milihenry, "Q" on a scale calibrated up to 250 full scale, with multipliers of 1 or 2, and capacitance from 40 mmf to 450 mmf ± 3 mmf. Built in oscillator permits testing components from 150 kc to 18 mc. Large 4½" panel meter is featured. Very handy for checking peaking coils, chokes, etc. Use to determine values of unknown condensers, both variable and fixed, compile data for coil winding purposes, or measure RF resistance. Also checks distributed capacity and Q of coils. No special equipment is required for calibration. A special test coil is furnished, along with easy-to-follow instructions. Shpg. Wt. 14 lbs.

MODEL QM-1

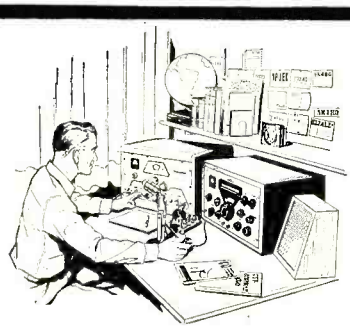
$44.50

HEATHKIT REGULATED POWER SUPPLY KIT

Here is a power supply that will provide DC plate voltage and AC filament voltage for all kinds of experimental circuits. The DC supply is regulated for stability, and yet the amount of DC output voltage available from the power supply can be controlled manually from 0 up to 500 volts. At 450 volts DC output, the power supply will provide up to 10 ma of current, and provide progressively higher current as the output voltage is lowered. Current rating is 130 ma at 200 volts output. In addition to furnishing B+ the power supply also provides 6.3 volts AC at up to 4 amperes for filaments. Both the B+ output and the filament output are isolated from ground. Ideal unit for use in laboratory, home workshop, ham shack, or service shop. A large 4½" meter on the front panel reads output voltage or output current, selectable with a panel switch. Shpg. Wt. 17 lbs.

MODEL PS-3

$35.50



Terrific values in amateur equipment!

DX-100 TRANSMITTER

DX-20 TRANSMITTER

DX-40 TRANSMITTER

HEATHKIT DX-20 CW TRANSMITTER KIT

The Heathkit model DX-20 "straight-CW" transmitter features high efficiency at low cost. It uses a single 6DQ6A tube in the final amplifier stage for plate power input of 50 watts. A 6CL6 serves as crystal oscillator, with a 5U4GB rectifier. It is an ideal transmitter for the novice, as well as the advanced-class CW operator. Single-knob band switching is featured to cover 80, 40, 20, 15, 11 and 10 meters. Pi network output circuit matches various antenna impedances between 50 and 1000 ohms and reduces harmonic output. Top-quality parts are featured throughout, including "potted" transformers, etc., for long life. It has been given full "TVI" treatment. Access into the cabinet for crystal changing is provided by a removable metal pull-out plug on the left end of the cabinet. Very easy to build from the complete step-by-step instructions supplied, even if you have never built electronic equipment before. If you appreciate a good, clean signal on the CW bands, this is the transmitter for you! Shpg. Wt. 18 lbs.

MODEL DX-20

$35.95

Heathkits...

By DAYSTROM

are designed by licensed ham-engineers, especially for you

HEATHKIT DX-40 PHONE AND CW TRANSMITTER KIT

A most remarkable power package for the price, the new DX-40 provides both phone and CW facilities for operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 75 watt plate power input on CW, or control carrier modulation peaks up to 60 watts for phone operation. Modulator and power supplies are built right in and single knob bandswitching is combined with a pi network output circuit for complete operating convenience. The tight fitting cabinet presents a most attractive appearance, and is designed for complete shielding to minimize TVI. A 4-position switch provides convenient selection of three different crystals or a jack for external VFO. The crystals are reached through access door at rear of cabinet. You can build this rig yourself and be proud to show it off to your fellow hams. Get your DX-40 now for many hours of operating enjoyment. Shpg. Wt. 25 lbs.

MODEL DX-40

$64.95

HEATHKIT DX-100 PHONE AND CW TRANSMITTER KIT

Listen to any ham band between 160 meters and 10 meters and note how many DX-100 transmitters you hear! The number of these fine rigs now on the air testifies to the enthusiasm with which it has been accepted by the amateur fraternity. No other transmitter in this power class combines high quality and real economy so effectively. The DX-100 features a built in VFO, modulator and power supplies, complete shielding to minimize TVI, and pi network output coupling to match impedances from approximately 50 to 600 ohms. Its RF output is in excess of 100 watts on phone and 120 watts on CW, for a clean strong signal on all the ham bands from 10 to 160 meters. Single-knob band switching and illuminated VFO dial and meter face add real operating convenience. RF output stage uses a pair of 6146 tubes in parallel, modulated by a pair of 1625's. High quality components are used throughout, such as "potted" transformers, silver-plated or solid coin silver switch terminals, aluminum heat-dissipating caps on the final tubes, copper plated chassis, etc. This transmitter was designed exclusively for easy step-by-step assembly. Shpg. Wt. 107 lbs.

MODEL DX-100

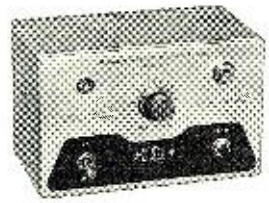
$189.50

FUNCTIONAL DESIGN . . .

The transmitters described on this page were designed for the ham, by hams who know what features are desirable and needed. This assures you of the best possible performance and convenience, and adds much to your enjoyment in the ham shack.

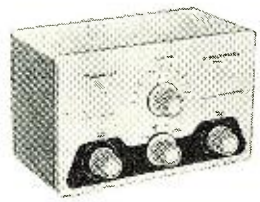
HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

Automatically turns off transmitter and gives visual signal



"AUTOMATIC" CONELRAD ALARM

GRID DIP METER



"Q" MULTIPLIER

COMMUNICATIONS-TYPE RECEIVER

An ideal receiver for the beginning ham or short wave listener

HEATHKIT "AUTOMATIC" CONELRAD ALARM KIT

This conelrad alarm works with any radio receiver; AC-DC-transformer operated—or battery powered, so long as the receiver has AVC. Fully complies with FCC regulations for amateurs. When the monitored station goes off the air, the CA-1 automatically cuts the AC power to your transmitter, and lights a red indicator. A manual "reset" button reactivates the transmitter. Incorporates a heavy-duty six-ampere relay, a thyratron tube to activate the relay, and its own built-in power supply. A neon lamp shows that the alarm is working, by indicating the presence of B+ in the alarm circuit. Simple to install and connect. Your transmitter plugs into an AC receptacle on the CA-1, and a cable connects to the AVC circuit of a nearby receiver. A built-in sensitivity control allows adjustment to various AVC levels. Receiver volume control can be turned up or down, without affecting alarm operation. Build a Heathkit CA-1 in one evening and comply with FCC regulations now! Shpg. Wt. 4 lbs.

MODEL CA-1
$13.95

HEATHKIT "Q" MULTIPLIER KIT

The Heathkit Q Multiplier functions with any AM receiver having an IF frequency between 450 and 460 KC, that is not "AC-DC" type. It derives its power from the receiver, and needs only 6.3 volts AC at 300 ma (or 12 VAC at 150 ma) and 150 to 250 volts DC at 2 ma. Simple to connect with cable and plugs supplied. Adds additional selectivity for separating signals, or will reject one signal and eliminate heterodyne. A tremendous help on crowded phone and CW bands. Effective Q of 4000 for sharp "peak" or "null". Tunes any signal within IF band pass without changing the main receiver tuning dial. A convenient tuning knob on the front panel with vernier reduction between the tuning knob and the tuning capacitor gives added flexibility in operation. Uses a 12AX7 tube, and special high-Q shielded coils. Instructions for connecting to the receiver and operation are provided in the construction manual. A worthwhile addition to any communications, or broadcast receiver. It may also be used with a receiver which already has a crystal filter to obtain two simultaneous functions, such as peaking the desired signal with the crystal filter and nulling an adjacent signal with the Q Multiplier. Shpg. Wt. 3 lbs.

MODEL QF-1
$9.95

HEATHKIT GRID DIP METER KIT

A grid dip meter is basically an RF oscillator for determining the frequency of other oscillators, or of tuned circuits. Extremely useful in locating parasitics, neutralizing, identifying harmonics, coil winding, etc. Features continuous frequency coverage from 2 mc to 250 mc, with a complete set of prewound coils, and a 500 ua panel meter. Front panel has a sensitivity control for the meter, and a phone jack for listening to the "zero-beat." Will also double as an absorption-type wave meter. Shpg. Wt. 4 lbs.

MODEL GD-1B
$21.95

Low Frequency Coil Kit: Two extra plug-in coils to extend frequency coverage down to 350 kc. Shpg. Wt. 1 lb. No. 341-A. $3.00

HEATHKIT ALL-BAND COMMUNICATIONS-TYPE RECEIVER KIT

This communications-receiver covers 550 kc to 30 mc in four bands, and provides good sensitivity, selectivity, and fine image rejection. Ham bands are clearly marked on an illuminated dial scale. Features a transformer-type power supply—electrical band spread—antenna trimmer—headphone jack—automatic gain control and beat frequency oscillator. Accessory sockets are provided on the rear of the chassis for using the Heathkit model QF-1, Q Multiplier. Accessory socket is handy, also, for operating other devices that require plate and filament potentials. Will supply +250 VDC at 15 ma and 12.6 VAC at 300 ma. Ideal for the beginning ham or short wave listener. Shpg. Wt. 12 lbs.

MODEL AR-3
$29.95
(Less cabinet)

Cabinet: Fabric covered cabinet with aluminum panel as shown. Part no. 91-15A. Shpg. Wt. 5 lbs. $4.95.

Heathkits...

By DAYSTROM

are outstanding in performance and dollar value

HEATHKIT REFLECTED POWER METER KIT

The Heathkit reflected power meter, model AM-2, makes an excellent instrument for checking the match of the antenna transmission system, by measuring the forward and reflected power or standing wave ratio. The AM-2 is designed to handle a peak power of well over 1 kilowatt of energy and may be left in the antenna system feed line at all times. Band coverage is 160 meters through 2 meters. Input and output impedances for 50 or 75 ohm lines. No external power required for operation. Meter indicates percentage forward and reflected power, and standing wave ratio from 1:1 to 6:1. Another application for the AM-2 is matching impedances between exciters or R.F. sources and grounded grid amplifiers. Power losses between transmitter output and antenna tuner may be very easily computed by inserting the AM-2 in the line connecting the two. No insertion loss is introduced into the feeder system, due to the fact that the AM-2 is a portion of coaxial line in series with the feeder system and no internal connections are actually made to the line. Complete circuit description and operation instructions are provided in the manual. Cabinet size is 7-3/8" x 4-1/16" x 4-5/8". Can be conveniently located at operating position. Shpg. Wt. 3 lbs.

MODEL AM-2

$15.95

HEATHKIT VARIABLE FREQUENCY OSCILLATOR KIT

Enjoy the convenience and flexibility of VFO operation by obtaining the Heathkit model VF-1 Variable Frequency Oscillator. Covers 160-80-40-20-15-11 and 10 meters with three basic oscillator frequencies. Better than 10 volt average RF output on fundamentals. Plenty of output to drive most modern transmitters. It features voltage regulation for frequency stability. Dial is illuminated for easy reading. Vernier reduction is used between the main tuning knob and the tuning condenser. Requires a power source of only 250 volts DC at 15 to 20 miliamperes and 6.3 volts AC at 0.45 amperes. Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts throughout. VFO operation allows you to move out from under interference and select a portion of the band you want to use without having to be tied down to only two or three frequencies through use of crystals. "Zero in" on the other fellow's signal and return his CQ on his own frequency! Crystals are not cheap, and it takes quite a number of them to give anything even approaching comprehensive coverage of all bands. Why hesitate? The model VF-1 with its low price and high quality will add more operating enjoyment to your ham activities. Shpg. Wt. 7 lbs.

MODEL VF-1

$19.50

Heathkits...

By DAYSTROM

are the answer for your electronics hobby.

HEATHKIT BALUN COIL KIT

The Heathkit Balun Coil Kit model B-1 is a convenient transmitter accessory, which has the capability of matching unbalanced coax lines, used on most modern transmitters, to balance lines of either 75 or 300 ohms impedance. Design of the bifilar wound balun coils will enable transmitters with unbalanced output to operate into balanced transmission line, such as used with dipoles, folded dipoles, or any balanced antenna system. The balun coil set can be used with transmitters and receivers without adjustment over the frequency range of 80 through 10 meters, and will easily handle power inputs up to 250 watts. Cabinet size is 9" square by 5" deep and it may be located any distance from the transmitter or from the antenna. Completely enclosed for outdoor installation. Shpg. Wt. 4 lbs.

MODEL B-1

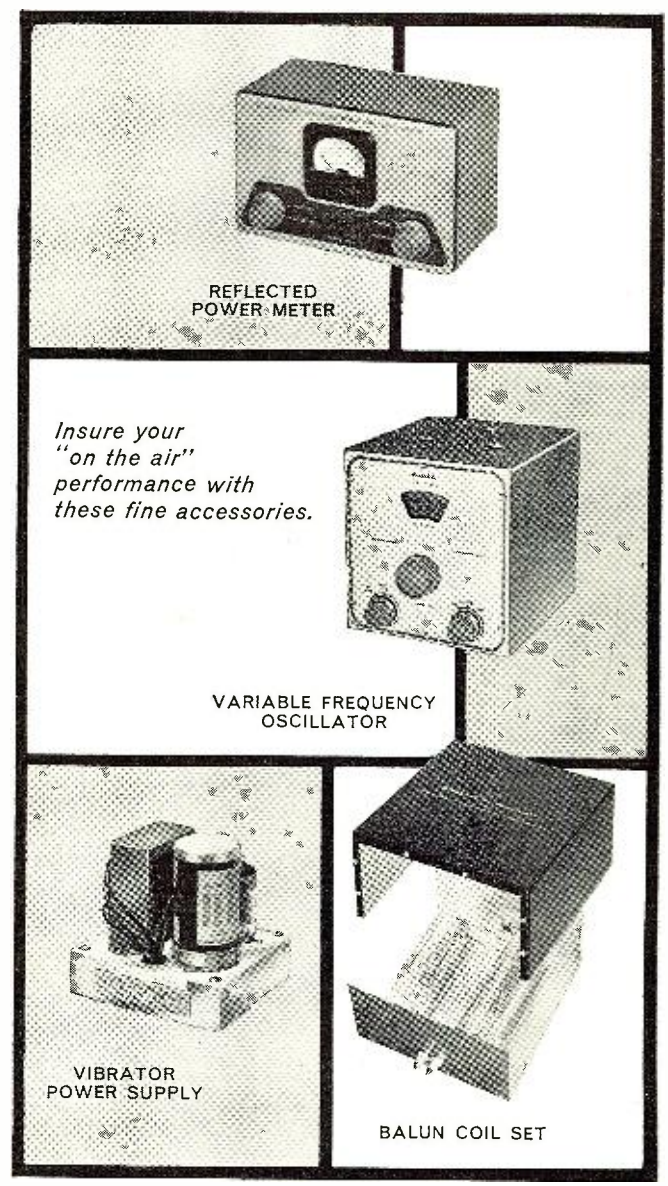
$8.95

HEATHKIT 6 OR 12 VOLT VIBRATOR POWER SUPPLY KITS

These little power supply kits are ideal for all portable applications with 6 volt or 12 volt batteries, when you are operating electronic equipment away from power lines. By replacing the power supplies of receivers, small public address systems, or even miniature transmitters with these units, they can be used with conventional 6 or 12 volt batteries. Use in boats, automobiles, light aircraft, or any field application. Each unit provides 260 volts DC output at up to 60 miliamperes. More than one power supply of the same model may be connected in parallel for increased current capacity at the same output voltage. Everything is provided in the kit, including a vibrator transformer, a vibrator, 6X4 or 12X4 rectifier, and the necessary buffer capacitor, hash filter, and output filter capacitor. Shpg. Wt. 4 lbs.

6 VOLT MODEL VP-1-6
12 VOLT MODEL VP-1-12

$7.95 Each



HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT ELECTRONIC IGNITION ANALYZER KIT

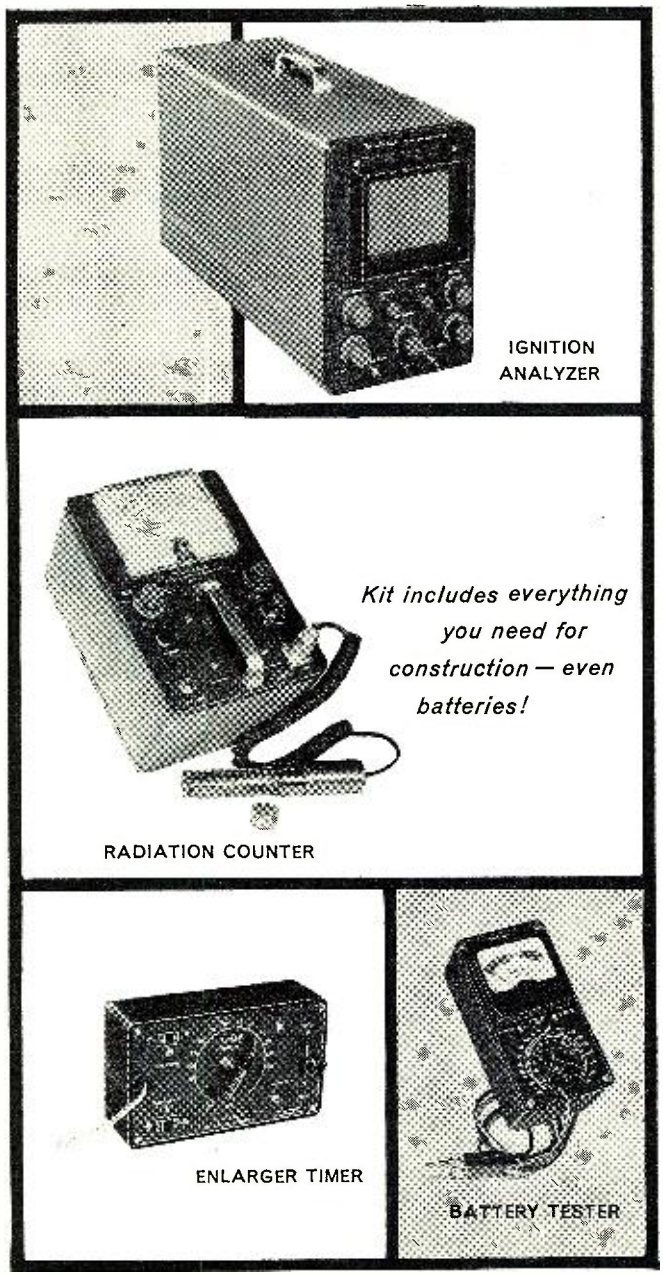
Previous electronic experience is not necessary to build this fine ignition analyzer. The construction manual supplied has complete step-by-step instructions plus large pictorial diagrams showing the exact placement and value of each component. All parts are clearly marked so that they are easily identified. The IA-1 is an ideal tool for engine mechanics, tune-up men, and auto hobbyists, since it traces the dynamic action of voltage in an ignition system on a cathode-ray tube screen. The wave form produced is affected by the condition of the coil, condenser, points, plugs, and ignition wiring, so it can be analyzed, and used as a "sign-post" to ignition system performance. This analyzer will detect inequality of spark intensity, a poor spark plug, defective plug wiring, breaker-point bounce, an open condenser, and allow setting of dwell-time percentage for the points. An important feature of this instrument is its ability to check dynamic performance, with the engine in operation (400 to 5000 RPM). It will show the complete engine cycle, or only one complete cylinder. Can be used on all types of internal combustion engines where breaker-points are accessible. Use it on automobiles, boats, aircraft engines, etc. Shpg. Wt. 18 lbs.

MODEL IA-1
$59.95

HEATHKIT PROFESSIONAL RADIATION COUNTER KIT

This Heathkit professional-type radiation counter is simple to build successfully, even if you have never built a kit before. Complete step-by-step instructions are combined with giant-size pictorial diagrams for easy assembly. By "building it yourself" you can have a modern-design, professional radiation counter priced far below comparable units. Provides high sensitivity with ranges from 0-100, 600, 6000 and 60,000 counts-per-minute, and 0-.02, .1, 1 and 10 miliroentgens-per-hour. Employs 900-volt bismuth tube in beta/gamma sensitive probe. Probe and 8-foot expandable cable included in kit price, as is a radiation sample for calibration. Use it in medical laboratories, or as a prospecting tool, and for civil defense to detect radioactive fallout, or other unknown radiation levels. Features a selectable time constant. Meter calibrated in CPM or mR/hour in addition to "beep" or "click" from panel-mounted speaker. Prebuilt "packaged" high voltage power supply with reserve capacity above 900 volt level at which it is regulated. Merely changing regulator tube type would allow use of scintillation probe if desired. Employs five tubes (plus a transistor) to insure stable and reliable operation. Kit price includes batteries. Shpg. Wt. 8 lbs.

MODEL RC-1
$79.95



Heathkits...

By DAYSTROM

are supplied with comprehensive instructions that eliminate costly mistakes and save valuable time

HEATHKIT ENLARGER TIMER KIT

The ET-1 is an easy-to-build electronic device to be used by amateur or professional photographers in timing enlarger operations. The calibrated dial on the timer covers 0 to 1 minute, calibrated in 5-second gradations. The continuously variable control allows setting of the "on" cycle of your enlarger, which is plugged into a receptacle on the front panel of the ET-1. A "safe light" can also be plugged in so that it is automatically turned "on" when the enlarger is turned "off." Handles up to 350 watts with built-in relay. All-electronic timing cycle insures maximum accuracy. Timer does not have to be reset after each cycle, merely flip lever switch to print, to repeat time cycle. A control is provided for initial calibration. Housed in a compact plastic case that will resist attack of photographic chemicals. A fine addition to any dark room. Shpg. Wt. 3 lbs.

MODEL ET-1
$11.50

HEATHKIT BATTERY TESTER KIT

The BT-1 is a special battery testing device that actually "loads" the battery under test (draws current from it) while it is being tested. Weak batteries often test "good" with an ordinary voltmeter but the built-in load resistance of the BT-1 automatically draws enough current from the battery to reveal its true condition. Simple to operate with "good-weak-replace" scale. Tests all kinds of dry cell batteries within ranges of 0-15 volts and 0-180 volts. Slide switch provides for either 10 ma or 100 ma load, depending on whether you're testing an A or B battery. Not only determines when battery is completely exhausted, but makes it possible to anticipate failure by noting weak condition. Ideal for testing dry cell hearing aid, flashlight, portable radio, and model airplane batteries. Test batteries in a way your customers can understand and stimulate battery sales. Shpg. Wt. 2 lbs.

MODEL BT-1
$8.50

HEATHKIT CRYSTAL RADIO KIT

The Heathkit model CR-1 crystal radio is similar to the "crystal sets" of the early radio days except that it has been improved by the use of sealed germanium diodes and efficient "high-Q" coils. The sealed diodes eliminate the critical "cats whisker" adjustment, and the ferrite coils are much more efficient for greater signal strength. Housed in a compact plastic box, the CR-1 uses two tuned circuits, each with a variable tuning capacitor, to select the local station. It covers the broadcast band from 540 to 1600 kc. Requires no external power whatsoever. This receiver could prove valuable to emergency reception of civil defense signals should there be a power failure. The low kit price even includes headphones. Complete step-by-step instructions and large pictorial diagrams are supplied for easy assembly. The instruction manual also provides the builder with the basic fundamentals of signal reception so that he understands how the crystal receiver functions. An interesting and valuable "do-it-yourself" project for all ages. Shpg. Wt. 3 lbs.

MODEL CR-1
$7.95

Heathkits...

By DAYSTROM

are easy and fun to build, and they let you learn by "doing-it-yourself"

HEATHKIT TRANSISTOR PORTABLE RADIO KIT

Heath engineers set out to develop a "universal" AM radio, suitable for use anywhere. Their objective was a portable that would be as much "at home" inside as it is outside, and would feature top quality components for high performance and long service life. The model XR-1 is the result of these efforts. Six name-brand (Texas Instrument) transistors were selected for extra good sensitivity and selectivity. A 4" by 6" PM speaker with heavy magnet was chosen to insure fine tone quality. The power supply was designed to use six standard size "D" flashlight cells because they are readily available, inexpensive, and because they afford extremely long battery life (between 500 and 1000 hours). Costs you no more to operate from batteries than what you pay for operating a small table-model radio from the power line. An unbreakable molded plastic was selected for cabinet material because of its durability and striking beauty. Circuit is compact and efficient, yet components are not excessively crowded. Transformers are prealigned so it is ready for service as soon as construction is completed. Has built in rod-type antenna for reception in all locations. Cabinet dimensions are 9" L x 8" H x 3¾" D. Comes in holiday gray, with gold-anodized metal speaker grille. Compare this portable, feature by feature, to all others on the market, and you'll appreciate what a tremendous dollar value it represents! Shpg. Wt. 4 lbs.

MODEL XR-1
$34.95
(Less batteries)
(With cabinet)

HEATHKIT BROADCAST BAND RADIO KIT

This table-model broadcast radio is fun to build, and is a fine little receiver for your home. It covers the standard broadcast band from 550 to 1600 kc with good sensitivity and selectivity. The 5½" PM speaker provides surprisingly good tone quality. High-gain IF transformers, miniature tubes, and a rod-type built in antenna, assure good reception in all locations. The power supply is transformer operated, as opposed to many of the economy "AC-DC" types. It's easy to build from the step-by-step instructions, and the construction manual includes information on operational theory, for educational purposes. Your success is assured by completely detailed information which also explains resistor and capacitor color codes, soldering techniques, use of tools, etc. A signal generator is recommended for final alignment. Shpg. Wt. 10 lbs.

Cabinet: Fabric covered cabinet with aluminum panel as shown. Shpg. Wt. 5 lbs. Part no. 91-9A. $4.95.

MODEL BR-2
$18.95
(Less cabinet)

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT FUEL VAPOR DETECTOR KIT

Protect your boat and its passengers against fire or explosion from undetected fuel vapor by building and using one of these fine units. The Heathkit Fuel Vapor Detector indicates the presence of fumes on a three-color "safe-dangerous" meter scale and immediately shows if it is safe to start the engine. A pilot light on the front panel shows when the detector is operating, and it can be left on continuously, or just used intermittently. A panel control enables initial calibration of the detector when installed. Features a hermetically-sealed meter with chrome bezel, and a chrome-plated brass panel. It is very simple to build and install, even by one not having previous experience. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from your boat batteries. The kit is complete in every detail, even to the inclusion of a spare detector unit. Shpg. Wt. 4 lbs.

6 volt MODEL FD-1-6
12 volt MODEL FD-1-12
$35.95 EACH

HEATHKIT BATTERY CHARGE INDICATOR KIT

The Heathkit model CI-1 Marine Battery Charge Indicator has been designed especially for the boat owner, although it has found use in service stations, power stations, and radio stations where banks of batteries are kept in reserve for emergency power. It is intended to replace the hydrometer method of checking storage batteries, and to eliminate the necessity for working with acid in small, below-decks enclosures. Now it is possible to check as few as one, or as many as eight storage batteries, merely by turning the switch and watching the meter. A glance at the meter tells you instantly whether your batteries are sufficiently charged for safe cruising. Dimensions are 2-7/8"W x 5-11/16" H x 2" D. Operates on either 6 or 12 volt systems using lead-acid batteries, regardless of size. Simple installation can be accomplished by the boat owner in fifteen minutes. Shpg. Wt. 3 lbs.

MODEL CI-1
$16.95

HEATHKIT ELECTROLYSIS DETECTOR KIT

The Heathkit model ED-1 Electrolysis Detector indicates the extent of electrolysis currents between the boat's common ground and underwater fittings, except on boats having metal hulls. These currents, undetected, could cause gradual corrosion and deterioration of the propeller or other metal fittings below the water line. It is particularly helpful when installing electrical equipment of any kind, or to determine proper polarity when power is obtained from a shore supply. Easy-to-build, the model ED-1 consists of a hermetically-sealed, waterproof meter, special sensing plate, and sufficient wire to install, including the necessary hardware. Mounts on instrument panel where it can be easily seen. Requires no power for operation, and gives instant warning to guard your boat for a lifetime. Shpg. Wt. 2 lbs.

MODEL ED-1
$9.95

HEATHKIT RF POWER METER KIT

The Heathkit RF Power Meter Kit is designed to sample the RF field in the vicinity of your transmitter, whether it be marine, mobile, or fixed. Output meter is merely placed in some location close to the transmitter, to pick up RF radiation from the antenna. Requires no batteries, electricity, nor direct connection to the transmitter. It provides you with a continuing indication of transmitter operation. You can easily detect if power is dropping off by comparing present meter readings with past ones. Operates with any transmitter having output frequencies between 100 kc and 250 mc, regardless of power. Sensitivity is 0.3 volts RMS full scale, and a special control on the panel allows for further adjustment of the sensitivity. Meter is a 200 ua unit, mounted on a chrome-plated brass panel. The entire PM-1 measures only 3¾" W x 6¼" L x 2" D. An easy way to put your mind at ease concerning transmitter operation. Shpg. Wt. 2 lbs.

MODEL PM-1
$14.95

Heathkits...

By DAYSTROM

now offer you completely modern marine equipment with outstanding design features

HEATHKIT TRANSISTOR RADIO DIRECTION FINDER KIT

The Heathkit Transistor Radio Direction Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit). The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 5 lbs.

MODEL DF-1

$54.95

TRANSISTOR
RADIO DIRECTION FINDER

Heathkits...

By DAYSTROM

are sold only by direct mail, passing middleman profits on to you

Pioneer in "do-it-yourself" electronics

HOW CAN YOU MISS?

The Heath Company maintains a technical consultation service, should you experience some sort of difficulty in construction or operation. Although only a very small percentage of our customers ever have occasion to use this service (usually only beginners in electronics) it is still reassuring to know that technical help is available when needed. A service department is also available, should you wish a complete factory check of operation and alignment or repair. After you build your first Heathkit you'll realize how easy it is.

Free Catalog

Send for this informative booklet listing more than 100 "do-it-yourself" kits.

HEATH COMPANY A Subsidiary of Daystrom, Inc. **BENTON HARBOR 15, MICH.**

ORDER BLANK

NOTE: All prices subject to change without notice.

Enclosed find ( ) check ( ) money order for_____
Please ship C.O.D. ( ) postage enclosed for_____pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS include postage for weight shown. ORDERS FROM APO'S must include full remittance. All prices F.O.B. Benton Harbor, Mich.

Name_____

Address_____

City & Zone_____State_____
(PLEASE PRINT)

SHIP VIA
- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	MODEL NO.	PRICE
		POSTAGE	
	☐ SEND FREE Heathkit Catalog	TOTAL	

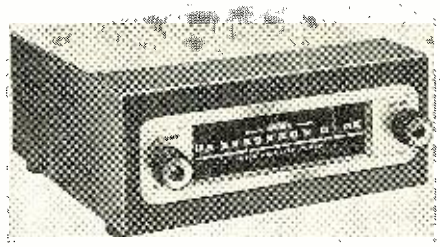
Hi-Fi-Audio Product Review

MILLER FM TUNER

J. W. Miller Company, 5917 S. Main St., Los Angeles 3, Calif. is now offering a moderately priced and compact FM tuner as its #560.

The new tuner is self-powered, completely shielded and has flywheel tuning, built-in antenna for local reception, edge-lighted dial, tuning indicator, and carries *UL* approval.

Sensitivity is 3 microvolts for 20 db quieting. Frequency response is ±



.5% from 20 to 20,000 cps. The circuit has negligible drift with the a.f.c. and meets FCC specifications on radiation.

The tuner is housed in an attractive cabinet which measures 10" wide, 4¼" high, and 7½" deep. The six-tube circuit consumes 35 watts.

BATTERY STEREO RECORDER

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. has developed a new self-contained stereophonic tape recorder for field use.

With this lightweight, small-size yet professional unit, motion picture pro-

ducers, sound engineers, and stereo enthusiasts are enabled to experiment with and produce stereophonic recordings.

Three single-speed models are available: 3.75, 7.5, or 15 ips. Models at 15 ips meet primary NARTB standards while those employing 7.5 ips meet secondary NARTB standards. Measuring 8½"x11"x10", the "Stereo-Magnemite" weighs only 17 pounds.

The high gain recording-playback amplifiers are powered by inexpensive dry-cell flashlight batteries and one "B" battery which last 100 operating hours. Constant tape speed over the full winding cycle is achieved by means of a centrifugal ball-bearinged, triple-compensated flyball governor on the spring motor.

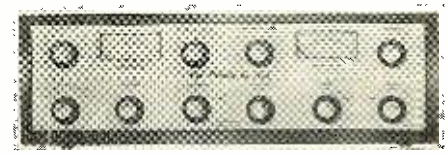
Complete technical specifications and prices are available from the manufacturer on request.

STEREO PREAMP-CONTROL UNIT

Pilot Radio Corporation, Long Island City 1, N. Y. has added a stereo preamplifier-audio control, the Model SP-215, to its line of hi-fi components.

The new unit is a professional type, bi-channel preamplifier, housed in a brushed brass and burgundy metal enclosure with inputs for stereo FM-AM broadcasts, stereo tapes, stereo discs, microphones, and other stereo signal sources. It has a separate output for recording stereo tapes, two vu meters, and controls for setting reference and peak recording levels.

Other features include bass and treble controls, volume and loudness controls, and a balance control for



equalizing the level between the channels. The SP-215 can be used with two power amplifiers as the basis of any stereo sound system.

Dimensions of the unit are 4¾" x 14$^{9}/_{16}$" x 10$^{5}/_{32}$". Write the manufacturer direct for additional details and price.

"UNI-FI" TUNER-AMPLIFIER

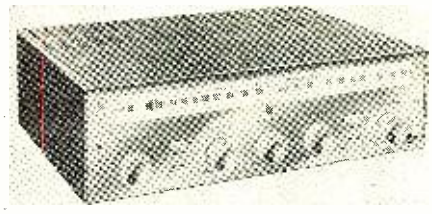
Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has added a tuner-amplifier combination to its "Knight" line of audio equipment.

The "Uni-Fi" combines an FM-AM tuner and a complete 15-watt amplifier on a single chassis. Since the unit is equipped with a preamp and has a full set of controls, it is only necessary to add a record changer and speaker for a complete hi-fi set-up.

The built-in amplifier employs two EL84's in the output stage and delivers a full 15 watts. A switching circuit converts the conventional volume control of the "Uni-Fi" to a loudness control to permit full-range sound even at low listening levels.

Also included are rumble and scratch filters, separate bass and treble controls, three-position record

compensator, and a three-position selector switch which lets the user play music through either of two speaker systems or both simultaneously. Output terminals match 4, 8,



or 16-ohm speakers and a high-impedance output jack permits convenient tape recording of FM or AM programs.

The company will supply full details on this new unit upon request.

BATTERY/TRANSISTOR RECORDER

Filnor Products, Inc., 101 West 31st Street, New York 1, N. Y. is now offering a fully transistorized, battery operated, portable tape recorder which is being imported from West Germany and marketed as the "Tel Tape."

Weighing less than two pounds and measuring only 8½" x 6½" x 2½", the unit will operate on only four ordinary

penlite batteries. It records speech and song for use at home and for student study. The unit records, plays back, and erases and even incorporates variable speed controls. The unit comes complete with earphones and microphone.

Dept. P202 of the importer will supply full details plus price information and delivery dates on request.

CHANGER-MANUAL PLAYER

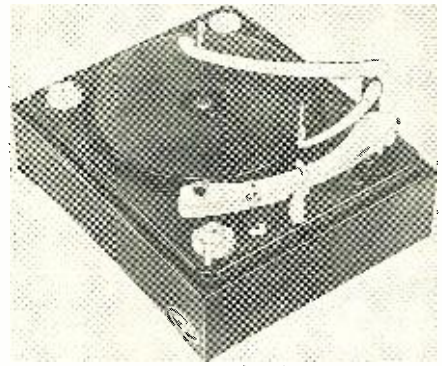
Garrard Sales Corp., 80 Shore Road, Port Washington, N. Y. has announced that its RC121 changer has been replaced by a dual-purpose record player which converts instantly from an automatic intermix changer to a single play unit with the tone arm completely free. The new model is the RC121/II.

The new unit is especially adaptable to replacement or service technician applications since it will fit into virtually any cabinet area designed for a record changer.

In addition to the features incorporated in the previous model, the unit has a new unitized control for automatic and full manual operation. In the automatic mode, the changer will handle 12" and 10" records intermixed in any order. An exclusive new spindle

positively prevents double record drop and affords extra protection against center hole wear.

There is a special stop/pause feature control that interrupts performance



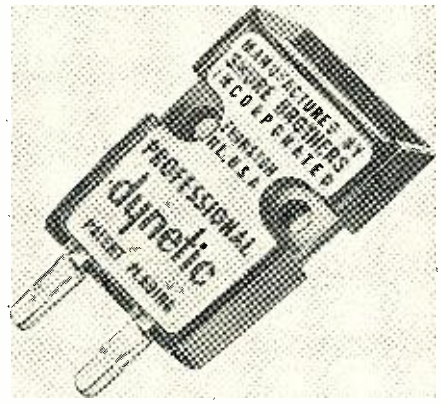
at any point and permits it to be started again without losing groove position; or the record can be rejected at the user's option.

Department K38 of the company will supply full details on request.

NEW SHURE CARTRIDGE

Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. has developed a new high-fidelity phonograph cartridge which employs a unique moving magnet principle for superior response and elimination of hum and "needle talk."

Known as the "Professional Dynetic," the new cartridge is designed for use in record changers and transcription tone arms. Its tracking force



is 3 to 6 grams. Response is flat from 20 to 20,000 cps. Since the magnet turns on a vertical axis, the needle tip is placed at the end of a light metallic beam, providing very low needle point mass. The new cartridge can be used with any amplifier having a magnetic phono input.

The "Professional Dynetic" comes with a 1 mil diamond needle for LP's and a 2.7 mil sapphire needle for 78 rpm records.

SCOTT 36-WATT AMPLIFIER

H. H. Scott, Inc., 111 Powdermill Road, Maynard, Mass, has added a 36-watt amplifier to its 210 high-fidelity component series and designated it as the Model 210-F.

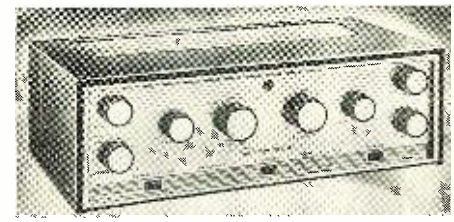
The amplifier has the company's new dynamic noise suppressor including separate controls for low-frequency and high-frequency noise suppression. This development suppresses rumble from old changers and noise from worn records without blocking music.

The front panel includes a record compensator and selector, relative bass and treble loudness selectors, a volume selector, three-position speaker selector, and pickup selector. The 210-F contains complete tape recording facilities—an instantaneous monitoring switch and a NARTB tape playback channel for recorded tape. There are two special tape output connections on the rear.

In the optional mahogany case, the amplifier measures 15½" x 5" x 12". The company will supply a free bulletin on the Model 210-F upon written request to Department P.

GROMMES STEREO PREAMP

The *Grommes High Fidelity Division* of *Precision Electronics, Inc.,* 9101



King St., Franklin Park, Ill. has just introduced a new stereo preamplifier, the Model 208.

Designed to work with two high-quality basic power amplifiers, the Model 208 unifies and controls the separate components of a stereo system. It will handle stereo program material from any source, including FM-AM tuner, tape, phono pickup, etc.

The circuit consists of two independent channels for each of the five inputs with ganged selector, turnover, roll-off, volume, bass and treble controls. A function switch is included to enable either channel A or B to be used as a monaural preamp driving both power amplifiers when no stereophonic program source is available.

The preamp is self-powered with d.c. on the filaments to make it especially suited for operation direct from tape heads. There is variable equalization on both channels for stereo records.

For complete specifications on the Model 206, write the manufacturer direct.

