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RADIO & TV NEWS

SEPTEMBER
1957
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See Page 37

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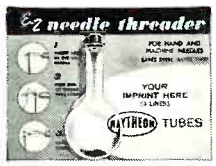

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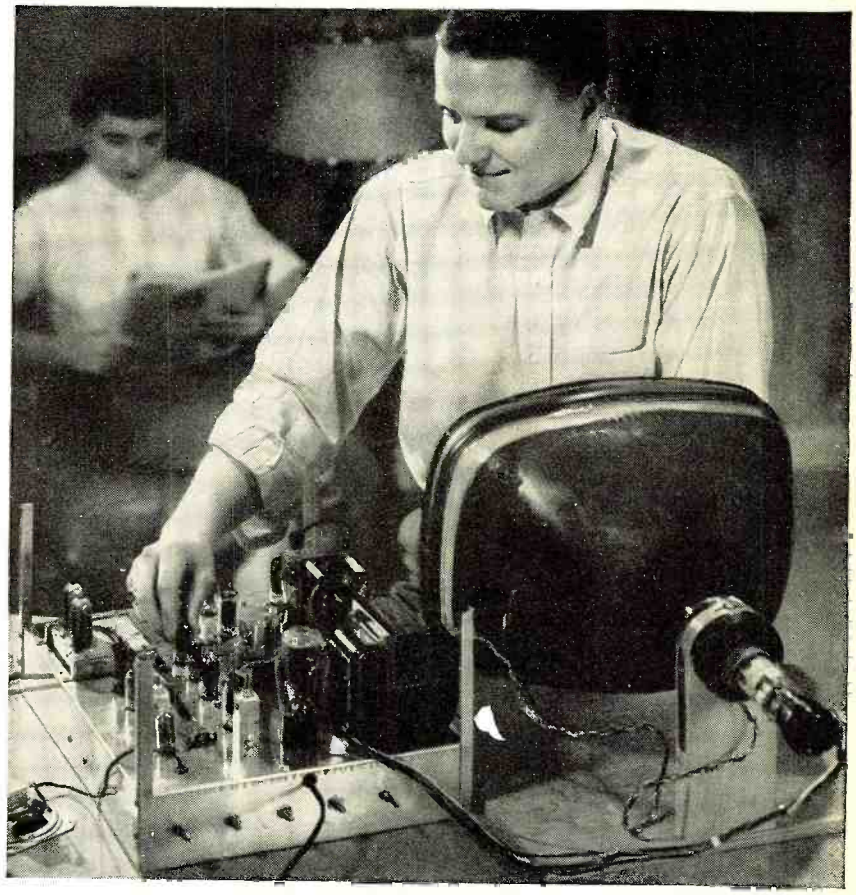

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ELECTRONIC CONSTRUCTION

DEPARTMENTS

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For the RECORD

OPPORTUNITIES UNLIMITED

IT WAS not our intention, in selecting the theme of job opportunities for this issue, to encourage a rash of job switches or sow the seeds of discontent in the hearts and minds of our readers.

Indiscriminate job switching, in the long run, benefits neither individuals nor industry. The reasons behind this are fairly obvious. From the employee's standpoint after a certain number of job changes, the law of diminishing returns comes into play. It may be a smart move for the fresh-out-of-college engineer to "sample" several jobs and companies in the course of a couple of years but once his family is established and his roots put down in the community, there may have to be some real soul searching before the decision is made to transfer half way across the country to a new post. Such decisions are, of course, personal and each person faced with such a choice will have to weigh all of the advantages and disadvantages before saying "yes" or "no."

From an industry standpoint, rapid turnover in technical personnel is a matter of all-too-real out-of-pocket losses. Given two engineers—or lab technicians, or technical draftsmen—with identical training and similar personality traits—one already employed by the company and the other being considered for the job—the second man will rarely be ready to pull his full weight on his new job until a period of time, ranging from six months to a year, has elapsed and he has "caught on" to the way that *that particular company* handles *his particular job*. This is not to say that companies should never hire new people for expansion nor improve their present set-ups, but just a round of the childhood game of "musical chairs" rarely achieves the desired end.

If, however, after reading this issue and pondering the opportunities you might be missing, you *do* something about your career—this discontent can pay valuable dividends. If it leads you to renewed effort, additional study, the taking of steps to up-grade your present level—it becomes an asset—one that any employer is glad to discover among his personnel.

In this connection, we would like to suggest that an annual or semi-annual review of your job might be worthwhile—not one of those New Year's Resolution type things but a sober and careful evaluation of "Where am I going? Am I getting anywhere—if not, why not? Have I gone as far as my training will allow? Is there anything I can do to remedy this situation? Is there room at the top in my company if I take the additional courses and prepare myself for a better job?"

If the answer is "yes, there is a chance for me to improve my position in my own company"—the rest is up to you. Many firms are happy to give a leg up to their own people—running in-plant courses, paying tuition for college and correspondence courses, picking up the check for membership fees in technical societies, buying books for loan to employees, etc.

If after exploring all of the avenues of advancement within your own company, the roads appear to be dead-end—too many contemporaries holding the jobs immediately above you, management with a lack of imagination and the will to branch out into new lines, a rudimentary or no research and development program—then it's time for a change.

One of the saddest commentaries on American life today is that virtually everyone is seeking "security" rather than "opportunity" when considering a job. This "gray-flannel-suit" mentality and the willingness to be regimented, coddled, and cossetted from ivy halls to ivied cemetery has a great number of our best minds seriously worried.

In discussing the critical problem of "creeping inflation" in our national economy those most concerned have pointed out that rising wages and wider benefits without a concomitant increase in job productivity is one of the most terrifying aspects of the situation. Soft spots are gradually developing in the economy which could mean trouble.

The answer, of course, is new and better things which will stimulate sales. The researcher, engineer, the production man with imagination, the salesman with drive, and the inventor of the "better mousetrap" are the boys who will be responsible for keeping the economy on an even keel. The population is rising, the market is there—what the engineer with vision will do about it is one of the exciting things about living in this age of electronics and the future. How do you fit into this picture of progress? Read this issue carefully and then see whether or not you can qualify as a Twentieth-Century pioneer! . . W. S.

DON'T MISS

"Your Career in Electronics"

(See advertisements on page 170-171)