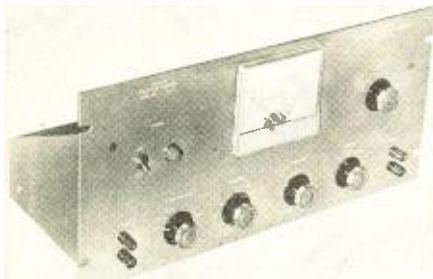
SENSITIVE FLUTTER METER

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. has developed a sensitive measuring device which meets the standards set by the SMPTE for flutter and wow.

The new instrument is designed to fill the need for a sensitive, rapid, and accurate method of visual indication of wow and flutter content of all types of tape recorders and playback equipment including 33⅓, 45, and 78 rpm discs and 16 and 35 mm. sound mechanisms.

A built-in 3000 cps oscillator is in-

corporated for recording purposes. This permits the flutter meter to be used as a complete instrument in itself and eliminates the necessity for calibrating and using external oscillators. A three-range filter is included



to study and isolate flutter and wow components. These ranges are .5 to 6 cps for wow, 5 to 250 cps for flutter, and the combined flutter and wow of .5 to 250 cps.

Complete technical specifications and direct factory prices may be obtained by writing the Instrument Division of the company.

E-V STEREO CARTRIDGE

Electro-Voice, Inc. of Buchanan, Mich. is in production on a stereo phono cartridge which will retail in the moderate price class.

The Model 21D provides a frequency response of 20 to 16,000 cps ± 2.5 db to RIAA and a .5 volt r.m.s. output in accordance with the *Westrex* 1A requirements. Compliance is 2×10^{-6} cm/dyne and tracking force is 6 grams. The stylus is .7 mil and the unit weighs 2.4 grams. It will mount on standard ½" and 7/16" tone-arm centers.

The cartridge uses a single stylus and two ceramic elements. For the replacement market, the cartridge will be equipped with a diamond needle. According to the company, this new cartridge can be used to play conventional LP's as well as the stereo discs.

AUDIO CATALOGUES

SPEAKER EXPANSION SYSTEMS

University Loudspeakers, Inc. 80 S. Kensico Ave., White Plains, N. Y. announces the availability of a new brochure covering its progressive speaker expansion plan.

With the aid of charts, the PSE plan is concisely presented. The audiophile is shown how to choose his basic speaker or speaker system from a wide selection of available speakers and network components and then guided through a progression of steps that would enable him to add components until he achieves his "dream" system without discarding any of the original items.

OXFORD COMPONENT LINE

Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill. has just released a colorful 12-page catalogue which provides complete information on its line of speakers including those in the PM replacement line; for p.a.

applications; intercom, weatherproof, hi-fi, extended range, full range, coaxial, rear seat, TV, radio and special type speakers.

The catalogue gives complete specs and each speaker type is illustrated.

ARKAY HI-FI CATALOGUE

Arkay, 120 Cedar Street, New York, N.Y. has announced the availability of its 1958 catalogue covering audio, TV, high-fidelity, and stereophonic components in factory wired and kit form.

The publication provides complete descriptions, specifications, and prices. The catalogue is available without charge on request.

FISHER RADIO-PHONO DATA

Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, N. Y. is offering copies of its new radio-phonograph brochure without charge to interested persons.

The new publication contains complete information about the company's high-fidelity consoles and includes electrical as well as mechanical specifications. Those wishing a copy of the 8½" x 11" brochure should write the manufacturer direct. —30—

MAY 2
Fifth Annual Conference for Engineers and Architects. Sponsored by Ohio State College of Engineering, Columbus, Ohio. Program and preregistration information available from Assoc. Dean Harold A. Bolz, chairman of Conference.

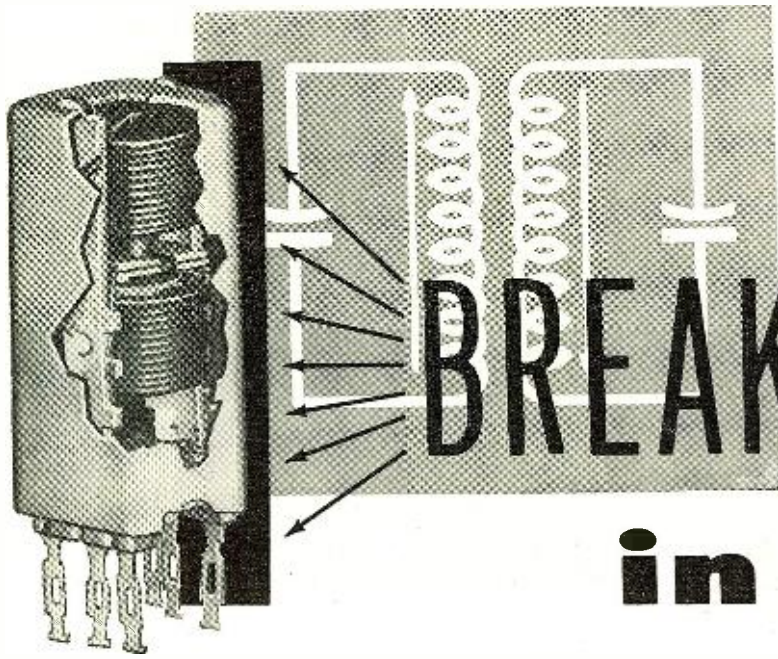
MAY 5, 6, 7
PGMTT National Symposium. Sponsored by IRE and PGMTT. Stanford University. Program information from Dr. K. Tomiyasu, G-E Microwave Lab., 601 California Ave., Palo Alto.

MAY 9
Eighth Annual Radio-Television Industry Conference and Banquet. Radio-Television Center, San Francisco State College. For further information contact Jack Sampson in care of the College at 1600 Holloway Ave., San Francisco 27, Calif.

MAY 13, 14, 15
Spring Assembly Meeting of Radio Technical Commission for Marine Services. Sponsored by FCC. Benjamin Franklin Hotel, Philadelphia.

MAY 19, 20, 21
1958 Electronic Parts Distributors Show. Conrad Hilton Hotel, Chicago. General Manager, Kenneth C. Prince, 11 S. La Salle St., Chicago 3, Ill.

MAY 27, 28
Second EIA Conference on Maintainability of Electronic Equipment. University of Pennsylvania, Philadelphia, Pa. Contact EIA Engineering Dept., 11 W. 42nd St., New York 36, N. Y., for program details.



BREAKDOWNS in AM F. Transformers

By **JOHN M. DOYLE**

The popular slug-tuned miniature i.f. transformers have characteristic patterns of fault development.

BREAKDOWN of i.f. transformers in radio receivers employing miniature types occur frequently enough to justify special, rapid analysis and repair techniques.

Normal complaints for this type of difficulty are: (1) no sound, although all tubes are lit; (2) rapid fluctuations in volume accompanied by a "popping" sound; or, (3) loss of sensitivity, along with noise similar to the rustling of paper. Refer to Fig. 1 which shows that portion of the circuit in a typical AM receiver with which we are concerned.

Our first objective is to isolate the trouble to a specific portion of the receiver. If the first symptom is present, we can eliminate the audio stages from consideration by touching the grid of the first audio amplifier at the center tap of the volume control. The resulting amplified noise voltage (60 cps) will be heard at the loudspeaker, exonerating the audio stage. For the second and third symptoms, we know by the nature of the defect that the audio section is operating. The tests to be described herein serve to localize the difficulty more closely, for they have one effect in common—abnormal a.v.c. voltages.

Irrespective of which symptom is evident, our first measurement is made by connecting a v.t.v.m. to either point *A* or *B* in Fig. 1. In the case of a dead receiver, point *A* is preferred. The meter may give an indication of up to +4 volts, rather than the slightly negative normal contact bias obtained at an idling detector of approximately −.6 volt. If the reading is positive by any amount, the logical procedure is to determine whether the tube or the coil is defective. A gassy detector, for instance, would develop a positive voltage due to the flow of reverse current. Clip the meter lead to point *A* and pull the detector tube. If upon doing so the positive voltage disappears, the tube is at fault. If, on the other hand, the *output* i.f. transformer is the cause of the trouble, the plus reading will increase and may reach as high as 90 volts in an a.c.-d.c. receiver.

EDITOR'S NOTE: *If you look at nothing but the schematic, the AM i.f. strip has not changed in decades. If you look at the sets themselves, however, things—especially i.f. cans—are not what they used to be years ago.*

With the vast majority of small receivers being of the a.c.-d.c. type employing series-string heaters, the described procedure may seem somewhat confusing, for in pulling any tube we are effectively "shutting off" the set. However, it must be remembered that, for a brief period of time (an average of approximately 20 seconds), the cathodes of those tubes remaining in place are still hot enough to emit a considerable volume of electrons. The decay of "B+" will follow an exponential curve during cooling and will not be instantaneous. Conditions will therefore remain stable long enough to permit a reliable check.

In those cases where one-volt tubes are employed (a.c.-d.c.-battery sets), the reader is cautioned not to pull and replace tubes while the receiver is turned on. The filament-circuit electrolytics employed will charge to a high voltage when the string is opened with the set in operation. If, as is customary, the tube is plugged back in as soon as the meter reading is observed, the resultant capacitor discharge surge could knock out every tube in the set. Therefore the receiver must be turned off and a tube checker employed in such cases. For testing the transformers, the resistance-measurement method is used. This technique is fully described later.

Returning to test point *A* in the dead receiver, when normal negative contact bias is indicated, transfer the hot lead of the v.t.v.m. to point *B*. If a small positive voltage is now noted here, clip the meter lead to point *B* and pull the i.f. amplifier tube. Should the positive voltage disappear, the tube is gassy or otherwise defective. When the positive reading remains and does not change appreciably, the converter tube is also pulled. The reasoning already noted with respect to the condition of the tube is applied. (It is of interest to note that a gassy tube will seldom give a positive reading greater than 2 volts.) When the positive reading increases as the tubes are pulled, the *input* i.f. transformer is breaking down.

We will next discuss the case of a receiver exhibiting the second symptom; *i.e.*, rapid fluctuations in volume accompanied by a popping sound. With a local station tuned in, some value of a.v.c. voltage (assume −4 volts) will be generated by the detector. Connect the meter to point *A*. Two different types of meter fluctuation may be observed at this point, depending on which transformer is defective. If the meter tends to fluctuate in a negative direction, the *input* transformer is faulty. The presence of "B+" leakage across this transformer removes part of the bias normally developed by a.v.c. action. This causes the tube to amplify more than normal, with a greater output resulting at the detector.

A positive check is to clip the meter lead to point *B* and remove the tubes in the same manner as previously described for a dead receiver. The voltage at point *B* is usually considerably less than at point *A* when this defect is present. If the meter fluctuates in a positive direction (from negative toward zero), the output transformer is defective.

With a rectified voltage of −4 volts, the intermittent "B+" leakage will be cancelling part of this negative voltage, but only for the duration of the leakage burst. Since the grid of the i.f. amplifier is fed by a relatively slow-acting *RC* filter (in the a.v.c. line), it does not have an opportunity to follow the rapid shifts in voltage that occur at the diode during the "B+" flashover. Therefore, the stage gain of the i.f. amplifier will be almost constant and the rectified current of the detector is mostly dependent upon arriving signal strength. Thus, the leakage of "B+" will only result in the popping noise heard at the loudspeaker, and will not cause an increase in over-all signal delivered to the detector.

The final symptom is loss of sensitivity and noise similar to the rustling of paper. Again, tests on the a.v.c. system are employed to locate the trouble. With the set tuned to a distant station (when possible) or to no station at all, a positive voltage of approximately .1 to .5 volt will be noted at either point *A* or *B*. Tests for defective tubes are carried out as previously described. The breakdown in one of the transformers, when it is the factor here, is due to a combination of the defects noted for the first two symptoms. While we have a steady leakage current, as with a dead receiver, it is very much lower and does not paralyze the tubes. We also have a form of flashover that is much steadier than the type which produced the popping sound for the second symptom. Here, again, the tube which gives the highest positive indication when pulled, is located in the output circuit of the defective transformer.

Final proof of breakdown can be obtained for any of the noted symptoms by the resistance method previously mentioned. Turn the receiver off, disconnect the a.v.c. lead from the secondary of the suspected transformer, and connect the v.t.v.m. in its place. Next, connect an external power supply of 100 volts as shown in Fig. 2. If the receiver is of the a.c.-d.c. type and employs a metallic rectifier, the external power supply is not required. Merely pull one of the tubes, which breaks the heater string and leaves only the "B+" for your convenience.

When power is applied to the circuit just set up, the voltage reading on the meter will tell whether there is any breakdown (leakage) between the windings of the i.f. transformer. An examination of Fig. 3, which is a simplified equivalent of Fig. 2, shows what happens. Whatever leakage resistance exists in the transformer is placed in series with the resistance of the meter.

With the circuit completed by the leakage path, there will be some voltage drop across the input resistance of the meter, with the rest of the source voltage being dropped across the leakage resistance in the transformer, which will generally be much higher. If we know how much voltage is dropped across the meter (indicated by its reading), we also know that the remainder of the applied voltage appears across the leakage resistance. The ratio between these two voltage values is also the ratio between the resistance of the meter and the leakage resistance. Thus, with a little calculation, we can determine exactly how much leakage resistance actually exists.

For example, if 100 volts is applied in the case of Fig. 3, and a reading of .5 volt is obtained on a v.t.v.m. whose input resistance is 10 megohms, leakage resistance would be about 2000 megohms. Generally, when using a v.t.v.m. for this test, a reading of .1 volt or more will indicate significant leakage in the transformer. The v.t.v.m. is recommended, as its relatively high resistance on the lowest d.c. scale will provide more accurate indications.

Although repair of such components as i.f. transformers is not ordinarily attempted, it is certainly worth consideration dollar-wise and customer-wise. While some replacement type transformers are readily obtainable, there are many special types used by different manufacturers where this does not hold true, and for which no substitute proves entirely satisfactory. Rather than keep the set in the shop for an unknown length of time while attempting to obtain a replacement, you can often repair the set immediately.

Once the defective unit has been definitely found, mark the underside of the chassis to avoid error when the

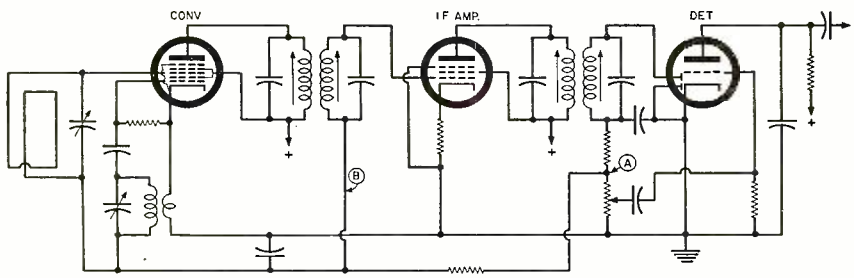


Fig. 1. Relevant portion of the circuit of a conventional broadcast receiver.

Fig. 2. Test for leakage between primary and secondary of i.f. transformer.

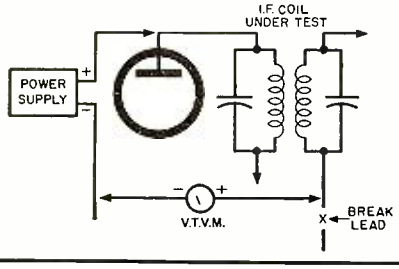


Fig. 3. Equivalent circuit for Fig. 2, showing leakage path. Meter and leakage resistances are in series across supply.

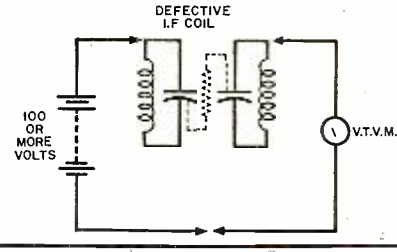
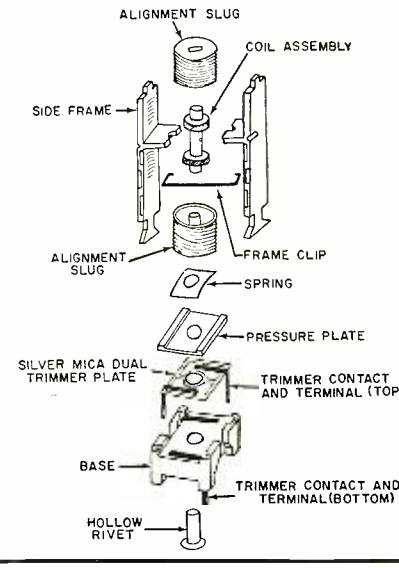


Fig. 4. Exploded view of a typical K-Tran of the type used as miniature i.f. transformer in latter-day AM sets.



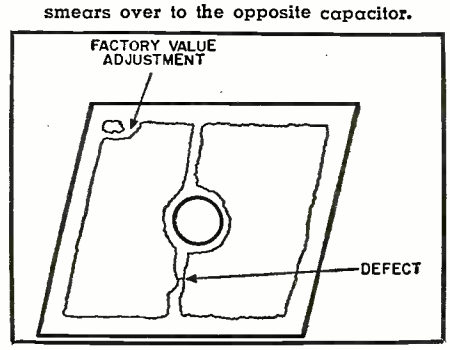
transformer is re-installed. (If the transformer is one of the widely used *K-Tran* units, it is usually coded with a green dot next to the grid lug.) The transformer is then removed and taken out of its can. Heat the solder on each lug in turn and, with a needle, unwind the coil leads attached thereto. Put a touch of glue on each wire just above the base plate, so that the wires will stay in place when the lower assembly is removed. Unscrew the top slug. Remove the bottom slug by spreading the side bars. By further spreading these bars, the trimmer assembly can then be detached from the rest of the coil.

An "exploded" view of a complete *K-Tran* is shown in Fig. 4. The trimmer assembly is held together by means of a hollow rivet passing through the center. On the upper, or coil side, is a beaded portion of the rivet which must be removed. This can be done by using a grinder or a file. Next, push the rivet through the assembly and lift off the spring and pressure plate. The trimmer is now exposed for examination.

With the familiarity that comes from going through such a procedure once, this disassembly can be accomplished in little more time than it takes to describe.

The type of defect that usually will be observed is shown in Fig. 5. Apparently, during the process used in printing the trimmers, some of the silver paint may become smeared. This defect is now cut out using the edge of a razor blade or a very sharp, slender knife. If available, a small amount of silver paint is then applied to the metal connectors which bear against the silver mica trimmers, by again using the needle or a toothpick. The unit is then re-assembled. There is always enough excess length on the rivet so that, by using firm pressure, it may be pushed back through the assembly and beaded over. The initial rebeading is easily accomplished by using a ¼"-shank Phillips type screwdriver. The job is completed with a ball-peen hammer. The remaining assembly is simply the reverse of the method used for disassembly. Although this procedure may, at first, seem somewhat difficult, proficiency is attained with a little practice. -30-

Fig. 5. Leakage usually occurs when the coated-on plate of the capacitor on one side of the i.f. transformer smears over to the opposite capacitor.



The 5-inch screen of this new airborne TV set shows a pilot his exact location.

Airborne Closed-Circuit Television

Cockpit TV set pictures pilot's ground location.

AN AIRBORNE closed-circuit TV device that pictures constantly for the pilot of a jet plane the exact location of his plane in relation to the ground was unveiled recently. The device, called the "Horizontal Situation Display," automatically correlates information fed into it by navigational computers and instruments and presents a TV picture in the form of a map of the terrain below the plane. A plane image, projected over the map, always corresponds to the pilot's position over the terrain. The electronic system was developed by *Avion* division of *ACF Industries, Inc.* under Air Force contract.

Navigational computers have already taken over the complex job of determining a plane's true course, speed, and location. However, the pilot or a crew member heretofore still had to take the numerical information supplied by the computers and put it on a map before the pilot could determine exactly where he was in relation to his home base or destination. The Horizontal Situation Display relieves the pilot of that chore. On a 5-inch screen mounted on the instrument panel, the device shows the plane image superimposed on an aeronautical map.

In operation, signals from a navigation computer are fed into the unit and actuate controls governing map and plane image positions. The result is picked up by a remote TV camera, whose output is then applied to the cathode-ray tube on the instrument panel. —30—

SHIPPED ON APPROVAL

NO MONEY WITH ORDER

NO C.O.D.

Model TD-55 — TUBE TESTER . . . Total Price $26.95 — Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

Model TW-11 — TUBE TESTER . . . Total Price $47.50 — Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

Model TV-12 — TRANSCONDUCTANCE TUBE TESTER . . . Total Price $72.50 — Terms: $22.50 after 10 day trial, then $10.00 per month for 5 months.

Model 770-A — VOLT-OHM-MILLIAMMETER . . . Total Price $15.85 — Terms: $3.85 after 10 day trial, then $4.00 per month for 3 months.

Superior's New Model TD-55 EMISSION TYPE

TUBE TESTER

For the Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester.
For the Professional Serviceman, who needs an extra Tube Tester for outside calls.
For the busy TV Service Organization, which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by: 1. Simplification of all switching and controls. 2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

You can't insert a tube in wrong socket
It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"Free-point" element switching system
The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum.

Checks for shorts and leakages between all elements
The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

Elemental switches are numbered in strict accordance with R.M.A. Specifications.
The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Complete with carrying case..... **$26.95 NET**

Superior's New Model TW-11

STANDARD PROFESSIONAL TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, 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. **All elements are numbered according to pin-number in the RMA base numbering system.**
- Model TW-11 does not use 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. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects 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.

Housed in hand-rubbed oak cabinet... **$47.50 NET**

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

★ **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%.

★ **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

EXTRA FEATURE:
Model TV-12 Also Tests 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.

Housed in hand-rubbed oak cabinet... **$72.50 NET**

Superior's New Model 770-A

POCKET-SIZED VOLT-OHM MILLIAMMETER

USING THE NEW "FULL VIEW" METER
71% MORE SCALE AREA

Occupies exactly the same space used by the older standard 2½" Meters, yet provides 71% more scale area. As a result, all calibrations are printed in large easy-to-read type.

- Housed in round-cornered, molded case. Beautiful black etched panel.

6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 Volts • **6 D.C. VOLTAGE RANGES:** 0-7.5/15/75/150/750/1500 Volts • **2 RESISTANCE RANGES:** 0-10,000 Ohms, 0-1 Megohm • **3 D.C. CURRENT RANGES:** 0-15/150 Ma., 0-1.5 Amps. • **3 DECIBEL RANGES:** —6 db to +18 db, +14 db to +38 db, +34 db to +58 db.

Complete with test leads..... **$15.85 NET**

USE APPROVAL FORM ON NEXT PAGE

We invite you to try before you buy any of the models described on this and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

TRY FOR 10 DAYS

before **you buy!**

then **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price!

- Model 77 completely wired and calibrated with accessories (including probe, test leads and portable carrying case) sells for only $42.50.
- Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- Model 77 uses new improved SICO printed circuitry.
- Model 77 employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.
- Model 77 uses a selenium-rectified power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.
- Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

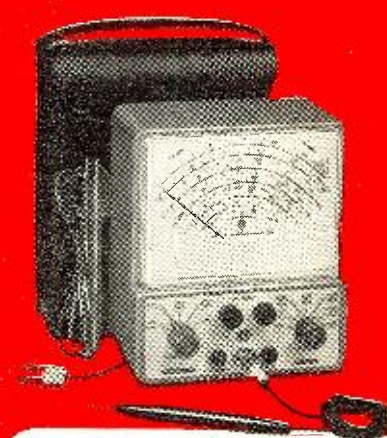
AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

SPECIFICATIONS

• **DC VOLTS** — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • **AC VOLTS (RMS)** — 0 to 3/15/75/150/300/750/1,500 volts. • **AC VOLTS** (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts. • **ELECTRONIC OHMMETER** — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • **DECIBELS** —10 db to + 18 db, + 10 db to + 38 db, + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • **ZERO CENTER METER** — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe and test leads. Use it on the bench — use it on calls. A streamlined carrying case, included at no extra charge, accommodates the tester, instruction book, probe and leads. Operates on 110-120 volt 60 cycle. Only ..... **$42.50 NET**



Model 77 — VACUUM TUBE VOLTMETER . . . Total Price $42.50 — Terms: $12.50 after 10 day trial, then $6.00 per month for 5 months.

Superior's New Model 76

ALL PURPOSE BRIDGE

IT'S A CONDENSER BRIDGE IT'S A RESISTANCE BRIDGE IT'S A SIGNAL TRACER IT'S A TV ANTENNA TESTER

Specifications

CAPACITY BRIDGE SECTION
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

SIGNAL TRACER SECTION
With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

TV ANTENNA TESTER SECTION
Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals. *Complete with R.F. and A.F. probes and test leads* . . . . . **$26.95 NET**

Model 76 — ALL PURPOSE BRIDGE . . . Total Price $26.95 — Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

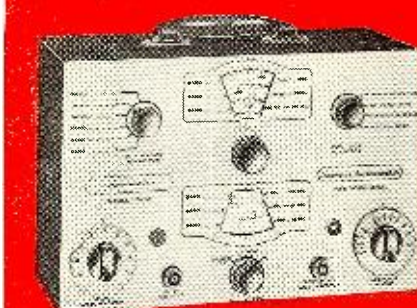
Superior's New Model TV-50

GENOMETER

7 Signal Generators in One!

- R.F. Signal Generator for A.M.
- R.F. Signal Generator for F.M.
- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

R.F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics
VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.
BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.
CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.
DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.
MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)
Complete with shielded leads . . . **$47.50 NET**



Model TV-50 — GENOMETER . . . Total Price $47.50 — Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-466 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after o 10 day trial positively cancelling all further obligation.

Name .....

Address .....

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

All prices net, F.O.B., N.Y.C.

- ☐ Model TD-55 .....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TW-11 . . . .Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-12. . . . .Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.
- ☐ Model 770-A . . . .Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 77.....Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model 76.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-50.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

Receiving "Explorer's" Radio Signals

By **D. RIPANI**, W9JAQ

Some puzzling aspects concerning signals from our first earth satellite are cleared up here.

THE reception of 108.00 mc. and 108.03 mc. radio signals from Explorer I, and future satellites operating in the v.h.f. band, clearly demonstrate two interesting phenomena that may prove puzzling at first.

The first is the "Doppler Effect." Recalling high school physics, "Doppler Effect" was usually illustrated by imagining an observer standing at a railroad crossing and a train rushes by with its whistle blowing. As the train approaches this observer, the whistle's pitch sounds higher in frequency and as the train recedes the pitch becomes lower. While the train is directly abreast of the observer, the whistle's true pitch is heard. Obviously, the whistle has not changed its pitch. What has changed, though, is the velocity of propagation. As the train approached the observer the relative velocity of propagation, in relation to the observer increased and, consequently, the whistle's pitch rose in frequency. As the train sped away, the velocity of propagation decreased and the apparent frequency dropped. While the train was abreast of the observer, the relative velocity of propagation did not change and the tone heard was the true sound of the train whistle.

Like so many others, the author relegated "Doppler Effect" to some obscure corner of the brain and forgot it, that is, until the first time he listened for the Explorer on 108.03 mc.—and couldn't hear it. Using a low-noise, crystal-controlled converter feeding a *Collins* 75A4, set for 800-cycle bandpass, nothing was heard until the receiver was tuned about 2 kc. higher in frequency. At 108.032 the signal was heard just above the noise level. And when it had finally faded out about 9 minutes later, it was transmitting on about 108.028 mc.; a total shift of approximately 4000 cycles. Dusting off the old physics books revealed a formula for calculating Doppler shift as applicable to sound waves, but with minor alterations, it is suitable for determining frequency shift.

$\pm f_s = VF/984$

where:

$\pm f_s$ = plus and minus maximum frequence shift.

V = speed of the satellite in feet per second.

F = satellite frequency in megacycles.

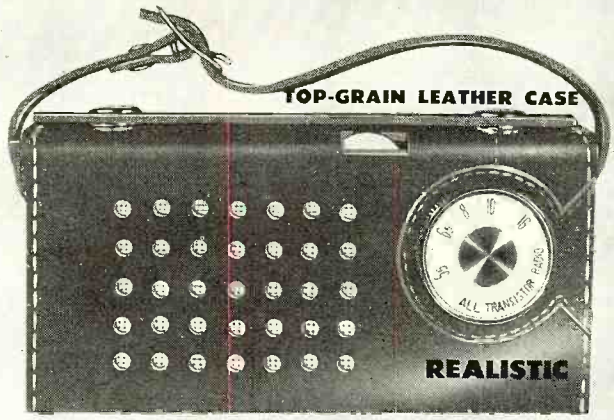
With the Explorer's velocity of about 18,000 m.p.h., or 26,400 feet per second and a frequency of 108.03 mc., the value is approximately ± 2900 cycles.

This total shift of almost 6 kc. holds true for a satellite passing directly overhead but in most cases the satellite will pass at some distant point thereby lowering somewhat the total frequency shift. Here in Wisconsin, at a point nearly one thousand miles away, the maximum shift proved to be about 3200 cycles. A quick substitution of Sputnik's frequency of 20 mc. in the formula (same approx. speed as Explorer) gives an answer of ± 500 cycles—which explains why most listeners did not notice the Doppler shift on Sputnik's signal. On the other hand the Doppler shift can be a real problem in space communications unless automatic frequency control devices are incorporated in the receivers —as jets, using single-sideband communications have already discovered. In fact, as an interesting sidelight, a few minutes with the formula will reveal some pertinent as well as troublesome future communications problems that may need solving when superspeed spaceships take off. Using a speed of 90,000 m.p.h. and a frequency of 200 mc., this Doppler shift can amount to 50 mc.!

The other interesting observation involves the orbiting time. Explorer's time of complete orbit was given as almost 115 minutes, yet our clocked intervals came to 121 minutes. This proved puzzling until it was recalled that although the Explorer requires only 115 minutes to return to the same spot in space, the earth beneath it has in the meantime moved almost 2000 miles further east and for "line of sight" reception of Explorer's signal, the satellite had to continue for an additional ninth of an hour, about 6 minutes, to get in radio range. —30—

RADIO SHACK BARGA N

6 TRANSISTORS



$29.95 EXCLUSIVE

Radio: RN-6277 Ship. 3 lbs.
Battery RN-2502 Sale! 75c

GUARANTEED to equal or exceed 6-TRANSISTOR RADIOS PRICED $40 - $50 - $60 - $70

ENTIRELY LEATHER ENCASED! Radio Shack's fabulous 6-transistor midget-portable radio bargain also includes these exciting features: **built-in speaker, separate earphone with cord and jack, printed circuitry, ferrite antenna, AGC superhet circuit, conelrad markers, enough audio "sock" to drive even 12" speakers from phone jack, top-grain leather including strap — no plastic!** Runs 100's of hours on a single tiny 9V battery — no short-life flashlight cells! True 5½" x 2¾" x 1½" pocket size. Over 18,000 mail-order customers tell us it's the best buy in the world! **Mail your order today — immediate delivery.**

SALE! 4-SPEED VARIABLE-SPEED TURNTABLES!

★ Built-in Optical Stroboscope

Built like a battleship! Solid castings, precision machining, hi-fi performance, big and quiet heavy-duty 4-pole motor with instant variation of all four speeds. Famous "Realistic"-brand quality. And it's yours — while our LIMITED supply lasts — at a price actually lower than a record changer. Strobe mounted under table; viewed thru lighted optical system. 13¾" w. x 14⅛" d. Clearance above 2" and 4½" below. 110-130V. 60 cy. AC.

Comparative Market Value ~~$79.50~~

SALE! $39.50

$4 DOWN, $5 MONTHLY

Order No. RN-9050. Ship. 23 lbs. $39.50
Rock Maple Base for Realistic Mark IX
Order No. RN-9050R Ship. 10 lbs. $12.00

SALE! REALISTIC HI-FI TONE ARMS

★ Silicon Oil VISCOUS Damped
★ Exclusive PLUG-IN Heads (2)
★ 4 Separate Balance Weights For Latest Model Pickups

Licensed under CBS patent no. 2676806

12" Arm — ~~$29.95~~
16" Arm — ~~$39.95~~

Your Choice **$13.90**

12" Arm — Order RN-8148
16" Arm — Order RN-6602

SALE! $3.50 TEST TAPE!

95¢

7 COMPLETE professional tests for tape recorders. Has instructions to test timing, record level, —10 db record level, head alignment, fine alignment, signal-to-noise. Ship. wt. ¾ lb. **Order No. RN-D110.**

IN THE WHOLE WORLD ONLY RADIO SHACK HAS THE

1958 REALISTIC FM TUNER

3 Microvolts for 30 DB Quieting

$47.50

$5 Down $5 Monthly

YOU GET a fabulous high fidelity tuner with specifications **no one can duplicate under $80.00** — Armstrong FM circuitry, balanced AFC, tuned RF stage, 3-gang condenser, 6 tubes (2 dual for 8-tube function), ultra-compact size.

Other Realistic FM-II specs: 20-20,000 cps freq. resp.; gold, maroon-and-white metal cabinet; size: 9⅝" W x 4⅜" H x 6⅛" D. 117V 60 cy. AC. Ship. wt. 9½ lbs. **Order 36-RN-888.**

FREE! 224-Page Electronics and Hi-Fi Buyers' Guide

MAIL ORDERS TO: **RADIO SHACK CORP.**
167 Washington Street, Boston 3, Mass.

- ☐ Realistic 6-Trans. Radio (#RN-6277) at $29.95
- ☐ 9 Volt Battery for Radio (#RN-2502) at 75c
- ☐ Realistic Turntable (#RN-9050) at $39.50
- ☐ Unfinished Base for Table (#RN-9050B) at $12.00
- ☐ Realistic 12" Tone Arm (#RN-8148) at $13.90
- ☐ Realistic 16" Tone Arm (#RN-6602) at $13.90
- ☐ Test Tape (#RN-D110) at 95c
- ☐ Realistic FM-II Tuner (#36-RN-888) at $47.50
- ☐ FREE: 224 Pg. Electronics Buyers' Guide

☐ Check ☐ Cash ☐ Purchase Order

Name .....

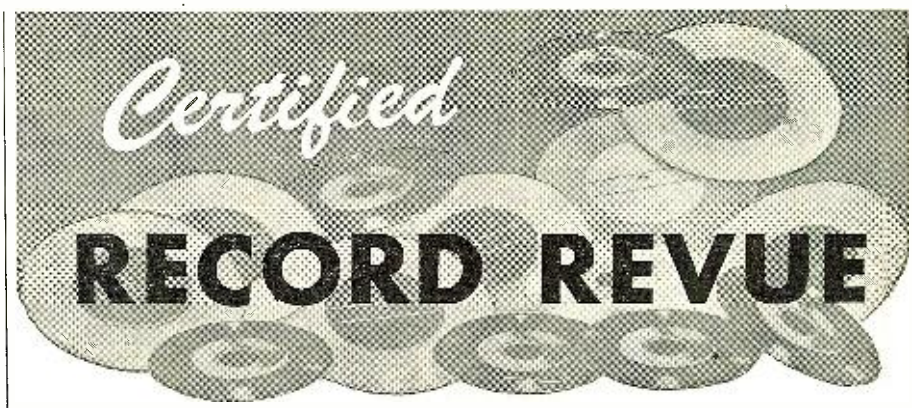
Street .....

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

RADIO SHACK CORP.

BOSTON, MASS. NEW HAVEN, CONN.

Over 35 Years of Continuous Service to Electronics, Radio, Science!



By BERT WHYTE

IN SPITE of all the smoke-screen and whoopla to the contrary, you can put it down in your book that the stereo disc is a reality. By the time you read this chances are that many of you will already have obtained a stereo cartridge and will have purchased your first stereo disc. I don't mean to imply that there will be stereo discs festooning the walls of record shops, but there will be enough of them issued or announced to stimulate any serious hi-fi man into action.

The San Francisco and Los Angeles Audio Shows were really the jump off for the stereo disc, even though the products of the major record manufacturers were heard only as experimental demonstration discs in the rooms of the various cartridge manufacturers. But Sid Frey and his "Audacious Fidelity" stereo records were there and the cartridge boys were there and between the two of them, enough stereo noise was made so that the major record companies and the public got the message loud and clear.

As of right now you can buy the *Audio Fidelity* stereo discs in many of the New York hi-fi shops, and you can buy either an *Electro-Voice* ceramic stereo cartridge, or a *Fairchild,* or *Miratwin* magnetic stereo cartridge so you can hear 'em. Within a few weeks there will be stereo cartridges forthcoming from *Brush, Shure, Webster Electric, Pickering, Grado, Weathers, ElectroSonic,* and others.

I know of quite a few special stereo preamps and single chassis-double amplifier stereo power amps being frantically readied by manufacturers big and small. As for compatibility, it has been pretty well established and accepted that unless you own a monaural pickup with exceptionally high vertical compliance, playing a stereo disc with anything else will injure it for future stereo use. In other words when playing stereo discs, the prudent person will be playing them with a stereo cartridge.

All this activity on the stereo disc is quite understandable. As a luxury item, hi-fi has felt the pinch of the recession too, in fact more than many people are willing to admit. The stereo disc looks like the way out of the economic jungle, thus the push. If all goes well, I'll review the first stereo discs, next month.

BEETHOVEN
CONCERTO FOR VIOLIN AND ORCHESTRA IN D MAJOR
Arthur Grumiaux, violinist with Concertgebouw Orchestra of Amsterdam conducted by Eduard Van Beinum. Epic LC3420. Price $3.98.

The umpteenth version of this great concerto, but not one which can be lightly dismissed. Grumiaux and Van Beinum team up to give us one of the most distinguished performances on records. Theirs is the straightforward, "classical" approach and a refreshing change from the mannered displays which characterize so many performances these days. Grumiaux's clean, vibrant tone and Van Beinum's judiciously paced and proportioned accompaniment earn for them a place beside the august Heifetz/Munch and Milstein/Stern recordings.

The recorded sound is generally quite clean, with an excellent balance between violin and orchestra. Only a somewhat over-resonant bass line keeps the sound below the sonic heights reached by the Heifetz recording.

TCHAIKOVSKY
SYMPHONY #6 (PATHETIQUE)
New York Philharmonic Orchestra conducted by Dimitri Mitropoulos. Columbia ML5235. Price $3.98.

As most readers are probably aware, Mitropoulos is leaving his post as conductor of the New York Philharmonic this season, to be succeeded by the redoubtable Leonard Bernstein. Mitropoulos henceforth will devote most of his talents to conducting opera at the Metropolitan. Mitropoulos' conducting has always been the subject of much controversy. In some types of repertoire he is unsurpassable . . . and in other types he is nigh unbearable. I have always had a suspicion that the music in which Mitropoulos seems least comfortable, is of relatively little moment to him. I think this kindly, talented man has the latent ability to conduct superbly, any work of music, provided he has deep convictions about the worth of the music. He has always been a tireless experimenter and an innovator in his choice of programs. He has always championed "new" music and I particularly remember an impassioned speech he made to an audience some years ago at the Ravinia Festival in Chicago, upbraiding them when attention wandered from some modern score. Thus his choice of program material at Carnegie Hall was often subject to criticism from the conservatives in the Philharmonic Society and his musical adventuring constrained. His recording career is equally chequered . . . *Columbia,* like all record companies must depend on a certain number of "potboilers," symphonic warhorses which they must have in their record stables to appeal to a large public. Mitropoulos has had to contribute his share, with results which were not consistently happy.

But to *Columbia's* credit, there have been occasions when Mitropoulos was allowed to take the bit in his teeth and strike out in new directions. Thus we have some memorable legacies of Mitropoulos's tenure with the Philharmonic. Who can forget his masterly version of Alban Berg's "Wozzeck," the gi-

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

gantic strength of his reading of the Shostakovich Tenth Symphony, or the searing intensity he applied to the Vaughn Williams 4th Symphony? And one can only hope that *Columbia* had the good sense to record and will some day issue his tremendous performances of the Mahler 3rd and 6th symphonies.

In his appearances with the Metropolitan, Mitropoulos is evidently enjoying the opportunity to work with this larger scaled music. He has already earned the commendation of the critics for the revitalized orchestral sections in the music of the more normal operatic repertoire and has elicited rave notices for his truly fabulous performances of Straus' "Salome" and "Elektra."

Well, I haven't mentioned this recording of the "Pathetique," thus far, mainly because I felt a tribute was in order to a very fine gentleman and conductor, who has often been poorly (and often unjustly) served by the critics. This recording is typical of what I was talking about . . . it is a good, well-proportioned reading, happily free from the mannered sentimentality with which so many conductors insist on festooning the work. But neither does the reading strike any sparks . . . it is as if Mitropoulos had decided after numberless performances of the work that there wasn't much left to say. More is the credit to him if this be so . . . rather this than to become banal and trite with a great show of obviously contrived drama.

As a sonic achievement, this recording is quite good . . . a big, full, high-level recording that is equal to and in some ways superior to the Kubelik and Monteux recordings. Summing up . . . not Mitropoulos at his brilliant best, but certainly good enough to satisfy those who will be buying the record for its excellent sound.

HAYDN
SYMPHONY #96
MOZART
SYMPHONY #35 (HAFFNER)
Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50129. Price $4.98.

Here is Paray again cutting across the line of his musical "nationalism," this time with Papa Haydn and Mozart. The Haydn reading is well executed, with proper respect for tempi and dynamics. The Mozart was really quite a surprise . . . being, quite possibly, one of the finest versions on records. It has grace, lyricism and at the same time plenty of zest and spirit in the *allegro* and *presto* sections. A few days after I heard this recording, I learned why Paray was not to be taken lightly as an interpreter of Mozart. It seems that during the recent Mozart year celebration, he had an award conferred on him by the Mozarteum of Salzburg, for "distinguished service to the music of Mozart," the only conductor in America so honored. Very sharp, clean sound, with acoustics slightly less resonant than ideal, characterize the two works on the disc.

SCHUMANN
SYMPHONY #3 (RHENISH)
Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50133. Price $4.98.

Music is generally thought of as being an international language, but it is surprising how many conductors are "nationalistic," specializing in the music written by composers of their native lands. Thus we bring to mind conductors like Kubelik and Talich who espouse the cause of Dvorak, Smetana, and Janacek, the late Toscanini with his Verdi and Rossini, Bruno Walter with Beethoven, Brahms, and Mahler, and Paul Paray with Ravel, Debussy, Franck, and Roussel. Of course, no conductor can limit his repertoire entirely to native composers and hope

to gain wide recognition. So the Italian Toscanini became a great conductor of the music of Beethoven, and thus Frenchman Paray is highly regarded for his readings of Schumann.

This recording of the Schumann "Rhenish" symphony, continues in the vein of Paray's readings of the Schumann 2nd and 4th symphonies. It is vigorous, almost earthy and at the same time is splendidly lyrical. In this most massively constructed of all the Schumann symphonies, Paray elicits some noble sounds from his big orchestra. Although the acoustics of the new Ford Auditorium in Detroit where this recording was made are somewhat "dry" as compared to the old Orchestra Hall, the engineers have been able to cope with it and a listen to the wonderful broad brass chordal effects in the 4th movement will confirm this.

The sound, in general, is very clean and crisp, with a fine balance and deeply resonant bass line. Evidently Paray enjoys this score, for if you will listen carefully at the beginning of the third movement, you can hear him singing the lovely melody introduced by the clarinets and bassoons. All in all, an extremely effective performance, enhanced by the excellent sound.

A WORLD OF MUSIC
Capitol PA08412. Price $4.98.
SERENADE
Capitol PA08413. Price $4.98.
Capitol Symphony Orchestra conducted by Carmen Dragon.

These two albums should rack up a lot of sales for *Capitol*. They certainly have all the elements to succeed. In a World of Music, Carmen Dragon trots out some tired warhorses like the Prelude to Carmen, Smetana's "Dance of the Comedians," Die Fledermaus Overture, Londonderry Air, La Cucaracha, and others of similar persuasion, and proceeds to whip them into life. In big, lush arrangements, Dragon gets some fine spirited playing from his exceptionally good orchestra.

In "Serenade," Dragon flips the other side of his musical coin and gives out with richly romantic fare like Grieg's "Ich Liebe Dich," Mendelssohn's "On Wings of Song," Kreisler's "Old Refrain," and others. Here, too, is orchestral playing of uncommon merit. Shared by both albums is a great, clean sound of the multi-mike type. The "World of Music" has some of the most remarkable acoustic treatment I've ever heard, and the "presence" this affords, especially to the brass, is nothing short of phenomenal.

VIVALDI
L'ESTRO ARMONICO
(12 CONCERTI GROSSI)
Jan Tomasow and Willi Boskowski, violinists, with Chamber Orchestra of the Vienna State Opera conducted by Mario Rossi. Vanguard BG572. Special Price $9.96. Three discs.

The old *Vox* recording of this work which has served so well, will have to give way to this new *Vanguard* effort. This is in every way superior . . . the performance is better integrated, much smoother while maintaining its vigor. The soloists are absolute top-drawer and their confident, assured playing falls lovingly on the ear.

The ensemble work of the orchestra is superb, very precise and polished. The sound is perhaps the most outstanding difference between the two albums. The *Vox* was a good recording for its day, but in comparison to this it seems thin and formless. Here we have a moderately close-up sound with all the strings cleanly articulate and a big acoustic perspective allowing for a sound of great projection and brilliance.

The 12 concerti are a source of endless fascination, but if this is your first experience

with them it is suggested that you take them in easy doses, say one side at a time. Even the most dedicated music lover might be a little weary if he tried to listen to all six sides and 12 concerti in order!

While not as plushly packaged as the *Vox* album, on the special anniversary deal it's almost 5 dollars cheaper in price and with its other advantages, is without question the recording of choice.

CONCERT ENCORES

Mantovani and his Orchestra. London LL3004. Price $4.98.

London's breadwinner has come up with another album that is certain to hit the best-seller lists. Concert Encores in this case is pretty much on the "pop" concert side with staples like "Clair de Lune," the "Can-Can" from La Boutique Fantasque, "Song of India," "Perpetuum Mobile," and others. The performances are in Mantovani's distinctive style, with great soaring strings in the huge, live acoustics, over-all bright clean sound.

DEBUSSY
IMAGES POUR ORCHESTRE

L'Orchestre de La Suisse Romande conducted by Ataulfo Argenta. London LL1735. Price $4.98.

Unhappily for music lovers everywhere, this is probably one of the last recordings by the brilliant young Spanish conductor, Ataulfo Argenta. Mr. Argenta's most promising career was cut short by his untimely death in a recent auto crash. Strange that so much of the young musical talent in the world have met their deaths in accidents these past few years. First there was William Kapell, then Guido Cantelli, and now Argenta. All the more tragic when one considers that conducting seems to be a profession with great longevity. Toscanini was almost 90, Monteux is over 80, so is Bruno Walter and Beecham and Klemperer are well into their seventies.

The most familiar number in this work is, of course, "Iberia." "Gigues" and "Ronde de Printemps," while interesting in their own right, have not had the popular appeal of "Iberia." Although this is music composed by a Frenchman, "Iberia" so uniquely captured the flavor of the Spanish idiom, that it became part of Spain's musical traditions. Thus it should not be surprising to find "Iberia" as a staple in the repertoire of a Spanish conductor, nor surprising to find that in the hands of a gifted Spanish conductor such as Argenta, that the score takes on new hues and meanings.

Argenta turns in a stunning performance combining the essential grace and rhythm of the score with nuances and subtleties of dynamics and expression which are unmistakably Spanish. Fortunately, the Suisse Romande players caught the spirit of the occasion and Argenta has managed the minor miracle of making an essentially Swiss-French orchestra sound like they were straight out of old Madrid.

London has lavished some superb engineering on the disc, as is evident in the silken smoothness of the strings, the bright urgency of the brass, and the clean sharp transients of the percussion. Wrapped in very live, spacious acoustics, the over-all sound is compelling in its realism.

If you particularly enjoy Spanish music, you would be wise to acquire this disc and all of Argenta's previous output, including the notable "Music of Spain" series. With Argenta gone, his discs are likely to become hard-to-get collectors items.

MUSIC FOR STRINGS

Leopold Stokowski conducting his Symphony Orchestra. Capitol PA08415. Price $4.98.

Eureka! At long last *Capitol* seems to have

solved the problem of balance in its Stokowski recordings. This is sheer magnificence, with the first and second strings lushly smooth, the celli rich and resonant and, above all, a truly dark and sonorous contrabass sound lending weighty support to the brilliance of the higher string choirs. What a difference! I am indeed impressed. The program here is designed to show off the Stokowski mastery of strings and it does so in most convincing fashion, as anyone who gives this a listen will agree.

The first side opens with two Bach transcriptions and three Gluck pieces. The second side has the incredibly lovely Borodin "Nocturne" and the haunting beauty of Rachmaninoff's "Vocalise" sandwiching the brilliant "Moto Perpetuo" of Paganini. The absolute sensation on this disc and worth the price alone, is the second of the Bach works, the "Preludio." Obviously, Stokowski could not have had this string group together as a unit for very long. Yet in this "Preludio," is some of the finest string playing I have heard since Stokowski left the Philadelphia Orchestra.

Here is your massed precision, the superb attacks and ritards, the utterly expressive phrasing and dynamics, all in the glowing lambent beauty of tone that has come to be recognized as "Stokowskian." Would that the recent "Tocatta and Fugue in D minor" been accorded such splendidly balanced recording! Oddly, in the surge and swell of those lovely strings in the "Preludio," it was reminiscent of the "Tocatta" of long years past. This is simply fabulous!

It is fervently hoped that now *Capitol* seems to have found the key to balance, that it will be applied to their program of more expensive works.

THE CONCERT MASTERS OF NEW YORK

David Broekman, conductor. Decca DL9955. Price $3.98.

Here, too, is string playing of the highest order from a group aptly named the Concert Masters of New York. This group quite literally is composed of concert-masters . . . men who were either soloists or first desk men with most of the major symphony orchestras in this country. Under the guidance of the well-known David Broekman, they display their talents on a Bach "Chaconne" and the 3rd "Brandenburg Concerto" on the first side and then on the second side they tackle the incredible complexities of Paganini's "Caprices," including the famous 24th caprice which is used in the "Rhapsody on a Theme of Paganini" by Brahms and Rachmaninoff. It is a fantastic feat and a fantastic sound to hear these massed strings perform the pyrotechnics of the Paganini caprices as if they were but a solo instrument.

The string sound is miked fairly close, but with good spacious acoustic perspective and is alternately super smooth or crisply bright and incisive as the scores demand. I think I can safely say that this is the finest classical recording *Decca* has ever made in the United States.

MAHLER SYMPHONY #4

Anny Schlemm, soprano, with Saxon State Orchestra of Dresden conducted by Leopold Ludwig. Decca DL9944. Price $3.98.

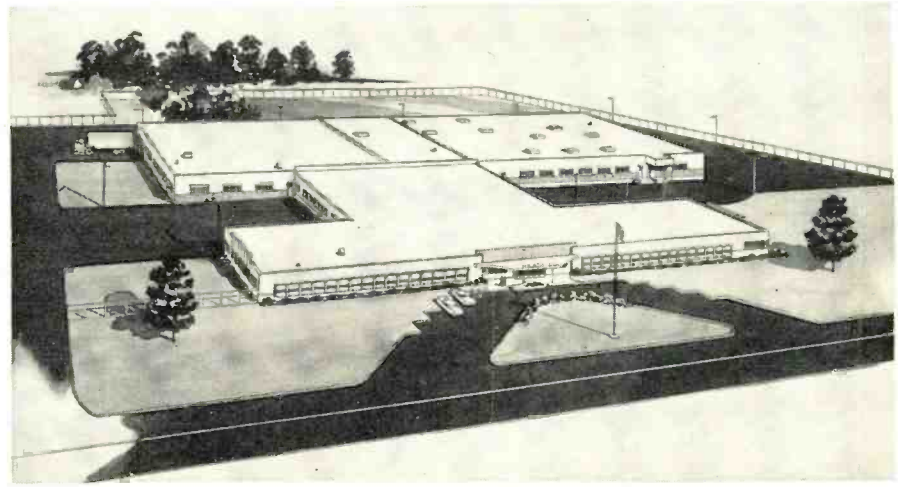
Most people think of Mahler as a gloomy brooding type of composer, until they hear his 4th symphony and realize that even Mahler had some sunshine in his soul. There is little doubt that this symphony is the most lyric of his works and quite easy for most people to assimilate. It abounds in bright little dance-like figures and melodies of haunting beauty and poignancy.

For many years the old Bruno Walter was the preferred recording, withstanding the assaults of several newer versions. Now it must give way to this superb reading by Ludwig. This conductor, little-known in this country, has managed just the right tempi, used just the right phrasing and dynamics, and achieved just the right balance for an almost totally satisfactory recording. Anny Schlemm has not the most suitable voice for the demands of Mahler, but she is steady and intelligent and displays very good taste in her rendition.

Soundwise, this is one of the most "hi-fi" recordings to come from *Deutsche Grammophon*. The engineers have used their fabulous knowledge of acoustic balance as always, but in this instance with a closer mike pick-up which affords great presence. The resultant sound is wide in range, clean and bright, but with that natural smoothness that characterizes *Deutsche Grammaphon* sound.

Well, that is that, for this month. I hope to have a number of standard discs for your edification along with whatever stereo discs I can lay my hands on for reviewing. In any case, I'll let you know what is going on in "stereo disc-ery." —30—

Heath Company, a subsidiary of Daystrom, Inc., has completed occupancy of its new plant on the shore of Lake Michigan near Benton Harbor. With over 140,000 square feet of the most modern plant equipment, this factory becomes the largest in the nation devoted to direct-mail selling of electronic instruments in kit form. The company formerly occupied seven separate buildings.



RCA Reg. $119.50 RADIATION COUNTER ON SALE at McGEE for $29.95

RCA Model WF-10A, Radiation Geiger counter for amateur and professional use. Explore for Uranium or check for atomic fall-out radiation. Complete with test sample. Simple to use, weighs only 5 lbs. In aluminum case. 7¾"x8½"x3½". Indicates presence of radioactivity in 3 ways, by meter, neon light and headphones. Requires 2—67½ volt Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit, $5.29 extra. 3 sensitivity ranges, 0-100, 0-1000 and 0-10,000 counts per minute. A terrific value from McGee. RCA Model WF-10A with tubes and headphone, less batteries, $29.95. Battery kit, $5.29 extra.

MODEL WF-12A *Regular $149.50*—McGEE'S PRICE—$34.95

RCA Model WF-12A, Radiation Geiger counter. Similar to WF-10A, except has an external probe. Priced with tubes and headphones at $34.95, less batteries. Kit of 2—XX45 Burgess "B," plus 3 ±2 flashlight cells, $5.29 extra.

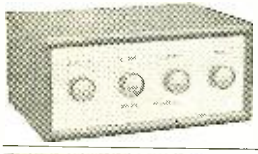
MODEL WF-11A *Regular $154.50*—McGEE'S PRICE—$37.95

RCA Model WF-11A, Radiation Geiger counter. Explore for Uranium or check for atomic fall-out. Uses extra sensitive Bismuth tube. Test sample included. Simple to use, weighs only 5 lbs. Weatherproof case 7¾"x8½"x3½". Indicates presence of radioactivity 3 ways, by meter, neon light and headphones. Requires 2 Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit $5.29 extra. 3 sensitivity ranges, 0-200, 0-2000, 0-20,000 counts per minute. A terrific value. RCA WF-11A, Sale price, $37.95 with tubes and headphone. Battery kit, $5.29 extra. Similar size to WF-10.

RCA Model WF-15A (not illustrated). Has 10 sensitive tubes, 3 ranges to 100,000 counts per minute. Size, 11"x47/8"x7½". Weight 8 lbs. Original price, $475.00. McGee's Sale price, $99.50. Battery kit, $5.37 extra.

RCA Model WF-16A (not illustrated). Has 10 sensitive tubes, 3 ranges to 200,000 counts per minute. Size, 11"x47/8"x7½". Weight 8 lbs. Original price, $750.00. McGee's Sale price, $149.50. Battery kit, $5.37 extra.

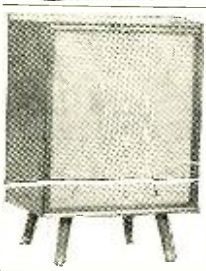
WF-10A WF-12A



16 Watts Factory Wired Hi-Fi Amp $34.95

Combination offers: Model 5L-20 with B-125X speaker board, $51.95; with new B-250X, 4 speaker board, $59.95; with Norelco 9762M, $69.95; with H-4H cabinet speaker system, $69.95.

New, 1958 model Imperial Slim-Line 16 watt high fidelity amplifier (20 watts peak), with built-in pre-amplifier. Full range audio response from 15 to 22,000 cps. Dual tone controls; full 18 db bass and full 15 db treble boost. Input for radio tuner, tape recorder and phono. Input compensation for the new 1958 model, 4 gram General Electric variable reluctance cartridges, as well as the famous G.E. RPX-050, RPX-052 and crystal phono cartridges. 5 position selector switch selects inputs and record compensation. Compensation for AES and RIAA phono records. A factory built amplifier at less than kit prices. Output impedance matches 8 or 16 ohm high fidelity PM speakers. Price includes tubes: 2—12AX7, 1—12AU7, 2—EL84 and 5Y3GT. Modern multi-color leatherette covered wood cabinet at no added cost; matches blond or mahogany finish speaker systems. Size: 5¼" tall, 11¼" wide, 8" front to back. Ship. wt. 15 lbs. Model SL-20 Imperial, List price, $69.50. McGee's Sale price, $34.95.



NEW 1958 "COMPLETE HI-FI SPEAKER SYSTEMS IN CABINETS"

The new, 1958 Hollywood 4-speaker systems are designed to give realistic reproduction from your Hi-Fi audio amplifier or FM-AM radio. Built-in Juke Box full bass response. Built-in LC crossover networks. Fully enclosed, acoustically lined. Standard models 35" tall, 19" deep and 25" wide. Deluxe models 37" tall, 27½" wide, 23½" front to back, $5.00 extra. Choice of Mahogany or Blond finishes. We will ship mahogany unless you specify blond.

MODEL H-4H SYSTEM, $39.95

Model H-4H Hollywood 4-speaker high fidelity speaker system. 20 watts, response 20 to 17,500 cps. Choice of Mahogany or Blond finish enclosure. Features a 12" Diffusion Cone 6.8 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2—5" tweeters. Built-in variable brilliance LC crossover network. Model H-4H, ship. wt. 55 lbs. Price, $39.95. Larger deluxe cabinet, $5.00 extra.

MODEL Z-4Z SYSTEM, $49.95

Model Z-4Z, Hollywood 4-speaker high fidelity speaker system. 25 watts, response from 18 to 17,500 cps. Choice of Mahogany or Blond finish enclosure. Features a 15", 21½ oz. Alnico V Utah heavy duty woofer, plus 6" mid-range and 2—5" tweeters. Built-in variable brilliance LC crossover network. Model Z-4Z, ship. wt. 57 lbs. Sale price, $49.95. Larger deluxe cabinet, $5.00 extra.

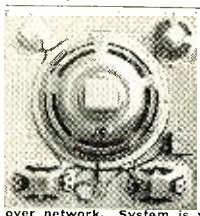
Imperial 81 and 91 systems are offered in the larger Blond or Mahogany cabinet, 37" tall, 27½" wide and 23½" front to back. Enclosure is acoustically lined to approach an infinite baffle. Ideal for any Hi-Fi system and priced at worth of speakers alone. LC crossover network and variable brilliance control. Features heavy woofers and horn tweeters.

IMPERIAL 81, $69.95

25 watts, response 18 to 20,000 cps. A complete speaker system in the above described enclosure, ready to connect to your Hi-Fi amplifier. Built-in LC, 3 way crossover network. Speakers included are 15", 21½ oz. Utah woofer, 8" 6.8 oz. mid-range and horn type Pioneer PT-3 tweeter. 8 ohms impedance. Stock No. Imperial 81, speaker system. Ship. wt. 80 lbs. Sale price, $69.95.

IMPERIAL 91, $89.95

Imperial 91, 30 watt speaker system with 5 speakers. Response, 16 to 20,000 cps. A complete speaker system in the above enclosure, ready to connect to the 8 ohm output of your high fidelity amplifier. Includes the 21 oz. Utah 15" woofer, two of the 8", 6.8 oz. mid-range speakers and two of the PT-3 Pioneer horn type tweeters. Built-in LC type, 3 way crossover network. Imperial 91, speaker system. Ship. wt. 90 lbs., Sale price, $89.95.



TREMENDOUS McGEE VALUE—NEW 1958 HI-FI SPEAKER SYSTEMS ON BAFFLE BOARDS

Model B-125-X, high fidelity 15-watt, 5-way speaker system, mounted on an 18" square baffle board. Has 12" High Efficiency woofer, 2—4x6" mid-range speakers, plus a 4" high-range and 3" tweeter; all with Alnico V magnets. Built-in crossover network with variable brilliance control. Ship. wt. 11 lbs. Stock No. B-125-X, 5-way, 15-watt Hi-Fi speaker system. **AUDIOPHILE VALUE $30.00. SALE PRICE $18.95.**

SALE PRICE $18.95

DELUXE HI-FI 25 WATT SPEAKER BOARD $29.95

Model B-250X, 4 matched Hi-Fi PM speakers mounted on a baffle board. 18" wide and 30" tall. For installation in your own cabinet or play as it comes. Features 15" woofer, 10" mid-range, 5¼" and 5" tweeters; built-in proper LC cross-over network. System is wired ready to connect the two leads to any 8 ohm amplifier or FM-AM radio. 25 watts capacity, from 18 to 17,500 cps. AB matched for finest audio reproduction. $50.00 list value. McGee's sale price, $29.95.

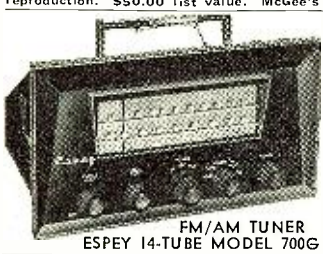
World Famous Imported from Holland NORELCO HI-FI PM SPEAKERS

12" Model 9762-M reg. $59.97 Sale Price $39.95
12" Model 9760 reg. $32.97 Sale Price $19.95
8" Model 9750 reg. $22.17 Sale Price $15.95

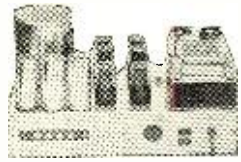
NORELCO Model 9762—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 11,000 gauss. Regular $59.97 net, on sale at McGEE for only $39.95.

NORELCO Model 9760—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 8,000 gauss. Regular $32.97 net, on sale at McGEE for only $19.95.

NORELCO Model 9750—8" wide range Hi-Fi PM speaker, res. 50 to 20,000 cps at 10-watts. Voice coil 6 ohms—New Alnico VI magnet gives 13,500 gauss. Regular $22.17 net, on sale at McGEE for only $15.95; or 2 for $30.00.



FM/AM TUNER
ESPEY 14-TUBE MODEL 700G



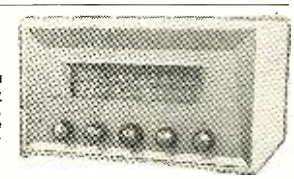
ESPEY 24 WATT
MODEL 501G AMPLIFIER

22 TUBE ESPEY FM-AM TUNER-AMPLIFIER SALE PRICE $99.95

Espey Model 700G-501G, complete 14 tube FM-AM tuner and matching 8 tube, 24 watt ultra-linear amplifier. A regular $199.50 value on sale at McGee for $99.95. Features AFC on FM. Receives broadcast 550 to 1700 kc and FM, 88 to 108 mc. Built-in preamplifier. Separate bass and treble controls, record equalization. Response, 10 cps to 20,000 cps, auxiliary input jacks. Tuner chassis is 14" long, 8½" high, 10" deep. (Leatherette cabinet for tuner only, $7.95 extra.) Amplifier 12"x8"x5" (push-pull, parallel 6V6 output tubes). Price includes all tubes, knobs and escutcheon plate. Shipping weight 42 lbs. A true McGee value.

Combination offer with Garrard RC-98 changer and 4G-052 G.E. cartridge, $174.95, no speaker included. Why not order a Norelco or our new B-250X speaker board with your Espey?

ESPEY 14 TUBE FM-AM WITH BUILT-IN HI-FI AUDIO $69.95



Espey Model HF-250C, 14 tube FM-AM chassis with push-pull 6V6, 10 watt audio. A true Hi-Fidelity receiver built by a nationally famous maker of fine custom chassis. Ultra-linear output used in Williamson type circuit gives frequency response of 10 to 22,000 cps. Output taps of 4, 8 and 16 ohms. Separate RF stage on FM and AM assure high sensitivity. Temperature compensated FM front end for minimum drift. Separate bass and treble tone controls. Pre-amp for all types of magnetic cartridges. 2nd input for crystal phono, tape recorder or TV. 3 position equalizer for accurate reproduction of all records. Built-in antennas for both FM and AM. Response plus or minus 1 db from 10 to 22,000 cps. Harmonic distortion less than 1%. Sensitivity: FM, 8 mv for 30 db quieting; AM, 75 mv for 6 db signal to noise ratio. Off-on-volume and equalizer are combined on a concentric control. Has 2 AC outlets on rear of chassis. Beautiful edge lighted flywheel inertia slide rule dial. Size: 17¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable). Model HF-250C Sale price, $69.95.

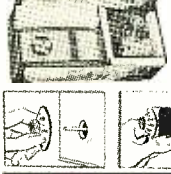
Espey chassis with our P15-CR, 15" coaxial speaker, both $89.95.
Espey chassis with $54.95 list, model 9760M, 12" Phillips speaker, both for $89.95.
Espey chassis with $99.95 list, model 9762M, 12" Phillips speaker, both for $104.95.

24 INCH CUSTOM TELEVISION CHASSIS $129.95

McGee offers this nationally famous make 24" television chassis with aluminized picture tube at a terrific saving. Full power transformer operated with switch type cascode tuner. All regular wiring—no printed circuits. Chassis is mounted on a baseboard and shipped with picture tube installed. Area required for chassis; 28" wide, 20" high and 20" front to back. Safety glass size, 23 13/16"x19¾". Tuner and controls are mounted on a separate vertical bracket to make it easy to move when installing. Price includes all tubes and 24" 24YP4 aluminized picture tube. Knobs and safety glass included. Good quality audio. 2—8" and 2—5" speakers are furnished, mounted on a baffle board 24"x19¾". Stock No. MG75-02, with all tubes and 45 day picture tube warranty. Sale price, $129.95. Price with one year picture tube warranty, $133.95.

Stock No. MG75-02-HF10, same as MG75-02 except with push-pull 6V6 Hi-Fi amplifier and with 2—12" PM's and 2—5" tweeters on a baffle board. Sale price, $149.95.

Stock No. MG75-01, similar in appearance to the 24" model illustrated, except set includes a 21" 21ATP4A aluminized picture tube. McGee's sale price, $99.95 with 45 day picture tube warranty. 1 year picture tube warranty, $4.00 additional. 3 speed automatic Collaro record changer, plugs into any of the above TV chassis, $24.95 extra.



ALLIANCE "IT" T.V. TUNER REMOTE CONTROL $4.94

REG. $19.50 LIST

McGee Special Purchase Sale! Alliance "IT" remote tuner for your TV set. A small battery operated motor turns your tuner clockwise or counter-clockwise. Attractive bakelite case fits palm of your hand. Made to sell at over $14.00 dealers net. McGee offers them for $4.94, 3 for $12.50 wtih flashlight batteries. Also adaptable to many other uses. Add 40¢ per unit for packing and postage.

AUTOMATIC CHANGERS AT LOW PRICES

Special prices on VM 3 speed Hi-Fi record changers. Equipped with plug-in heads. Features 4 pole motor, intermixes 10" and 12" records of the same speed, shuts off after last record has played. Size: 13½"x 13¼". Ship. wt. 12 lbs. VM-935 and VM-936 are the same changer except the 936 is on a base as illustrated. Price includes 45 RPM spindle.

MONARCH UA8H $27.95

VM-936HF $32.95

VM-935HF with RPX-050A G.E. VR cartridge, $29.95.
VM-936HF on base with RPX-050A G.E. VR cartridge, $32.95. 1 mil diamond needle, $8.95 extra.

Latest 4 speed English imported Monarch record changer. Features a 4 pole motor, 9" turntable with molded rubber record pallet. Balanced tone arm readily accepts most makes of Hi-Fi cartridges. Plays 16⅔, 33⅓, 45 and 78 RPM records. Intermixes 10" and 12" records of the same speed. Shuts off after last record has played. Compact size, 12¾" x 10⅞". Ship. wt. 15 lbs. Large 45 RPM spindle, $1.88 extra. Choice of blond or mahogany wood mounting base, $4.50 extra. Offered with several types of cartridges.
UA8-H with Ronette flip-over Hi-Fi crystal cartridge, $27.95.
UA8-4G050 with latest General Electric VR cartridge, $29.95.
UA8-4G052 with latest G.E. cartridge, 1 mil diamond and 3 mil sapphire stylus, $39.95.

Latest Garrard Renown II, RC-121 II, latest 1958 Garrard Hi-Fi, 4 speed changer with plug-in head shell, Net $42.50, with G.E. 4G-050 cartridge, $51.45, with G.E. 4G-052 cartridge, $61.80. 45 RPM spindle, $3.50 extra.

3 SPEED HI-FI COLLARO $27.95

Model RC-54, 3 speed (33⅓, 45 and 78 RPM) Collaro record changer with a ceramic crystal cartridge (no pre-amplifier required). Features diamond 1 mil and sapphire 3 mil needle, 4 pole motor. Base size, 12" x 13¼". For 110 volt, 60 cycle AC operation. These changers were intended for use by a nationally known Hi-Fi set manufacturer. McGee bought them at a substantial saving. Stock No. RC-54 Collaro changer with crystal cartridge, equipped with diamond 1 mil and sapphire 3 mil needle. McGee Sale Price, $27.95.

Tan leatherette covered wood base, 13 x 14½ x 37/8", shipped separate at $3.65 extra.

Within the Industry

(*Continued from page 28*)

school is housed at 5601 First Avenue, North, Birmingham, Alabama . . . **EAGLE ELECTRIC MFG. CO., INC.**, Long Island City, N. Y., advises that it has just purchased the entire assets of the **MATOL CORP.** They have also acquired the automatic screw machine department of the **CHASE BRASS & COPPER CO.** and the bottom turn knob socket division of **ALCOR MFG. CO.**

* * *

RICHARD P. GIFFORD has been named manager of engineering for *General Electric Company's* communication products department.

Mr. Gifford will have the responsibility of coordinating the firm's engineering activities in the fields of mobile radio communications, microwave relay, power line carrier current, and terminal equipment.

He joined the company's broadcast engineering section in 1946 and was active later that year as a member of a team of engineers which established the first microwave relay from New York to Schenectady for television transmission purposes. By 1956 he had been promoted to manager of advanced engineering for the company's communication products department and was given responsibility for development of new techniques in the communications art.

Mr. Gifford has been a member of the Electronics Industries Association for the past ten years and a member of the IRE since 1950.

* * *

HUGHES AIRCRAFT COMPANY will grant master of science fellowships to 150 college graduates to help them pursue advanced studies in science and engineering.

Fellows will be selected from applicants with outstanding scholastic records from universities throughout the nation. Those selected will work towards masters degrees at the University of Southern California, University of California at Los Angeles, California Institute of Technology, or the University of Arizona.

* * *

T. B. THOMPSON has been appointed marketing administrator, broadcast equipment group, *RCA Victor Company, Ltd.*, Montreal. At the same time, **D. C. TUCKER** is now marketing administrator of this organization. Mr. Thompson has been with the firm since 1957 and graduated from the University of Toronto with honors in electrical engineering. Mr. Tucker was formerly associated with *Canadian Marconi Company*, Montreal . . . **THOMAS C. FLYNN** has joined the public relations department of *International Telephone and Telegraph Corp.* as manager of trade press . . . *General Precision Equipment Co.* announces the appointment of **EDWIN A. LINK** as president of the firm and his resignation as vice-chairman of the board . . . **LOYD DOPKINS** is now general sales manager of the *Radio Craftsmen* division of *Precision Radiation Instruments, Inc.* . . . **R. W. (DICK) WALTER** has been named sales manager of the high-fidelity components division of *Thorens Company* . . . The appointment of two vice-presidents of *Sylvania Electronic Tubes*, a division of *Sylvania Electric Products Inc.*, has been announced. **W. HERBERT LAMB** is vice-president, television picture tubes and **WALTER A. WEISS** is vice-president, radio tubes . . . **G. J. JANOFF** is now the manager, market planning, entertainment receiving tubes, *RCA* electron tube division . . . *Sperry Gyroscope Company* has named **E. U. DA PARMA** executive vice-president . . . **HAL B. AVERY** has been named to the newly created position of sales planning manager, television section, *Hotpoint Company* . . . The appointments of **LES A. THAYER** as general sales manager and **E. K. (GENE) BUTLER** as manager of marketing services for *Belden Manufacturing Company* have been announced by the firm . . . **DONALD J. TRICEBOCK** is the new manager of the electronics division, *Diamond Power Specialty Corp.* . . . *P. R. Mallory & Co. Inc.* has appointed **CHARLES A. BARNES** controller . . . **KENDALL CLOUGH** has been promoted to the post of director of engineering for the *Paraplegics Manufacturing Company, Inc.* . . . *Raytheon Manufacturing Company* has appointed **DAVID R. HULL** vice-president for defense programs . . . Four new executive and sales appointments have been announced by *The Tenna Mfg. Co.* **MORTON MENDES** is promoted to the post of executive vice-president, **HARVEY LUDWIG** is now vice-president in charge of sales and advertising, **STANLEY B. GOSS**, electronic distributors' sales manager, will also handle manufacturers' business, and **MAX BAUER**, a newcomer to the firm, is now assistant sales manager . . . *Radio Corporation of America* has elected the following three new vice-presidents: **DR. JAMES HILLIER** is now vice-president, *RCA Laboratories;* **RAYMOND W. SAXON** is vice-president and general manager of the radio and "Victrola" division; and **JOSEPH M. HERTZBERG** is vice-president, defense marketing, defense electronic products . . . **PAUL PETRACK** has been named chief engineer for semiconductors, components division, *International Telephone and Telegraph Corp.* . . . **C. E. HAMANN** has retired after more than 46 years of service with the *General Electric Company.* He was manager of application engineering and product service for the firm's rectifier department at the time of his retirement . . . *International Resistance Company* has announced the resignation of **CHARLES H. GRIFFITH**, vice-president of sales . . . **LOUIS A. DURGIN**, senior engineer at *Allen B. Du Mont Labs., Inc.*, died recently. —30—

Build the Best– build ALLIED knight®-kits

the finest electronic equipment in money-saving kit form

LOWEST COST
ALLIED'S giant buying power passes biggest savings on to you—you do the easy assembly and your finished instrument equals the performance and appearance of equipment selling for several times the low KNIGHT-KIT cost. Your savings are BIG.

EASIEST TO BUILD
KNIGHT-KIT "Step-and-Check" instruction manuals with wall-sized picture diagrams are marvels of clarity—it's like having a good instructor at your side. No experience required—you can easily build any KNIGHT-KIT and get professional results.

LATEST DESIGN
Each ALLIED KNIGHT-KIT incorporates the very latest circuitry for top-quality performance. Tried and proved professional design and the use of premium quality parts throughout help insure your building success to bring you quality results.

COMPLETE KIT SELECTION:
- HI-FI
- HOBBY
- INSTRUMENT
- AMATEUR

MONEYBACK GUARANTEE. When properly assembled, KNIGHT-KITS fully meet published specifications or we refund your money in full.

EASY TERMS. If your KNIGHT-KIT order comes to $45.00 or more, you can make your purchase on our attractive Easy Payment Plan.

High Fidelity Everyone Can Afford

- World's Finest Hi-Fi Kits
- Custom-Styled
- Easiest to Build Hi-Fi
- Money-Saving

knight-kit High Fidelity FM-AM Tuner Kit

Model Y-787
$49.95
Only $4.99 down

- Latest Time-Saving Printed Circuit Design
- Flywheel Tuning
- Automatic Frequency Control
- 2.5 μv FM Sensitivity
- True High Fidelity Response
- Beautiful Custom-Styled "Space Saver" Case

The best-looking, best-performing FM-AM tuner kit your money can buy! Carefully designed for quick, easy construction—a tuner you'll enjoy assembling and be proud to own, both for its amazing musical performance and outstanding beauty. Covers the full AM broadcast band and 88 to 108 mc FM. On FM, *sensitivity is a remarkable 2.5 microvolts for 20 db of quieting;* hum and noise, –60 db; IF bandwidth, 200 kc at 50% down on curve; response, ± 0.5 db, 20-20,000 cps. On AM, *sensitivity is 3 microvolts for 10 db signal-to-noise ratio;* IF bandwidth, 8 kc at 50% down on curve; response, 20-8000 cps. Outstanding features include: Inertia Flywheel Tuning for effortless, accurate tuning; Automatic Frequency Control (plus AFC disabling) to "lock-in" FM stations; printed circuit board (with most of the kit wiring already done for you) assures time-saving, error-free assembly; pre-aligned RF and IF coils; tuned RF stage on FM; drift-compensated oscillator; neon glow tuning pointer; cathode follower output; two output jacks—one for recorder, one for amplifier; rotatable built-in ferrite antenna for AM. Includes beautiful French-gray case with chrome-finished tapered feet, 4 x 13 x 8". Ideal for use with 18, 20 or 30 watt KNIGHT-KIT amplifiers. Ready for easy assembly. Shpg. wt., 12 lbs.

Model Y-787. FM-AM Tuner Kit. Net only.....**$49.95**

knight-kit 18-Watt Complete Hi-Fi Amplifier Kit

Model Y-786
$39.95
Only $3.99 down

- The Last Word in Custom Hi-Fi Styling
- Full 18 Watts with Superb Hi-Fi Specifications
- 8 Inputs for Every Desired Signal Source
- Printed Circuit Switch and Printed Circuit Boards
- Full Equalization for All Record Types

Here is a custom-styled, easy-to-build complete Hi-Fi amplifier at a price that defies comparison. Delivers full 18 watts output with wide-range, flat frequency response for true hi-fi reproduction. Features 8 inputs for every possible signal source, including NARTB equalized tape head input. At full 18 watts output, distortion is only 0.5%; uses new RCA 6973 hi-fi output tubes. Frequency response is ± 1 db, 20-30,000 cps; tape head and magnetic cartridge sensitivity, 5 microvolts for 18 watts output; hum and noise level better than 60 db below 18 watts. Output taps for 4, 8 or 16 ohm speakers. Controls: Input and Record Equalization; Bass Boost and Attenuate; Treble Boost and Attenuate; Volume. Simplest assembly is made possible through the use of an exclusive printed circuit switch and two printed circuit boards—most of the kit wiring is already done for you. With custom-styled French-gray "space-saver" case on tapered feet finished in chrome, 4 x 13 x 8". Complete with case, tubes, all parts, and step-by-step instructions, for easy, error-free assembly. Shpg. wt., 15 lbs.

Model Y-786. 18-Watt Hi-Fi Amplifier Kit. Net only.....**$39.95**

EASY TERMS TO FIT YOUR BUDGET. ALLIED KNIGHT-KITS may be purchased under our Easy Payment Plan. Your order need total only $45.00 or more—only 10% down, small monthly payments thereafter. No red tape—fast handling assured.

Our 37th Year

® Registered Trade-Mark of Allied Radio Corporation

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

Now you can have Custom-Styled Hi-Fi in ALLIED

knight-kit 30-Watt Complete Hi-Fi Amplifier Kit

Model Y-762
$76.95
Only $7.69 down

- Full Equalization, ±½ db of Recommended Accuracy
- Printed Circuit Switches • Printed Circuit Boards
- 8 Inputs For Every Possible Signal Source
- Full 30 Watts Output • Custom-Styled Beauty

Comparable to the best in Hi-Fi—at far less cost! Deluxe features include: Linear-deluxe Williamson-type circuit for flawless response; equalization for all records within ½ db of recommended accuracy; 2 exclusive new printed circuit switches in preamp section (no complex wiring to do); 3 printed circuit boards for time-saving, error-free assembly; separate, continuously variable Level and Loudness controls; use of premium 12AY7 tube for low noise and hum; DC on all filaments of preamp tubes; exclusive A-AB-B speaker selector switch (use speakers of mixed impedances without mismatch). 8 inputs: Tape Head direct; G.E. and Pickering cartridges; Ceramic cartridge; Microphone; Auxiliary; Tape Preamp; Tuner (with separate Level Set control). Power amplifier response, ± ½ db, 15-100,000 cps at full 30 watt level; distortion—harmonic, 0.55% at 30 watts—IM, 0.74% at 20 watts. Separate Bass and Treble controls; rumble filter switch; variable damping. Output, 8 and 16 ohms. With smart French-gray cabinet, 4 x 15 x 15". Ready for easy, money-saving assembly. Shpg. wt., 32 lbs.