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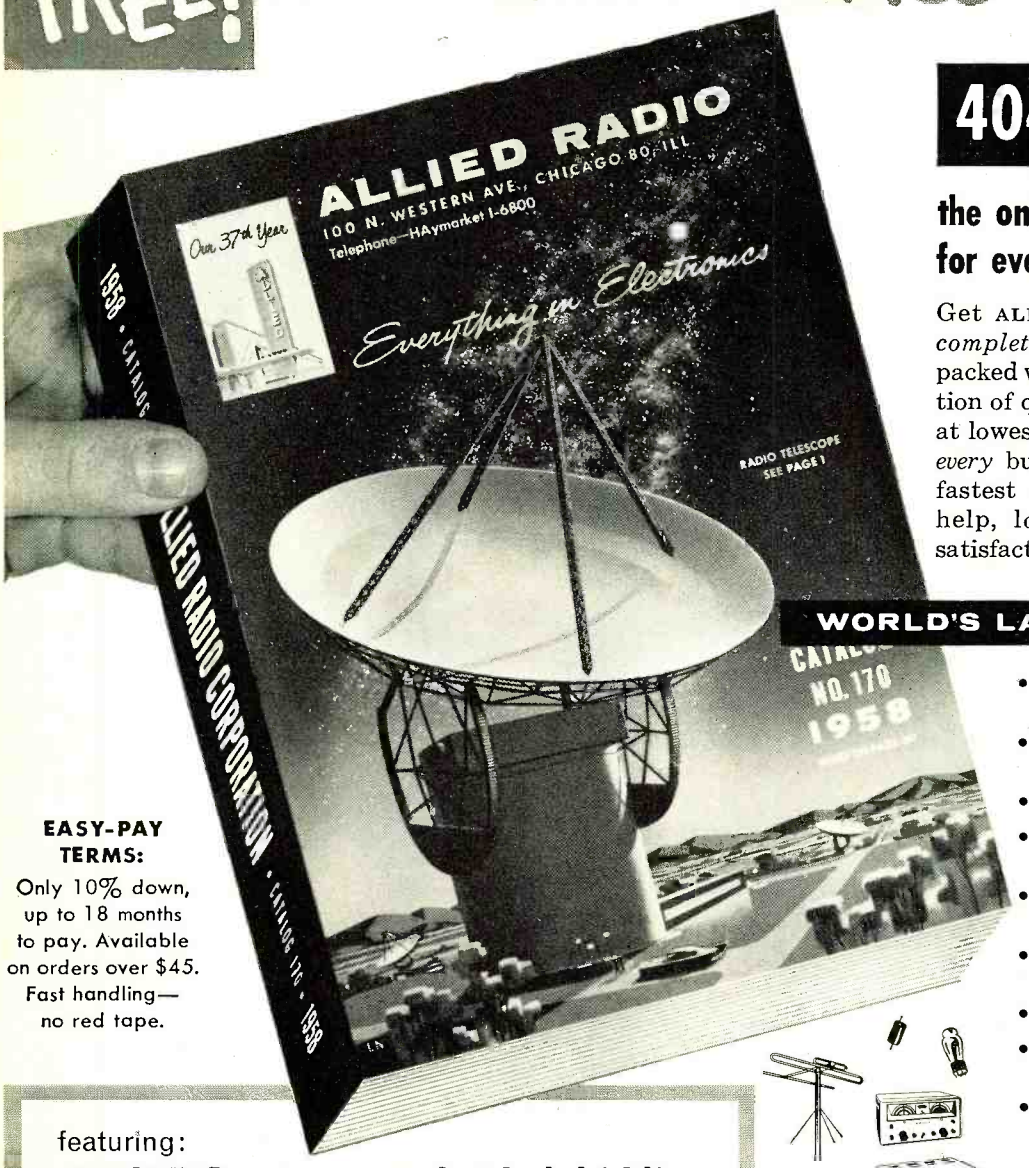

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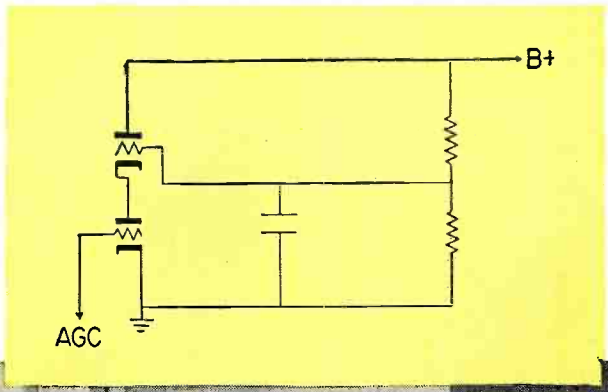

Simplified schematic is a typical cascode circuit in which double-triode amplifiers are tested for transconductance and plate current under actual operating conditions. In this way, Sylvania offers you maximum assurance of proper circuit performance when you repair TV tuners. Regardless of make or model TV, Sylvania tuner tubes mean dependability backed by industry's most exhaustive dynamic testing program.

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All tuner tubes are fixed-bias tested under conditions which simulate actual applications in TV sets. Cascode types are subjected to series Gm and series Ib tests in typical circuits. In addition, all types are checked both before and during life tests for serviceability at high and low line voltages.

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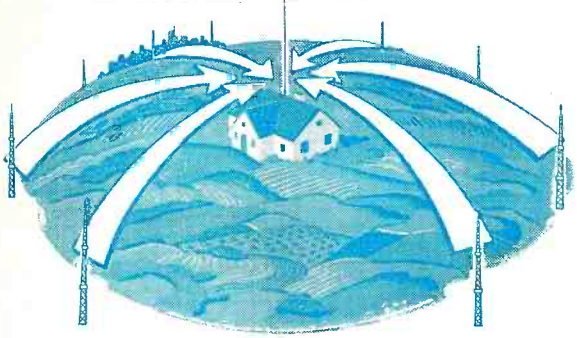

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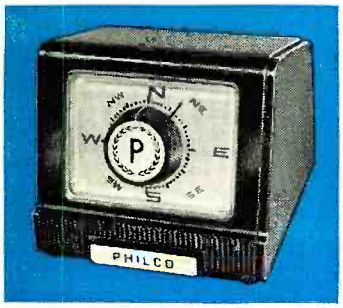

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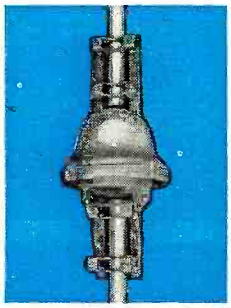

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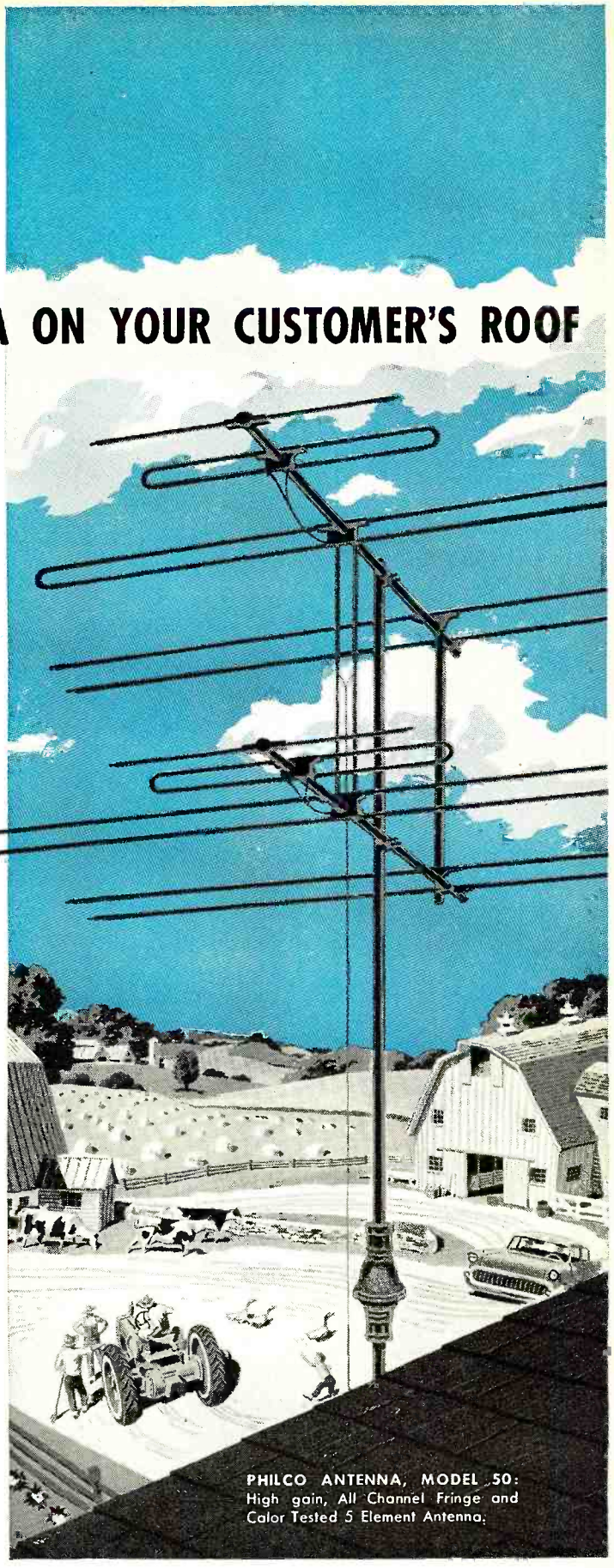

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WASHINGTON EDITOR

A STORMY ROAD LIES AHEAD for toll-TV, notwithstanding the approving comments of some of the Commissioners.

Members of both the House and the Senate have lashed out against not only the proposed tests, but FCC's verdict that it has the authority to sanction pay-see television without further Congressional approval.

The strongest criticism has come from Senator Strom Thurmond, who has introduced a bill which would prohibit any fee charges for home television. A member of the powerful Senate Commerce Committee and its communications subcommittee, the Senator said that he had studied the problem of subscription video for quite some time and felt that the result of . . . "permitting pay-TV to be used generally would be the same as having the Congress impose a new tax on the people of this country."

The Thurmond measure, identical to the bill introduced in the House last January by Congressman Emanuel Celler, would amend the Communications Act to declare that the Commission . . . "shall not authorize nor permit any television station to impose a toll, fee, subscription, or other charge, directly or indirectly, on the general public, for the privilege of viewing television programs received over television sets located in the home." Those found guilty of a violation could be fined up to $10,000 or imprisoned for not more than five years, or be fined and imprisoned.

Commenting further on the serious situation that would obtain if the FCC were permitted to approve experimental pay-TV, the legislator said that the . . . "Congress must face the fact that it would be most difficult later to tell the experimenters who had spent millions of dollars, that pay television had been classified as against the public interest. . . ." The Senator added that certainly pay-TV would cost the public more than the present system, and we have no proof that the viewers would receive any better programs if the pay plan is authorized.

Attacking FCC's statement regarding its authority to green-light pay-TV, Senator Thurmond said that he was willing to give the Commission broad powers in matters of scientific concern, but . . . "pay television has raised another question . . . a matter of policy completely divorced from scientific development."

In this instance, the Senator said,

NEW TELEVISION STATION GRANTS

An additional listing of new construction permits and changes that have been made in station call letters. List continued next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Kansas	Hays	.....	7	174-180	81.3
Montana	Great Falls	.....	3	60-66	118
Texas	Nacogdoches	.....	19	500-506	20.1

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
Georgia	Columbus	WTVM (Formerly WDAK-TV)	28	554-560
Pennsylvania	Harrisburg	WCMB-TV (Formerly WTPA)	71	812-818
"	Harrisburg	WTPA (Formerly WCMB-TV)	27	548-554
"	Lock Haven	WBPZ	32	578-584

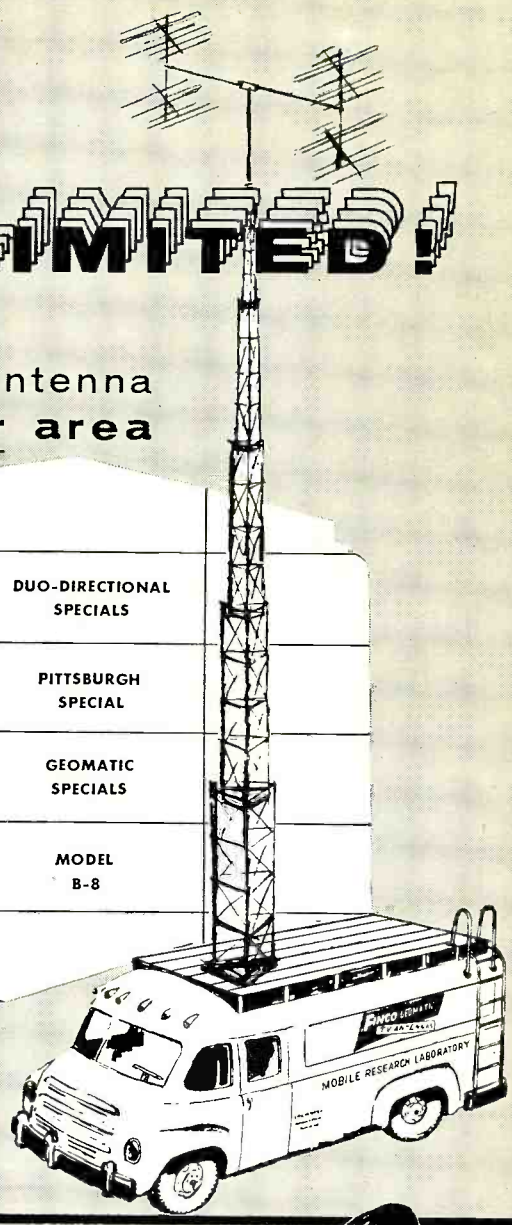
* ERP = (effective radiated power, kw.)

FINCO® announces

MODELS UNLIMITED!

NOW . . . you can sell a TV Antenna designed for your area

	BUFFALO SPECIAL	SYRACUSE-ROCHESTER SPECIAL	DUO-DIRECTIONAL SPECIALS
	SAN DIEGO B-6	CHICAGO SPECIALS	PITTSBURGH SPECIAL
LONGVIEW, TEXAS SPECIAL	VICKSBURG SPECIAL	FLORIDA, WEST COAST SPECIAL	GEOMATIC SPECIALS
	PATENTED FIDELITY PHASING	DETROIT-TOLEDO SPECIAL	MODEL B-8
UHF-VHF SPECIALS	MODEL B-66		
MODEL B-7	FRONT-TO-BACK SPECIALS		



• IN SOLVING UNUSUAL, LOCALIZED RECEPTION PROBLEMS, FINCO has proved that the only positive way to develop the most efficient and economical TV Antenna is by actual MOBILE RESEARCH LABORATORY TESTS combined with Expert Topology and Channel Power Plotting.

If a distributor qualifies, Finco's research department assumes the task of studying the specific, local reception problems. If the problems can possibly be solved the result is an *exclusive* Red-Hot, *High-Profit* Hi-Performance Antenna For Your Area —

Hundreds of FINCO research projects are now in process or already completed, giving dealers and servicemen a big jump on their competition. The total cost to your Jobber IS HIS COOPERATION . . . urge Your Jobber to write, wire or call *FINCO TODAY!*

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is often imitated . . . the leader always is!

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Form No. 20-199

Congress . . . "has the duty of protecting the public interest."

AN AUTOMATIC ELECTRONIC COMPONENT tester is now being used by the Air Force. Known as the Automatic Life Test and Data Recording Rack for tubes, transistors, and crystal diodes, the machine has eight specimen racks, each containing 100 sockets.

Tests, lasting as long as 1000 hours, can be conducted without further attention by an operator, and the results can be automatically recorded by an electric typewriter.

When set on *automatic,* the control console will give accurate readings on all 800 specimens at a rate of less than ten seconds per specimen. At any time the manual control can be switched on and a reading taken on a particular specimen.

Special environmental chambers for heat, vibration, and altitude tests are being installed. When this equipment is in place, it will be possible to set the components in these chambers with lead wires connected to the sockets in the automatic test racks. This will permit complete environmental and age testing without removal from fixtures, thus reducing the danger of damage to valuable equipment through breakage.

The test racks are housed in twelve cabinets, approximately seven feet high, two feet wide, and eighteen inches deep.

A 3000-MILE CHAIN of floating telemetry bases in the Atlantic Ocean, is now being established by the USAF Air Research and Development Command. This chain, to be located between the islands of St. Lucia and Ascension, will fill in the missile tracking gap that presently exists in ARDC's 5000-mile missile test range, which is used to test Army, Navy, and Air Force long-range missiles.

The links in the chain, six telemetry ships, have been modified with electronic equipment to record and transmit data concerning missile tests to Cape Canaveral, Florida, where the range control station of ARDC's Air Force missile test center is located.