Model Y-762. 30-Watt Hi-Fi Amplifier Kit. Net only.....**$76.95**

knight-kit High Fidelity FM Tuner Kit

Model Y-751
$38.95
Only $3.89 down

- Authentic High Fidelity FM Response
- Flywheel Tuning • Automatic Frequency Control
- Printed Circuit • Pre-Adjusted Coils and IF's
- 4 Microvolt Sensitivity Guaranteed

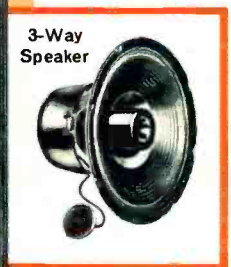
Here is top value in creative engineering, impressive hi-fi performance and distinctive design—a tuner you'll be proud to build and own. Covers the full FM band, 88 to 108 mc. Features Automatic Frequency Control (with disabling feature) to "lock-in" stations and prevent drift; Inertia Flywheel Tuning for velvet-smooth, accurate station selection; pre-adjusted RF coils; pre-aligned IF's; cascode broad-band RF amplifier; drift-compensated oscillator; neon bulb pointer. All critical wiring is already done for you in the form of a printed circuit board—assembly is simple. Sensitivity is 4 microvolts for 20 db of quieting across entire band; output, 2 volts at 1000 microvolts input; IF bandwidth, 200 kc; response, 20-20,000 cps. with only 0.6% distortion. Output jacks for amplifier and tape recorder; cathode follower output. Ideal for use with the KNIGHT-KIT amplifiers, or any amplifier with phono-tuner switch. Features custom-styled case in French-gray, with tapered chrome-finished feet, 4 x 13 x 8". Includes all parts, tubes and step-by-step instructions for easy assembly. Shpg. wt., 12 lbs.

Model Y-751. Hi-Fi FM Tuner Kit. Net only.....**$38.95**

knight-kit Deluxe 3-Way Speaker System Kit

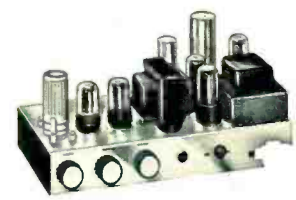
Model Y-937
$89.50
Only $8.95 down

- Pre-Finished "Quik-Craft" Corner Enclosure
- Klipsch Designed and Licensed
- Famous Knight 12" 3-Way Speaker
- Easy to Assemble—Top Hi-Fi Quality
- Choice of Enclosure Finishes



Deluxe quality high fidelity speaker system at a money-saving low price. Easy to assemble—all you need is a screwdriver. System includes KNIGHT "Quik-Craft" corner-type folded-horn enclosure kit, and the famous-value KNIGHT 3-Way 12-inch speaker. Just assemble the enclosure—*no finishing required*—all surfaces are finished in hand-rubbed Korina blonde, mahogany or walnut. The speaker is the new 3-way type: 12" woofer cone for bass (full 1¾ pound woofer magnet), conical radiator for mid-frequencies, built-in compression-type tweeter (with wired level control and calibrated dial) for highest frequencies. Unexcelled enclosure efficiency and superb speaker performance combine to cover the whole spectrum of audible sound for true hi-fi response from 35 to 15,000 cps, ± 3 db. Kit includes 12" 3-Way speaker, prefinished enclosure panels, grille cloth, hardware and instructions. *Specify Korina blonde, mahogany or walnut when ordering.* Shpg. wt., 44 lbs.

Model Y-937. 3-Way Speaker System Kit. Net only.....**$89.50**



knight-kit 10-Watt Hi-Fi Amplifier Kit

Y-753
$23.50
$2.35 down

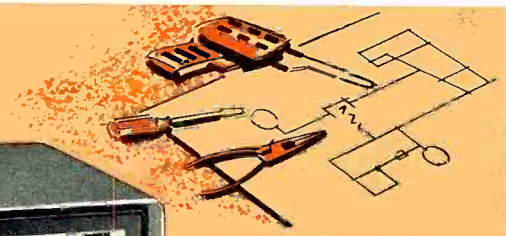
Low-cost, authentic hi-fi amplifier. Response, ± 1 db, 30-20,000 cps. Input for crystal phono or tuner; chrome-plated chassis is punched for preamp kit below, to permit use of magnetic phono. Only 0.5 volt drives amplifier to full output. Separate bass and treble controls. Only 1% harmonic distortion. Matches 8-ohm speaker. 7 x 13 x 6". With all parts, tubes and instructions. Shpg. wt., 13 lbs.

Model Y-753. Net only..**$23.50**
Y-235. Preamp Kit.....**$ 3.10**
Y-757. Metal Cover....**$ 3.95**

ALLIED RADIO *America's Pioneer in Electronic Kits*

knight-kits

THE VERY FINEST MUSICAL QUALITY—SO EASY TO BUILD
MONEY-SAVING HI-FI EVERYONE CAN AFFORD



So Easy To Build
Anyone can build KNIGHT-KIT Hi-Fi. No experience required to get top results!

knight-kit High Fidelity Preamplifier Kit

Model Y-754
$39.95
Only $3.99 down

- Exclusive Printed Circuit Switches and Boards
- Equalization ±½ db of Recommended Accuracy
- 8 Inputs Including Tape Head
- Self-Powered
- DC on All Tube Filaments
- Custom-Styled

Sensational Hi-Fi design at amazing low cost. Provides precise record equalization guaranteed within ½ db of recommended accuracy!—more accurate than all but the most expensive factory-built preamps. Includes exclusive new KNIGHT-KIT printed circuit switches for easy, error-free assembly; 2 printed circuit boards eliminate all other wiring, except for power supply and control leads—so easy to build. Has built-in power supply; includes premium 12AY7 and ECC82 tubes. Frequency response, ± 0.5 db, 10-50,000 cps. Has 8 inputs: Tape Head; G.E. Phono; Pickering Phono; Ceramic; Microphone; Auxiliary; Tape Preamp; Tuner. Level adjustment for tuner input. Includes separate Bass and Treble controls; separate Level and Loudness controls; Rumble Filter switch; DC on all tube filaments; cathode follower output; 2 extra AC outlets. You get every advanced hi-fi feature in this easy-to-build preamplifier at the lowest possible cost. Includes beautiful custom-styled French-gray case, with tapered chrome-finished legs, 4 x 13 x 8". With all parts, tubes, step-by-step instructions; ready for easy assembly. Shpg. wt., 12½ lbs.

Model Y-754. Hi-Fi Preamp Kit. Net only.....**$39.95**

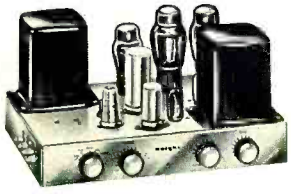
knight-kit 25-Watt Hi-Fi Basic Amplifier Kit

Model Y-755
$44.50
Only $4.45 down

- Hi-Fi Response, ± 0.5 db, 10 to 120,000 cps
- Only 0.15% Distortion at 30 Watts Output
- Printed Circuit Wiring Board
- Chrome-Plated Chassis
- Williamson-Type Circuit with Over 25 Watts Output

Here's superb Hi-Fi performance at less than half the cost of a comparable commercially-assembled unit. Williamson-type linear-deluxe circuit delivers over 25 watts of virtually undistorted reproduction. Ideal for use with the KNIGHT-KIT preamp at left. Includes printed circuit board for simplified, error-free assembly. Remarkable hi-fi response, ± 0.5 db, 10-120,000 cps at 20 watts. Harmonic distortion, 0.15% at 30 watts; IM, 0.4% at 20 watts. Hum level, 85 db below 25 watts output. Output impedances, 4, 8 and 16 ohms; output tubes, 2-5881. Includes balance control for precise matching of the output tubes; variable damping control for maximum performance with any speaker system—prevents low-frequency distortion from overdamping or underdamping. Very attractive black and chrome styling, 6¼ x 14 x 9". An outstanding engineering achievement in a basic hi-fi amplifier, delivering performance equal to the finest commercially assembled units. Includes all parts and tubes; with step-by-step instructions, ready for easy assembly. Shpg wt., 25 lbs.

Model Y-755. 25-Watt Amplifier Kit. Net only.....**$44.50**
Y-759. Metal Cover for above; black finish. 5 lbs. Net.....**$4.25**



knight-kit 20-Watt Hi-Fi Amplifier Kit

Y-750
$35.75
$3.57 down

True hi-fi for less! Complete with full set of controls and built-in preamplifier. Response, ± 1 db, 20-20,000 cps; distortion 1% at 20 watts. Inputs for magnetic phono, microphone, crystal phono or recorder, and tuner. Compensation positions for 78 and LP records. Separate bass and treble controls. Output impedances, 4, 8, 16 and 500 ohms. Chrome-plated chassis. 7 x 13 x 8¾". Ready for easy assembly. Shpg. wt., 20 lbs.

Model Y-750. Net only..**$35.75**
Y-758. Metal Cover.....**$4.15**

knight-kit 2-Way Hi-Fi Speaker System Kit

Model Y-789
$49.95
Only $4.99 down

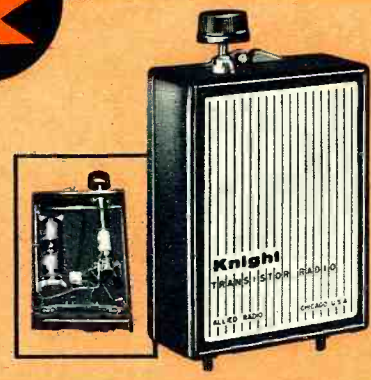
- Easy to Assemble—Pre-Finished Enclosure
- High Fidelity Response, 45 to 14,000 cps
- 12" Woofer and Horn-Type Tweeter
- A Wonderful Money-Saving Speaker Value

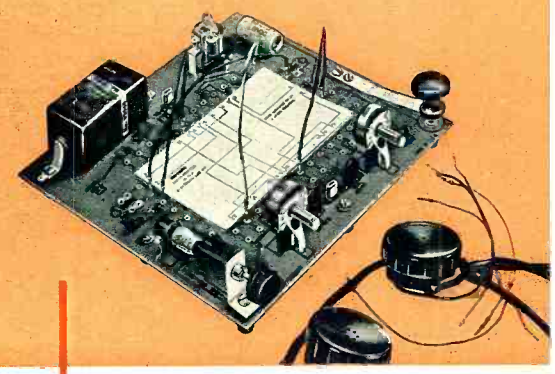
BIG SAVINGS—assemble your own quality KNIGHT-KIT 2-way speaker system—it's quick and easy! The cabinet is *pre-finished* in full-grained, high luster blonde or mahogany—you just assemble 7 pieces, mount the speaker components and enjoy rich, thrilling hi-fi sound—at incomparably low cost. Special Jensen-engineered baffle features "ducted port" construction to bring out the full beauty of bass notes, perfectly matching the Jensen woofer and compression tweeter; genuine L-pad control is rear-mounted to permit adjustment of tweeter for best tonal balance. Impedance, 16 ohms. The assembled unit delivers a frequency response of 45 to 14,000 cps. Enclosure measures 26 x 19 x 14". Beautifully styled to blend in any room. Kit includes Jensen 12" woofer, Jensen compression-type tweeter, pre-finished wood parts (with grille cloth installed), acoustic material, glue, hardware and step-by-step instructions. Absolutely no furniture finishing required. *Specify blonde or mahogany finish when ordering.* Shpg. wt., 33 lbs.

Model Y-789. 2-Way Speaker System Kit.
Net only.....**$49.95**

knight-kit HI-FI IS AVAILABLE ON EASY TERMS TO FIT YOUR BUDGET

Fascinating ALLIED knight-kits FOR EXPERIMENTERS AND HOBBYISTS





knight-kit 2-Transistor Pocket Radio Receiver Kit

Model Y-262 $14.65

- Loud, Clear Local Reception
- Newest Printed Circuit Board
- Built-In Loop Antenna
- Complete Kit—Nothing Else To Buy

It's fun to build this pocket-size two-transistor radio—and you'll enjoy its crystal-clear local broadcast-band reception wherever you go! Fits in your pocket, or with its button-down flap, can be worn from your belt. Completely self-contained with built-in ferrite loopstick antenna—no external antenna needed. Extremely efficient reflex type 2-transistor circuit actually does the work of 3 transistors! Printed circuit board reduces building time to about one hour. Has air-dielectric variable capacitor for easy, accurate station tuning. Operates for months and months on long-life alkaline battery supplied. Sensitive miniature earpiece provides crystal-clear tone. Handsome tan carrying case, plastic-impregnated, is styled to resemble leather; only 4x3¾x1¾". Kit includes all parts, transistors, earpiece, battery and case. Shpg. wt., 1½ lbs.

Model Y-262. Net only **$14.65**

knight-kit "Trans-Midge" Transistor Receiver Kit

Model Y-767 $2.45

Tiny, cigarette-pack-size one-transistor radio kit—fascinating to build—so low-priced. This novel miniature receiver will provide endless listening pleasure the moment assembly is completed. Covers the local AM broadcast band with exceptional sensitivity and selectivity. Special features include: Efficient, slug-tuned coil for excellent station separation; external knob for easy station tuning; low-drain transistor operating for months from single penlight cell supplied; hinged-back, red plastic case. Kit includes all parts, transistor, battery, compact case and easy-to-follow instructions for quick assembly. (External antenna and headphones required.) Shpg. wt., 8 oz.

Model Y-767. Net only **$2.45**
J-149. 4000 Ohm Headphones. 1 lb. . . **$2.15**
C-100. Antenna Kit. 1½ lbs. **$1.03**

knight-kit 10-Circuit Transistor Lab Kit

Model Y-299 $15.75

Sensational experimenters' transistor kit—an electronic marvel! Perfect for experimenter, student or hobbyist. Assemble basic parts once, then complete project after project (10 in all), by simply plugging leads into proper jacks on printed circuit board—no wiring changes needed. You learn how transistors operate by "plugging in" to make any one of the following circuits; AM radio for strong headphone reception; 2-stage audio amplifier; wireless broadcaster; code practice oscillator; electronic timer; electronic switch; electronic flasher; photoelectronic relay; voice-operated relay; capacity-operated relay. Includes all parts, 2 transistors, battery, headphones, circuit leads, relay, photocell, special guide cards for each project, explanation of each circuit. 3 lbs.

Model Y-299. Net only **$15.75**

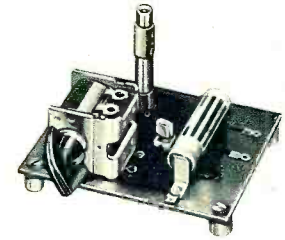
knight-kit 5-Transistor Superhet Personal Portable Radio Kit

Model Y-766 $29.95

- Styled to Equal the Finest
- Push-Pull Audio Drives 3½" Speaker
- Printed Circuit for Easy Building
- 200 Hour Battery Playing Life

Beautiful, easy-to-build transistorized personal portable with every ultra-modern design feature: 5 Texas Instrument Co. transistors; latest printed circuit chassis for easy, error-free assembly; bigger-than-average 3½" speaker; class B push-pull audio output; built-in high-gain ferrite loopstick antenna; plus phone jack output for private listening. Provides sensitive reception of the AM broadcast band with exceptional tone quality. Ultra-smart high-impact ivory plastic case has handsome gold trim with ebony accents; includes pull-out handle; only 7½x3⅜x1¾". With all parts, transistors, 9 volt transistor radio battery, carrying case and instructions anyone can easily follow. Shpg. wt., 2 lbs.

Model Y-766. Net only **$29.95**



1-Transistor Radio Kit

$3.95 Offers excellent AM local broadcast headphone reception. Printed circuit board for easy assembly. Operates from single penlight cell for months. Complete with all parts, transistor and penlight cell. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-765. Net only **$3.95**

"10-In-One" Electronic Lab Kit

$12.65 Famous experimenters' kit. Builds any of 10 fascinating projects, including broadcast receiver, wireless phono oscillator, code practice oscillator, signal tracer, relays, etc. Shpg. wt., 5 lbs.

Model Y-265. Net only **$12.65**

"6-In-One" Electronic Lab Kit

$8.45 A favorite with beginners. After basic wiring is completed, you make circuit changes without soldering. Builds any of six favorite projects, including radio, wireless broadcaster, etc. Shpg. wt., 3 lbs.

Model Y-770. Net only **$8.45**

Crystal Set Hobby Kit

$2.15 Entertaining, educational. Delivers clear headphone reception of local broadcast stations. With all parts, ready for easy assembly. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-261. Net only **$2.15**

Wireless Broadcaster Kit

$9.50 Play music or make announcements through your radio set—no connection to set required! Loads of fun—easy to build. Works up to 50 feet from set. Shpg. wt., 3 lbs.

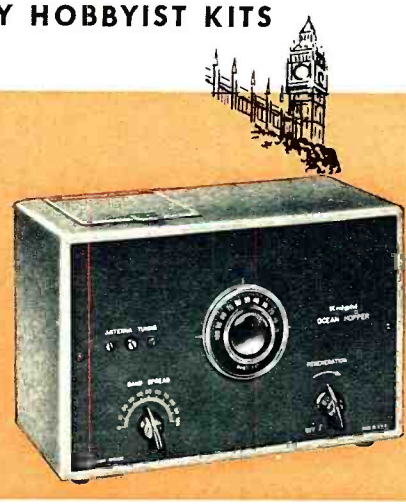
Model Y-705. Net only **$9.50**

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

FUN TO BUILD . . . INSTRUCTIVE . . . LATEST CIRCUITS FOR TOP PERFORMANCE

WIDEST CHOICE OF QUALITY HOBBYIST KITS

Interruption of light beam triggers relay, which in turn sounds chime or bell, turns on lights, etc.



knight-kit Photoelectronic Relay Kit

Model Y-702 $13.50

Advanced-design, ultra-sensitive photoelectronic relay—build it yourself and save! Dozens of uses: for automatic control of lights, door announcer, burglar alarm, counting devices, etc. Provides dependable operation up to 250 feet with white light, up to 125 feet with "unseen" light (red filter) from Light Source Kit listed below. Selectable operation, with "trip" for burglar alarm to provide continuous ringing of alarm; and "auto" if relay is to operate each time beam is broken (for chimes, counting devices, turning on lights at darkness). Has SPST relay operated from thyratron; 6.3 v. terminals provide power for accessories. For 105-120 v. 50-60 cy. AC use. 6 lbs.

Model Y-702. Relay Kit. Net only . . **$13.50**

Model Y-703. Light Source Kit. With bulb and red filter. Shpg. wt., 3½ lbs. Net . **$6.75**

knight-kit "Ocean Hopper" All-Wave Radio Kit

Model Y-740 $11.95

This top-performing regenerative receiver puts a world of listening pleasure at your finger-tips. Tuning range (using coils listed below) is virtually world-wide; covers 155 kc to 35 mc, including every type of radio transmission: AM broadcast, marine, aircraft, distress channels, direction-finding, Amateur, frequency standard, foreign broadcast, and police. With bandspread tuning. For use with headphones or 3-4 ohm PM speaker. Kit is supplied with standard broadcast band coil and all tubes and parts. (Less extra coils, headphones, speaker and cabinet.) Shpg. wt., 5 lbs.

Model Y-740. Net only **$11.95**

Y-746. Cabinet for above. 1½ lbs. Net **$2.90**

Extra coils available: Long Wave Coil (155-470 kc), Net 79c. Short Wave (1.65—4.1 mc; 2.9—7.3 mc; 7—17.5 mc and 15.5—35 mc), Each 65c.

knight-kit "Space-Spanner" Bandswitching World-Wide Radio Kit

Model Y-243 $15.95

- Broadcast or Short Wave Reception
- Sensitive Regenerative Circuit
- Convenient Bandspread Tuning
- Built-In Loudspeaker

Imagine the thrill of hearing overseas broadcasts on a precision receiver you've built yourself—and then, at the flip of a switch, being able to tune to your favorite local broadcast station! Bandswitch selects exciting short wave, including foreign broadcasts, amateur calls, aircraft, police and marine radio on the 6.5 to 17 mc range, as well as standard 540-1700 kc broadcasts. Features highly sensitive regenerative circuit. Includes built-in 4" PM speaker and beam-power tube for strong volume and clear tone. Headphone connectors are available for private listening; switch cuts out speaker. Controls: Bandspread, Main Tuning, Antenna Trimmer, Bandswitch, Regeneration, Volume. 7x10x6". Easy to build from step-by-step instruction manual. For 110-120 v., 50-60 cy. AC or DC. (Less cabinet.) Shpg. wt., 5 lbs.

Model Y-243. Net only **$15.95**

Y-247. Cabinet for above. Shpg. wt. 2 lbs. Net. **$2.90**

"Ranger II" Superhet Receiver Kit

$17.25

Popular Broadcast band receiver built and enjoyed by thousands. Features built-in antenna, automatic volume control, ball-bearing tuning condenser, PM dynamic speaker. Handsome plastic cabinet. Easy to assemble. AC or DC operation. Shpg. wt., 8 lbs.

Model Y-735. Net only **$17.25**

knight-kit 2-Way Intercom System Kit

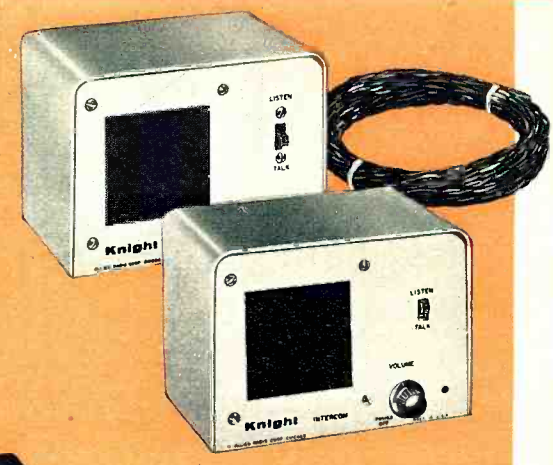
Model Y-295 $14.75

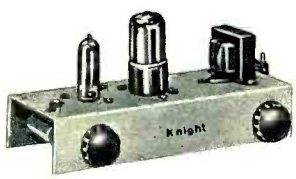
- Low Cost—Easy to Assemble
- High Gain—Clear Tone
- Handsome Metal Cabinets
- Includes 50-Foot Cable

Easy to build at lowest cost—ideal for home, office, shop or school. Consists of Master unit and Remote unit. Remote unit may be left "open" for answering calls from a distance, for "baby sitting", etc. Remote also may be set for "private" operation—cannot be "listened-in" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier, combination volume control and on-off switch, plus pilot light. Each unit has 4" PM dynamic speaker. System responds to even a whisper. Handsome Antique white cabinets, each 4¾x6½x4⅜". With all parts, tubes and 50-ft. cable (up to 200-ft. may be added). For 110-120 v., AC or DC. 8 lbs.

Model Y-295. Master and one Remote. Net only . . **$14.75**

Y-296. Extra Remote Station Kit. 3 lbs. **$3.75**





Phono Amplifier Kit

$9.45

Build it yourself—and save! Ideal for use in a portable phonograph—just add record player and 3-4 ohm speaker. 1½ watts output. Inverse feedback circuit. Easy to assemble. Shpg. wt., 3 lbs.

Model Y-790. Net only **$9.45**

Electronic Photoflash Kit

$28.50

Ideal for color or black and white photography. 1/700th-of-a-second flash; 50 watt/second output. Synchronizes with any camera with X or O shutter. (Less battery.) Shpg. wt., 4 lbs.

Model Y-244. Net only **$28.50**

Code Practice Oscillator Kit

$3.95

Ideal for beginners learning the code. Transistorized circuit. Operates for months from single penlight cell supplied. Clear, crisp 500 cycle tone. Jacks for headphones; screw terminals for key. 1 lb.

Model Y-239. Net only **$3.95**

Phono Oscillator Kit

$5.85

"Broadcasts" recorded music through any standard radio set up to 50 feet away. No direct connection to set required. Easy to build—fun to use. Shpg. wt., 2 lbs.

Model Y-760. Net only **$5.85**

FINEST ELECTRONIC EQUIPMENT IN EASY-TO-BUILD MONEY-SAVING KIT FORM

Better By Far— ALLIED knight-kit QUALITY TEST INSTRUMENTS

knight-kit Low-Cost Tube Tester Kit

Model Y-143 $29.75

- With 16 Filament Voltages
- 600 Latest Tube Types Listed
- Easy-to-Read 4½" Meter
- Tests Series-String TV Tubes

Expertly designed for complete, up-to-date coverage of tube types. Tests *series-string TV tubes;* tests 4, 5, 6 and 7 pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Tests for open, short, leakage, heater continuity and performance (by amount of cathode emission). Big 4½" square meter has clear "GOOD-?-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 16 filament voltages from 0.63 to 117 volts to check virtually all receiving tubes; blank socket for future type tubes. Universal-type selector switches permit selection of any combination of pin connections. Single-unit, pre-assembled 10-lever function switch simplifies and speeds assembly. Up-to-date illuminated roll chart lists over 600 tube types. Counter model case, 5 x 14 x 10". Easy to build. 14 lbs.

Model Y-143. Net only **$29.75**
Y-142. Portable Case model. 15 lbs. Net **$34.75**
Y-141. Picture Tube Adapter. 1 lb. Net ..... **$ 4.25**

knight-kit RF Signal Generator Kit

Model Y-145 $19.75

Build this wide-range, extremely stable RF signal generator—save two-thirds the cost of a comparable wired instrument! Large, semi-circular dial is clearly calibrated; range is covered in 5 separate bands for close accuracy in setting individual frequencies. Ideal for aligning RF and IF stages in radio and TV sets and for troubleshooting audio equipment. Delivers output on fundamentals from 160 kc all the way out to 112 mc; useful harmonics to 224 mc. Has built-in 400-cycle sine-wave audio oscillator for modulating RF; audio is also available externally. Features high-stability Colpitts circuit. Convenient jack for external modulation. Maximum audio output 10 volts; RF output over 0.1 volt on all ranges. Step and continuous-type attenuator controls. Supplied with precision-wound coils that require no adjustment. 7 x 10 x 5". Shpg. wt., 11 lbs.

Model Y-145. Net only **$19.75**

knight-kit 1000 Ohms/Volt VOM Kit

Model Y-128 $16.95

Exceptional accuracy and versatility at amazing low cost. Ideal for service shop, lab or Amateur use. Large 4½", 400 microamp meter with separate scales for AC and DC voltage and current, decibels and resistance. *Uses 1% precision resistors;* has 3-position function switch and 12-position range switch. *38 ranges* include: AC, DC and output volts, 0-1-5-10-50-500-5000 (1000 ohms/volt sensitivity); Resistance, 0-1000-100,000 ohms and 0-1 meg (center scale readings of 60, 150 and 1500 ohms); Current, AC or DC, 0-1-10-100 ma and 0-1 amp; Decibels, −20 to +69 in 6 ranges. Precision resistors are used as shunts and multipliers to assure exceptional accuracy of measurements. With all parts, battery, test leads and black bakelite case with convenient carrying handle, 6¾ x 5¼ x 3¾". A great value in an easy-to-build quality instrument. Shpg. wt., 2½ lbs.

Model Y-128. Net only **$16.95**

knight-kit Vacuum Tube Voltmeter Kit

Model Y-125 $24.95

- 200 μa Movement, 4½" Meter
- Includes AC, Peak-to-Peak
- Balanced-Bridge, Push-Pull Circuit
- 1% Film-Type Resistors

Top buy in an extremely stable, highly accurate VTVM. Easy to assemble—entire chassis is printed circuit board. Perfect for radio-TV service work, lab and Amateur use. Features low-leakage type switches; 1% film-type precision resistors; balanced-bridge, push-pull circuit (switch to any range without readjusting zero set); zero center scale and direct-reading db scale; polarity reversing switch. Ranges: Input Resistance, 11 megs; DC and AC rms, 0-1.5-5-15-50-150-500-1500; AC Peak-to-Peak, 0-4-14-40-140-1400-4000; Response, 30 cycles to 3 mc; Ohms, 0-1000-10K-100K and 0-1-10-100-1000 megs; db, −10 to +5. Includes all parts, tubes, battery, test leads and portable case, 7¾ x 5¼ x 4-⅜". Easy to assemble. Shpg. wt., 6 lbs.

Model Y-125. Net only **$24.95**
Y-126. Hi Voltage Probe; extends DC to 50,000 v. ..... **$ 4.75**
Y-127. Hi-Frequency Probe; extends AC to 250 mc. ..... **$ 3.45**

6V-12V Battery Eliminator Kit

$32.95 High current rating; continuously variable filtered output; delivers 15 amps at 6 volts, 10 amps at 12 volts. May be used as battery charger. Two meters provide simultaneous current and voltage readings. Shpg. wt., 18 lbs.

Model Y-129. Net only **$32.95**

Transistor Checker Kit

$8.50 Checks gain ratio of all types of transistors; checks germanium and silicon diodes; checks for continuity and shorts. A valuable instrument at very low cost. Easy to assemble. Shpg. wt., 2½ lbs.

Model Y-149. Net only **$8.50**

Flyback Checker Kit

$19.50 Checks condition of all types of horizontal output transformers and deflection yokes, as well as TV linearity and width coils. 4½" meter; widest range in its field. Shpg. wt., 6 lbs.

Model Y-118. Net only **$19.50**

Sweep Generator Kit

$43.75 Extreme linearity on a par with costly lab instruments; fundamentals to 250 mc; output flat within 1 db; electronic blanking. Easy, money-saving assembly. Shpg. wt., 16 lbs.

Model Y-123. Net only **$43.75**

Capacitor Checker Kit

$12.50 Tests capacitors while in the circuit! Has widest range—20 mmf to 2000 mfd. Exclusive circuit for cancelling lead capacity. "Magic Eye" indicator. Save 60% over factory-wired units. 5 lbs.

Model Y-119. Net only **$12.50**

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

ADVANCED-DESIGN INSTRUMENTS FOR SERVICE, INDUSTRIAL AND RESEARCH USE IN EASIEST-TO-BUILD, MONEY-SAVING KIT FORM

knight-kit 20,000 Ohms/Volt VOM Kit

Model Y-140 $29.50

Outstanding quality and performance at money-saving low price. Features 1% precision multipliers; 4½" meter accurate within 2% of full scale deflection; 50 microamp sensitivity for 20,000 ohms/volt input resistance on DC; front panel "Zero adjust"; single switch to select function and range. 32 ranges: AC, DC and output volts, 0-2.5-10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg.; DC ma, 0-0.1-10-100; DC amps, 0-1-10; Decibels, −30 to +63 in six ranges. Moisture-resistant film-type resistors for extreme accuracy. Carefully engineered circuit design achieves high sensitivity and extremely versatile application. Kit includes all parts, battery, test leads and black bakelite case with highly legible white markings; size 6¾ x 5¼ x 3¾". Easy to assemble. Shpg. wt., 5 lbs.

Model Y-140. Net only..... **$29.50**

knight-kit High-Gain Signal Tracer Kit

Model Y-135 $26.50

A remarkable value in an easy-to-build instrument which permits visual and aural signal tracing of RF, IF, video and audio circuits. Has *highest gain in its price class.* Traces signal from antenna to speaker. Reproduces signal at plate or grid connection of any stage. Identifies and isolates "dead" stages. Features: usable gain of *91,000;* "magic eye" with calibrated attenuators for signal presence indication and stage-by-stage gain measurements; built-in 4" PM speaker; combination 2-position probe, one for RF (6 mmf. input), the other for audio. Provides noise test; built-in watt-meter calibrated from 25 to *1000 watts;* provision for external scope or VTVM. Binding posts provide output transformer and speaker substitution test, plus external 280 volts B+. With all parts, tubes and probe. 7x10x5". 12 lbs.

Model Y-135. Net only..... **$26.50**

knight-kit 5" Wide-Band Oscilloscope Kit

Model Y-144 $69.00

Only $6.90 down

- 5 mc Width for Color TV
- Horizontal Sweep to 600 kc
- 25 mv/inch Sensitivity
- Z-Axis Input
- Printed Circuit Construction

Equals or betters the performance of commercially wired scopes costing far more. Two printed circuit boards and laced wiring harness assure wiring accuracy and cut assembly time. Ideal for lab use, color TV servicing and high frequency applications. Wide sweep range—*15 to 600,000 cps.* Vertical response, ± 3 db, 5 cps to 5 mc; only 1 db down at 3.58 mc color burst. High vertical sensitivity of .025 rms v/inch. Input capacity, 20 mmf. Outstanding features: cathode follower inputs; 2nd anode provides 1400 volts high-intensity trace; push-pull amplifiers; positive and negative locking; frequency-compensated attenuator; Z-axis input; one volt P-P calibrating voltage; astigmatism control; retrace blanking circuit; DC positioning control. Includes CRT. 14½ x 9½ x 16". 40 lbs.

Model Y-144. Net only..... **$69.00**
Y-148. Demodulator Probe. Net..... **$ 3.45**
Y-147. Low Capacity Probe. 12 mmf. Net..... **$ 3.45**

Voltage Calibrator Kit

$12.75

Permits use of any scope as precision peak-to-peak AC voltmeter. Puts a true square-wave voltage on scope screen. Selects any voltage between .01 and 100 volts; feeds external signal direct to scope for instant comparison. Shpg. wt., 5 lbs.

Model Y-136. Net only..... **$12.75**

knight-kit 5" General-Purpose Scope Kit

Model Y-146 $42.00

Only $4.20 down

- Phantastron Linear Sweep
- 25 mv/inch Sensitivity
- Printed Circuit Board
- Retrace Blanking Circuit

Feature for feature the world's best oscilloscope kit value. A standout in its class with all these fine features: *Printed Circuit* wiring board and laced harness for quick, error-free assembly. *Phantastron Sweep Circuit* for high linearity of sweep from 15 to 150,000 cps. *25 Millivolts Per Inch Sensitivity*—3 times that of similarly priced scope kits. *Calibration Voltage*—1 volt peak-to-peak square wave, fully regulated. *Vertical Amplifier*—frequency response ± 3 db, 3 cps to 1.5 mc (± 6 db to 2.5 mc). Includes: Directly coupled positioning controls; retrace blanking circuit; frequency-compensated vertical input attenuator; positive and negative internal sync; high 2nd-anode voltage for high-intensity trace; input capacity, 45 mmf. Kit includes CRT. 9½ x 13¾ x 17¾". 26 lbs.

Model Y-146. Net only..... **$42.00**

Resistance Substitution Box

$5.95

Easily determines resistor values required in a circuit. Makes available 36 standard 1-watt resistance values in 2 ranges between 15 ohms and 10 megohms, with 10% accuracy. Slide switch selects range; 18-position switch for value selection. Shpg. wt., 2 lbs.

Model Y-139. Net only..... **$ 5.95**

Capacitance Substitution Box

$5.95

Makes it easy to find capacitor values needed in a circuit. Provides 18 standard values from .0001 mfd to .22 mfd, ± 20%. All values are 600 volt, except .15 and .22, which are 400 volt. 18-position selector switch. Shpg. wt., 2 lbs.

Model Y-138. Net only..... **$ 5.95**

Audio Generator Kit

$31.50

Excellent design; range, 20 cps to 1 mc; less than .25% distortion; 600 ohm output. Ideal for hi-fi testing; offers the flat response of a lab standard. Shpg. wt., 16 lbs.

Model Y-137. Net only..... **$31.50**

R/C Tester Kit

$19.50

Measures capacitance and resistance. Balanced-bridge circuit; indicates power factor; tests capacitors at rated voltage. Large, easy-to-read dial and "magic eye." Shpg. wt., 10 lbs.

Model Y-124. Net only..... **$19.50**

EASY TERMS AVAILABLE

Take advantage of the most liberal Easy Pay plan in electronics. On Knight-Kit orders totaling $45 or more—just 10% down, small monthly payments thereafter. Low carrying charges—no "red tape."

knigh -kits FOR THE RADIO AMATEUR

knight-kit All-Band Amateur Receiver Kit

Model Y-726
$104.50
Only $10.45 down

- Tunes 540 kc to 31 mc
- Built-In Q-Multiplier
- Constant Running HF Oscillator
- Worthy of the Advanced Ham Operator
- Printed Circuit Bandswitch
- Printed Circuit Board
- 1.5 μv Sensitivity

A sensational communications receiver value with all the selectivity, sensitivity and features of high-priced commercial units. Uses printed circuitry throughout, including the exclusive new KNIGHT-KIT printed circuit bandswitch, for remarkably easy assembly. Covers 540 kc to 31 mc in 4 ranges; calibrated, electrical bandspread on 80-10 meter Ham bands; slug-tuned Hi-Q coils; continuous, VR tube-regulated B+ applied to HF oscillator lets you switch from standby to receive with no drift; built-in Q-multiplier peaks desired signal or nulls interference; delayed AVC; provision for crystal calibrator (below). Sensitivity, 1.5 microvolts for 10 db signal-to-noise ratio. Selectivity: variable from 300 cps to 4.5 kc at 6 db down. Exalted BFO injection. Controls: Main tuning, bandspread, band selector, Q-multiplier selectivity, Q-multiplier tune, null-off-peak, BFO pitch, RF gain, AF gain, BFO-MVC-AVC-ANL, off-stby-rec-cal, antenna trimmer, and phone jack. Cold-rolled 1/16" steel chassis. Handsome metal cabinet, 10 x 10 x 16½". (Less phones, 8-ohm loudspeaker and S-meter.) 23 lbs.

Model Y-726. Amateur Receiver Kit. Net..... **$104.50**
Y-727. S-Meter Kit for above. 1 lb. Net..... **$9.50**

knight-kit 50-Watt CW Transmitter Kit

Model Y-255
$38.95
Only $3.89 down

- Ideal for the Novice
- Pi Antenna Coupler
- Bandswitching—80 to 10 Meters

There's exceptional value in this very popular bandswitching transmitter kit. Compact and versatile, it's the perfect low-power rig for the beginning novice as well as the seasoned veteran. Has bandswitching coverage of 80, 40, 20, 15 and 10 meters. Rated at 50 watts—actually operates at up to 60 watts on 80 and 40 meters. Oscillator is efficient 6AG7; final is reliable 807. Crisp, clean, cathode keying of oscillator and final. Built-in pi coupler permits use with random length antennas. Has highly effective TVI suppression. Other features not usually found in transmitter kits at this low price include: Ceramic-insulated final tank capacitor; pre-assembled switches; pre-wound parasitic chokes; ceramic coil forms; coax connector; crystal and VFO socket on front panel; power take-off jack for accessory equipment. Meter reads either plate or grid current of final. Takes crystal or VFO without circuit changes. Cabinet interior and chassis are copper-finished. Size, 8½ x 10½ x 8¼". With tubes and all parts for easy assembly. (Less crystal and key.) Shpg. wt., 19 lbs.

Model Y-255. 50-Watt Transmitter Kit. Net only..... **$38.95**

Model Y-725
$28.50
Only $2.85 down

knight-kit Self-Powered VFO Kit

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread; separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output: 40v on 80, 20v on 40. With Spot-Off-Transmit switch for spot frequency tuning. Extra switch contacts for operating relays and other equipment. Attractive metal cabinet, 8¾ x 6 x 6". Ready for easy assembly. Shpg. wt., 8 lbs.

Model Y-725. VFO Kit. Net only..... **$28.50**

knight-kit 100 Kc Crystal Calibrator Kit

Model Y-256
$10.50

Crystal frequency standard at very low cost. Gives marker every 100 kc up to 32 mc. A "must" for marking band edges. Mounting flanges for installation in or back of receiver cabinet. Size only 1½x 1½x3". Requires 6.3 v. at 0.15 amp and 150-300 v. DC at 3-6 ma. Trimmer for zero-beating with WWV; On-Off switch. Complete with tube, crystal, all parts and easy-to-follow instructions. Shpg. wt., 1 lb.

Model Y-256. 100 Kc Crystal Calibrator Kit. Net only..... **$10.50**

Model Y-253
$5.85

knight-kit Amateur RF "Z" Bridge Kit

Measures standing wave ratio (SWR) and impedance of antenna systems; ideal for adjusting antenna systems for optimum results. Measures impedances from 20 to 400 ohms up to 100 mc; SWR to 150 mc. Any VOM may be used for null indicator. With coax input and output connectors. Meters both input and bridge voltage. Calibrated dial gives direct impedance reading; includes 1% precision resistor for precise calibration adjustment. With all parts and handy plasticized SWR chart (less meter). 2½ x 3 x 4½". Shpg. wt., 1½ lbs.

Model Y-253. "Z" Bridge Kit. Net only..... **$5.85**

ORDER BLANK ALLIED RADIO 100 N. WESTERN AVE., CHICAGO 80, ILL.

Our 37th Year

ALLIED RADIO, Dept. RE; 100 N. Western Ave., Chicago 80, Ill.
Ship me the following KNIGHT-KITS:

Quantity	Description	Model No.	Price

$.....enclosed. (For parcel post, include postage—express is shipped collect).
☐ My Down Payment in the amount of $..... is enclosed. Send Time Payment form.

Name.....

Address.....

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

ALL PRICES NET F. O. B. CHICAGO

FREE 1958 404-PAGE ALLIED CATALOG

See the 1958 ALLIED 404-Page Catalog for complete listings of more than 50 KNIGHT-KITS, covering Hi-Fi, Hobby, Test Instrument and Amateur Kits. The 1958 ALLIED Catalog is your complete Buying Guide to the world's largest stocks of everything in Electronics.

☐ Send FREE 404-Page 1958 ALLIED Catalog.

Transistorized FM Receiver

By **JACK NAJORK**

Simple changes permit the transistorized FM wireless microphone of July 1957 issue to be used as receiver.

READERS of RADIO & TV NEWS who have constructed the transistorized FM microphone (July 1957 issue) may be interested in the following modifications that can be made to convert this circuit into an FM receiver.

By grounding Base 2, increasing emitter bias, and adding a 100,000-ohm control as shown in the diagram below, the tetrode transistor becomes a superregenerative detector capable of receiving regular FM broadcasts and low-channel TV sound. Although the superregenerative detector recovers FM audio by means of slope detection, the audio quality can be surprisingly good for so simple a device.

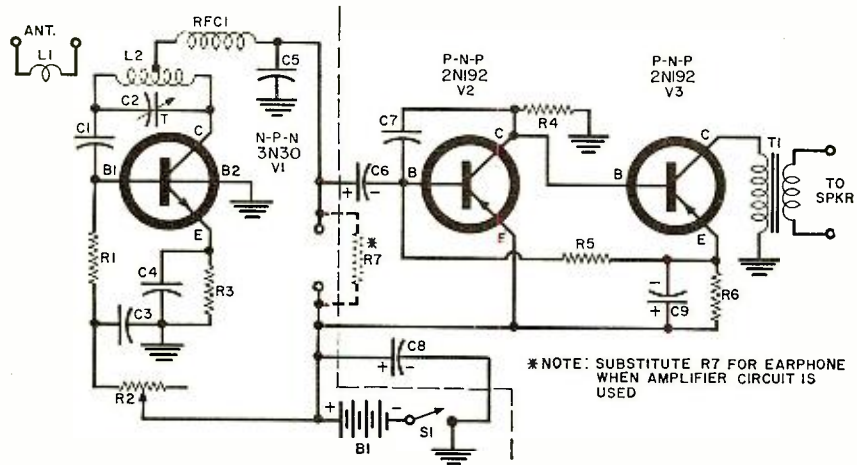
As is true with most superregenerative circuits, certain component values are quite critical and may require experimentation for optimum results. This is especially true of the emitter bias resistor R_3.

A high-impedance dynamic earphone can be connected in series with the collector to make a simple one-transistor FM receiver. When coupled to an external FM dipole, this circuit brought in the two local FM stations with good clarity. Current drain of the tetrode in this circuit is approximately .3 ma. at 6 volts.

While the original article designated the *G-E* type 3N30 tetrode which has a rated frequency cut-off of 120 mc., the author used a less expensive version of this unit, the 3N29, which has a rated cut-off of 30 mc. Whether this individual unit is a freak or whether all 30 mc. units will operate at 100 mc. is not known, although one engineering opinion has it that the 30 mc. units will generally operate with reduced gain at frequencies above rated cut-off. Cost of the 3N29 is roughly half that of the 3N30.

After the bugs were worked out of the detector it was decided to add a transistorized audio amplifier to bring the audio output up to loudspeaker level. This circuit, shown below, uses two *G-E* 2N192 triode transistors in a class A direct-coupled circuit. Base bias resistor R_5 should be selected for maximum output consistent with low distortion. A standard size pentode-to-voice-coil output transformer was used in lieu of the more expensive miniaturized units generally specified. Those accustomed to audio in terms of watts will find it difficult to believe that this circuit, with an input of 4 ma. at 6 volts, will drive a speaker. Although the power output has not been measured, it is assumed to be approximately 10-15 milliwatts which drives a 12" speaker in a bass reflex enclosure to comfortable listening levels. —30—

Schematic of FM "receiver" with a companion transistorized audio amplifier.



R_1—6800 ohm, ½ w. res.
R_2—100,000 ohm, ½ w. res.
R_3—1200 ohm, ½ w. res.
R_4—22,000 ohm, ½ w. res.
R_5—22,000 to 100,000 ohm res. (see text)
R_6—470 ohm, ½ w. res.
R_7—8200 ohm, ½ w. res. (see "Note" above)
C_1—47 μμfd. ceramic capacitor
C_2—5-20 μμfd. mica or air trimmer
C_3, C_4—1000 μμfd. ceramic capacitor
C_5—100 μμfd. ceramic capacitor
C_6—1 μfd., 10 v. elec. capacitor
C_7—.005 μfd. ceramic capacitor
C_8, C_9—20 μfd., 10 v. elec. capacitor
L_1—2 t. link, spaced ½" from L_2
L_2—8 t. #20 en. wire, ¼" dia., ¾" long, center-tapped
RFC_1—30 t. #28 en. wound on 1 w., high-value resistor
T_1—8000 ohm to v.c. trans. (standard pentode output trans.)
B_1—6-volt battery
S_1—S.p.s.t. switch
V_1—"n-p-n" transistor (General Electric 3N30)
V_2, V_3—"p-n-p" transistor (General Electric 2N192)

LAFAYETTE PROFESSIONAL TURNTABLE
with AUTHENTIC HYSTERESIS SYNCHRONOUS MOTOR

Value ~~129.50~~ Only **64.50**
SAVE OVER 50%

PROFESSIONAL TURNTABLE WITH HYSTERESIS-SYNCHRONOUS MOTOR

The **Lafayette Model PK-225** is a *true* hysteresis-synchronous motor and is free from speed variations due to fluctuations in line voltage, load and temperature. It is the smoothest type known, completely free from "cogging" (the minute variations of speed which show up as wow and flutter)!

ONLY LAFAYETTE'S HYSTERESIS—SYNCHRONOUS MOTOR, in its price class, is made to extremely fine tolerances (on the order of .00001 inches)! Only Lafayette's motor has 16 cores; a high permeability rotor magnet, ball thrust bearings, oilite sleeve bearings plus felt oil reservoir, cooling fins as an integral part of the rotor and a hollow rotor core for maximum efficiency and minimum heat. Only Lafayette's motor can be oiled from above, without disassembly, through a unique oil feed system. Only Lafayette's motor has a self-aligning armature.

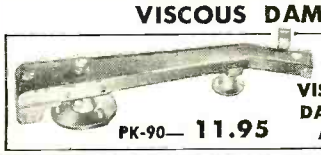
Here's THE turntable—the last word in professional high-fidelity performance! A fine precision instrument in every sense. Just look at some of these ***OUTSTANDING FEATURES:*- WOW AND FLUTTER:** Less than 0.2% • **TURNTABLE:** Heavy, diecast aluminum. Lathe-turned for perfect balance and concentricity. 12" diameter—weighs approx. 4 lbs. and provides amazingly constant speed; the extra-heavy rim acts just like a flywheel to prevent speed variations • **TRUE-HYSTERESIS-SYNCHRONOUS MOTOR:** For smooth, low-noise, wow- and flutter-free operation • **RUMBLE AND NOISE:** 50db below average recorded level • **INTEGRATED SPEED CONTROL:** For all 3 speeds—78, 45 and 33⅓ rpm • **2 OVERSIZE, HEAVY DUTY IDLERS:** Precision-ground; provide positive constant-speed rim drive • **SINGLE BALL THRUST BEARING:** Turntable rides smoothly over ball bearing floating on thin film of oil • **FREE FLOATING, SHOCK-MOUNTED MOTOR** • **RUBBER CUSHION SHOCKMOUNTS** • **AUTOMATIC IDLER DISENGAGEMENT** • **CORK AND RUBBER MAT** • **STAINLESS STEEL PRECISION SPINDLE** • **POWER REQUIREMENTS:** For 105-130 volts, 60 cps AC; draws 16 V.A. • **ACCESSORIES SUPPLIED:** 45 RPM adapter, Strope disc • **SIZE:** 2⅛" above and 4" below motor board; 14¾" deep x 12¼" wide • **SHIPPING WEIGHT:** 16 lbs.

LAFAYETTE MODEL PK-225 ..... Net **64.50**

Deluxe Woodbase for PK-225 and 12" Tone Arm (Specify Finish). Shpg. wt., 13 lbs. ..... Net **14.95**

Deluxe Woodbase for PK-225 and 16" Tone Arm (Specify Finish). Shpg. wt., 15 lbs. ..... Net **15.95**

VISCOUS DAMPED TRANSCRIPTION TONE ARMS



PK-90— 11.95 VISCOUS DAMPED ARM

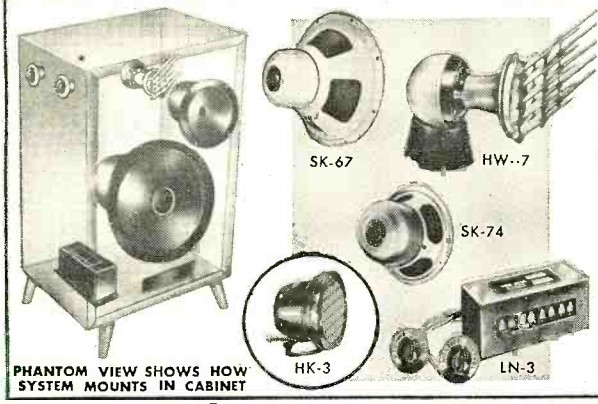
LICENSED UNDER CBS U. S. PATENT NO. 2676806

PK-170— 17.95 VISCOUS DAMPED ARM

SPECIAL MONEY-SAVER COMBINATION

PK-225 Turntable, PK-90 12" Tone Arm, New GE VRI! Series Triple-Play Cartridge Model 4G-052 with Genuine GE Diamond and Sapphire Styli. ***SPECIAL!*** ..... Net **81.50**

3 WAY SYSTEM WITH 15" WOOFER . .8" MID-RANGE SPEAKER . . HORN TWEETER . .CROSSOVER NETWORK



PHANTOM VIEW SHOWS HOW SYSTEM MOUNTS IN CABINET

• **15-INCH WOOFER WITH 31.5 OZ. MAGNETIC (SK-67)** • **8-INCH MID-RANGE SPEAKER (SK-74)** • **NEW HIGH FREQUENCY ACOUSTICAL LENS TWEETER (HW-7)** • **3-WAY CROSSOVER NETWORK (LN-3)**

Lafayette presents this outstanding 3-way speaker system designed for the high fidelity enthusiast who desires performance formerly possible in multi-speaker systems costing many times this price. You won't believe your ears when you hear the superb reproduction throughout the entire audio spectrum. The SK-67 15" woofer provides phenomenal bass response, the SK-74 8" speaker delivers full bodied, mid-range frequencies, and the HW-7 high frequency acoustical lens tweeter faithfully reproduces the highest audible frequencies. Crossover points at 350 and 5000 cycles are provided by the LN-3 3-way inductance-capacitance network with continuously variable presence and brilliance controls that adjust tone balance to personal taste. Shpg. wt., 25 lbs.

SY-93. Complete System as listed above ..... Net **55.50**

2 WAY SPEAKER SYSTEM 40-16,000 CYCLES

• **25 WATT WOOFER** • **CROSSOVER NETWORK** • **IMPORTED HI-FI TWEETER** • **LEVEL BRILLIANCE CONTROL**

This 2-way speaker system is another excellent buy for the moderate purse. It is basically the same as the SY-85 system described at the top of the page, but incorporates the deluxe SK-68 speaker with 21.5 oz. Alnico V magnet. This results in more efficient reproduction and extension of the lower register. Complete system includes the SK-68 12" 25 watt woofer, HK-3 cone type tweeter and LN-2 crossover network with level-brilliance control. Range of system 35-16,000 cycles. Shpg. wt., 18 lbs.

SY-87—Complete System ..... Net **27.50**

NEW! POWER MEGAPHONE... Portable Sound Broadcaster

• **Uses 8 Flashlight Cells** • **Completely Self-Contained** • **Weighs only 6½ lbs. with Batteries** • **High Efficiency Horn Projects Sound 1000 Ft.** • **Shoulder Strap for Portability and Ease of Use** • **Microphone Detachable On 10-Foot Cord** • **For Construction, Auctions, Carnivals, Fire & Police Use** • **Also Ideal for Marine, Railroad, Civil Defense, Sporting Events**

A power megaphone with many unusual features and many applications. Basically a highly efficient sound projector horn with a built-in microphone, capable of amplifying and projecting the voice with a range of 1000 feet. The microphone is a telephone-type element, easily replaceable, and may be detached and extended up to 10 feet from the horn. The reflex-type horn is extremely light-weight, rubber-rimmed, of strong, sturdy spun aluminum construction with 2¾' air column and is supplied with a strap for carrying or placing on the shoulder. A press-to-talk switch on the microphone provides for economy of power use—power is used only when actually talking. No warm-up time required—amplification is instantaneous. A patented non-linear current limiting device restricts current flow to safe levels for longest battery life. Uses 8 size "D" flashlight cells in series with an approximate life of about 10 hrs. of use. Battery housing serves as base for entire assembly. Battery compartment opens easily by means of 2 thumbscrews for battery replacement. Size 17" long overall; horn mouth is 12" diam. Shpg. wt., 8 lbs. less batteries.

PA-12 — Power Megaphone, Less batteries. ..... Net **29.50**

BATTERIES FOR ABOVE— Burgess No. 2 or RCA VS036—8 Required ..... Net each **.13**

Reg. Value ~~69.50~~ ONLY **29.50**

SHOULDER STRAP & DETACHABLE MIKE JUST AIM & TALK

Lafayette Radio
165-08 Liberty Ave.
JAMAICA 33, N. Y.
INCLUDE POSTAGE WITH ORDER

NEW YORK, N.Y.	BOSTON, Mass.	BRONX, N.Y.	NEWARK, N.J.	PLAINFIELD, N.J.
100 6th Ave.	110 Federal St.	542 E. Fordham Rd.	24 Central Ave.	139 W. 2nd St.
REctor 2-8600	HUbbard 2-7850	FOrdham 7-8813	MArket 2-1661	PLainfield 6-4718

FREE LAFAYETTE CATALOG

A Must For Every Hi-Fi Enthusiast

New! Years Ahead!

NEW 180 PAGE ELECTRONIC CATALOG FEATURING THE BEST BUYS IN THE BUSINESS

The newest and largest assortment of Electronic, Radio and TV parts, Hi-Fi and Public Address Components and systems, Test Equipment, tubes, Transistor Kits and miniaturized components for transistor circuitry, Ham Equipment, Builders Kits, Tools, Books, Microscopes, Binoculars, Telescopes, Cameras, and Drafting Equipment.—*ALL AT LOWEST PRICES*—Catering to the economy minded dealer, serviceman, engineer, technician, experimenter and hobbyist. *CRAMMED FULL OF MONEY SAVING BUYS. SEND FOR YOUR FREE COPY TODAY.*

LAFAYETTE STEREO TUNER KIT

THE MOST FLEXIBLE TUNER EVER DESIGNED

- 11 Tubes + Tuning Eye + Selenium Rectifier • 12 Tuned Circuits
- Dual Double-Tuned Transformer Coupled Limiters
- Separately Tuned FM and AM Sections • Dual Cathode Follower Output
- Armstrong Circuit with FM/AFC and AFC Defeat
- Multiflex Output for New Stereo FM

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 ± ½ db, full 200 kc bandwidth and sensitivity of 2 microvolts for 30 db quieting with full limiting at 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 20-5000 cps ± 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 escutcheon 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 13¾" W x 10⅜" D x 4½" H. Shpg. wt., 18 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit and the "Triumvirate" of these 3 units form the heart of a top quality stereo hi-fi system.

KT-500.....Net **74.50**

LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.

- Self-Powered • DC On All Filaments • 24 Positions of Equalization
- Tape Head Input, High Impedance • Dual Cathode Follower Output Stages

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07 harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phono, tuner or tape. Tasteful styling, brilliantly executed. Size 12¾ x 9⅛ x 3¾". Shpg. wt., 10½ lbs.

KT-300—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions. ..... Net **39.50**

LT-30—Same as above completely wired and tested with cage and instruction manual. Net **59.50**

DELUXE 70 WATT BASIC AMPLIFIER

- Conservatively Rated At 70 Watts • Inverse Feedback • Variable Damping
- Metered Balance And Bias Adjust Controls • Available In Kit and Wired Form

Here's ultra-stability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wire range linear Chicago output transformer, variable damping control, meter for bias and balance and gold finish chassis. Frequency response 10-100,000 cps ± 1db. Hum and noise 90 db below full output. IM distortion less than 1½% at 70 watts, less than 0.3% below 30 watts. Harmonic distortion less than 2% at 70 watts from 20 to 20,000 cps ± 1 db. Output impedance 4, 8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14½ x 10 x 7⅜" including cage and knobs. Shpg. wt., 40 lbs.

KT-400—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions. .....Net **69.50**

LA-70—Same as above completely wired and tested with cage and instruction manual. Net **94.50**

NEW! LAFAYETTE SCOOP!

DUAL WIDE-ANGLE TWEETER

Only **5.95**

Modernize Your Hi-Fi System

Modernize your high fidelity listening by adding this wide-angle dual-tweeter to extend treble range in a 2-way or 3-way speaker system. Mounts directly on any 12" speaker and converts it to a coaxial type. Response 2500 to 16,000 cps. Recommended crossover 2500 to 4000 cps. Heavy magnets for high efficiency. Dispersion angle approx. 125° horizontally. Impedance 16 ohms (2-8 ohm units in series). Will handle up to 20 watts program in 2 or 3-way systems. Incorporates specially designed chrome-plated steel bracket of rigid construction to prevent resonances. Measures 12" L x 2" D x 2⅞" H overall. Shpg. wt. 2 lbs.

SK-100 Dual Tweeter ..... Net **5.95**

Lafayette Radio DEPT RE P. O. BOX 511 JAMAICA 31, N. Y.

☐ Send FREE LAFAYETTE Catalog 305

Name ..... CUT OUT AND MAIL TODAY

Address .....

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

The Zero Clipper

(*Continued from page 41*)

equipment. This construction is recommended, if possible, because it gives a firm, solid support with minimum capacity between leads and components.

In operation, first set the potentiometer for no clipping (maximum noise) and then turn the control for the most intelligible signal. One unexpected dividend was operation with signals which were completely intelligible, but with a high background noise. The zero clipper circuit made these signals more pleasant by cutting down the background noise at the expense of a small amount of audio distortion. Other applications which suggest themselves are: cutting down background hiss and scratch with old phonograph records and cutting down the unpleasant high level of background noise in a phone transmitter which uses peak clipping to increase apparent modulation percentage. —30—

CAUTION FOR SQUARE-WAVE TESTING TRANSISTOR AMPLIFIERS

By RUFUS P. TURNER

RECENTLY, a colleague of the author lost three transistors in a row by burn-out, for no apparent reason, while attempting a square-wave test of a transistorized audio amplifier. A trouble-shooting analysis of the circuit revealed that the transistors were being wrecked by a high-voltage pulse generated by the steep fall of the wave across the primary of the coupling transformer in the collector circuit.

The situation is very much the same as in the small, flyback-type power supplies in Geiger counters in which a choke coil is connected in the plate circuit of a tube. When the grid is pulsed with a saw-tooth or similar steep-wave signal, the rapid fall of current generates 1 or more kilovolts across the choke. The difference is that the insulation of the tube is good enough to withstand this voltage, but the transistor cannot take it because of its low peak inverse voltage rating.

Caution therefore is needed when square-wave testing a transistorized amplifier having transformer or choke coil coupling. Every effort should be made to ascertain that flyback action will not produce a voltage in excess of the peak inverse rating of the transistor. Perhaps, it would be more sagacious to dispense with the square-wave test altogether and to employ instead harmonic distortion, intermodulation, and frequency-response measurements until such time as transistor peak inverse ratings are greatly improved.

This situation caused us to wonder if some of the mysterious burn-outs of transistors might not have been attributable to the same cause. A quick poll of our associates revealed that they had indeed lost transistors with sudden swiftness in pulse amplifiers, blocking oscillators, and similar circuits in which the "wrecking voltage" was developed by the steep waveform across a collector-circuit inductor. —30—

VIDEO ELECTRIC COMPANY says: DOWN WITH RISING COSTS OF ELECTRON TUBES

OVER ONE MILLION USED TUBES TO SELECT FROM at only

Each and every tube is tested by our supplier under actual operating conditions in Radio, FM, Hi-Fi, Industrial Equipment and Television Chassis or Intricate Testing Equipment for Mutual Conductance and Life Test.

Below Is a Partial List of Over Three Hundred Popular Types! Write for Free Complete List and Order Blank!

0A2	5AX4GT	6BC5	6L7	7J7	19
0B2	5AZ4	6BC7	6N7	7N7	19AU4GT
0Z4	5BK7	6BC8	6Q7	7Q7	19BG6G
1A5GT	5BR8	6BD6	654	7X7/XXFM	19J6
1A7GT	5BQ7	6BE6	658GT	7Y4	19T8
1B3GT	5CG8	6BF5	65A7	7Z4	24A
1C5GT	5J6	6BF6	65B7Y	12A8	25AV5
1H4G	5T8	6BG6G	65C7	12AB5	25AX4
1H5GT	5U4G	6BH6	65F5	12AQ5	25BQ6
1J6	5U4GA	6BJ6	65F7	12AT6	25DN6
1L4	5U4GB	6BK5	65G7	12AT7	25L6GT
1L6	5U8	6BK7	65H7	12AU6	25W4GT
1N5GT	5V4G	6BL7GT	65J7	12AU7	25Z5
1Q5GT	5V6GT	6BN6	65K7	12AV5	25Z6
1R5	5X8	6BQ6GT	65L7GT	12AV6	26
1S5	5Y3GT	6BQ7	65N7GT	12AV7	35A5
1T4	5Y4G	6BS8	6SQ7	12AX4GT	35B5
1T5GT	6A7	6BX7GT	6SR7	12AX7	35C5
1U4	6A8	6BY5G	6S57	12AZ7	35L6GT
1U5	6AB4	6BY6	6T4	12B4	35W4
1V2	6AB7	6BZ6	6T8	12BA6	35Y4
1X2	6AC7	6BZ7	6U4GT	12BA7	35Z4GT
2A3	6AF4	6C4	6U5	12BD6	35Z5GT
2A7	6AG5	6C5	6U8	12BE6	36
2AF4	6AG7	6C6	6V3	12BF6	37
3AL5	6AH4GT	6CB5	6V6	12BH7	39/44
3AU6	6AH6	6CB6	6W4GT	12BK5	42
3AV6	6AK5	6CD6G	6W6GT	12BQ6	43
3BC5	6AL5	6CF6	6X4	12BR7	45
3BE6	6AL7	6CG7	6X5	12BV7	50A5
3BN6	6AM8	6CL6	6X8	12BY7	50B5
3BY6	6AN8	6CM6	6Y6G	12CA5	50C5
3BZ6	6AQ5	6CM7	7A4/XXL	12DQ6	50C6
3CB6	6AQ6	6CN7	7A5	12F5	50L6GT
3CF6	6AQ7GT	6CS6	7A6	12J5	50X6
3C56	6AR5	6CU5	7A7	12K7	50Y6
3DT6	6AS5	6CU6	7A8	12L6	56
3LF4	6AS7G	6D6	7B4	12Q7	57
3Q4	6AT6	6DE6	7B5	12SA7	58
3Q5GT	6AT8	6DQ6	7B6	12SG7	71A
3S4	6AU4GT	6DT6	7B7	12SJ7	75
3V4	6AU5GT	6E5	7B8	12SK7	76
4BC8	6AU6	6F6	7C4	12SL7GT	77
4BQ7A	6AU8	6F8	7C5	12SN7GT	78
4BZ7	6AV5GT	6H6	7C6	12SQ7	80
5AM8	6AV6	6J4	7C7	12SR7	84/6Z4
5AN8	6AW8	6J5	7E5	12V6GT	117L7GT
5AQ5	6AX4GT	6J6	7E6	12W6GT	117N7GT
5AS8	6AX5GT	6J7	7E7	12X4	117P7GT
5AT8	6B4G	6K6GT	7F7	12Z3	117Z3
5AU4	6B8	6K7	7F8	14A7/12B7	117Z6
5AV8	6BA6	6K8	7G7/1232	14B6	
5AW4	6BA7	6L6	7H7	14Q7	

GUARANTEE: We guarantee to replace FREE for one (1) year any tube purchased from us which fails to function efficiently under actual operating conditions. Refunds will be made promptly for any defective merchandise.

SEND for our *FREE* complete *TUBE & PARTS LIST* and order blank.

FREE
Bonus Antenna Given with Any TV Set Order!!

FREE
RCA "Cheater" Cord Given with Any Tube Order of $7.00 or More!!

WE HAVE OVER
1000 USED TV SETS
At All Times In Our Huge Warehouse

Buy one or more of these WORKING TVs to sell or use as your own second set! All sets in GOOD WORKING condition!

Your Choice—Console or Table Model

10"....$23.00		17"....$46.00	
12"....$28.00		19"....$58.00	
14"....$33.00		20"....$64.00	
16"....$40.00		21"....$72.00	
	24"....$99.00		

When ordering TVs, state whether table model or console is desired. Also, preference on make of set. All TVs sent railway express F.O.B. Newark. On any quantity, WIRE or CALL today!

VIDEO ELECTRIC COMPANY

FREE POSTAGE
in U.S.A. and Territories on orders over $5.00. 25¢ handling charge on orders under $5.00. 25% deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

Phone
HUmboldt 4-9848

79 CLINTON PL. NEWARK, N. J.

Service Notes

BRIGHTNESS RANGE, PHILCO

In some 1952 models, the range of the brightness control is not adequate to permit cutting off of beam current entirely in the minimum-brightness position. This is considered objectionable by some users. In order to bring the range down enough to permit extinguishing the picture completely at minimum settings, resistor R_{313}, in the cathode circuit of the picture tube, may be reduced in value from 82,000 ohms to 68,000 ohms.

When this exchange is made, a slight decrease in light output at maximum brightness also occurs. To recover this loss R_{314}, also in the cathode of the picture tube, is reduced from 120,000 ohms to 100,000 ohms.

ADMIRAL IMPROVEMENTS

Suggested changes noted here apply to the 17B1, 17C1, 17K1, and 17L1 chassis, as well as to their combination v.h.f.-u.h.f. counterparts (17AB1, 17AC1, etc.).

While a.g.c. action is inherently good in these receivers, which use a gated-a.g.c. circuit, the full capabilities of this circuit may not be realized in some earlier models. If improvement is desired, check the value of C_{428}, connected between the plate (pin 3) of the a.g.c. stage (V_{401}) and the flyback transformer. See Fig. 1. If this is a 300-$\mu\mu$fd. unit, replace it with another whose value is .001-μfd., 1600 volts. This will increase the amplitude of the keying pulse fed to the stage.

In some of the v.h.f.-u.h.f. sets, there may be a tendency for strong signals to produce overload. If this occurs, check the value of R_{401}, also in the plate circuit of the a.g.c. amplifier and going to the primary circuit of T_{303}, the third i.f. transformer, through resistor R_{315}. If R_{401} is 10 megohms, replace it with another whose value is 15 megohms.

If there is a tendency for sound to distort due to frequency drift in the sound detector—specifically, drift in

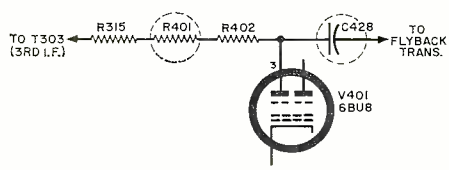


Fig. 1.

the quadrature tank circuit connected to pin 7 of V_{201}, the 6DT6—a change in the value of R_{207}, which shunts this tank, should remedy the condition. The 220,000-ohm unit in this position should be replaced with a 100,000-ohm resistor.

All changes suggested here were incorporated at various points during the production of these *Admiral* receivers.

PIX QUALITY IN ARVIN TV

Changes in the video-amplifier circuit of "D" series receivers (chassis 379 and 382) can be made to improve picture quality, especially under weak-signal conditions. These are made in the input and output circuits of V_8, a 6AQ5, the second video amplifier. The original circuit, Fig. 2A, is revised to correspond to the circuit shown in Fig. 2B as follows: Peaking coil L_{209}

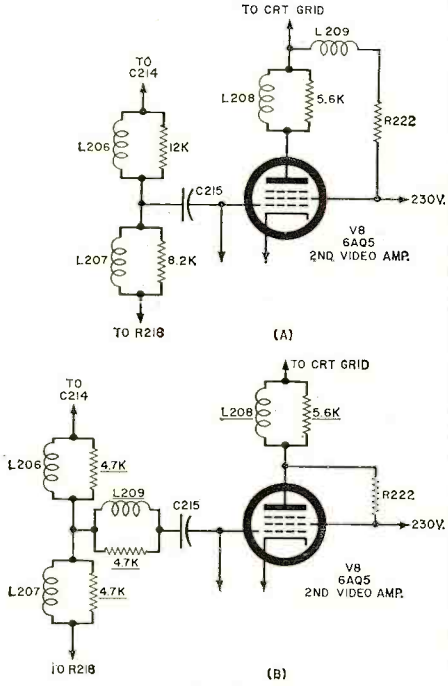


Fig. 2.

is moved from the plate circuit of the stage and connected in series with C_{215} in the grid circuit, as shown. R_{222} is then reconnected directly between the screen grid and the plate of the video amplifier. A 4700-ohm resistor is shunted across L_{209} and the shunt resistors across L_{206} and L_{207} are each changed to 4700 ohms.

POOR FOCUS AND WASH-OUT

Sometimes receivers using low-voltage, electrostatically focused picture tubes, like the 21MP4, may show poor focus and wash-out of the picture in the center area of the picture-tube screen. This may be noted, for example, in *Montgomery Ward* models 25WG-3075A & B, -77A & B, and -79A. This condition is generally the result of incorrect positioning of the ion trap.

Visual inspection of the 21MP4 picture tube will show that the electron gun is closest to the glass neck on one side. The ion trap magnet should be positioned on this side. When the receiver is viewed from the rear, then, this will mean that the ion trap should be on the left in nearly all cases. It may be necessary to reverse the ion trap to adjust it for maximum brilliance. —30—

New TV Front Ends

(*Continued from page 68*)

plate and the mixer grid circuit is provided by a capacitor and "gimmick" for the low channels; for the high band, the individual coils at the end of each strip of 2 or 3 channel sections couple between each other.

The advantages of the disc-type tuner include its ease of disassembly, repair, and servicing, as well as the rugged construction made possible by the self-wiping kidney springs and the solid molded discs. In some early models, the detent spring and its roller rode directly on the scalloped edge of the smaller disc, but even the strong plastic used could not bear the constant pressure; in later models a steel plate is riveted to the disc and the steel edge bears against the detent roller.

As far as alignment is concerned, the complexity of the disc tuner is about half way between that of a turret tuner and a wafer-switch tuner. Only a few channels must be adjusted in order to align one particular one. If a coil has to be repaired, it is easy to get at since the entire assembly can be removed as simply as a turret could be slipped out of its bearings. This tuner is also somewhat shorter and takes less space than the turret and most switch tuners. This is an important feature in the already cramped space of today's compact TV sets.

Another version of a disc-type tuner is the *Standard Coil* "Fireball," which is still more compact and simpler than the one just described. In the "Fireball" tuner, as shown in Fig. 12, the two tubes are side by side in front and a single rotating disc contains all tuned switching circuits. Principally available in the Neutrode circuit, described in more detail in the next paragraph, this tuner combines very good noise and gain figures with a very simple mechanical arrangement.

By unsnapping the cover, all components are accessible and servicing is quite simple. At the same time individual stage adjustments are possible for the input, plate, and mixer-grid coils; and oscillator adjustment for each channel is done from the front in the usual manner. This tuner has 13 positions, allowing for the addition of u.h.f. without major change. For u.h.f. reception, the oscillator "B+" is disabled and separate coils are added outside the main disc, making the tuner a 41-mc. two-stage amplifier.

Turret Tuners

No discussion of tuners would be complete without covering the latest version of the enduring *Standard Coil* turret tuner. Readers will be familiar with the appearance of this unit, but the new circuits used merit some explanation.

Fig. 13 is the circuit diagram of the latest Neutrode turret tuner, as used in the *Packard-Bell* chassis 98D3. The major features are the neutralized triode r.f. amplifier and the d.c. type remote-control fine tuning. A 6BN4 high-frequency triode is used as r.f. amplifier, and the capacitor network going from the plate circuit to the grid circuit serves to neutralize the otherwise regenerative condition of a triode amplifier at high frequencies. Note that the 6BN4 has double socket pins for grid and cathode to reduce internal lead inductances. Otherwise the circuit is extremely simple and straightforward. Contained on a single turret channel strip or segment are the r.f. amplifier grid coil, the plate circuit, and the mixer grid network, as well as the oscillator coil. Coupling between the r.f. amplifier and the mixer is inductive, and optimized for each channel by the configuration of the coils on the segment.

The oscillator circuit uses a single coil between grid and plate and this coil is, as usual, adjusted by a self-contained slug accessible from the front of the tuner. In place of the concentric shaft and fine tuning mechanism is a choke coil and a diode, mounted close to the oscillator tube socket.

The electronic fine-tuning system actually operates on the oscillator signal itself, since the 1N87 crystal rectifies a portion of the oscillator signal. The 1000-$\mu\mu$fd. bypass capacitor filters out the r.f. component and the remote fine-tuning control, not shown, is a 50,000-ohm potentiometer going to ground. As the potentiometer resistance is varied, the impedance represented by the crystal is varied. This, in turn, changes the oscillator frequency. The choke coil going to ground from the crystal provides a d.c. return path and serves as high impedance for the r.f. signal. Frequency variations obtained by this method range from .5 mc. at the low TV channels to 1.1 mc. at the high band.

If fine tuning does not properly change the oscillator frequency, the bypass capacitor may be shorted. In the event of oscillator failure or operation at completely wrong frequencies, disconnect the 1.8-$\mu\mu$fd. capacitor to eliminate the fine tuning circuit as a trouble source. The most likely defect in this circuit is a noisy or defective potentiometer or a bad diode.

This tuner, in addition to the novel fine-tuning circuit, also has a noise figure equal to most cascode tuners and almost as much over-all gain. Alignment and servicing is slightly simpler than for cascode turret tuners, since the neutralizing adjustment does not usually have to be repeated on different channels and there is practically no alignment required on the other r.f. circuits. Repairs of the turret segments, shaft, or other mechanical parts are the same as for other turret tuners except that, in this model, only a single segment is used for all tuned circuits. —30—

BC-645 XMTR RECEIVER

15 Tubes 435 To 500 MC

Can be modified for 2-way communication, voice or code, on ham band 420-450 mc. citizens radio 460-470 mc, fixed and mobile 450-460 mc. television experimental 470-500 mc. 15 tubes (tubes alone worth more than sale price!) 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955 and 1—WE316A. Now covers 460 to 490 mc. Brand new BC-645 with tubes, less power supply in factory carton. Shipping weight 25 lbs. **$29.50**

PE-101C DYNAMOTOR for BC-645, has 12-24V input (easy to convert for 6V Battery operation) only **$7.95**

UHF ANTENNA ASSEMBLY, for BC-645 **$2.45**

Complete set of 10 Plugs for BC-645 $5.50

CONTROL BOX for above **$2.25**

SHOCK MOUNT for above **1.25**

CONVERSION BOOKLET. Instructions for most useful surplus rigs **$2.50**

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES

Type	Description	Excellent Used	Brand NEW
BC-453	Receiver 190-550 KC.	$14.95	$18.95
BC-454	Receiver 3-6 Mc.	9.95	12.95
BC-455	Receiver 6-9 Mc.	9.95	13.50
BC-456	Modulator	3.45	4.95
BC-450	3-Receiver Control Box.	1.49	1.95
BC-451	Transmitter Control Box	1.25	1.49
BC-696	Xmtr 3-4 Mc (like new)	6.95	8.88

BC-457 TRANSMITTER—4-5.3 Mc. complete with all tubes and crystal. BRAND NEW **$7.88**

BC-458 TRANSMITTER—5.3 to 7 Mc. Complete with all tubes and crystal. BRAND NEW **$7.88**

BC-459 TRANSMITTER—7-9.1 Mc. complete with all tubes and crystal. BRAND NEW **$12.95**

ARC-5/T-19 TRANSMITTER—3 to 4 Mc. BRAND NEW complete with all tubes & crystal **$8.88**

110 Volt AC Power Supply Kit, for all 274-N and ARC-5 Receivers. Complete with metal case, instructions **$7.95**
Factory wired, tested, ready to operate **$11.50**

SPLINED TUNING KNOB for 274-N and ARC-5 RECEIVERS. Fits BC-453, BC-454 and others. Only **49c**

LORAN APN-4

FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or plane. Indicator and receiver complete with all tubes and crystal.

INDICATOR ID-6B/APN-4, and **RECEIVER** R-9B/APN-4. BRAND NEW only **$48.49**

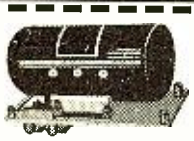
Complete Kit of Accessories for Above: PE-206 Inverter, Set of Plugs, Visor for Indicator, Operation Manual. ALL BRAND NEW **$49.50**

SPECIAL APN-9A LORAN Receiver less tubes, NEW (demilitarized) Indicator. **$24.50**

TS-100/AP OSCILLOSCOPE

(worth $750) OUR LOW PRICE **$33.33**

Can be used with linear sweep or general purpose test scope. Cables included. Also used with circular sweep as precision range calibrator. Self-contained in metal case 8" x 12½" x 16" deep. For 110 V 50 to 1200 cycles AC. Excellent used, like new, with all tubes including crystals and C. R. Tube.



MOBILE TRANSCEIVER DYNAMOTOR

Model DM 35—Special Buy! Output 625 Volts DC @ 225 Ma. Input 12½ V @ 18.7 Amps, DC. Size 8x4¼x4". BRAND NEW **$13.50**
Excellent Used **$9.25**

Type	Input	Output	Excellent Used	BRAND NEW
DA-19-A	28V 11A	400V .400A	$4.99	$6.95
DM-28	28V	224V .07A	2.95	4.95
DM-32A	28V 1.1A	250V .05A	2.95	5.95
DM-33A	28V 5A	575V .16A		
	28V 7A	540V .25A	1.95	3.95
DM-34D	12V 2A	220V .080A	4.25	5.50
DM-37	25.5V 9.2A	625V .225A	5.95	8.95
DM-40	14V 3.4A	172V .138A	1.75	3.45
DM-53A	28V 1.4A	220V .080A	3.95	5.95
DM-64A	12V 5.1A	275V .150A		7.95
PE-73C	28V 20A	1000V .350A	8.50	11.50
PE-86	28V 1.25A	250V .050A	2.95	5.24
PE-186	28V 11A	400V .400A		6.95

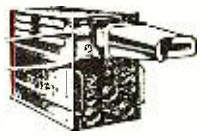
FL-5 FILTER 79c

TELEGRAPH KEY, NEW 95¢

BC-442 ANTENNA RELAY

Wonderful Value! Consists of ¾ amp 2" RF Ammeter (antenna current indicator), 0-10 scale. Transmitter-Receiver Switching relay, in aluminum case with associated components. BRAND NEW **$2.49**

AN/APN-9 LORAN SYSTEM



TERRIFIC BUY! Value $1200 **OUR PRICE $169.50**

Used in ships and aircraft. Determines position by radio signals from known xmitters. Accurate to within 1% of distance. Complete with tubes and crystal. Exc. used.