Slow Army freight-supply cargo vessels were selected as the floating bases. These ships will be capable of remaining at their stations for as long as three weeks if necessary. However, when possible, the ships will only be *on station* while missiles are actually being tested. Upon completion of each mission the ships will return to South American ports of Recife and Belem in Brazil, and Georgetown, British Guiana, to pick up supplies and, when necessary, undergo drydock overhaul.

The number-two hold on these vessels functions as the telemetry center; actually the electronic brains of the ship. In each vessel, this area has been de-humidified, air-conditioned, sound-proofed, and insulated to insure accuracy of the data received

(*Continued on page* 140)

(Commercial)

FCC License Exams

your Guarantee of Success in Electronics

in a Minimum of Time

mail coupon NOW!

here's proof . . .

Name and Address	License	Time
Walter Eggers, Pacific Grove	1st	12 weeks
Paul Reichert, West Salem, Ohio	2nd	10 weeks
Harold Phipps, La Porte, Indiana	1st	28 weeks
John H. Johnson, Boise City, Okla.	2nd	12 weeks
James Faint, Johnstown, Pa.	1st	26 weeks

James Glen:

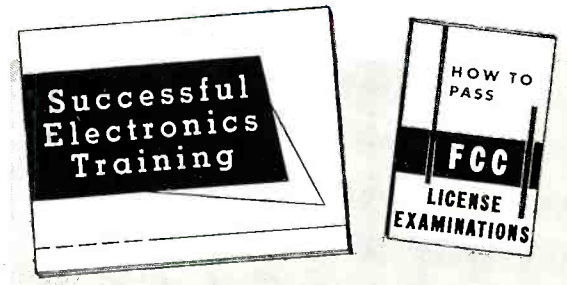
When Jim enrolled, he was a temporary employee of the City of Tacoma, Washington. In the space of 14 months, he completed the Master Course and received his first class license. He is now installing and maintaining mobile and microwave equipment.

James S. Glen, Jr.
2920 Knob Hill Road
Tacoma, Washington

To Cleveland Institute

Aerojet-General
American Airlines
American Telephone & Telegraph Co.
Bendix Radio
Braniff Airways
Burroughs Corp.
Capital Airlines
Continental Air Lines, Inc.
Convair
General Electric
Glenn L. Martin Co.
Goodyear Atomic Corp.
IBM
International Telephone & Telegraph Co.
Mohawk Airlines
Motorola
North American Aviation, Inc.
Northwest Airlines
Philco
RCA
Ryan Aeronautical Co.
**Plus many others*

Get Both FREE



Accredited by National Home Study Council

Cleveland Institute of Radio Electronics

Desk RN-9, 4900 Euclid Ave., 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? .....

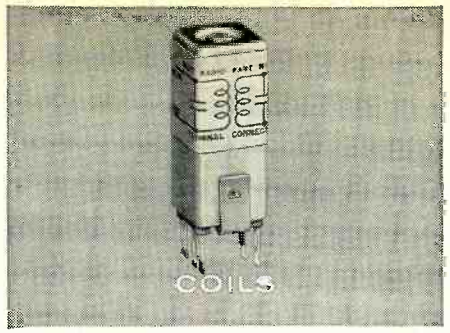
In what branch of Electronics are you interested? .....

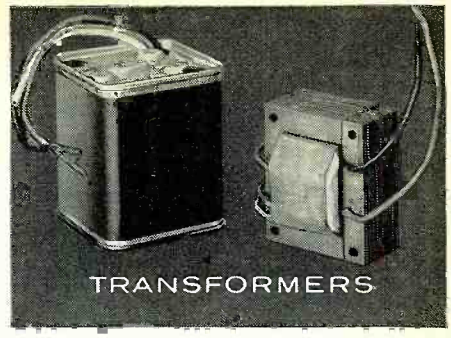
Name ..... Age.....

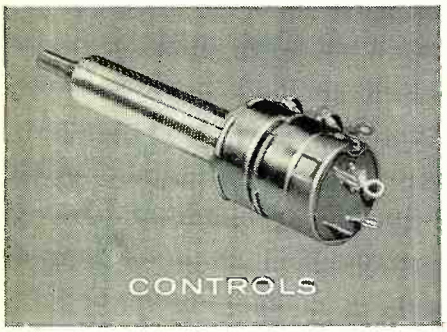
Address .....

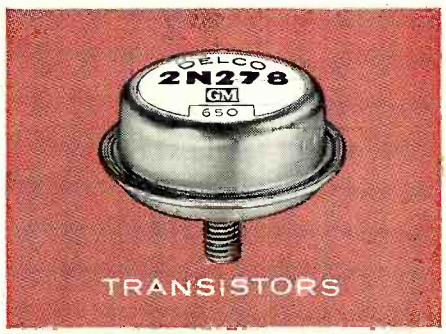
City ..... Zone..... State.....

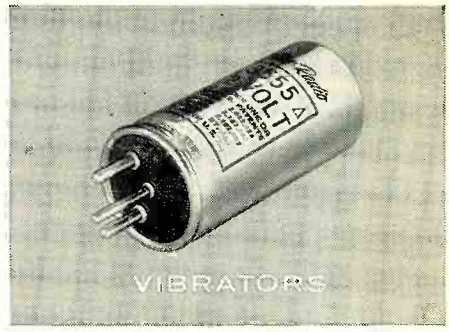
Special Tuition Rates to Members of Armed Forces Desk RN-9

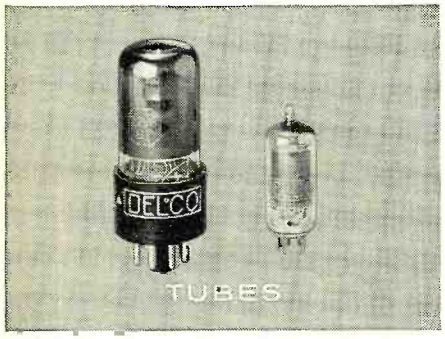












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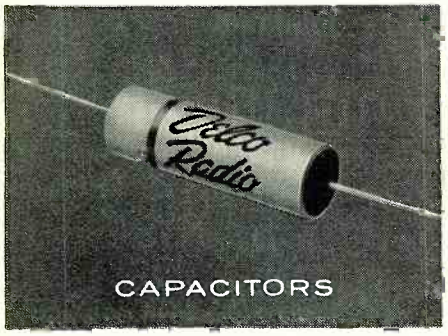

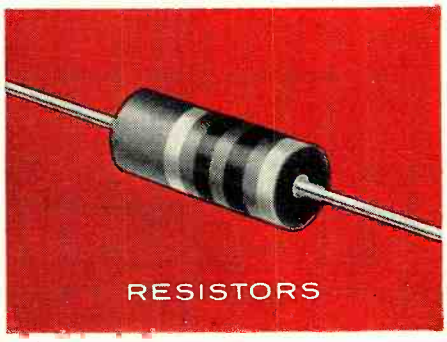

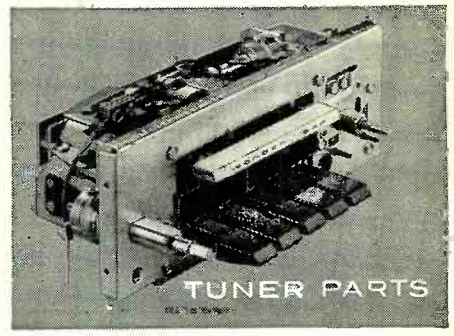

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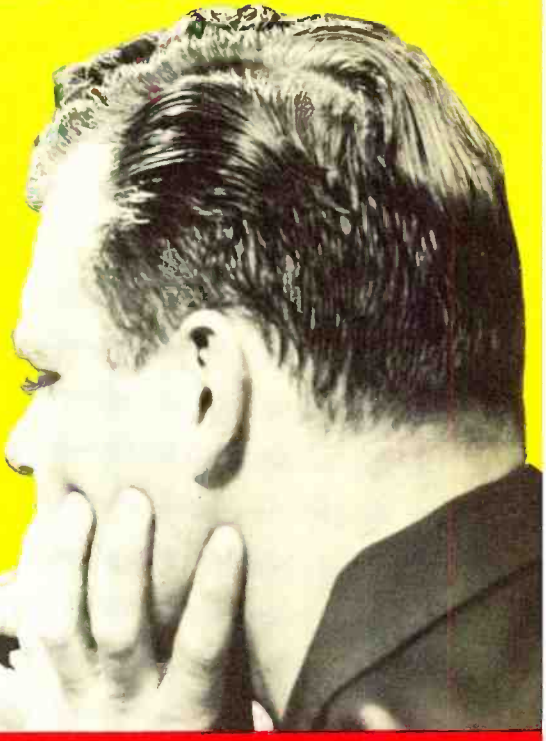
Servicing or Communications by Practicing at Home in Spare Time