NEW VALUES—JUST ARRIVED!

AN/APR-4 RECEIVER only. 38 to 4000 Mc in 5 tuning unit ranges. High precision laboratory instrument used to monitor or indicate frequency of any signals within its range. Includes wide and narrow band IF strip selected from panel. Outputs provided for attachments to pulse analyzer, panadapter, etc. Input 115 V 60 cy. BRAND NEW **$69.50**

Tuning Units for above—each $39.50

AN/ARN-5A AIRCRAFT RECEIVER. 11 tube superhet, 3-crystal control UHF for static-free reception. Exc. used with tubes **$24.95**

SCR-625 MINE DETECTOR

Locate buried metal objects up to 24" or more. Detects by means of tone. Operating wt. 15 lbs. Shpg. wt. 40 lbs. New Complete with batteries **$28.50**

SCR-522 2-METER RIG!

Terrific buy! VHF Transmitter-receiver, 100-156 Mc, 4 channels, Xtal-controlled. Amplitude modulated voice. They're going fast! Excellent condition.

SCR-522 Transmitter-Receiver, complete with all 18 tubes, top rack and metal case. **COMBINATION** Special **$33.33**

Receiver only, with all tubes **$19.50**
Transmitter Only, with all tubes **$22.25**
Accessories for above available.

EE-8 FIELD PHONES

Talk as far as 17 miles! Dependable 2-way communication at low cost! Ideal for home, farm, field. Up to six phones can be used on one line. Each phone complete with ringer. Originally cost govt. $65.00 each. Excellent condition. **OUR PRICE, EACH** **$12.95**

DIRECTIONAL ANTENNA, 3-6 Mc.
Collapsible type, folds down to minimum size. **NEW** **$1.49**

BD-71 SWITCHBOARD, NEW $11.95
BD-72 SWITCHBOARD, NEW $16.95

DYNAMIC HANDMIKE, with "Press-to-talk" Switch, cord and plug—BRAND NEW, only **$2.95**

DYNAMIC HANDMIKE, aircraft, made by Telephonics Corp. Press-to-talk switch. BRAND NEW **$4.95**

DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special **$3.95**

BC-605 INTERPHONE AMPLIFIER

Easily converted to AC intercom set—ideal for home, office or factory.
BRAND NEW, with original schematic **$4.95**
AC Conversion Instructions .65

Hi-Fi DYNAMIC HEADSET with Cushions
Freq. Range: 40-14000 CPS. No Distortion. **BRAND NEW** **$7.95**

IMPEDANCE MATCHING Plug-in Transformer, 2000 to 600 ohms. Brand New **97c**

MICROPHONES

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike	$5.45	$8.95
T-30	Carbon Throat Mike	.39	.79
T-45	Army and Navy Lip Mike		1.33
T-24	Carbon Mike		5.95
TS-9	Handset		4.95
RS-38	Navy Type	2.79	4.95

HEADPHONES

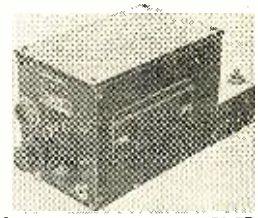
Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	$2.25	$4.95
HS-33	Low Impedance	2.79	4.95
HS-30	Low Imp. (featherwt.)	1.49	2.25
H-16/U	High Imp. (2 units)	3.75	7.95
CD-307A	Cords, with PL55 plug and JK26 Jack		.99

SCHEMATIC DIAGRAMS For any equipment on this page, each **65c**

Please include 25% Deposit with order—Balance C.O.D. 50c Handling Charge on all orders under $5.00. All shipments F.O.B. Our Warehouse, N.Y.C.

G & G Radio Supply Co.
Telephone: CO 7-4605
51 Vesey St., New York 7, N. Y.

234-258 MC RECEIVER



AN/ARR-2, BRAND NEW, tubes included: 7-9001, 3—6AK5, 1—12A6. Schematic included. Complete with 11 tubes, our low price! **$9.99**

With 28 V. 1.6A Dynamotor, complete. **$12.98**

110 VOLT AC POWER SUPPLY KIT for above **$9.75**

BENDIX DIRECTION FINDER

For commercial navigation on boats and planes. Complete installation comprises:
MN-26-C Receiver, used, with 12 tubes **$16.50**
MN-26-C With 12 Tubes, BRAND NEW **$24.95**
MN-20-E Rotatable Loop **4.25**
MN-52 Azimuth Control Box **2.95**
All necessary accessories for above in stock.

ARB NAVY RECEIVER-TRANSMITTER
Receiver 4 band 195-9050 Kc. Transmitter 3000-9050 Kc and 2300-4200 Kc. 28 V Dynamotor. ALL BRAND NEW, complete **$88.50**

NAVY RECEIVER TYPE ARB

Four Band. 195 to 9050 kc. Low Freq., Ship, Broadcast—40 to 80 meters. Includes tubes and dynamotor, for 24 volt operation. Easily converted for 110 V., 12 V, or 6 V. Schematic Included. Excellent Condition. Overall: 8¼" x 7¼" x 15¼". Wt. 30 lbs.

COMPLETE WITH ALL TUBES, Special **$21.50**

BC1206-C BEACON RECEIVER

195 to 420 Kc. made by Setchel-Carlson. Works on 24-28 volts DC. 135 Kc. IF. Complete with 5 tubes. Size 4" x 4" x 6". Wt. 4 lbs. **$8.88**
BRAND NEW
Brand New, less tubes **$5.95**
USED, with tubes **5.95** USED, less tubes **2.95**

BC-659 TRANSMITTER & RECEIVER

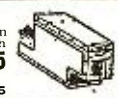
27 to 38.9 Mc F.M. Two preselected channels crystal controlled. 5 to 10 watts. Complete with speaker, tubes. Excellent Used **$11.95**
POWER SUPPLY for above, 117 V 60 Cycles AC. Excellent used **$16.95**
Vibrator Supply for 6-12-24 Volts **9.95**

BC-221 FREQUENCY METER
Special Buy! Complete with operating manual. LIKE NEW only **$99.50**
BC-221 Modulated **$129.50**

BC-221 FREQUENCY METER CASE
Aluminum Case for BC-221 or TS-164 Freq. Meters. Shock Mounted. BRAND NEW (add 50c for packing) **$3.99**
Original 1000 Kc Crystal for BC-221. BRAND NEW **$8.45**

LM FREQUENCY METER
Crystal calibrated modulated. Heterodyne. 125 Kc to 20,000 Kc. With Calibration book. **$49.50**
Exec. Cond. Less Calibration Book **$29.50**

ARC-5/R28 RECEIVER



2-meter Superhet, 100 to 156 Mc in 4 crystal channels. Complete with 10 Tubes **$22.45**
BRAND NEW
110 V AC Power Supply Kit for above **$9.75**

ARC-5/T-23 TRANSMITTER
100-150 Mc Includes 2—832A, 2—1625 Tubes. BRAND NEW **$19.95**
SPECIAL OFFER! Limited quantity ARC-5/T23 xmitters. BRAND NEW, less tubes **$7.95** Excellent Used, less tubes **$5.95**

ARC-5 MARINE RECEIVER-TRANSMITTER
Navy Type Comm. Receiver 1.5 to 3 Mc BRAND NEW with 6 tubes **$16.95**
Navy Type Comm. Transmitter 2.1-3 Mc BRAND NEW with 4 tubes and Xtal **$12.45**
MODULATOR for above, new, with tubes **$4.95**

BC-603 FM RECEIVER. 10-channel push button tuning or continuous tuning, 20-28 Mc. Complete with speaker, tubes, squelch, 12-V Power Supply. Exc. **$14.95**
BC-683 same as above except 27 to 38.9 Mc. **$24.95**

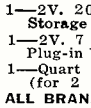
BRAND NEW SPECIAL PURPOSE TUBES

In Original Individual Packing

Type	Each	Type	Each	Type	Each
2C42	$4.95	304TL	8.95	837	1.15
2C46	3.50	CRP-730A	3.45	1625	.26
5D21	4.50	813	6.95	1626	.16
RK-34	.39	815	2.99	2X2	.39
RK65	7.25	826	.44	6A7	.35
2J724B	.35	829B	7.50	6AG5	.33
VR105	.79	832A	5.95	6J6	.33
VR150	.79				

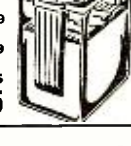
NEW! Cathode Ray Tubes NEW!

3CP1	$1.18	5BP4	$2.22
3FP7	1.18	5CP1	2.45
5BP1	2.22	5FP7	1.44
		9LP7	1.88



WILLARD 6-VOLT MIDGET STORAGE BATTERY
3 Amp. Hour. **BRAND NEW.** 3⅝" x 1-13/16" x 2⅜". Uses Standard Electrolyte Only **$2.69**

2 VOLT BATTERY "PACKAGE"
1—2V. 20 Amp. Hr. Willard Storage Battery **$2.79**
1—2V. 7 prong Synchronous Plug-in Vibrator **1.49**
1—Quart Bottle Electrolyte (for 2 cells) **1.45**
ALL BRAND NEW! Combination Price **$5.45**



Transistor Code Oscillator

(*Continued from page 47*)

C_2, C_3, and C_4 are used to change the resonant frequency of oscillator. Several capacitors of different values were tried in order to obtain the best possible range of tones. An interesting note is that the volume control R_4 is essentially a tone control. An increase or decrease in collector voltage changes the frequency of oscillation. As shown in Fig. 1, one position of S_2 was left vacant so that the natural frequency of oscillator can be utilized. Capacitors in parallel with the primary give a greater variation of tones.

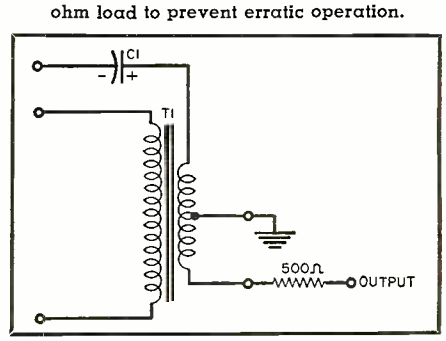
Volume control R_4 was tried in several different positions. It works best in the position shown, since the drain on the battery is low. R_1 and R_2 are base biasing resistors and are not critical. However, R_2 should be at least 10,000 ohms so that the feedback signal is not shorted to ground. The combination of R_1 and R_2 will be an additional drain on the battery. These should be large to reduce the drain. R_1 should be adjusted so that collector current will be between 0.2 and 0.5 ma.

Any value of C_1 will work as long as its reactance is low at the operating frequency. The only critical connection is the wiring of the secondary for feedback. It must be positive for oscillation, so it may be necessary to reverse the leads on the secondary if the oscillator doesn't work at first.

The battery was chosen because of its compact size, although one with higher voltage and of larger size can be used with an increase in the value of R_4. As shown in Fig. 1, the key and headphones are in series across one half of the secondary. In this arrangement, keying does not interfere with normal operation of oscillator, since it does not appreciably change the load on the circuit.

Since this unit is easily constructed from ordinary parts, it can be used by anyone desiring an audio oscillator. It will work well in any situation where an audio signal is needed. It should have at least a 500-ohm load to work into to prevent erratic operation. See Fig. 2. Where the load circuit is lower than 500 ohms, a suitable resistor of about this value should be inserted in series with the output. —30—

Fig. 2. The code oscillator described here should work into at least a 500-ohm load to prevent erratic operation.



TV CIRCUITS PUZZLE

By JOHN A. COMSTOCK

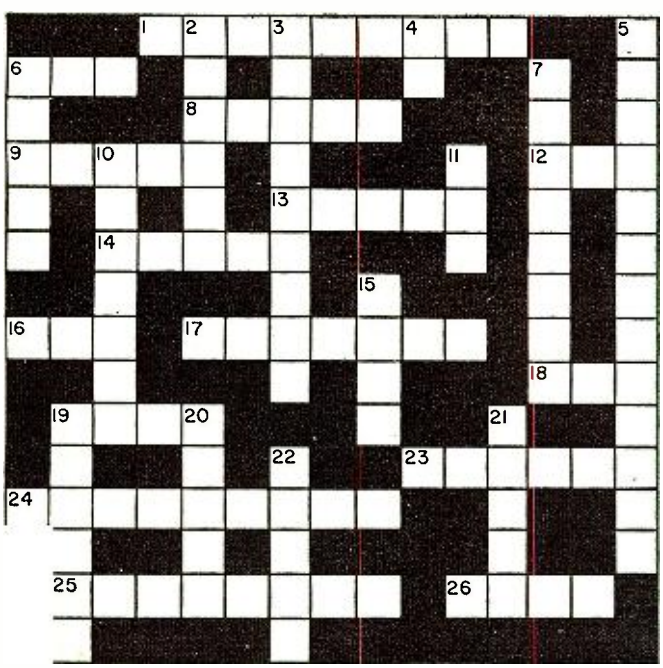
(*Solution on page* 161)

ACROSS

1. The purpose of the video ——— is to increase the amplitude of the video signal frequencies.
6. A type of TV antenna in which the various elements are in a vertical plane and spread out fanwise from a lower junction.
8. The first series of circuits that receives the incoming signal immediately after the antenna.
9. In a color TV receiver, it is the function of the subcarrier oscillator to generate the ——— subcarrier frequency.
12. A regulator type of circuit that maintains the output of a TV receiver constant irrespective of a fluctuating input signal.
13. The ——— amplifier in a TV receiver enlarges amplitudes of sound frequencies.
14. In this circuit, the incoming signal is combined with a local oscillator signal to produce an i.f. signal.
16. The matrix amplifier in a color TV set is a combination of voltage divider ———works and amplifier stages.
17. The function of the TV ——— is to snare minute voltages and currents from passing radio waves and transfer them to the lead-in.
18. The inner structure in the neck of a CRT.
19. An ion —— is often placed around the neck of a picture tube to deflect ion particles.
23. When the image on a TV set is compressed or folded over at the top or bottom, this usually indicates the vertical ——— control needs adjusting.
24. The function of the vertical ——— control is to adjust symmetry of image in vertical plane.
25. A crystal diode often serves as video ——— in many TV sets.
26. The deflection ——— in a TV set deflects the electron beam in the CRT.

DOWN

2. The ——— amplifier in a color TV set amplifies and reproduces the three primary color voltages from the incoming signals.
3. The horizontal ——— control is used to adjust the symmetry of the image in the horizontal plane.
4. The — amplifier in an intercarrier TV set amplifies both picture and sound signals. (Abbr.)
5. The FM sound detector of a TV set.
6. When the image on the screen of a set lacks sharpness and the scanning lines are coarse, the ——— control is adjusted to pinpoint the electron scanning beam.
7. The horizontal —— generator in a TV circuit operates at a frequency of 15,750 cps.
10. Circuit in audio section used to prevent amplitude variations.
11. A ——— is used in many of the circuits of a TV set as a control to vary voltage. (Abbr.)
15. A weak tube in the picture portion of a set will often cause the image to appear to be covered with ———.
19. A three-element tube often used as r.f. amplifier in the tuner of TV sets.
20. In a color TV set, the subcarrier signal is passed through a ——— shifting network before entering the "Q" demodulator.
21. Pertaining to the picture.
22. A control that is used to adjust image width.



Sound on Tape

By BERT WHYTE

IT WASN'T generally noted around the San Francisco or Los Angeles Audio Shows, but *RCA* dropped a bombshell in the pre-recorded tape business, and when the first shockwave really hits, there is gonna be some people who will really flip! Without much fanfare, but through a series of conferences with many of the tape machine manufacturers, *RCA* exhibited a unique machine which will revolutionize the stereo tape field. This unit will, in time to come, probably be recognized as the tool which opened the door to low-cost mass stereo tape sales.

Now get this friends . . . the *Victor* unit was a specially designed machine which will accept a magazine-type tape cartridge. This cartridge is to contain about an hour's music and it will be played at a tape speed of *3¾ inches per second.* The tape passes over a special *4-channel* head which reproduces stereo from the *two top heads* and then without interruption at the end of the forward run, starts to play stereo from the *two lower heads* as the tape is neatly and *automatically being rewound* in the cartridge! Now hold on Jack, this isn't all . . . by means of a new type of extremely tiny gap in the magnetic heads, plus some equalization tricks the once-lowly 3¾ inch per second tape speed achieves a *response to 15,000 cycles!* And last, but hardly least . . . because of the slower tape speed and the "half-track stereo head" feature, *an hour* of stereo tape music is expected to cost no more than *$6.95 to $7.95!*

Among other ideas envisioned in the not too distant future would be "tape changers" in which a number of tape cartridges could be stacked like disc records and changed automatically. As of now there are no machines available, but the *Victor* folks are said to be tooling for production within the next year. *Shure Bros.* in Chicago have announced they will produce the four-channel head and *Ampex* is supposed to be working on a compatible design. Now there's that word again! Compatible in this case means the machine manufactured would have the ability to play today's normal reel-type tapes, as well as the new magazine variety. *Shure Bros.* in a press release takes this stand for compatibility as well, urging that before any further development is undertaken on the cartridge machines that standards be set up which would protect the investment people now have in conventional machines and tapes.

As you can imagine, this idea has caused a furor in recording circles. All the idle speculation of what the stereo disc would do to the tape market is forgotten in the realization that now stereo disc and tape can both be mass media. Co-existence is more than ever assured and it is generally felt that it now will be a long time before either media makes obsolete the other.

I hardly need add, that this cartridge development coupled with the stereo disc, will set off a great new hi-fi boom, and obviously if you've been planning to buy new equipment or expand your old system, it would be most unwise not to "go stereo." And I don't think you need concern yourself about equipment obsolescence. Cool heads prevailed in the industry with the stereo disc, and you can be certain that when the tape cartridge comes, it will be compatible with your present equipment. I'll try to keep you posted on any new developments in this most intriguing new field.

WEBER

INVITATION TO THE DANCE
Bamberg Symphony conducted by Heinrich Hollreiser. Phonotapes Cameo SC409. Price $4.98. (11 minutes)

This is quite well done and with the popularity of the music should have a brisk sale. Hollreiser conducts with a light hand on the orchestral reins and lets the music speak for itself. His men seem to enjoy their work for their playing is vigorous and spirited. Soundwise this is big, close-up recording, very sharp and bright, perhaps even a shade too bright for some speaker systems. Directionality was very good as was depth positioning. Tape noise is the only bothersome flaw.

VOICE OF THE SEA
Cook Stereo Recording 5011. Price $11.95.

This is, of course, taken from the original stereo tape from which *Cook* derived his now famous record of "The Voice of the Sea." This is among the first batch of *Cook* stereo tapes and I am afraid he was rushing to get them on the market. For although *Cook* has an altogether admirable sleeve-type tape box, there is an alarming lack of

any information, either on or in the box or on the tape reel. No doubt he will rectify this shortly.

Meanwhile we can enjoy anew, and greatly enhanced by stereo, the stentorian blasts of the Queen Mary's whistle, the highly directional coded whistle signals of the tugboats, the ear-splitting whine of the Navy cruiser turbines, the cone-bustin' blat of the Passamaquoddy fog horn, the atmospheric clang of buoy bells, and the shrill cries of the seagulls. The second half is devoted to the surf sounds and while their thunder and hissing surge is more impressive in the lack of distortion afforded by the stereo, directionality here is meaningless.

Having worked aplenty with binaural *Magnecorders,* with which Emory made most of his stereo tapes, I know the signal-to-noise problem those early magnetic heads imposed. There is tape hiss here, yes, but remarkably less than one would have imagined.

THE KING OF ORGANS

Bill Floyd at the Wurlitzer in the N. Y. Paramount. Cook 1150st. Price $11.95.

This is the other side of the *Cook* stereo coin. This is his very latest stereo recording, made a few months ago with modern equipment in New York's famous Paramount Theatre. The organ at the Paramount is a real monster, requiring two 50 hp turbines to furnish the necessary 16,000 cubic feet of air per minute. It is noted for its huge augmented percussion battery.

Bill Floyd is the latest in a long line of distinguished organists who have presided over the instrument and he seems thoroughly at home with his massive friend. Floyd gives us some tasteful, tuneful arrangements of such numbers as "Anything Goes," "Swing Low Sweet Chariot," "I Married An Angel," "Body and Soul," "Fascinatin' Rhythm," and many others. Indeed, this is one of the most value packed tapes yet issued, there being so much tape on the reel that it threatens to spill over the edges and must be retained by a rubber band or adhesive of some sort.

This gargantuan organ makes an almighty sound, but the recording is less close up than we have come to expect from *Cook.* It is therefore somewhat lacking in brilliance. However owners of big speakers and lovers of the throbbing pedal, can hear some fabulous rumbles, way down in the subbasement around 25-40 cycles. Directionality is very good for an organ and tape hiss was minimal.

THE GLENN MILLER SOUND IN STEREO

Members of the Original Glenn Miller Orchestra conducted by Maxwell Davis. Omegatape ST7026. Price $10.95.

This is as close as you are ever likely to hear what the Glenn Miller Orchestra sounds like in stereo . . . at least on this side of Valhalla. *Omegatape* rounded up as many of the old Miller gang as they could and

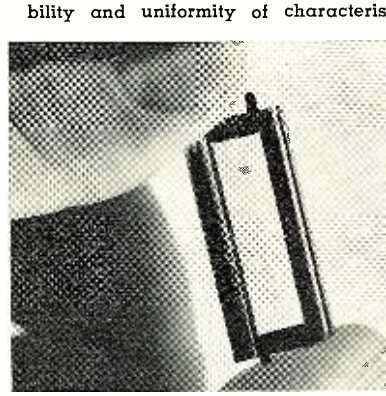
then recorded them sticking as closely as possible to the original orchestration. As is befitting, the tape opens with the "Sunrise Serenade," and then continues with staples of the Miller repertoire such as the "Song of the Volga Boatman," "Moonlight Cocktail," "Anvil Chorus," "Chattanooga Choo-Choo," and others.

Unfortunately, with all the blandishments of stereo available, the engineers who recorded this largely negated this with one of the most dry, circumscribed sounds you can imagine. The miking was ultra-close and everything sounds clean enough, but there is strictly no "air" around the orchestra, no roundness, and absolutely no sense of depth. For those who like this sort of dry and close up recording I can report you will hear some great brass sounds and heavy percussion, especially that of the beat drum. If the powers that be at *Omegatape* want to increase the sale of this tape, I suggest a judicious application of the echo chamber.

PORTS OF PLEASURE
Les Baxter and his Chorus and Orchestra. Capitol ZC20. Price $12.95.

This stereo tape is just the opposite of the tape previously reviewed. Here is modern, big band, exotica at its stunning best. Here you have sharp, crisp, clean, close recording, but all is enrobed in spacious acoustics which affords a terrific sense of "liveness." Les Baxter has whipped up a batch of originals, highly programmatic and evocative as you can appreciate from titles such as "Tahiti—A Summer Night at Sea," "Shanghai Rickshaw," "The Pearls of Ceylon," "Harem Silks from Bombay," and others in the same vein. There is fine direction here and a good sense of depth too, along with adequate center channel "fill." The numbers may smack of Hollywood, but they make for pleasant listening and with the very large percussion battery which is used, the hi-fi man will have a ball. —30—

Here is a new construction technique being used by Sylvania in their 6FH6 beam pentode (TV horizontal amplifier). The construction uses a unique type of grid, called the "Framelok" grid, in which the grid wires are drawn taut and are individually locked in place in "ladder" sequence on a one-piece window-like frame made of flat metal. The arrangement provides better grid alignment, improves stability and uniformity of characteristics.



Microphones for Recorders

(Continued from page 46)

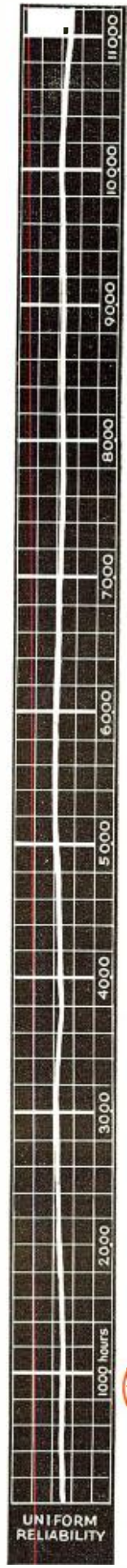
duces a response the recorder will not record unless, of course, you are prepared to spend a lot more money and go out and buy a professional tape recorder. While expense of this kind will produce professional quality results, most home users will consider it hardly worthwhile, because results obtained with much less expensive equipment can be quite good. The condenser microphone is basically a high-impedance device that requires a special matching preamplifier that delivers the polarizing voltage needed for operation.

Ribbon Microphones

The ribbon type microphone uses a piece of foil between a magnet gap instead of a complete circular coil as in the moving coil. As such, it is basically a very low-impedance device having a low output sensitivity. The simple ribbon microphone has what is known as a bidirectional characteristic. It picks up back and front, but not on the sides (Fig. 4). The older ribbon microphones had a rather poor frequency response and, in addition, they were not very sensitive. But modern improved designs in ribbon microphones may have a sensitivity comparable to a good dynamic microphone along with a very smooth frequency response. Early ribbon microphones were quite fragile and required care in handling. In later types this problem has been largely overcome, although it is still not recommended that a ribbon be used outdoors without some sort of suitable wind protection.

The ribbon microphone requires a little more care in use, because one has to make sure that the sounds to be picked up are either in back or in front of the microphone, or they can be both. For example, a ribbon microphone can easily be used for picking up dialogue. Two people talking one to the other can stand a reasonable distance, as much as four feet or so, apart and have the microphone between them. Provided you know what you are doing, this can be a more comfortable arrangement than using a unidirectional or cardioid microphone, where the two people speaking have to be much closer to one another, or else each has to step up to the microphone when he says something.

For musical work, too, the ribbon can be useful although it is usually on the expensive side. Arranging a few of the instrumentalists on each side (or rather back and front) of the microphone and keeping people away from the blank sides will accommodate more people in a group than some other methods. If you have a wind instrument, such as a cornet, that makes much more sound than the other instruments, a ribbon can be useful in toning this down, by having the cornet player almost on the "edge" position of



the microphone. There are also some cardioid and other directional pattern microphones using a ribbon-type transducer, but their sensitivity is below that of "straight" ribbons.

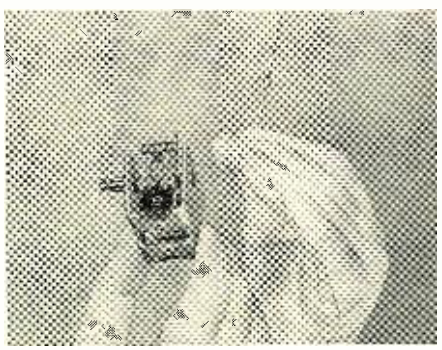
There was a time when a microphone had to be big to be good—one might say, any good. But to achieve smooth response, particularly at the high frequencies, a microphone needs to be *small*. This is why the smaller modern dynamics and ribbons are usually so superior. But for the home recorder they are also less sensitive, so if you seek quality this good, you will probably need a preamplifier. Your problem is one of evaluating your needs to see if the expense is justified.

Most professional microphones come with an adapter for fitting to any particular type of stand that may be needed at the moment and also with a vibration shock mount that prevents the microphone from picking up vibration due to people walking across the floor and that kind of thing. This usually adds $50 or so to the price of the microphone and is really something that the home user can do without. Simple precautions, such as standing the microphone on a foam rubber pillow, will serve the same purpose equally well and it is much less expensive.

With the wide range of microphones now available from a variety of manufacturers, there is no reason why anyone with a home recorder cannot have a lot of fun and expand the usefulness of his recorder, selecting a suitable microphone for the purpose at reasonably low cost. As an aid to the reader in summarizing some of the important characteristics of the microphones discussed, Table 1 is included. This table gives a number of important comparative characteristics of the various microphone types.

The foregoing suggestions, along with a little practice to get the "feel" of how things are done, will soon have you getting real fun and greater use and versatility from your present tape recorder. —30—

A tiny new electronic component that may replace the ordinary tuning capacitor in some applications has been announced by Pacific Semiconductors. The new component, shown here with an ordinary capacitor, is the Varicap, a member of the semiconductor family. The useful property of the Varicap is that its capacitance can be varied by changing an applied bias voltage. Hence it can be used in place of reactance tube circuits for FM transmitters and receivers.



Testing FM Tuners

(*Continued from page 52*)

Warm-up drift is usually corrected, in some measure, by the addition of temperature compensating capacitors and in some FM tuners an automatic frequency control system is used. In that case these tests should be performed first with the system operating and then without any a.f.c. correction. The difference between results will give an idea of the efficiency of this circuit.

To check oscillator drift accurately another oscillator of the same frequency range is required. It should be a unit that is crystal controlled. The two oscillator signals are connected to a crystal diode as shown in Fig. 5 and their output is then the "difference frequency." If both oscillators are at the same frequency, zero beating is possible. As the FM tuner warms up the beat signals will increase in frequency. To measure the beat frequency connect the detected signal to the vertical terminals of the oscilloscope and drive the horizontal scope sweep from a calibrated audio generator going up to at least 200 kc. One minute after the FM tuner is turned on, adjust its local oscillator to zero beat, indicated by no vertical deflection at the scope. As the local oscillator varies in frequency the scope will show sine-wave signals indicating the amount of frequency drift. Now the audio generator is adjusted to produce a single circle on the scope and the actual drift frequency is directly readable at the audio generator. Repeat measurements are taken every minute as the FM tuner warms up. After the first 10 minutes, readings are taken every 10 minutes for the first hour.

Oscillator drift due to voltage variation is measured in the same manner except that a *Variac* is used to change the line voltage. Usually the voltage is varied from 100 to 130 volts and the frequency drift is observed immediately after the voltage change. This frequency drift is expressed as the number of cycles of drift per 1% of line voltage change. Where an a.f.c. system is used, the drift due to changes in signal input level can be checked in the same manner. It is necessary to wait until the local oscillator has warmed up and then the signal generator, with standard modulation, is connected and the input level is varied in steps from 11 to 11,000 microvolts. The observed frequency drift is an indication of the interaction between a.f.c. and a.v.c. circuits.

A number of other tests can be made on FM tuners but since they are either quite complex to perform or else do not yield any data of interest to the user they are omitted here. It is safe to say that any tuner which has successfully passed the tests described will be a really good piece of equipment and will give very satisfactory FM reception. —30—

Mac's Service Shop

(*Continued from page* 64)

hatpin drawn through some of the coils and capacitors?"

"It indicates the coil or capacitor is variable. Notice, too, a single, short, heavy horizontal line means 'ground.'"

"How about these things that look like dominoes standing side by side?"

"You mean on that tube-layout pictorial? That is the connection panel for the push-button switches. Notice the letters of the alphabet are spaced across the top of the vertical rows of dots and a number is alongside each horizontal row. Each connection is thus indicated by a letter-number combination, and they are so indicated on the diagram. For example, see how this slider connects 'C_5' to either 'C_4' or 'C_6.' That makes tracing a circuit through the switches very easy."

"Are those standard American tubes?"

"No, but a slip of paper attached to the diagram says they can be replaced with American types. It says an American 1AJ4 will replace a European DF96; a 1AN5 replaces a DF97; a 1AH6 replaces a DAF96; a 3C4 replaces a DL96; and a 1AB6 replaces a DK96."

"Well, what are you going to do about the motorboating?"

"Easy, Sorrel-Top, easy! I think I'm getting a clue. See how the volume control and both tone controls are tied in more or less with the negative feedback loop from the voice coil to the bottom end of the volume control? Remember each of these controls affected the motorboating. Now if something were happening to shift the phase of the feedback, we could easily get just what we're getting."

"Maybe someone connected the feedback wire to the wrong side of the voice coil," Barney suggested.

"No; the set was working perfectly when packed for shipment home, and no one has touched it since it arrived. If we can find the cluster of resistors and capacitors used in the feedback circuit network, we may find something wrong there. Hm-m-m-m, this bunch has the right values."

As he talked, Mac was gently moving the resistors and capacitors in a group mounted on the output transformer. Suddenly the motorboating ceased and the radio played loudly and clearly.

"That was real tough," Mac said with a sheepish grin. "Two of the resistors were rubbing together and shorting out."

"OK, but let me say here and now you are welcome to all the foreign sets that come in. I've enough trouble when I have good service literature I can understand. Having to puzzle out the diagram or circuit as well as the symptoms is too, too much."

"You've got a point there. Something such as this makes us appreciate how good our service literature is. We

are going to have to charge more for working on foreign sets than we do for domestic receiver service where both our experience and our service literature help so much."

"Yeah, and I see a lot of those parts are of a special sort that would have to be obtained directly from the manufacturer. That's another headache that we have to face."

"Before a foreign manufacturer can expect to do a large business over here, he is going to have to make it easy to obtain special parts and see to it that the service technician has adequate service data. Maybe he could arrange to have his sets covered by the major service data publishers. We won't turn down any foreign set service, but I don't think it would be wise to solicit this kind of service. We seem to be getting plenty as it is. Within the last week we have had two German receivers, a Japanese receiver, and a Dutch tape recorder in here."

"One last question," Barney said as he wiggled his way into his shop coat. "What were you doing with the dictionary?"

"Trying to puzzle out the abbreviations on these trimmers. See, they are marked 'TOL, TVL, TVK, TVM, TOK, and TOM.' From what I can pick up in this German-English dictionary, I think 'TOL, TOM, and TOK' indicate the oscillator trimmers for the long-, medium-, and short-wave bands respectively. 'TVL, TVM, and TVK' must be the r.f. trimmers for the same bands."

"Ach! German abbreviations yet!" Barney muttered. —30—

Glowing electroluminescent panels—man's newest source of light—glow with letters and figures in a new display system developed by scientists at the Westinghouse Research Laboratories. Bright enough for use in broad daylight and no thicker than a sheet of ordinary glass, the display shows only the exact information desired, without the need for dial watching or estimated readings. The new display is expected to find eventual use in such places as military aircraft, in certain industrial processes, and in the automobile of the future.

A Day in the Shop

(*Continued from page* 61)

the flyback which throws the 6AL5 into heavy conduction and produces a high voltage. Of course, in this case, pulling the 6AL5 restores the raster. If ever you see this fault in the house, *always* pull the 6AL5 before going farther."

A matched pair of .001-μfd. capacitors has been wired in while the bench man is talking and on comes the raster. But, after a couple of minutes, off goes the *picture* leaving just a blank white raster. The bench man waggles the contrast control, sees jumping lines on the raster and observes, "The video amp is all right anyway." He explains that, if the video-amplifier tube were open, the raster would stay quite steady when the contrast control was rotated—"when you fiddle the control you vary the current through the tube and the control is always dirty enough to disturb the raster if you waggle it violently."

Next he lifts the first i.f. tube in and out of its socket, observes that there is no flicker at all on the raster and says, "Change the 6CB6's one at a time while I clean up the bench for a clear start after lunch." A few minutes later Jack triumphantly announces, "It's the first i.f. tube," but immediately afterwards comes a disappointed correction: "Whoops, there goes the picture again." After trying the second i.f. tube—this time waiting awhile before committing himself—he says with relief, "This time I have it." Checking the tube in the tester, he finds it is gassy but only after it has been on for a few minutes.

The bench man then plugs the tube back and shows how it can be tested for gas in the set. "See how the voltage is slightly more positive at the grid end of the grid resistor than it is at the bias-line end? That indicates gas in the tube. Notice that, on a strong signal, there is enough a.g.c. voltage to buck the gas-derived positive voltage and keep the set operating with a slightly washed out picture. That explains why the customer didn't complain about picture trouble as well as complete disappearance of the raster. He probably receives only the very strong local channel."

Raster Present but Dim

After lunch, the fourth set is ready for service, with a note on the job sheet "Insufficient brightness—high-voltage seems normal." "Probably the .03 on the picture tube (Fig. 3A) has gone down," says the bench man; and a quick check underneath confirms the guess, a charred resistor telling the tale. The .03-μfd. capacitor, which filters pin 10 of the picture tube, shorts, burning up the 100,000-ohm resistor. The manufacturer recommends that, in replacing this capaci-

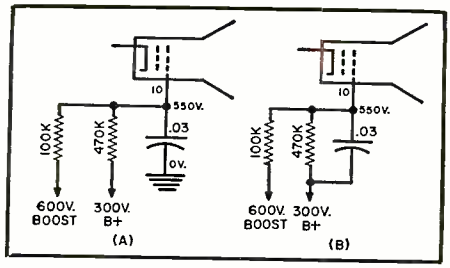


Fig. 3. Voltage across the .03-μfd. unit in (A) caused frequent breakdown. Rewiring as in (B) relieved the stress.

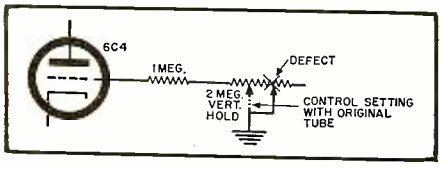
tor, the new one should be wired in with the negative end connected to the 300-volt "B+" line instead of to ground, thus putting only 250 volts across the component instead of 550.

After replacing the capacitor in this way (and the resistor as well), it is noticed that we can only just fill the raster vertically. "Looks like insufficient drive from the oscillator," says the bench man. "It's usually the plate-load resistor of the 6C4 in this set." A measurement of the resistor seems to confirm the guess, as the 3.3-megohm resistor measures 4 megohms; but after replacing it, there is not much change in the height. Trying a new 6C4, the picture cannot lock. To be sure the new tube is not defective from birth, the bench man tries another new one, with the same result.

He notices that, as the vertical-hold control is slowly rotated, the picture suddenly reverses direction from a very rapid upward roll to a very rapid downward roll. "I wonder if there is a break in the track of the control, making the circuit go open before we get far enough to lock the picture?" An examination of the control shows this is indeed the case. See Fig. 4. "But why did the *old* tube work all right?" asks Jack. "Because it has characteristics such that it hits the right frequency with less grid-leak resistance, so the slider does not reach the crack by the time the picture has been locked: different tubes need slightly different circuit constants to work at a certain frequency."

One thing that keeps this TV business interesting is the fact that, whether in the shop or in the home, we learn something new almost every day. This one day we have been talking about was a typical one. Perhaps you got as much pleasure out of reading about it as we did from recalling it. As our wives point out only too often, whether we are writing, talking, or listening, they know what the topic is—"shop!" —30—

Fig. 4. When this tube was changed and the hold control was readjusted, a break in the control track that had no effect before then suddenly became important.



Basic Counting Circuits

(*Continued from page 49*)

add more resistance in the grid circuit of all right-hand tubes. This drives the right-hand grids positive and switches each stage to the *zero* condition—left-hand tube cut off and right-hand tube conducting.

If a negative pulse is now applied to the input of the first stage, it will drive this stage to the *one* condition. The neon light of the first stage is now on, indicating that one pulse has been applied to the input. If another input pulse is applied, the first stage will switch back to the *zero* condition, and its neon light goes out. As the first stage returns to the *zero* condition, its right-hand tube conducts and its plate voltage decreases. This feeds a negative pulse into the second stage, switching the latter to the *one* condition. The light in the second stage thus comes on to indicate that *two* pulses are now stored in the circuit.

Table 1 shows the condition of each stage after each input pulse. It also shows that the neon lights which are on at any given time indicate the total number of pulses stored in the circuit. In the table, the flip-flop stages are listed in reverse order (4th, 3rd, 2nd, and 1st) to show that the conditions of these stages represent the binary number stored in the circuit. For example, the conditions are 0011 after the third input pulse, and 0011 is the binary equivalent of the decimal number 3.

As shown at the bottom of Table 1, all four stages are back to their starting conditions after the 16th input pulse. At this time, the right-hand tube of the fourth and final flip-flop stage conducts and provides a negative pulse at the output terminal of the complete chain. The entire circuit therefore produces one output pulse for every 16 input pulses. The output pulse may be fed into a mechanical counter having numbered discs like those used to indicate automobile mileage.

As pulses 17, 18, 19, etc. are applied, the circuit will repeat the switching actions listed in Table 1. The circuit will store the input pulses until 16 more have been accumulated and will then provide another output pulse to the mechanical counter. At any given time, the total number of input pulses is therefore indicated by the counter and the neon lights. The number indicated by the counter should be multiplied by 16, since it receives only one pulse for every 16 applied to the input. To this product should be added the number of pulses still stored in the circuit as indicated by the neon lights.

Applications

The circuit shown in Fig. 4 can be extended to any number of stages. The number of stages required is determined by the rate at which the mechanical counter can operate. Most

commercially available counters will not operate much in excess of about 20 counts per second. The number of flip-flop stages should therefore be sufficient to reduce the frequency of the input pulses to 20 per second, or less, at the output.

Circuits of the type shown in Fig. 2 are commonly used in nuclear instrumentation for counting the pulses produced by geiger and scintillation counters. One such scaling unit is shown in Fig. 1. Such circuits are also used for counting objects passing on an assembly line or conveyor belt. In this application, a phototube provides an input pulse to the flip-flops as each object to be counted passes by.

Similar circuit arrangements are used in automatic packaging machinery. After the desired number of units have been packaged, as indicated by the number of pulses produced by a phototube, an output pulse is produced by the last flip-flop stage. This pulse is used to stop the packaging action or to activate a conveyor which brings the next container into the packaging position. —30—

The Cable Tracer-Checker

(Continued from page 42)

ters lend themselves to such an "automatic" numbering system, it is possible with any voltmeter to determine at once by the voltage reading obtained, the two ends of any one conductor without any reference to others.

If any of the conductors in a cable is open, you simply do not get a reading for that conductor. If any two conductors are shorted together inside the cable, these two will cause the voltmeter to read the same voltage, and the voltage readings for other conductors will be incorrect, with one exception. Thus, if conductors 2 and 3 (Fig. 3B) were shorted, touching conductor 1 with the positive meter lead would give a reading of 1.25 instead of 1; number 2 would read 2.5; number 3 would also read 2.5; number 4 would read 3.75; and number 5 would read 5.

It is not necessary to use an extra wire for conductor 0. Use one of the wires in the cable for this line. To determine which conductor it is at the voltmeter end, connect the positive voltmeter lead to any of the conductors and move the negative lead from one conductor to the other until you get the maximum up-scale deflection. This will occur when the negative lead is connected to conductor 0. You may then proceed to identify the other lines by the rapid procedure described previously.

Switch *S* was not included in the author's cable tracer-checker. The battery is simply removed when the instrument is not going to be used. The switch is a "plus" that eliminates this inconvenience, for those who wish it. —30—

Service Industry News

IN OUR NEXT issue, we will feature the first in the projected series on service associations. The first group whose story will appear is MARTS—Milwaukee Association of Radio and Television Services. This active and successful group was one of the first respondents to our request for contact with associations. If you would like us to bring the story of your own organization to the attention of the industry, simply fill out the coupon on this page and return it to us right away. The questionnaire we send you will enable you to give us the facts without undue difficulty.

The recent annual Midwest Electronic Forum, sponsored by the Television Service Association of Michigan, brought together service-association officials from many states. Representatives from service groups located in Texas, Iowa, Minnesota, Illinois, Indiana, Ohio, and Pennsylvania attended the round-robin meeting that preceded the opening of the forum.

The mechanics of administering the Detroit service licensing law and its effectiveness in removing some of the questionable practices in the service activity in that area, were of top interest to the visiting association leaders. The consensus among the service dealers present was that more than seventy-five per-cent of the established service dealers in the industry are now in favor of licensing for service dealers and technicians in their states.

The opinion expressed by Albert M. Haas of Philadelphia typifies the changed thinking toward formal licensing on the part of many outstandingly successful service dealers. Owner of the *Haas Television Service* of Philadelphia and prominent in Philadelphia service-association activities, Mr. Haas was a highly vocal opponent of licensing in any form. He was one of the leaders in forming the Greater Philadelphia Council of Service Associations which had as its objective the correction of service abuses through industry cooperation.

In discussing the subject, Mr. Haas said, "I am now convinced that licensing is the only way that the basic troubles of the service business can be corrected. Like the dealers in Detroit, we cooperated with our local law enforcement agencies in every possible way to eliminate the crooks and the incompetents from the business. But while we were giving freely of our time to get rid of one fast-dollar boy, two or three more were jumping into the business. Since there are no controls over the qualifications of men who get into this business, policing the service field under present laws is like trying to beat out a forest fire with a fly-swatter.

"I do think," continued Mr. Haas, "that the annual cost for a service dealer's license should be high enough to make his franchise to do business really worthwhile. If a service dealer had to pay one hundred dollars per year for his license, he would hesitate to jeopardize his franchise by engaging in questionable practices. Another thing, he would operate his shop on a business basis and get adequate charges for his labor and service calls. It would be a strong deterrent to the loading of charges for tubes and parts to make up for insufficient charges for labor or home service."

Members of the Television Service Association in Detroit have cooperated whole-heartedly with the license commission to make the ordinance successful. Where experience has shown that certain changes in the regulations were needed, such changes have been made by the commission. Since the ordinance served to eliminate the price advertising of service, it effectively closed that avenue of promotion for feeding suckers into fast-dollar operations.

Service Editor
RADIO & TV NEWS
1 Park Avenue
New York 16, New York

We want to tell you more about our association. Please send us your questionnaire.

Name of Association.....

Mailing Address .....

.....

Name of President or Corresponding Sec'y.....

In refuting claims that service licensing will eliminate the small service shops and part-timers, members of the license commission point to the figures on the number of businesses licensed since the ordinance went into effect. At the time the license measure was passed, it is said there were 492 separate listings under radio and TV service in the classified section of the Detroit telephone directory. At the present time, almost 800 service shops have been licensed to do business in the city of Detroit.

Commission members say that, while some of this increase is due to the licensing of shops in adjoining communities to enable them legally to handle service work in Detroit, by far the greater percentage of the increase represents small shops and part-timers who restrict their servicing activities to their neighborhood areas. It was pointed out by one commission member that most part-timers work from their homes and do not subscribe to the conventional business-type telephone service. The licensing ordinance does not discriminate against such industry members, he said. The only requirement is that they must meet the standards set up by the commission and abide by its rules and regulations.

Plans are under way to change the name of the Detroit association to the Television Service Association of Detroit so the former name, TSA of Michigan, can be used to designate the Michigan State Federation of Service Associations.

California

A study of the fee pricing system adopted by the members of the Radio-TV Association of Santa Clara Valley reflects the trend in the service industry to lift service and labor charges to a level commensurate with the costs of doing business.

Reporting on the new system of pricing, which is based upon fixed fees rather than on parts plus labor, Chet Spink, dynamic editor of the RTA Magazine, pointed out that, where the first suggested price list—issued in July 1956—recommended home service call charges of five dollars, the new schedule figures home service call charges at $6.25. The hourly bench rate on the first schedule was $5.00. Bench time, now described as TV shop fee, is figured at seven dollars per hour on the current schedule.

North Carolina

A lively, new service-association house organ recently made its debut in North Carolina. Titled the "E. T. A. Bulletin," it is published monthly by the members of the Electronic Technicians Association, Inc., P. O. Box 5193, Winston-Salem, N. C.

Reporting on efforts to encourage the formation of more local associations leading to the creation of a

(*Continued on page* 140)

state-wide organization, editor David T. Drage said:

"During the past month Clifton Lynch, Clive Pardew, and myself attended a meeting of the Radio and Television Service Dealers Association of Durham. A number of shop owners from surrounding towns were invited and attended. The main purpose of the meeting was to stir up interest to form associations in the nearby cities. Mr. Charles Womack gave a very interesting talk on planning for profits. He had the cost of doing business for shops in Virginia and North Carolina, which he compared with six shops in Durham.

"To finish the evening, I gave one of my pep talks on service charges and the need for an association. The next regular meeting of the Durham association will be held in Raleigh to help form an association there."

Texas

Members of the San Antonio Radio and Television Association re-elected C. W. Schertz of the *Lone Star TV Center,* to serve as president for the coming year.

Other officers elected at the regular annual meeting included O. O. Brigman. *Brigman Radio & TV,* vice-president; Don Van Der Brugen of *Sight & Sound of San Antonio,* secretary; and Tom Boyd of *Boyd's Radio & TV Service,* as treasurer.

Ralph McCoy of *City-Wide TV Service* and Roland Mueller, *M. & M. TV Service,* were elected directors to serve for the current year.

The 1958 aims of the association include state licensing for service dealers, expanded training programs sponsored by the association, group insurance and accounting, and the spreading of information to the public pertaining to member functions.

The San Antonio association is an affiliate of the state-wide Texas Electronic Association. —30—

ST. LOUIS ELECTRONICS CLUB

THE Electronics Club, organized by electronics manufacturers, manufacturers' salesmen, reps, and distributors in the St. Louis area, has been established in a luxurious suite at the Congress Hotel in St. Louis.

The club facilities consist of three dining areas, a lounge, conference room, butler's pantry, and bar.

Located on the 17th floor of the hotel, the club's membership will be limited to 60 firms. Any member may have use of the two private dining rooms for meetings, dinners, luncheons, etc. as well as use of the Conference Room without charge.

Officers of the Club are Norman W. Kathrinus, president; Herb Knaggs, vice-president; Tom Brown, secretary; and Mike Ebinger, treasurer. —30—

UNIQUE HI-FI CONTEST

THORENS Company, New Hyde Park, N. Y. has come up with a unique hi-fi contest whose pay-off covers a period of ten years.

Contestants are asked to name their favorite hi-fi salesman and tell why in 50 words or less.

The first year's prize is a Thorens TD-124 precision transcription turntable plus, for nine more years, one new Thorens high-fidelity component every year.

The "favorite salesman" will get $50.00 in cash and his boss will receive a like amount.

Judges of the contest will be a panel of editors of leading hi-fi publications. The winner of the contest will be announced in June.

Official rules and entry blanks are obtainable at hi-fi component dealers or from the company's current advertisements. —30—

A method used to transmit two TV programs on a single channel is being demonstrated here by means of the Blonder-Tongue Bi-Tran system. The method was proposed to the FCC some months ago (see December, 1957 issue). The system would enable each TV channel to transmit "A" and "B" programs. The "A" signal would consist of standard commercial programs as now provided and viewed on any TV set. The "B" signal would be assigned to those who seek to use existing television facilities and time. The "B" picture could be received privately, but only if the TV set were equipped for optional viewing by means of the small adapter shown on table with TV set at left.

Electronic "Accordion"

(*Continued from page 55*)

able resistor in place of one of the fixed resistors (such as R_1), closing the corresponding "key" (S_1) and comparing the signal produced with that obtained from a standard tuning fork or by sounding the desired note on a piano or other musical instrument. The adjustable resistor's value is then changed until the electronic "accordion" produces the desired note. The resistor's value is determined and a fixed resistor of the same value is installed.

A standard decade box or a calibrated potentiometer may be used when making these tests to determine the exact resistor values needed. A friend with a musically trained ear is a great aid when comparing the notes produced by the electronic "accordion" to the standard notes obtained from a conventional instrument.

In general, the resistors needed will have an "odd" value, that is, their values will fall between standard EIA (RETMA) values. The *exact* value needed is obtained by using either parallel or series combinations of resistors. For example, a 27-ohm resistor shunted by a 160-ohm resistor gives slightly over 23 ohms. Thus, each of the resistors shown in the schematic diagram (R_1 to R_{12}) in the base bias circuit will usually consist of two (or more) individual resistors.

The values of capacitors C_1 to C_3 are determined in a similar manner. Typical values will fall between 0.1 and 2.0 μfd. In general, each capacitor value will be chosen to modify the note produced as a given "key" is depressed so as to sound "sharps" and "flats" instead of sounding a completely new note. Some builders may prefer to use arbitrary values for the capacitors, using these components simply for specialized sound effects rather than for playing tunes.

Operation and Use

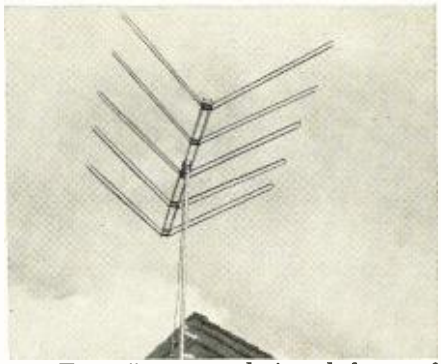
After the wiring is completed and checked and proper resistor and capacitor values have been selected and installed, a back cover can be added and the instrument is "ready for use."

The electronic "accordion" is held between the two hands, much like a conventional accordion. The fingers of the right hand are used to sound individual notes (by depressing the appropriate "key" switch), while the fingers of the left hand are used for switching the instrument's volume (by opening or closing S_{16} and S_{17}) or for introducing special sound effects by depressing the capacitor push-button switches (S_{13} to S_{15}). The power switch (S_{18}) is left closed all the time the instrument is being used. It is not necessary to switch the instrument "off" between musical selections, for example, since the steady current drain when no note is being sounded is very small.

—30—

"TNT TORQUE TV TENNA"

Snyder Mfg. Co. is now in mass production on its new "TNT Torque



TV Tenna" a unit designed for roof installation and providing ultra-fringe reception without bulk.

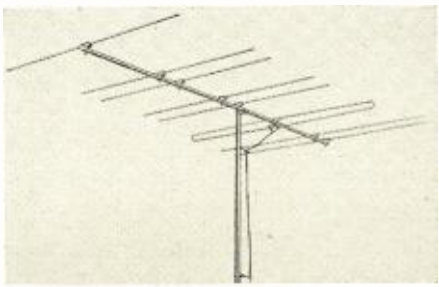
The antenna is made with all-live aluminum elements and is minus the complications of phasing bars and extra harness. The design features the company's patented "Torque" system which furnishes a half wave-length span acting as a full wave-length and with full-wave reception.

The antenna is available in three models with three, five, and seven elements. The three-element unit is for metropolitan area reception, the five is for fringe areas, while the seven-element model will handle ultra-fringe reception.

For full details on this pre-assembled unit, write the manufacturer direct at Philadelphia.

TWO FM ANTENNAS

Winegard Company of Burlington, Ia. has recently introduced two gold



anodized FM antennas which have been especially engineered to provide maximum pickup for hi-fi tuners.

The Model FM3A consists of the antenna, mast, universal roof mount, fasteners, lead-in wire and set clip. It is non-directional and comes pre-assembled. It can be used in urban, suburban, and near fringe locations.

The second unit, the Model FMY8, is a high-gain, 8-element yagi. It has flat frequency response across the entire FM band, with 10.2 db gain. It has been designed for fringe areas and long distance reception.

Write the manufacturer direct for full details and prices.

MICROWAVE ATTENUATORS

Antenna & Radome Research Associates, One Bond St., Westbury, N. Y. is now in production on a new series of microwave attenuators which feature a 3:1 bandwidth and high continuously variable attenuation with minimum insertion loss and low v.s.w.r.

The new *ARRA* units are five inches in diameter and cover the bands of .8 to 2.5 kilomegacycles and 2 to 6 kilomegacycles. The minimum insertion loss is .2 db and full insertion loss is at least 30 db over the full band.

These attenuators are applicable in all systems where variable radio-frequency attenuation is required. In ad-

dition, high resetability and accurate calibration make them suitable as laboratory instruments wherever accurate calibrated r.f. attenuators are required. For further details, write the manufacturer direct.

RMS "WAVEBOOSTER" ANTENNAS

Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 62, N. Y. has recently introduced the "Wavebooster" Series 1000 antenna line to the trade.

The new antennas utilize maximum weather-resistant construction and low silhouette design to reduce wind drag and stress. The folded dipole elements are double locked in high impact styrene plastic insulators to prevent element breakage resulting from the stress of icing and severe wind.

The company's "Quadro-Grip" U-bolt assembly grips the antenna cross-arm to the mast four times, preventing turning and slipping of the antenna on the mast. The new series is currently available in six models. Write the manufacturer direct for full details. —30—

Service Business Budgets

(*Continued from page 56*)

dollars income from the sale of time and labor. It had $2000 income from the sale of tubes, parts, and the like. However, at least 60% of this $2000 must be paid out to suppliers for the materials sold. In other words, out of that two thousand dollars, $1200 must be paid to suppliers, leaving a gross profit of $800 for use in the business.

"This gives us an operating income of $1000 from the sale of labor and $800 from the sale of parts—a total of $1800. Our operating costs are $1500. This leaves an average gross profit, theoretically, of $300 per month to use for ourselves or to expand the business.

"On an average in relation to the gross income of our businesses, we have six normal, three abnormal and three subnormal months. We are inclined to overspend during the abnormal months and fail to set aside the reserves we will need to tide us over the subnormal months. When your fixed operating expenses are fifteen hundred a month and your gross income is only twelve hundred, you are hard-pressed for money to pay your everyday bills. You don't have any money to pay on old accounts.

"That is why I feel that a business operating budget based on a realistically estimated annual volume is a must for every service dealer."

In the course of this discussion, another dealer pointed out that many shop owners commit themselves for telephone directory listing expenses that are completely out of line with the volume of business they are doing.

"Constant promotion is a *must* in the TV service business," he said. "A dealer must budget about five per-cent of his gross income from his service activities to maintain a normal volume of business. But this five per-cent must be used wisely.

"One dealer who recently folded up was spending about seventy-five dollars a month for phone directory listings. That amounted to about six per-cent of his total annual volume. He had no money available for any aggressive, more personalized promotions. His business just dried up.

"If that dealer had been operating on a budget he would have limited his directory listings to about twenty or twenty-five dollars a month. He would have used the rest in direct mail or other business-building types of promotion. If he had done that he would still be in business."

Every service business has its own pattern. This pattern can be determined by an analysis of gross income by months over a three to four year period. These figures can be used as an accurate measurement in anticipating income for the planning of a budget. Those are the information tools and the type of planning that help a business to grow. —30—

Closed-Circuit TV

(*Continued from page 38*)

system. Space forbids further descriptions of current applications of CCTV, but it should be noted that CCTV is performing also in the fields of advertising, production, and communication, sales meetings, bringing events to overflow audiences, military training and maneuver observation, and even in fund raising.

CCTV Sales and Costs

The various components of a CCTV system—cameras, lenses, control units, video monitors, accessories, booster amplifiers, broadband amplifiers, etc.—are available separately from most manufacturers. In general, however, a potential user of CCTV will do well to consider his equipment needs as a whole. This is best done in cooperation with the manufacturer of the CCTV equipment he intends to install. Some firms, for instance, maintain a no-charge sales engineering staff which surveys the user's needs, engineers the CCTV chain required to meet those needs, submits a system parts list, detailed drawings, and a complete cost estimate. Often the sales engineer is able to suggest a more efficient or economical system than the user had originally envisioned.

Costs vary as greatly as the range of complexity of CCTV systems. It is possible to purchase and install a complete basic CCTV chain for under $2000. Large, elaborate systems have cost as high as $250,000. But every user who has observed the remarkable resources of his CCTV system agrees that its initial cost has been repaid easily in money or in less tangible, but equally real, values.

R.F. Versus Video

There are two ways of distributing picture information for wired transmission. One method is to use a strictly video system in which the distributed signal is at video frequency (0 to 6 megacycles) for reception by studio-type video monitors. The second and more widely used system is the r.f. method, where the distributed signal output is a video modulated v.h.f. channel which can be received on a conventional TV set. Most CCTV camera units supply both r.f. and video outputs simultaneously.

The appropriate method for any application is determined by the degree of resolution (ability to reproduce fine detail) that is required, as well as by the factor of cost. A video system affords horizontal resolution of 600 lines across the monitor screen. This high rate is made possible by the video monitor, which requires no r.f. tuner and is available with a bandwidth as high as 10 megacycles. Certain other characteristics of the video monitor also make for superior picture quality. However, since the cost of a video monitor is usually higher than that of a conventional TV receiver, the video system is used mostly for installations, such as the one at the Los Angeles Water and Power Supply Steam Plant described previously, where maximum detail is of utmost importance. An r.f. system, on the other hand, is capable of 350- to 400-line resolution, which is broadcast studio quality and acceptable for most applications. The lower resolution of the r.f. system is a result of the narrower bandwidth of conventional TV receivers. The reduced cost and somewhat greater flexibility of this system were the reasons for its choice in the St. Mary's Hospital installation mentioned earlier.

In a typical basic video system, the camera signal feeds the control generator which contains synchronization, sweep and video circuits, and controls. A plug-in video amplifier boosts video output at the control generator output jack by 6 db to a 1 volt level. Connected by RG-11/U cable to a video monitor 200 feet distant, the signal level at the monitor would be 0.7 volt, or well within the 0.2 to 5 volt sensitivity range of most video monitors.

Philco Corporation's Government and Industrial Division uses its own closed-circuit industrial television system for security control in its main plant in Philadelphia. By using CCTV, one plant guard can observe the entrances to three classified areas. Employees appear on the monitor to be identified by the plant guard here.

In a typical basic r.f. system, the video amplifier is replaced by an r.f. modulator whose output is a v.h.f. channel (2 to 13) on which the camera signal along with synchronization signals are impressed. This v.h.f. output is then fed to the antenna terminals of a conventional TV receiver. In the *Blonder-Tongue* system shown on page 35, r.f. modulator output is 1 volt, and .5 volt video output is also available directly from the control generator.

Cameras and Controls

Television cameras for CCTV use are available in several sizes and levels of versatility, from the large studio-type cameras used in commercial telecasting down to a tiny camera slightly larger than a pack of cigarettes. The very largest, such as the studio broadcast type *RCA* model TK-30A, uses the image orthicon pickup tube type 5820. Some smaller cameras utilize the image dissector type of pickup tube. But the vidicon type 6198 pickup tube has found most favor for CCTV because it combines small size with good resolution (about 600 lines) and adequate sensitivity. The 6198 is 1-inch in diameter and about 6 inches long. The raster on the face of the tube is about ½" by ⅜". A smaller vidicon tube of ½" diameter is in existence. Cameras have been developed small enough to fit into the drilling shaft of an oil well. Cameras are also available with explosionproof, weatherproof, and underwater housings for unusual assignments. And at least two of the large firms in the field are now developing color cameras designed primarily for application in the closed-circuit television field.

Selection of camera type depends, of course, on the particular CCTV application in which it is to be used. For remote placement in dangerous, inaccessible, or inconvenient locations, the camera need mount only an optical focus control. Other adjustments (beam, gain, target, and electrical focus) are made on a separate control unit usually incorporated into the control generator, which can then be installed at a more convenient or safe position. Viewing of the image before the camera's lens is done on the video monitor or receiver at the final observation position. In one system, the *RCA* ITV.6, the camera control unit is combined with a video monitor in an integral unit.

Cameras intended for studio-type use (such as the *Kin-Tel* and the *Dage* 101) contain their own viewfinders. Some cameras (the *Du Mont* 100) contain their own full set of controls. Three and 4-lens turrets, remote, powered control of lens aperture and optical focus, rear controlled, and even remotely controlled lens turret rotators are also offered.

Large studio-type image orthicon cameras utilize lenses normally used

(*Continued on page* 146)

in 35 mm. motion picture work. Vidicon cameras, which constitute the most popular and widely used type, are designed to receive lenses originally designed for 16 mm. movie cameras. The "normal" or general purpose lens for a vidicon camera is a type "C" interchangeable mount lens of 1" focal-length and f/1.9 or f/1.5 speed. Such a lens provides a horizontal field of view 5 feet wide at an object distance of 10 feet. A wide variety of type "C" mount lenses in wide-angle and telephoto focal-lengths are available for special applications, including zoom type lenses which are variable in focal-length from 1.2 to 6 inches.

Scanning Standards

Most CCTV camera and control equipment is designed around the American broadcast television scanning standard of 525 lines per frame, 30 frames per second, with 60 fields per second interlaced 2 to 1. The advantage of such standardization is compatibility: it permits CCTV cameras to be used with conventional TV receivers, and also facilitates tieing in a CCTV system to a broadcast network if required.

On the other hand, some special equipment utilizes non-standard scanning standards, such as random interlace, non-interlace, extra fine horizontal line structure (for special, high resolution needs), and slow-scan (for facilitation of transmission of picture information in a narrow bandwidth over telephone lines). Still more specialized equipment operates with a spiral-type of scan, and TV equipment is available for display of picture information on screens different in aspect ratio from the conventional 4 to 3.

Audio

In many applications such as teaching, convention coverage, sales meetings, or in two-way visual communications, sound is a necessity. In a strictly video installation a separate audio system—microphone, amplifier, speaker—must be used, since video monitors make no provision for sound reproduction. In an r.f. installation a separate audio system can be employed; or an audio-video mixer may be used to incorporate sound with picture in the single channel v.h.f. output with a 4.5 megacycle picture-to-sound spread, which is equivalent to over-the-air transmission standards. The TV receiver will then reproduce both picture and sound. Which of the two methods is employed is a matter of economics. Where only a few TV receivers are involved, a separate audio system may be more practical. However, when many receivers are to be used or very long distances to be covered, it becomes less costly to utilize an audio-video mixer.

All in all, it would appear that closed-circuit TV, which is hardly out of its swaddling clothes, is headed for a bright, unlimited future. —30—

PREMIUM PROGRAM

Ram Electronics has launched a special program for its TV sweep and related components.

Depending upon the number of the firm's components a service technician buys, he may qualify for interesting premiums such as appliances, tools, etc. under the new "Share in Pleasure" plan.

Further details are available by writing directly to the company, 600 Industrial Ave., Paramus, N. J.

* * *

"IRISH" BANNER

ORRadio Industries, Inc. is featuring a handsome three-color banner

which is being used to advantage by dealers to attract more customers and to increase recording tape sales.

The white satin sheen banner is 21 inches wide and 28 inches long and the art work is in green and black.

Used on the wall, it attracts the attention of customers in the shop. Placed in the window, it catches the eye of sidewalk traffic.

Any dealer or distributor handling recording tape may obtain the display, without cost, by sending a postcard to the firm, Shamrock Circle, Opelika, Ala., attention of F. R. O'Sheen.

* * *

"DO-IT-YOURSELF" DISPLAY

A new counter display that enables customers to see how simple it is to tune a color TV receiver is being made available to *RCA Victor* dealers.

The multi-color "Do-It-Yourself" contains a back-lighted color transparency arrangement that operates like a color TV picture. Two knobs work like the "Tint" and "Color" controls on the firm's color receivers. The knobs are tuned according to the simple 3-step directions printed on the display and the customer sees what happens when an actual set is tuned.

When the unit is not being used to demonstrate tuning, it can be con-

EXPECTING A CHECK? You'll get it quicker if you give your postal delivery zone number with your address.

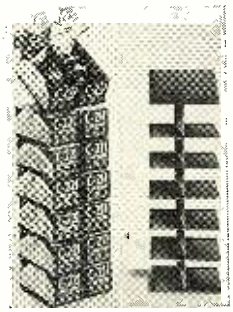
The Post Office has divided 106 cities into postal delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include **your** zone number in **your** return address—after the city, before the state.

verted into a flasher display with the transparency flashing from black-and-white to full color. This new display is available through the company's distributors.

* * *

NEW DISPLAY RACK

Perma-Power Company has made available a new display rack to stimulate sales of "Tube Briteners" and "Color Television Service Aids." The rack holds twelve individual boxes, six in each of two rows, with ample room at the top to display one or two open boxes with the individual products exposed. The rack takes little space, but does a big job in creating impulse buying. The display may be hung on the wall or used on counters.



The firm's representatives are supplying the new display to its distributors at no cost.

* * *

DISPLAY PACKAGING

CBS-Hytron, Danvers, Massachusetts, has followed up its Diode Display-Dispenser Card for the type 1N64 with a second featuring the 1N34A.

The compact merchandiser is designed to display and dispense diodes in handy five-pack and single-pack sealed polyethylene envelopes.

A convenient reference list of the types the component replaces is a feature of this card. Write-in prices serve to emphasize the economy of the five-pack.

The Diode Display-Dispenser Cards for both the 1N64 and the 1N34A are being displayed by the company's tube distributors.

* * *

NEW WALL CHART

A handy wall chart listing the company's exact replacement flybacks and yokes by original manufacturers' part numbers is available to technicians and distributors from *Chicago Standard Transformer Corporation.*

This chart, printed on index cardboard, lists each TV set manufacturer alphabetically. All units for which the firm has an exact replacement are listed in numerical order by manufacturer's part number. It provides the service technician and distributor with a quick, convenient way of determining the availability of an exact replacement unit.

Copies of this reference chart are available free of charge by writing to the company, 3501 Addison St., Chicago 18, Ill. and requesting DH-1.

* * *

TV HARDWARE DISPLAY

Television Hardware Mfg. Co., 400 S. Wyman St., Rockford, Ill., is now offering service dealers a new store display unit which features packaged sales of TV antenna hardware.

The basis of the new promotion is a sturdy display rack holding packages of everything from stand-offs to chimney mounts.

A total of 26 different hardware accessories is included in the new display deal. A balanced assortment of products provides 150 separate packages. The display unit itself is being offered free with the purchase of the complete hardware.

Service technicians wishing more information on "Deal 3912" should see their jobbers or write direct to the manufacturer. —30—

Studying for a Novice ham license is a "family affair" as far as the radio code and theory classes being sponsored by Allied Radio is concerned. E. F. Bachner III and his father, E. F. Bachner, Jr. (left) pit their team against Fred Huettner and his son, Charles. They are using the portable code training positions devised by Allied. Keys and jack boxes are mounted on boards which can be set up quickly at class time and dismantled when class is over. Two 14-week courses are offered by the company each year with a total enrollment upwards of 150 students. About two-thirds of those enrolling finish the course and, of these, 95 per-cent pass their FCC exams with flying colors.

How G-Y Signal Is Used

(*Continued from page* 63)

I, Q, or some other demodulation axes?" The answer to this question is quite pertinent—the chrominance signals which are recovered from the transmission must finally be matrixed with the *Y* signal (luminance or monochrome component). If we choose *R-Y, B-Y,* and *G-Y* (red minus *Y,* blue minus *Y,* etc.) these chrominance signals can be matrixed with the *Y* signal in the picture tube itself (using the red, green, and blue grids, plus the cathode). By using the picture tube as the point for matrixing, we eliminate a considerable number of components which would otherwise increase the receiver cost.

With *G-Y* detectors coming into widespread use, color-bar generators are beginning to provide a (*G-Y*)/90-degree test signal. This is a signal which has the same relationship to *G-Y* as *R-Y* has to *B-Y,* or that *I* has to *Q*. In other words, a (*G-Y*)/90-degree signal is in quadrature to a *G-Y* signal or 90 degrees away in phase. Hence, if we apply a (*G-Y*)/90-degree signal to a *G-Y* detector, the detector will develop no output (null) when it is operating properly.

This is a test which is entirely similar to applying an *R-Y* signal to a *B-Y* detector and checking for a null. Or, the test is similar to applying an *I* signal to a *Q* detector and looking for a null. Now, it will be quite apparent from Figs. 2, 5, or 8 that an *R-Y* detector will *not* null on a (*G-Y*) 90-degree signal. Likewise, a *B-Y* detector will not null on a (*G-Y*)/90-degree signal.

In conclusion, it should be noted that many of the modern receivers which utilize *R-Y* and *G-Y* color detectors also make use of vestigial color sideband response in the i.f. strip. In this arrangement, the color signal does not fall on the flat top of the i.f. curve, but instead is located on the sloping side of the curve which is opposite the slope on which the picture carrier is located.

Vestigial color sideband reception makes possible some further economies in receiver construction, but it is also readily evident that the signal-to-noise ratio of the i.f. signal must be impaired somewhat, due to the 6 db attenuation of the burst and chroma signals in the i.f. amplifier. On the other hand, the impairment of the signal-to-noise ratio encountered in the i.f. amplifier can be largely compensated by use of *R-Y* and *G-Y* detection for reasons already discussed.

Hence, it is apparent that the *G-Y* signal along with its associate, the (*G-Y*)/90-degree signal, is assuming quite an important role in the present-day color service picture. It behooves us all to become better acquainted with *G-Y* and its use in color-TV reception. —30—

"TAPE RECORDER MANUAL" compiled by Sams Staff. Published by *Howard W. Sams & Co., Inc.,* Indianapolis, Ind. 148 pages. Price $2.95. (Vol. 1.)

This is the first of a new series of service manuals covering tape recorders which is being offered to meet the increased demand for more comprehensive material on current-model tape recorders.

This first volume covers seven basic tape recorder chassis and two tape players released to the public during 1956 and 1957. Both home and professional type units are covered. The information provided includes general operation data, use of external speakers, mechanical and amplifier adjustments, cleaning, lubrication, etc. There is complete information on troubles and probable remedies, plus complete mechanical and electrical parts lists on each unit.

Photos show the actual recorder and amplifier, while the exploded view drawing gives complete assembly and parts list information. Schematics are included for the amplifiers, where required.

This volume should be of interest to both technicians and audiophiles who want to make adjustments on their own tape systems.

* * *

"AUTOMATIC RECORD CHANGER SERVICE MANUAL" by Sams Staff. Published by *Howard W. Sams & Co., Inc.,* Indianapolis. 148 pages. Price $2.95. Paper bound. (Vol. 10)

This most recent addition to this publisher's record changer service series covers ten units produced during 1956 and 1957.

Collaro, Crescent, Garrard, Miracord, Philco, RCA, Silvertone, Telefunken, V-M, and *Webcor* units are covered in this volume, with general specifications, operation data, changer cycle, mechanical adjustments, lubrication points, etc. included for each model.

In addition, the manual carries troubleshooting procedures and steps to take to remedy the fault. Mechanical and electrical components lists are given along with the over-all and exploded views of each changer covered by this volume.

* * *

"SELECTION AND APPLICATION OF METALLIC RECTIFIERS" by S. P. Jackson. Published by *McGraw-Hill Book Company, Inc.,* New York, 324 pages. Price $8.00.

This volume has been written for engineers and technicians as an aid to the proper selection and application of metallic rectifiers in a wide variety of electronic and electrical equipment designs.

Information is provided on the fundamentals and characteristics of these components, along with basic rectifier circuits and their related circuitry. One section deals with the general characteristics of metallic rectifier cells and provides a guide to the selection of the appropriate component.

The general discussion of the subject includes information on ratings, rating methods, and how to use typical data as provided by rectifier manufacturers.

The author, who is manager of commercial equipment engineering for *General Electric's* rectifier department, has kept his treatment of his subject as practical and potentially useful as possible. Since it has been assumed that this text will be used by those with a sound engineering background, the author hasn't hesitated to use mathematical "shortcuts" in dealing with his subject where indicated.

* * *

"BASIC TELEVISION" by A. Schure. Published by *John F. Rider Publisher, Inc.,* New York. Five Volumes. Price $10.00 the set. Paper bound. Single cloth-bound edition, $11.50.

For those who have thought about studying television but have been intimidated by the complexity of the average engineering text, this easy-to-take introduction to the subject should be encouraging. It is about as non-technical a treatment as it is possible to present about what is, essentially, a technical subject.

The author has based his presentation on the proven principle that "a picture is worth a thousand words." The text is lavishly illustrated with sketches, line drawings, cartoons, etc. to point up analogies and explain pertinent information.

The five volumes comprising this set cover the transmitter, the organization of the TV receiver, and an explanation of TV receiver circuitry (in three volumes). There is no reason why the student with an elementary radio and electronics background couldn't use this "course" as a springboard to a career as a service technician in the television field.

* * *

"TELEVISION INTERFERENCE, ITS CAUSES AND CURES" by Phil Rand. Published by *Nelson Publishing Company,* Redding Ridge, Conn. 56 pages. Price $1.75. Paper bound.

This book has been written by a

well-known ham, W1DBM, for his fellow amateurs as well as for the information and instruction of electronic engineers, television technicians, and television viewers.

The text is divided into ten chapters and six appendices. The body of the text deals with such problems as the sources and types of TVI, running down TVI, the television receiver, the radio transmitter, shielding and filtering, special v.h.f. problems, the design and use of high- and low-pass filters, external harmonic generation, and TVI from industrial, medical, and power sources. The appendix carries a fairly extensive bibliography on the subject, a list of TVI committees, a table of amateur band harmonic frequencies, a listing of U.S. TV channels and frequencies, tables of world-wide TV standards and channels, and excerpts from pertinent FCC rules.

With so much radio-controlled equipment on the market and so many services vying for the limited spectrum space, TVI is a growing problem and all those who operate or are responsible for the correct functioning of any equipment which might produce spurious signals would do well to read and heed the author's advice.

* * *

"TV AND RADIO TUBE TROUBLES" by Sol Heller. Published by *Gernsback Library, Inc.,* New York. 220 pages. Price $2.90 (soft cover), $4.60 (hard cover).

While this volume is directed mainly to the less experienced service technician there are lots of pertinent and helpful data that the old timers can and should use. This statement applies particularly to the first chapter which deals with, of all things, safety! The "old hand" is often the first to become careless due to his familiarity with the job and the product. This chapter should be "must" reading for all service technicians every six months.

It is unfortunate that, despite all sorts of safety campaigns and drives, year after year service work takes its toll of fingers and eyes among those in too much of a hurry to take the most elementary precautions.

It is the author's contention that much valuable service time is dissipated simply because technicians refuse to associate certain circuit faults with tube failures. The balance of the text is devoted to a discussion of the various faults that can be traced to tube failure or aging. The chapters cover tube and component damage, tube troubles in TV, picture and sound troubles, sync troubles, interference,—all caused by tube malfunction, picture tubes, radio tube troubles, and the replacement of tubes.

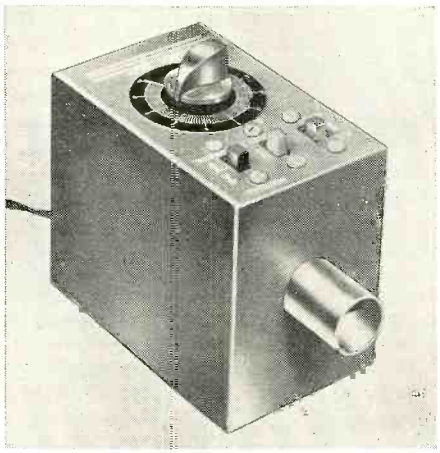
This is a new approach to service work and if, as the author contends, 70 per-cent of all service troubleshooting involves running down faulty tubes, this book should go a long way toward stepping up service output. —30—

What's New in Radio

PHOTOCELL RELAY KIT

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. has added a photocell electronic relay to its line of kits for the "do-it-yourself-er."

The new unit, KT-133, can be used in burglar alarm, door opener, light control, and counting applications. The



cadmium sulphide photocell is ultra-sensitive and requires no special high-intensity light source. It can be actuated by a flashlight at 250 feet. Provision is made for sensitivity adjustments as required by the application.

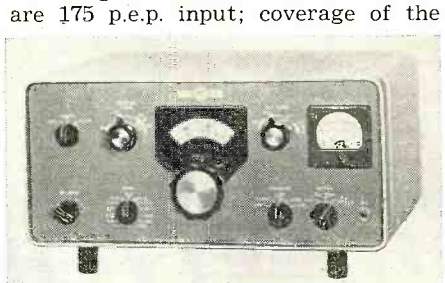
The controlled circuit operates on 117 volts a.c. with instructions for simple wiring changes to supply the external circuit with other desired voltages. The relay contacts are rated at 5 amps, permitting up to 500 watts external load on 117 volts a.c.

The kit comes complete with all parts, photocell, tube, chassis, silk-screened metal cabinet, and easy to follow instructions. The unit measures 3" x 4" x 5".

SSB TRANSMITTER

Collins Radio Company, Cedar Rapids, Iowa has announced the summer release of a new single-sideband transmitter, the 32A-1.