WITHOUT EXTRA CHARGE you get special NRI kits developed to give actual experience with TV-Radio equipment. You build, test, experiment with receiver or broadcasting circuits. All equipment yours to keep.

NRI Has Trained Thousands for Successful Careers in TV-Radio

Studio Engr., Station KATV
"I am now Studio Engineer at Television Station KATV. Before enrolling for the NRI Course, I was held back by limitation of a sixth grade education." BILLY SANCHEZ, Pine Bluff, Ark.

Has All the Work He Can Do
"Since finishing NRI Course I have repaired more than 2,000 TV and Radio sets a year. NRI training certainly proved to be a good foundation." H. R. GORDON, Milledgeville, Ga.

Has Good Part Time Business
"Quite early in my training I started servicing sets. Now have completely equipped shop. My NRI training is the backbone of my progress." E. A. BREDA, Tacoma, Wash.

Have the High Pay, Prestige, Good Future of a Skilled TV-Radio Technician

People *look up to* and depend on the Technician, more than ever before. Offices, plants, homes everywhere are obliged to buy his knowledge and services. His opportunities are great and are increasing. Become a TV-Radio Technician. At home, and in your spare time, *you* can learn to do this interesting, satisfying work—qualify for important pay. To ambitious men everywhere *here* in the fast growing Television-Radio field is rich promise of fascinating jobs, satisfaction and prestige as well as increasing personal prosperity.

Increased Opportunities in Growing Field

A steady stream of new Electronic products is increasing the job and promotion opportunities for Television-Radio Technicians. Right now, a solid, proven field of opportunity for good pay is servicing the tens of millions of Television and Radio sets now in use. The hundreds of TV and Radio Stations on the air offer interesting jobs for Operators and Technicians.

More Money Soon—Make $10 to $15 a Week Extra Fixing Sets in Spare Time

NRI students find it easy and profitable to start fixing sets for friends and neighbors a few months after enrolling. Picking up $10, $15 and more a week gives substantial extra spending money. Many who start in spare time soon build full time TV-Radio sales and service businesses.

Act Now—See What NRI Can Do for You

NRI has devoted over 40 years to developing simplified practical training methods. You train at home. Get practical experience, learn-by-doing. Address: **NATIONAL RADIO INSTITUTE, Washington 16, D. C.**

The Tested Way To Better Pay

See Other Side

CUT OUT AND MAIL CARD NOW

SAMPLE LESSON AND CATALOG BOTH FREE

NO STAMP NEEDED!
WE PAY POSTAGE

This card entitles you to Actual Lesson on Servicing, shows how you learn Television-Radio at home. You'll also receive 64-Page Catalog.

NATIONAL RADIO INSTITUTE, Dept. A B
Washington 16, D. C.

Please mail me the FREE sample lesson and 64-Page Catalog. (No Salesman will call.)

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

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

ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

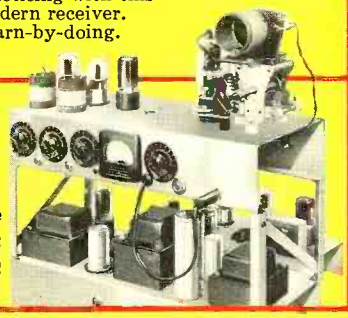
Technical "KNOW-HOW" Can Give You Interesting, Important Work
LEARN-BY-DOING with Kits NRI Sends at No Extra Charge

YOU BUILD AC-DC Superhet Receiver

NRI Servicing Course includes all needed parts. By introducing defects you get actual servicing experience practicing with this modern receiver. Learn-by-doing.

YOU BUILD Signal Generator

You build this Signal Generator. Learn how to compensate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver circuits. Make tests, conduct experiments.



YOU BUILD Broadcasting Transmitter

As part of NRI Communications Course you build this low power Transmitter, learn commercial broadcasting operators' methods, procedures. Train for your FCC Commercial Operator's License.

YOU BUILD Vacuum Tube Voltmeter

Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from NRI's easy-to-understand texts.

For Higher Pay, Better Jobs
Be a Television-Radio Technician

Servicing Needs More Trained Men

Portable TV, Hi-Fi, Transistor Radios, Color TV are making new demands for trained Technicians. Good opportunities for spare time earnings or a business of your own.

Broadcasting Offers Satisfying Careers

4000 TV and Radio stations offer interesting positions. Govt. Radio, Aviation, Police, Two-Way Communications are growing fields. Trained Radio-TV Operators have a bright future.

J. E. Smith, Founder

Train at Home the NRI Way Famous for Over 40 Years

NRI is America's oldest and largest home study Television-Radio school. The more than 40 years' experience training men for success, the outstanding record and reputation of this school—benefits you in many ways. NRI methods are tested, proven. Successful graduates are everywhere, from coast to coast, in small towns and big cities. You train in your own home, keep your present job while learning. Many successful NRI men did not finish high school. Let us send you an actual lesson, judge for yourself how easy it is to learn.

No Experience Necessary—NRI Sends Many Kits for Practical Experience

You don't have to know anything about electricity or Radio to understand and succeed with NRI Courses. Clearly written, well-illustrated NRI lessons teach TV-Radio-Electronic principles. You get NRI kits for actual experience. All equipment is yours to keep. You learn-by-doing. Mailing the postage-free card may be one of the most important acts of your life. Do it now. Reasonable tuition. Low monthly payments available. Address: **NATIONAL RADIO INSTITUTE, Washington 16, D. C.**

NRI Graduates Do Important Work

Now Quality Control Chief
"Had no other training in Radio before enrolling, obtained job working on TV amplifiers before finishing course. Now Quality Control Chief." T. R. Favaloro, Norwich, N. Y.

NRI Course Easy to Understand
"I opened my own shop before receiving my diploma. I have had to hire extra help. I am independent in my own business." D. P. Cressey, Stockton, Cal.

Works on Color-TV
"NRI changed my whole life. If I had not taken the course, probably would still be a fireman, struggling along. Now Control Supervisor at WRCA - TV." J. F. Meline, NewYork, N Y.

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P. L. & R.)
Washington, D.C.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

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SAMPLE LESSON
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See Other Side for more information on the Tested Way to Better Pay

THE INDEPENDENT SERVICE BUSINESS AND YOUR FUTURE

SOMETHING IS BEING DONE FOR INDEPENDENT SERVICE

This free booklet gives you all the details of your big Independent Service-Dealer national advertising campaign and the promotional tie-in material to help you increase your business.

The program is important to *your own* future. A nationwide survey conducted among independent service-dealers revealed that 88 out of every 100 of you are concerned for the future of independent service and want this campaign continued. Because of your remarkable interest, it is being continued. And it will be expanded as your interest and support grow.

Learn all about your Independent Service campaign, its supporting material, and how you can get the most from them. Ask your CBS Tube distributor for your free copy of booklet PA-163, or write to us.

Remember — each time you buy CBS tubes, you support your own independent Service-Dealer program. Keep it going . . . keep it growing . . . always specify CBS tubes.

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

For the best entertainment, tune to your local CBS station

millions of people will read powerful, large-space ads in

★ NATIONAL MAGAZINES

★ SUNDAY SUPPLEMENTS IN 164 KEY CITIES

★ LOCAL NEWSPAPERS

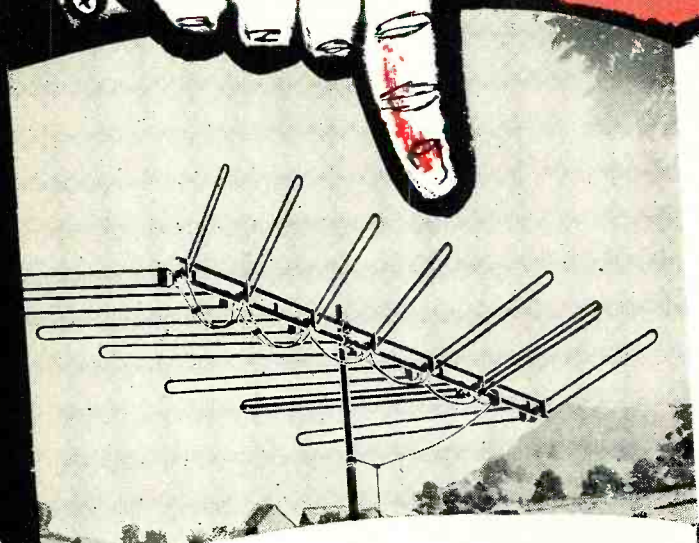
CHANNEL MASTER

Launches Another Dynamic

NATIONAL ADVERTISING CAMPAIGN

Once again Channel Master uncorks a massive national advertising drive to help you sell more outdoor antenna installations. These ads provide powerful sales support — right in your own local area . . . sparking new and replacement outdoor antenna installations . . . creating store traffic . . . promoting regular antenna check-ups.

featured in NEW NATIONAL ADS



CHANNEL MASTER® T-W ANTENNA

The revolutionary new T-W is America's largest selling outdoor antenna. In gain, front-to-back ratio and mechanical strength, the T-W is unequalled by any other Broad Band antenna. Available in 7, 5, and 3-element models.

® Reg. U.S. Pat Office and Canada

HOW YOU CAN WIN PRESTIGE and PROFITS WITH THIS CAMPAIGN

Sell a "Complete Channel Master Installation"

Consistent, big-space national advertising has created strong consumer preference for **all** Channel Master products. That's why it's now more profitable than ever for you to sell a "complete Channel Master installation"— featuring Channel Master masting, guy wire, transmission line, standout insulators, etc.

Identify Yourself as a Channel Master Dealer

Customers have confidence in you when you sell the brand they know best — and Channel Master is the **only** nationally advertised brand of TV antennas and accessories. Identify yourself with the leader. Display the prestige-building Channel Master banners, streamers, antenna check-up charts, and other materials. Available thru your local Channel Master Distributor. Call him Now!

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

PROOF
UNIVERSITY SPEAKERS STAY SOLD!

To insure valid statistics, this tabulation covers the largest selling brands, based on a four-year survey (April 1953 to March 1957) of classified and "Swap or Sell" ads for used high fidelity loudspeakers. All ads authenticated as placed by private individuals in Audio, High Fidelity and Music At Home

PERCENTAGE OF TOTAL INSERTIONS			
SPEAKER "A"	SPEAKER "B"	SPEAKER "C"	UNIVERSITY
46½%	23¼%	16¼%	13%

Fewest number of ads offer University equipment . . . outstanding testimonial of user satisfaction.

We have always believed that the tremendous volume of University speakers sold in the past to hi-fi enthusiasts attested to the genuine listening satisfaction designed into all our products.

We think that all legitimate hi-fi loudspeakers sound pleasing, but the acid test of listening satisfaction is a speaker's "staying power". Does it grow with your hi-fi tastes, continue to please year after year . . . or is it obsolete before its time . . . ready for swap, sale or discard?

Yes, in the "Swap or Sell" columns of the leading audiophile magazines, you soon know which of the prominent brands of loudspeakers readers outgrow . . . and, *by the absence of such ads*, which of these leading loudspeakers remain in the home!

The record speaks for itself. This accurate survey, taken over a span of four years, shows that speaker "B" has almost 50% more "for sale" listings than University . . . while speaker "A" is offered more than three times as often! Here is indisputable unsolicited testimony from average hi-fi users themselves that University *stays sold*, continues to serve year after year as a source of rich musical pleasure.

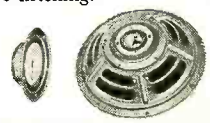
University offers the largest selection of speakers and components to meet every size and budget requirement

LISTEN *University sounds better*®

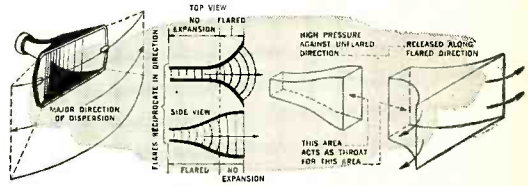
UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

. . . and here's why

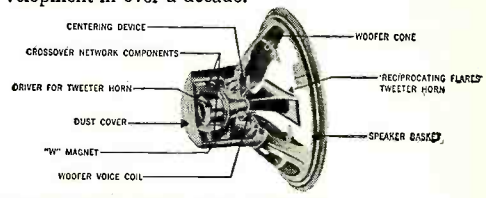
PATENTED DIFFUSICONE PRINCIPLE.
Available only on University Diffaxials. Mid and high frequencies are extended with remarkable efficiency through coaxial dual horn loading at the apex of the loudspeaker cone. A radial projector combined with aperture diffraction provides uniform, wide-angle dispersion, assuring *full fidelity* no matter where off speaker axis you may be listening.



EXCLUSIVE BI-SECTIONAL CONSTRUCTION
Typical of University's advanced design and fabrication techniques is the unique bi-sectional construction of completely independent basket and magnet assemblies. This results in a precision product—vibration and shock-proof in operation, built for trouble-free long life.



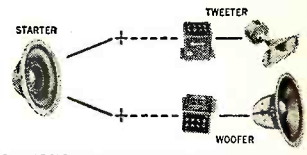
PATENTED "RECIPROCATING FLARE" DESIGN
On all University tweeters the compression driver is coupled to a "reciprocating flare" horn designed to provide *maximum* uniformity of wide-angle dispersion in the horizontal plane with optimum vertical coverage. This is the greatest single advance in wide-angle horn development in over a decade.



TRUE THRU-THE-AXIS DESIGN
In *true* thru-the-axis design, the tweeter driver unit is fitted to the "reciprocating flare" horn *thru the center* of the woofer magnet assembly. Only with *this* thru-the-axis design is it possible to project high frequencies thru a horn of scientific formula-correct length and configuration . . . and thus achieve highest efficiency, lowest distortion and uniform wide-angle treble reproduction.

MAXIMUM COMPONENT FLEXIBILITY
To meet the ever varying technical needs of expanding aspirations and improvements, University components are designed to provide a maximum of application and operational flexibility, e.g.: woofers with dual impedance voice coils, networks and filters to match all popular impedances and crossover frequencies, speakers having adjustable response devices, etc. ***Therefore . . .***

Only University can offer . . .