Among the features of this new unit are 175 p.e.p. input; coverage of the



80, 40, 20, 15, 11, and 10 meter bands; upper-lower sidebands; break-in c.w.; r.f. feedback; mechanical filters; permeability tuned precision v.f.o.; etc. Optional accessories such as a phone patch, directional wattmeter, and built-in antenna relay will be available.

The transmitter measures 6 9/16" high by 14½" wide, by 11" deep. Power output is 100 watts.

Write the company for further details and delivery dates.

COLOR TV MONITOR

The Broadcast and TV Equipment Department of *Radio Corporation of America* has announced the availability of a new "pure-picture" 21" television monitor for color programming in broadcast and closed-circuit operations.

The monitor, Model TM-21, is engineered for the ultra-high quality, stability, and uniformity required in color broadcast and closed-circuit operations. The 21" monitor reproduces faithfully all information contained in a compatible color picture. It presents the scene exactly as the camera sees it and facilitates pinpointing elements of the over-all TV system which may need adjustment.

As a reference standard for evaluating the color fidelity of the complete broadcast system, the TM-21 monitor

provides precision checks of color registration, color balance, shading, deflection and transmission system transients, effects of pedestal adjustments, as well as camera deflection linearity, chroma level, and phase or hue adjustments.

NEW CBS RECEIVING TUBES

CBS-Hytron of Danvers, Mass. has just released six new receiving tubes; two hybrid auto radio tubes, two series-string tubes, a v.h.f. tuner tube, and a color-TV high-voltage rectifier.

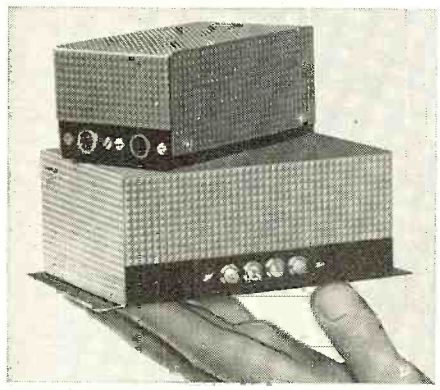
The hybrid auto tubes, Types 12AL8 and 12DL8, operate directly from a 12.6-volt automotive battery system.

The Types 3AF4A and 4AU6 have 450 ma. heaters with warm-up control for series-string television. They are identical to their 6.3-volt counterparts except for heater characteristics.

The v.h.f. tuner tube, designated as the 6CY5, combines a high signal-to-noise ratio, transconductance, and input impedance to provide a desirable gain and bandwidth factor for better TV performance. The sixth tube, the 3B2, is primarily for use in color-TV receivers as a high-voltage flyback rectifier. It features a peak inverse plate voltage of 35 kv. and a minimum d.c. output of 1.1 ma.

ELECTRONIC CONTROL SYSTEM

D. W. Thomas Engineering Inc., 806 Robertson Blvd., Los Angeles 35, Calif. has recently introduced a new transistorized subminiature electronic control system for garage doors,

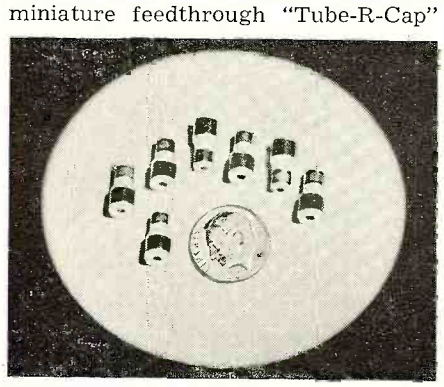


gates, freight car grain unloaders, blast furnace doors, and other applications requiring the control of electrical and electromechanical devices from remote locations.

Known as the "Ra-Trol", the new circuit consists of a crystal-controlled superheterodyne receiver and a channel-coded, r.f. modulated drift-free transmitter to eliminate interference with other services. The receiver is activated only by signals generated by its companion transmitter. Forty different operating channels are available. Normal control range is 100 feet.

CENTRALAB "TUBE-R-CAP"

Centralab of 900 E. Keefe Ave., Milwaukee 1, Wis. has introduced a new miniature feedthrough "Tube-R-Cap"



incorporating a resistor and capacitor in a single ceramic tube 7/16" long that mounts in a .190" hole.

This new *RC* feedthrough is de-

signed primarily for antenna filter applications in TV tuners. It can also be used as a bypass unit in other medium to high frequency applications.

Catalogued as the 732, capacity is 400 $\mu\mu$fd., 1000 working volts and resistance is .3 to 1 megohms. Additional information is available from the manufacturer.

VECTOR "ZIP STRIPS"

Vector Electronic Company, 1100 Flower St., Glendale 1, Calif. has announced a new line of terminal strips featuring its versatile "Zip Terminal" which is designed for rapidity and ease in wiring while occupying a minimum amount of space.

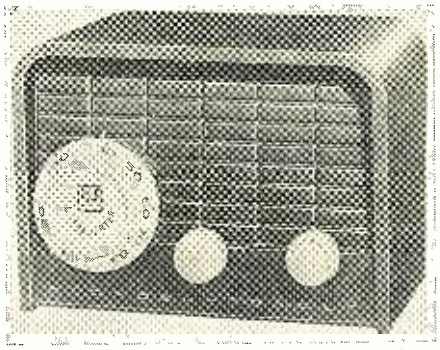
The new terminals speed up and simplify component wiring by providing two pairs of toothed gripper-jaws at right angles to each other to firmly retain wires as they are pushed in. An additional feature provides for self-strapping of adjacent terminals, accomplished by pushing down the smaller gripper-jaws over an adjacent tongue. A through-hole offset from the main gripper-jaw slot permits riser wires or other component wires to go through.

"Zip Strips" are supplied either with or without mounting brackets in a variety of sizes.

B-T "ULTRAVERTER"

Blonder-Tongue Laboratories, Inc., 9-25 Alling St., Newark 2, N. J. is now offering a redesigned version of its u.h.f. converter as the Model BTU-2R "Ultraverter."

Designed to meet the new FCC standards, the unit adds all u.h.f. channels from 14 through 83 to stand-



ard v.h.f. receivers. The circuit features a dual-speed channel selector, double-tuned input, low-noise triode amplification, and precise 300-ohm match.

Housed in a modern two-tone plastic cabinet, the unit uses two tubes and operates from 117-volt, 60-cycle power lines. The device measures 6¾" x 5" x 4¾" and weighs 4 pounds. It carries *UL* approval.

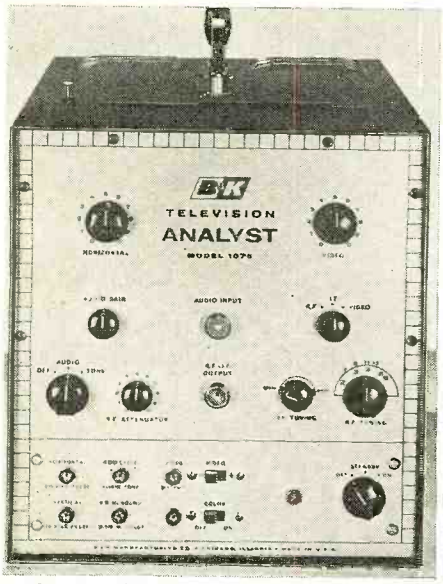
Additional details on the "Ultraverter" will be supplied upon letterhead request to the manufacturer.

TELEVISION ANALYST

B&K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill. has just announced the availability of its new Model 1075 signal-injection, direct-viewing television analyst for

quick, direct, and complete TV troubleshooting.

With the new unit, point-to-point signal injection and test pattern reproduction, any service technician can



easily troubleshoot and signal-trace any stage throughout the r.f., i.f., video, audio, and sweep sections of black-and-white and color TV receivers. The instrument quickly isolates and diagnoses TV troubles including intermittents. By use of the generated test pattern, it is possible to see the condition directly on the picture tube screen of the TV set itself. No external scope is needed.

Bulletin TAD-18, containing complete specifications and price, is available from the manufacturer on request.

FREQUENCY CHANGER

Carter Motor Company, 2793A W. George St., Chicago 18, Ill. has added the "Change-A-Cycle" frequency changer to its line of instruments for field use.

The new unit is said to operate on a principle entirely different from con-

ventional motor-generator devices. The a.c. input is rectified to d.c. and then fed to a special d.c.-to-a.c. converter, having a 60-cycle or 50-cycle output, as specified. A rheostat provides a ± 10% adjustment for cycle variation.

The design requires no transformer. The unit will work on any input fre-

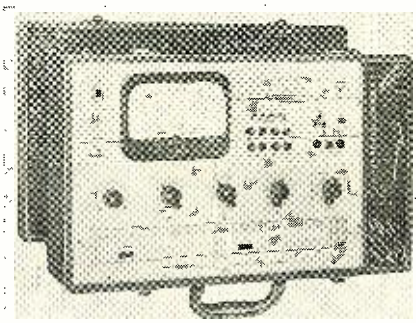
quency and output capacities range from 40 to 2000 watts a.c. The changer is available for single-phase or three-phase input.

Ray Simon, chief engineer of the company, will supply additional information to those writing him in care of the firm.

TRANSISTOR TESTER

Precision Apparatus Company, Inc., Glendale, N. Y. is now offering a portable transistor and crystal diode tester as its Model 960.

The tester gives comprehensive tests for I_{cbo}, gain, leakage, shorts, etc. on low-, medium-, and high-power



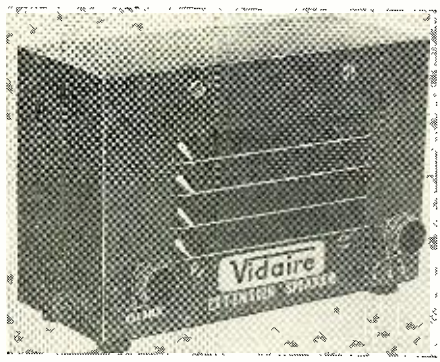
transistors of both the *p-n-p* and *n-p-n* types, as well as the new tetrode transistors.

The Model 960 is a self-contained, a.c.-operated unit. No batteries are used or required. It has an etched, three-color, brushed aluminum, die-drawn panel, and comes in a portable carrying case which measures 18" x 10½" x 6¼".

SPEAKER EXTENSION

Vidaire Electronics Mfg. Corp., Lynbrook, N. Y. is now offering an inexpensive extension speaker designed to be used with TV or radio receivers.

The Model ES-200 permits receiver volume to be adjusted from any point up to 20 feet from the set. The remote



unit permits either the remote or set speaker to be switched or both may be on at once. A volume control for adjusting the sound level is included.

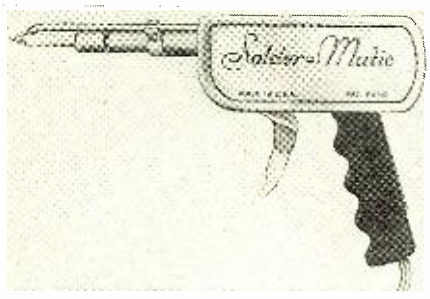
The extension unit is housed in a mahogany finished cabinet which will blend in with most interiors. A data sheet on this item is available.

"SOLDER-MATIC" IRON

Atlas Manufacturing Co., Inc., 1126 S. Decatur St., Montgomery, Alabama has begun distribution of a new type of soldering tool which is being mar-

keted as the "Solder-Matic Electric Iron".

The iron weighs only 6½ ounces and feeds the solder from a spool through a guide tube to the tip of the iron in



response to a trigger feed, leaving the operator's other hand free to hold work, thereby speeding soldering operations and improving the quality of joints.

The iron will be handled through hardware stores, electronic suppliers, and hobby shops. A catalogue sheet describing this new product is available without charge from the manufacturer.

A.C. V.T.V.M.

The Electron Tube Division of *Radio Corporation of America,* Harrison, N. J. has added a new high-sensitivity, alternating current vacuum-tube voltmeter to its line of test equipment for service applications.

The WV-74A can be used in measuring a.c. voltages from .01 volt to 100 volts and for decibel measurements from −40 to +40 db. The voltmeter is also useful as a wide-range audio preamplifier, having approximately 38 db maximum gain. Frequency range on all measurement and amplifier functions is from 20 to 500,000 cycles-per-second.

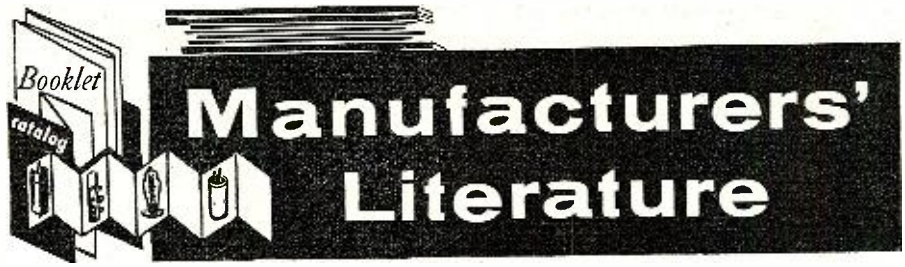
The instrument is designed for high-fidelity, broadcast, design and development, production, and servicing applications. It is housed in a die-cast aluminum case finished in durable blue-gray enamel. The voltmeter measures 7″ x 6½″ x 3¾″ and weighs 6 pounds. —30—

NUCLEAR TECHNOLOGY COURSE

CAPITOL Radio Engineering Institute of Washington, D. C. has set up a subsidiary, CREI Atomics, which will offer the nation's first advanced home-study course in nuclear engineering technology.

Scheduled to begin this fall, the new course will be designed to fill predicted needs for nuclear engineering technicians and other engineering personnel. The level of the course has been set for engineering and technical personnel in industry, government, and military services who plan to go into the field of atomic energy and its related applications.

The curriculum, which has been under development for a year, will be under the direction of Charles De Vore, formerly assistant technical information director of the U. S. Naval Research Laboratory. —30—



Manufacturers' Literature

EIA STANDARDS

The Engineering Department of Electronic Industries Association (formerly RETMA), Room 650, 11 W. 42nd St., New York 36, N. Y. has issued six new standards of interest to the industry.

The new publications are RS-170 covering electrical performance standards of monochrome studio facilities (price $1.10); RS-198 on ceramic dielectric capacitors (80 cents); recommended standards for export receivers, RS-201 (25 cents); RS-154-A on polarized dry electrolytic capacitors for general use ($1.10); RS-199 covering solid dielectric transmission lines ($1.20); and RS-202 on recommended practice for the preparation of outline drawings of electron tubes and bases ($1.20).

Any or all of these standards may be ordered from the Association. Payment should accompany all orders.

CERAMIC CATALOGUE

Centralab, a division of *Globe-Union Inc.,* 900 E. Keefe Ave., Milwaukee 1, Wisc. has issued a new 16-page, 2-color "Ceramic Catalogue" which highlights High Alumina bodies in addition to Steatite, Cordierite, and Zirconite ceramics.

Included in the publication are special sections on standard extrusions, ceramic properties and specifications, plus a clear-cut method for ordering ceramic pieces. Requests for this catalogue should be addressed to Gerry Klein in care of the company.

PICKING CANNON PLUGS

Cannon Electric Company, 3208 Humboldt St., Los Angeles 31, Calif. has issued a 40-page plug guide designed to facilitate the rapid selection of the correct component.

The guide provides an orientation to the 53,000 connectors manufactured by the company. A check list for selection includes important considerations such as size, number and style of contacts, mounting space, coupling methods, insulation, and environmental conditions.

The publication also shows photographs of representative connectors, gives basic information on application, and indicates specific catalogues to order for complete data on each series of connectors.

RCA SCHOOL EQUIPMENT

Radio Corporation of America, Educational Services, Dept. 57, Camden 2, N. J. has compiled a booklet which describes the firm's line of electronic equipment of particular interest to the educational field.

Included in this 16-page bulletin are details on sound systems, various types of audio equipment, tape recorders, "Victrolas," radio and TV sets, closed-circuit TV equipment, electron microscopes, test equipment, tubes, records, etc. Each unit is pictured and described in terms of its usefulness to educational institutions.

Educators and those concerned with installations of school equipment are invited to write for a copy of this new publication.

ELECTRONIC CHEMICALS

General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill. has just issued a 28-page technical bulletin covering the use of electronic chemicals.

The new booklet discusses such chemicals as oxide cleaners, cements, resin sprays, varnishes, etc. A brief description of each product in the company's line is given, then the technical specifications and other information is presented.

Entitled "Electronic Chemicals," the new book is available at a cost of $1.00 a copy through parts jobbers.

SUPREME BROCHURE

Supreme Publications, 1760 Balsam Road, Highland Park, Ill. is offering without charge a four-page brochure describing its newly published "1958 TV Manual."

A description of earlier television volumes and seventeen radio service manuals issued by the company is also included. Write the publisher direct for a copy of this brochure.

PISTON CAPACITOR DATA

JFD Electronics Corp., 6101 Sixteenth Ave., Brooklyn 4, N. Y. has just issued two new data sheets covering its piston capacitors.

Bulletins Nos. 205 and 206 furnish comprehensive performance characteristics and electrical and physical data on a number of the new panel mount quartz and glass dielectric trimmers.

These new data sheets are punched to fit the company's trimmer reference file folder.

DECADE BOX BULLETIN

Clarostat Mfg. Co., Inc., Dover, N. H. has included details on a unique power resistor decade box in a four-page bulletin which it is offering free on request.

The instrument itself will provide a power resistor of any known value from 1 ohm to 999,999 ohms, merely by twisting the six dial knobs. Or, if

BOGEN for P.A.

33 WATT AMPLIFIER
Complete with tubes and cage!

Reg. Price $107.50

This new Bogen Amplifier will deliver tremendous volume for big auditoriums or outdoor gatherings. Can be used with any number of speakers. Equipped with five controls. Has two microphone plus one phono input, all of them can be mixed. Inverse feed back circuit. Peak output 36 watts.

Gain: Microphones 130 db., phono 83 db. Response 30-15,000 cps. Seven tubes, push-pull 6L6GB Beam Power Output. Size 14½x9½xS¾. Operates on 115 volts AC, 60 cy. Shipping wt. 27 lbs. Can be used with any high impedance microphone and any type speakers.

olson PRICE $64.50

Stock No. AM-1

The Ultimate in the CHALLENGER LINE

OLSON PRICE $32.63

Reg. $55.00

STOCK NO. CA-66

RCA PORTABLE SPEAKERS

Heavy duty luggage type case, finished in attractive gray leatherette covering. Complete with two heavy duty RCA 12" Public Address speakers with 6.8 oz. Alnico V magnets. Each speaker equipped with 25 foot cable and plug. For use with Bogen or any other amplifier. Case divides into two parts so speakers can be placed anywhere. Equipped with internal straps to hold amplifier. 8 ohm Impedance. Overall size 11¼x24¾x18¼. Shipping wt. 20 lbs.

OLSON for COMBINATION DEALS

SAVE MORE! Order complete systems and save even more. Take your pick of any of these complete package deals, be assured of getting the finest equipment at the lowest prices.

AM-1 Amplifier, **CA-66** Speakers and Case, **M-105** Microphone, **M-95** Table Stand. **Stock No. AS-354** . . $94.30

AM-1 Amplifier, **Two S-317** Wide Angle Speakers, **M-105** Microphone, **M-95** Table Stand. **Stock No. AS-355** . . . $99.30

AM-1 Amplifier, **Two S-318** Dual Trumpets, **Two S-176** Driver Units, **M-105** Microphone, **M-95** Table Stand. **Stock No. AS-356** $128.50

PAGING SPEAKER

Reg. Price $42.00

OLSON PRICE $19.93

STOCK NO. S-317

WIDE ANGLE type. Weatherproof, indoor or outdoor. Can be used with Bogen or any amplifier. Complete with hermetically sealed 15 watt driver unit and mounting bracket. 8 ohm impedance. Size 7½ h. x 14 w. x 12" d. Shipping wt. 8 lbs.

DUAL TRUMPET

Reg. Price $38.00

OLSON PRICE $19.93

STOCK NO. S-318

WIDE ANGLE DUAL trumpet. Weatherproof for all indoor and outdoor use. Ideal for speech or music. Can be used with Bogen or any amplifier. Supplied less driver unit. Order unit No. S-176 below. One required. Size of bell mouth 18½x9¼, depth 10¼". Shipping wt. 15 lbs.

OLSON PRICE $13.95

STOCK NO. S-176

DRIVER UNIT Reg. $27.50

HERMETICALLY SEALED 25 WATT unit for above trumpet or any other trumpet. For speech and music. 16 ohm impedance. 60 watt peak. Heavy Alnico V magnet. Shipping wt. 5 lbs.

CRYSTAL MICROPHONE

Reg. Price $14.95

OLSON PRICE $4.25

STOCK NO. M-105

High impedance. Ideal for Bogen or any other amplifier. Swivel tilting head. Response from 100 to 8000 cps. Attractive green finish with chrome trim. Standard thread fits any stand. 5 ft. shielded cable. Shipping wt. 3 lbs.

Microphone Stands

FLOOR STAND with 3 point collapsible base. Chrome and black. Shipping wt 10 lbs.

$6.99 STOCK NO. M-94

DESK STAND chrome and black, for all microphones. Shipping wt. 3 lbs.

$1.55 STOCK NO. M-95

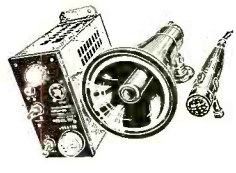
NEWEST MODEL—SAVE MONEY
BOGEN-UNIVERSITY Mobile PA System

For *ALL* makes and models of cars, busses, and trucks.

SAVE Almost 50%

Reg. Price $125.45

OLSON PRICE $63.74



6 VOLT MODEL—Stock No. AS-335

12 VOLT MODEL—Stock No. AS-336

Here's the answer to public address for Mobile use. Fits any make or model car, bus or truck. Ideal, compact, and easy to install. Universal mounting. Features include Beam Power Amplifier employing 2—6SF5, 1—6L6GA and 1—6X5GT tubes, remote control stand-by to reduce battery drain, fused power cable, calibrated volume control to 6 watts, gain 109 db., output 4.8 and 16 ohms. Size only 3¼x8x7". Choice of 6 or 12 volt models.

Speaker is the famous University IB8 Trumpet Reflex with 15 watt driver unit and universal mounting bracket. 8½" bell diameter x 9" long. Can be mounted inside or outside. Completely weatherproof.

Microphone is high-impedance crystal with satin chrome finish. Complete with attachments for use as a chest mike, for floor stand or handhold.

Bus manufacturers note: up to 12 additional 4" or 5" ordinary cone type speakers can be also added and built into bus for passengers.

Send For FREE Olson Catalog

We carry a full line of Bogen PA Equipment plus thousands of terrific bargains in Hi-Fi, TV, and Electronic Parts. Great values in Nationally advertised brands for the Ham. Equipment builder. Engineer, Tinkerer. Serviceman and Hobbyist. SAVE MONEY!

Send for your FREE copy today.

See and Hear . . . Every unit shown, plus the complete Bogen line is available at any one of our seven stores listed below. Come in soon and thrill to the tone of Bogen's new Amplifiers. Hear Tonal quality that defies description.

AKRON . . . . . 73 E. Mill St.
CHICAGO . . . . 4101 N. Milwaukee Ave.
CHICAGO . . . . . 123 N. Western Ave.
CLEVELAND . . . . . 2020 Euclid Ave.
PITTSBURGH . . . . . 5918 Penn Ave.
MILWAUKEE . . . . . 423 W. Michigan
BUFFALO . . . . . 711 Main Street

IT'S EASY TO ORDER FROM OLSON'S

MAIL ORDERS TO AKRON, OHIO. How to order: Order directly from this ad. For convenience, use this order blank. Fill in columns below with quantity desired, stock number, description, and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer Send a $2.00 deposit with your order and Olson will ship C.O.D. for the balance.

MONEY BACK GUARANTEE: Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund. Please—Minimum Order $5.00

Quan.	Stock Number	DESCRIPTION	Price Each	TOTAL
		1 Free Olson Catalog—		

NAME _____ T-58

ADDRESS _____

CITY _____ ZONE ____ STATE ____

Total	
Add Postage	
TOTAL AMOUNT	

Olson Radio Warehouse — **T-58 FORGE ST. AKRON 8, OHIO**

an unknown resistance value is to be determined, the box is placed in the circuit under working conditions and the six knobs adjusted until best results are obtained, whereupon resistance value is read directly off the dials.

Many of the practical applications for this instrument are outlined in the new bulletin.

STANCOR REPLACEMENTS

Chicago Standard Transformer Corporation, 3501 W. Addison St., Chicago 18, Ill. has issued a one-page data sheet on three new flyback transformers designed as exact replacements for *Philco* part numbers 32-8624/1, 32-8465-2, 32-8509/-2, 32-8484-2, and 32-8695/-1.

Used in 22 different chassis and 130 model numbers, the *Stancor* HO-276, HO-277, and HO-278 units are described in some detail on the data sheet. A schematic and photograph of each unit is also included in Bulletin #537 which is available on request.

PRECISION POT DATA

Clarostat Mfg. Co., Inc., of Dover, N. H. has issued a precision potentiometer table designed to facilitate the selection of the correct unit for a given application.

In a 8½"x11" page size to fit the data file or looseleaf binder, the table lists seven single-turn and one multi-turn type with dimensions, resistance values, tolerances, resolution, ratings, rotation, tandem groupings, torque, taps, weight, bearings, and other data.

G-E SOLDERING IRONS

General Electric Company, Schenectady 5, N. Y. has just issued an 8-page folder that describes and illustrates its complete line of soldering irons.

Features of the irons, including light weight, calorized and ironclad tips, and tubular heater are explained. Case histories of savings obtained by companies using the soldering irons are also included.

Those wishing a copy should specify Publication GED-3553. —30—

ARRL'S 10TH ANNIVERSARY CONVENTION

THE American Radio Relay League's 10th National Amateur Radio Convention is scheduled for August 15, 16, and 17 in Washington, D. C.

Headquarters will be the Sheraton-Park Hotel which is air-conditioned and provides a swimming pool and ample garage facilities. Special attention is being paid to the ladies, whether XYL's or licensed YL's. Events include a fashion show and sightseeing tours. A nursery will be available for children.

Inquiries concerning motels or other accommodations may be made to the Convention Housing Bureau, Greater National Capital Committee, 1616 K St., N. W., Washington, D. C. All who plan to attend should register as soon as possible. Pre-registration rates will be less than the registration rate at the convention. Further information is available from Federation of Radio Amateur Clubs, Inc., P. O. Box 3726, Washington 7, D. C. —30—

Answer to Puzzle appearing on page 125.

PHOTO CREDITS

Page	Credit
35, 140	Blonder-Tongue Labs., Inc.
39 (top)	"If All the Men in the World"
39 (bottom)	Shannon Luminous Materials Co.
47	General Electric Co.
48	Nuclear-Chicago Corp.
57, 58, 59	RCA
65	Admiral Corp.
66	Sarkes Tarzian
68 (top)	Standard Coil Products
68 (bottom)	Packard-Bell
92	Automatic Electric Co.
95	Avion Div., ACF Industries
104	Heath Company
128	Sylvania Electric Products Inc.
130	Pacific Semiconductors
133	Westinghouse Mfg. Corp.
148	Allied Radio Corp.

CLASSIFIED

RATE: 50¢ per word. Minimum 10 words. July Issue closes May 9th. Send order and remittance to: RADIO & TV NEWS, 1 Park Ave., N. Y. C. 16, N. Y.

RADIO ENGINEERING

ELECTRONICS! Associate degree—29 months. Technicians, field engineers, specialists in communications, missiles, computers, radar, automation. Start September, February. Valparaiso Technical Institute, Dept. N, Valparaiso, Indiana.

FOR SALE

DIAGRAMS for repairing radios $1.00. Television $2.00. Give make, model. Diagram Service, Box 672-RN. Hartford 1, Conn.

TUBES—TV, Radio, Transmitting And Industrial Types At Sensibly Low Prices. New, Guaranteed, 1st Quality, Top Name Brands Only. Write For Free Catalog or Call WAlker 5-7000, Barry Electronics Corp., 512 Broadway, New York 12N, N. Y.

TELEVISION Sets $11.95. Plus shipping. Jones TV, 147 High, Pottstown, Pa.

TUBES—Television, Radio, Guaranteed. Boxed, 75% off. Bell Electronics, 40 Canal, New York City 2.

RADIO & TV Tubes at manufacturers prices. Guaranteed—Send for free price list. Edison Electronic Tube Co., Menlo Park, N. J.

GOVERNMENT Sells—Surplus Electronics; Walkie-Talkies; Transceivers; Test Equipment; Oscilloscopes; Radar; Voltmeters; Misc.—Fraction of Army costs—Buy direct now from U. S. Government—"Depot List & Procedure" $1.00—Brody, Box 8-RT, Sunnyside 4, New York.

FOR Sale: 6C21 Surplus @ $8.00 each—2 for $15.00. 2C26 Surplus @ $3.00 each. 5BP1 Surplus @ $3.98 each—F.O.B. Olin Electronic Supply, 6009 Eastern Ave., Balto., 24, Md.

GOVERNMENT Surplus Snooperscopes, Radios, Mine Detectors, Parabolic Reflectors, Parts. Picture catalog 10¢. Meshna, Malden 48, Mass.

KITS—$2.98 each. Resistance box, Tube checker, Capacitance box. Special! Order 2—get one free. Includes instructions, new parts, surplus case. Hi Voltage probe—29¢, 3 Alignment tools—29¢. New, used, surplus parts assortment—$1.89. Allkit, Box 98, Midwood Station, Brooklyn 30, N. Y.

5KVA Variacs $50; 6KVA Saturable Reactors $60; 600VDC 50 MFD Pyranol Condensers $5; 0.75KVA 115/230/460 V Single phase Transformers $7.50. Scientific Equipment, Box 2155, Oak Ridge, Tenn.

LABORATORY Oscilloscope New 5 MC direct from factory guaranteed. Kit price $142. Write for free literature. Electronic Industries, Patterson, N. Y.

WANTED

LABORATORY Quality Equipment and Military Surplus Electronics bought, sold. Engineering Associates, 432 Patterson Road, Dayton 9, Ohio.

NOTICE

In replying to box numbers be sure to address letters to

RADIO & TV NEWS
1 Park Ave.
New York 16, N. Y.

Note: This does not apply to box numbers where city and state are shown

ART-13/T47A Transmitter $100.00, ART-13/T47 Transmitter $65.00, BC-788C Altimeter $75.00, R5/ARN-7 Radio Compass $60.00, BC-348 Rec'r Unmod. Q & R Models $35.00, ARC-1 Transmitter $90.00, AN/ARN-14C Radio Receiver $250.00. Ship via express, C.O.D. Subject to Inspection to: H. Finnegan, 49 Washington Avenue, Little Ferry, New Jersey.

CYLINDER and old disc phonographs. Edison, Conqueror, Idelia, and Oratorio models. Berliner Gramophones and Zono-o-phones, Columbia cylinder Graphophones, and coin-operated cylinder phonos. Want old catalogues and literature on early phonos prior to 1919. Will pay cash or trade late hi-fi components. Classified Box 50 % Radio & TV News, 1 Park Ave., N. Y. C. 16, N. Y.

CASH Paid! Sell your surplus electronic tubes. Want unused, clean transmitting, special purpose, receiving, TV types, magnetrons, Klystrons, broadcast, etc. Also want military & commercial lab test and communications gear. We swap too, for tubes or choice equipment. Send specific details in first letter. For a fair deal write, wire or telephone: Barry, 512 Broadway, New York 12, N. Y. WAlker 5-7000.

WANTED: Receiver R5/ARN-7, MN-62A Transceivers, RT18/ARC-1, AN/ARC-3, BC-788C, I-152C, Collins, Bendix equipment, Test Sets, Dynamotors, Inverters. We pay highest prices. Advise quantity, condition, price first letter. Aircraft Radio Industries, Inc., 70 East 45th St., N. Y. 17, telephone LExington 2-6254.

HIGH FIDELITY

DISGUSTED with "HI" HI-FI Prices? Unusual Discounts On Your High Fidelity Requirements. Write. Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

PRICES? Try ours! Everything in Hi-Fi. Factory sealed components. Write right now. Audion, 64-62 Booth St., Rego Park 74, N. Y.

DISCOVER our "Six Unique Services" on Hi-Fi; Stereo. Complete line. Write The Silver Trumpet, 406R Walnut, Alexandria, Indiana.

WHY Pay More! High Discount Hi-Fi Equipment. Write us your requirements. Stan-Burn, 558A Coney Island, Brooklyn 18, N. Y.

WORLD Renowned Hartley Speakers now available to Dealers, Servicemen, Custom Installers, lowest franchise requirements in high fidelity. Write Hartley Products Company, 521 East 162 Street, New York 51, N. Y.

SALES outlets wanted by speaker enclosure manufacturer and component supplier. Arc Electronics, 7219 South Fairfield, Chicago, Illinois.

TAPE & TAPE RECORDERS

TAPE Recorders, hi-fi components, tapes. Unusual Values. Free catalog. Dressner, 69-02 R, 174 St., Flushing 65. N. Y.

RECORDERS, HiFi, Tapes, Free Wholesale Catalog. Carston 215-R East 88 St., N. Y. C. 28.

TAPES—1200', $1.25. 1800', $1.65. Free catalog. Towers, #155, Philadelphia 5.

DISCOUNTS to 50%, recorders, tapes, hi-fi components, consoles, photograph equipment. Request specific prices only. Long Island Audio & Camera Exchange, 3 Bay 26th Street, Brooklyn 14-N, N. Y.

CORRESPONDENCE COURSES

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

INSTRUCTION

ENGINEERING Degrees, EE Option Electronics earned by home study. Residence classes also available. Pacific International University (operating as a college of engineering only at present), 5719-C Santa Monica Boulevard, Hollywood 38, California.

MISSILE Electronics: Learn basic circuits of transistors and magnetic amplifiers as used in Missiles and Satellites. Send $1.00 for booklet. Kits also available. Box 8087, Long Beach 8, Calif.

MISCELLANEOUS

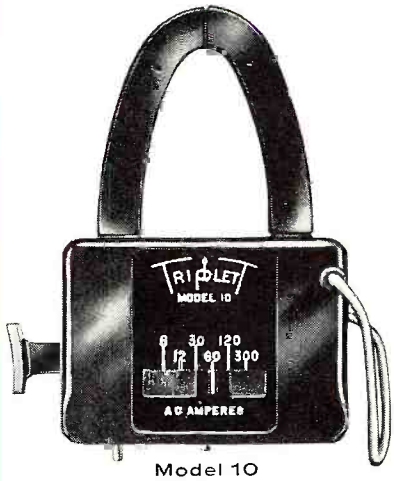
SAVE Money! Don't Buy until you get Our price list! All types Radio & TV tubes at Mfrs. prices! 100% Guaranteed! 24-Hour Service! Write United Radio Co., Newark, N. J.

TRADE-IN TV. Ship anywhere. $9 up. Write Justis Bros., Newport, Del.

INDEX OF Advertisers

MAY 1958

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

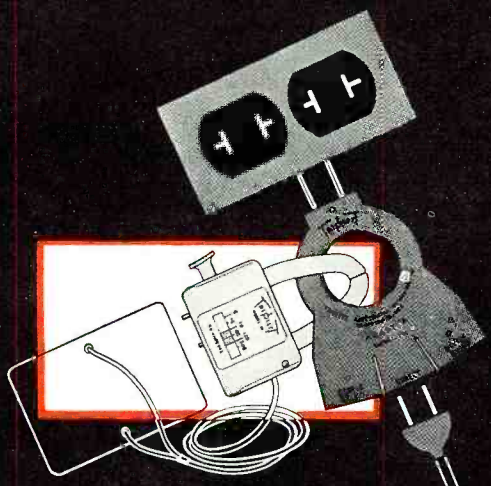


Model 10

Here is a real value—much more value than in any other clamp-on ammeter. Remember, in Triplett Model 100 you get not only a clamp-on ammeter but a genuine Triplett complete Volt-Ohm-Milliammeter with which you can measure AC volts, DC volts, AC and DC current, and Ohms.

BURTON BROWNE ADVERTISING

triple news from triplett



1st news: Triplett Model 10 Clamp-On Adapter

Just plug into any Triplett Model 310 Miniature VOM it becomes an AC clamp-on ammeter to measure AC amperes without cutting or opening current carrying wires. The split transformer yoke opens at the touch of a lever to fit around a single conductor or bus-bar for direct readings of AC amperes from 6 to 300 in 6 steps. Model 10 $14.50 net.

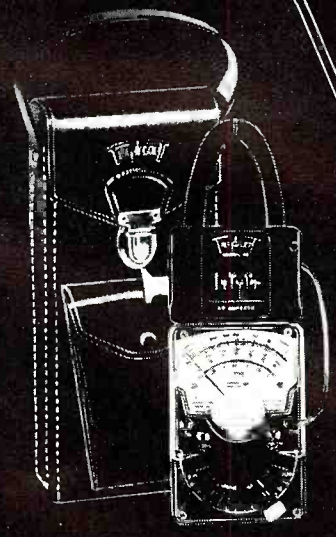
The Model 10 can be separated from the Model 310 as shown in the drawing at left by No. 311 lead attachment. This permits readings in difficult locations. No. 311 leads $1.90 net.

2nd news: Triplett Model 101 Line Separator

Serves to plug in at outlet to divide 2 conductor cords for clamp-on measuring. Makes accurate, rapid-testing of radio and TV sets, phonographs, appliances, motors, etc. possible without opening or splitting double conductors. Also serves to increase ammeter sensitivity 10X and 20X, if desirable, for easier reading. Model 101 $5.50 net.

3rd news: All four parts are available conveniently packaged in one handy, durable, high-quality carrying case. This complete package is known as Triplett Model 100 and is priced at $61.90 net.

Model 100 consists of Model 310 VOM, Model 10 Clamp-On Adapter, Model 101 Line Separator, No. 311 leads and carrying case with provision for all parts.



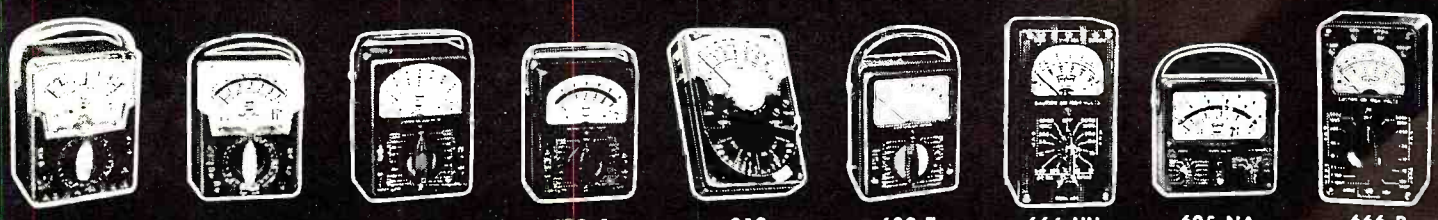
TRIPLETT

Triplett Electrical Instrument Company
Bluffton, Ohio

53 years of experience

In addition, to use with the Model 310, the Model 10 Adapter also can be used as a Clamp-On Ammeter with any Volt-Ohm-Milliammeter having a 3 AC volt scale at 5000 Ohms per volt such as Triplett Models 630, 630-A, 630-NA, 631, etc., by employing Triplett No. 611 leads, $1.90 net.

Triplett Model 100 gives you the world's most flexible test equipment for all electrical and electronic applications.



631 630-NA 630 630-A 310 630-T 666-HH 625-NA 666-R

3 Million Transistor Portables

Mean Big Battery Business and Bigger Dealer Profits

That's a lot of transistor portables that are going to be needing batteries this year . . . nearly three times as many as a year ago, and the figure is still growing.

For this skyrocketing new market, Mallory offers a complete line of transistor and portable radio batteries.

Mercury batteries, pioneered by Mallory, last longer, give steadier volume than ordinary batteries. Mallory Zinc-Carbon batteries are dependable and economical—meet all the requirements of today's modern portable radio sets, and flashlights as well.

Mallory Battery Company

A Division of

P. R. MALLORY & CO. Inc.

MALLORY

In Canada, Mallory Battery Company of Canada Limited. Toronto 4, Ontario

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

• Capacitors • Vibrators • Resistors • Controls • Switches • Filters

• Rectifiers • Power Supplies • Mercury and Zinc-Carbon Batteries