GENUINE PROGRESSIVE SPEAKER EXPANSION
The "Master Blueprint" that prevents your speaker from becoming obsolete, because you can *improve* without discarding existing speakers or systems! You choose from literally dozens of different starter speaker set-ups to suit your present taste and purse. Then, when and as you wish, you integrate these components into *tomorrow's* magnificent deluxe system . . . safeguarded by unmatched engineering flexibility and variety that makes "step-by-step" improvement a wonderful reality.

HIGH FIDELITY

These are just a few of the reasons why University assures you superior sound that lives and lasts through the years. As other satisfied purchasers know . . . you might spend more— but you can't equal University.

PROFESSIONAL RECOGNITION, GENERAL ELECTRIC ALL-AMERICAN

LIFE

Announcing

THE GENERAL ELECTRIC ALL-AMERICAN AWARDS FOR TV SERVICE TECHNICIANS WHO HAVE DISTINGUISHED THEMSELVES IN PUBLIC SERVICE

General Electric proudly establishes the All-American Awards to honor the TV Service Technicians of America for their good citizenship in many fields of public service.

Individually and as members of some three hundred trade groups, TV Service Technicians make many unheralded contributions to the welfare and happiness of their communities. You will find them repairing TV sets without charge in children's hospitals—teaching disabled veterans how to service TV sets—instructing Boy Scouts and other youth groups in elementary electronics—applying their specialized technical knowledge to many important fields of public service.

G-E All-American Award trophies will be presented to the eleven TV servicemen who, in the opinion of the judges, have achieved the most distinguished records of participation in community service during the two-year period ending September 30, 1957. In addition, General Electric will present $500 to each winner for use in community improvement activities.

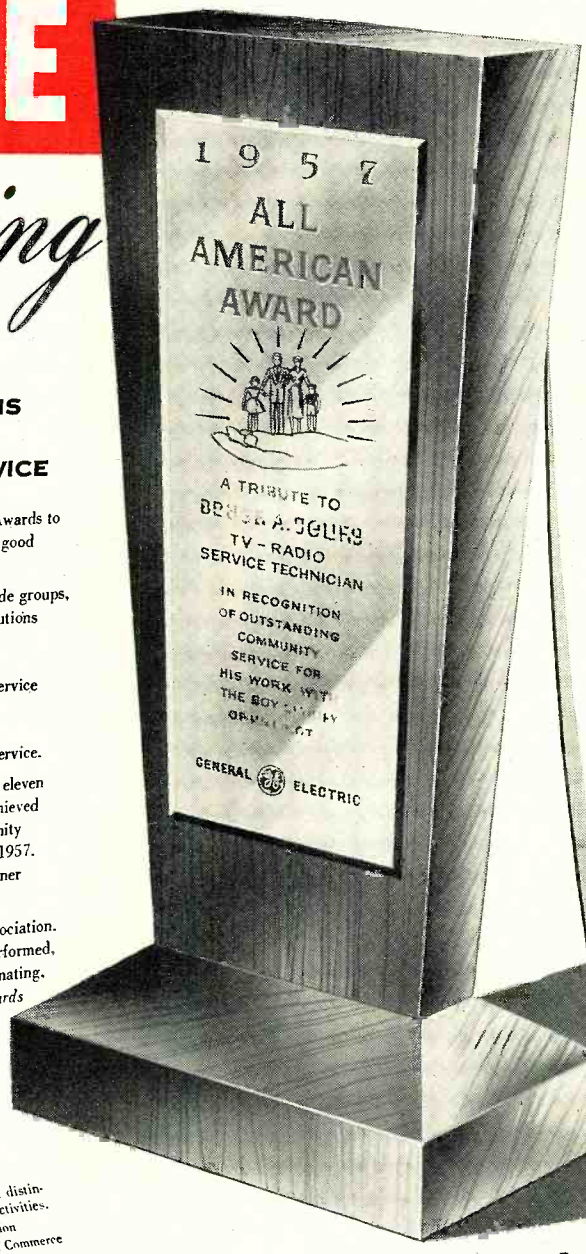
Nominations may be made by any individual, club or association. Simply write a letter describing the community service performed, give the name and address of the serviceman you are nominating, and mail it before October 19th to the *All-American Awards Committee, General Electric Company, Owensboro, Ky.*

All-American Award winners will be selected by a panel of distinguished citizens renowned for their own public service activities.

WENDELL BARNES, Administrator, Small Business Administration
WENDELL FORD, 1956-1957, Pres., National Junior Chamber of Commerce
HERMAN HICKMAN, Sports Authority and Commentator
ED SULLIVAN, Columnist and TV Personality

Decision of the judges will be final.

Establishment of the All-American Awards is another step in General Electric's program to give recognition to independent businessmen everywhere for their important contributions to America's progress. General Electric Co., Receiving Tube Department, Owensboro, Ky.



WINNERS TO BE ANNOUNCED IN DECEMBER

GENERAL ELECTRIC

Full-page General Electric national advertising spotlights community service of independent TV-radio technicians such as yourself.

Your customers and prospects are being asked to help select an All-American award-winning team of 11 outstanding service dealers.

A complete package of promotion aids and display tie-ins is waiting for you. Your G-E tube distributor has this timely, colorful material. Ask him to help make your shop All-American service headquarters!

These advertising tie-ins can open your door wide to new fall business—

Easel-back display, "Football Time Is TV Tune-up Time"... Large football-theme window banner... Eye-catching window streamers... Special direct-mail folder and postcard...Newspaper mats... "Set-owners' TV Service Guide", a business-building booklet to give to service prospects.

INCREASED SERVICE VOLUME—CAMPAIGN OFFERS YOU BOTH!

FOOTBALL IS HERE. The star-studded entertainment programs are back. Millions of TV owners need to have their sets checked for top performance. Timed for this fall market, General Electric has kicked off its All-American campaign in support of the TV-service profession—the biggest ever—to 25,000,000 readers of LIFE. Full-page ads feature the all-around job service dealers like yourself are doing in and for the community...point to shops like yours as neighborhood TV-radio service headquarters.

To assist you further as an independent TV technician...to help identify your shop as first choice for tune-up work...General Electric has ready for you, through your G-E tube distributor, a new, timely kit of displays and advertising aids that will catch the eye of football fans and other set-owners who want tune-ups and repairs.

You also can make good use of the special football schedule shown below, carrying your name and address. It's a reminder item that prospects for TV-service work will value and keep with them for many months.

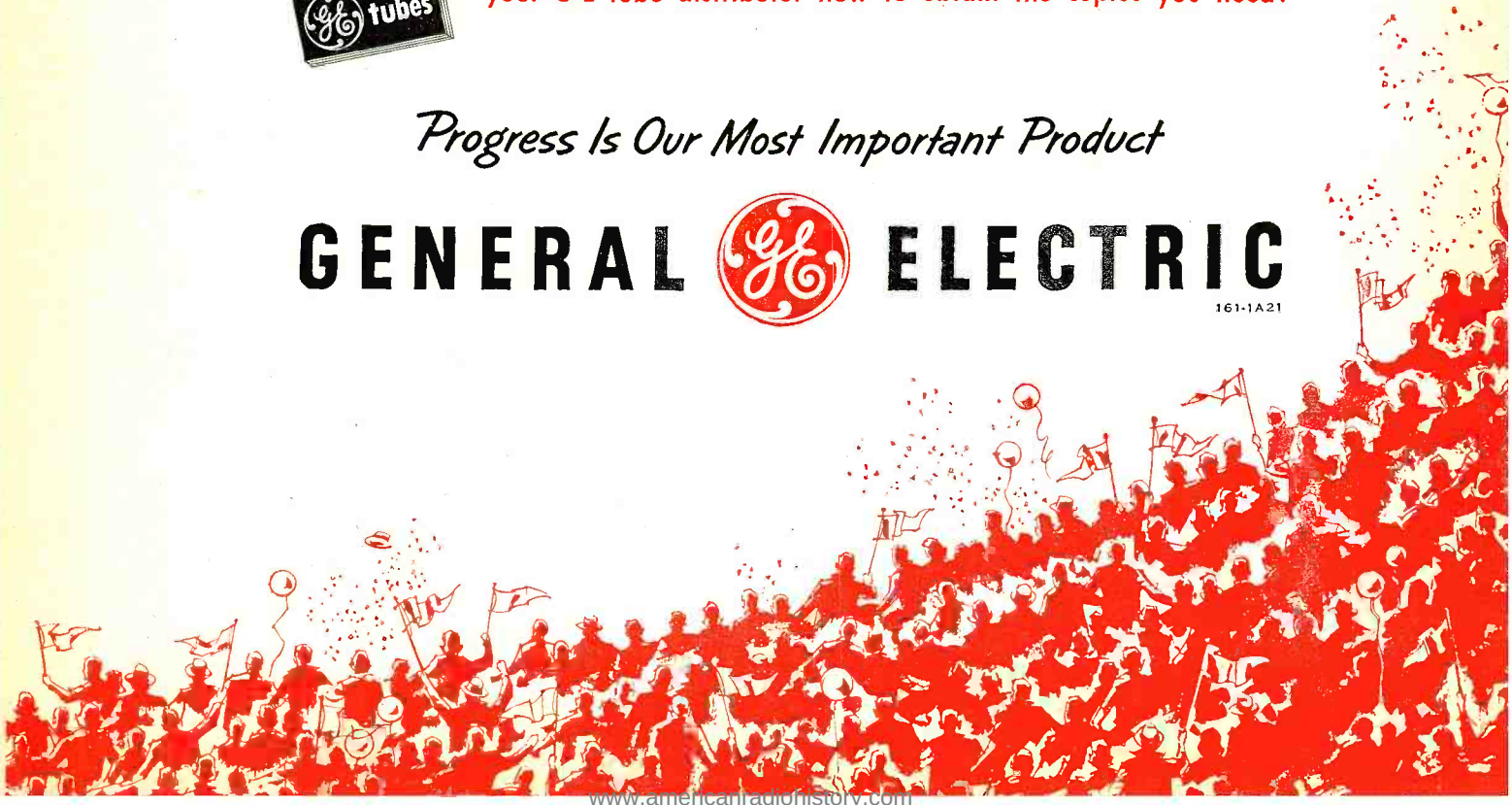
Phone your G-E tube distributor! Ask him how you can tie in *now* with this big General Electric fall campaign to strengthen your community standing, and underscore your reputation for service! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*

AVAILABLE IN QUANTITIES: 1957 college and professional football schedule, with space for your name and address. Everybody wants one. You can use this handy pocket guide to make friends for your shop and as All-American reminder advertising. Ask your G-E tube distributor how to obtain the copies you need!

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1A21

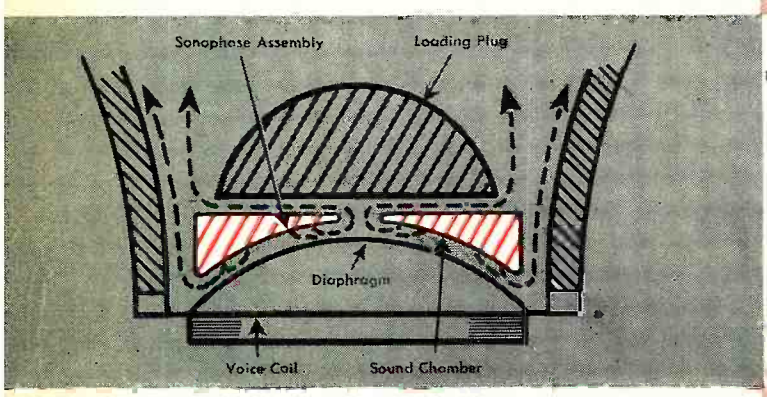


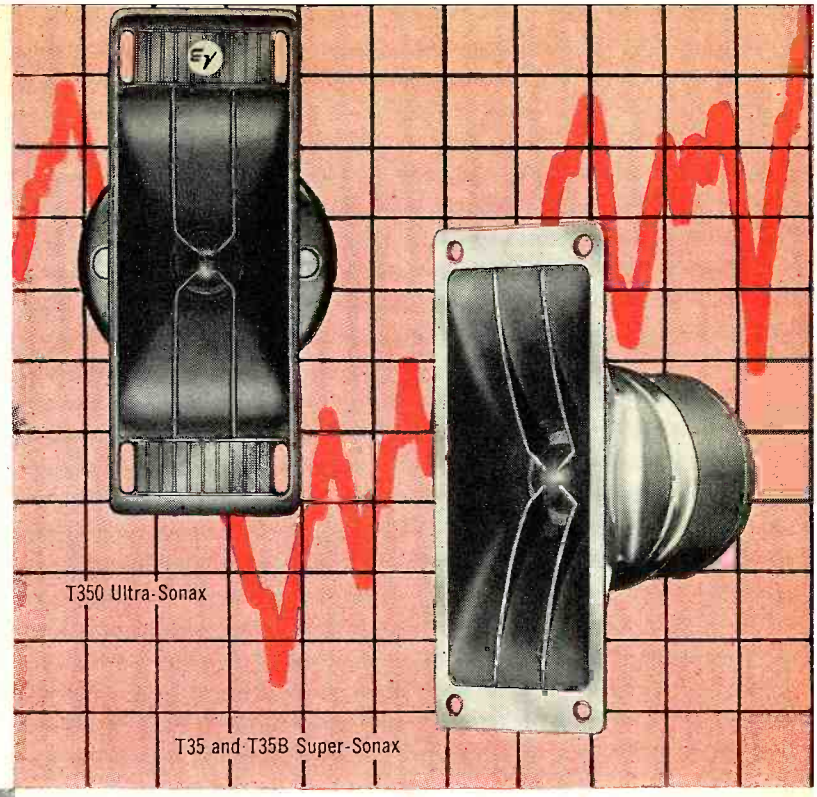
Electro-Voice®

NEW Ultra-Sonax and Super Sonax Very High Frequency Drivers, Diffraction Horns and Revolutionary E-V Sonophase Throat Design

No other manufacturer gives you very high frequency drivers combining all the customer benefits of these unique new Electro-Voice models. Today's folded horn and phase loaded speaker systems with their low first-octave response *require* flat, extended high range response beyond the very limit of audibility if essential musical balance is to be achieved. These very high frequency drivers, employing the time-tested diffraction principle and the new Avedon Sonophase throat design, overcome range and sensitivity limitations, function without distortion at the highest ranges.

All three models—T35, T35B and T350—have 180° dispersion patterns, program capacities of 50 watts, peak 100 watts, voice coils one inch in diameter and 16 ohms impedance. Chart shows other characteristics of each model.





Specifications	T35	T35B	T350
Frequency Response:	±2 db 2 kc—19 kc	±2 db 2 kc—18 kc	±2 db 2 kc—21kc
RETMA Sensitivity Rating:	57 db	54 db	60 db
Magnet Weight:	7 oz.	4 oz.	1 lb.
Gauss	13,500	9,000	20,000
Size:			7½ in. long x
Horn:	5¼ in. long x 2 in. wide		2⅞ in. wide
Pot Diameter:	2¼ in. maximum		3½ in. maximum
Depth:	3¼ in. overall	3 in. overall	4½ in. overall
Shipping Weight:	3 lbs.	3½ lbs.	9½ lbs.
Net Price:	$35.00	$22.00	$60.00

And These are the Reasons Why

The Avedon Sonophase Throat Design

The unique throat design illustrated here overcomes a problem common in conventional high frequency drivers. This is diaphragm deformation at high frequencies, occurring at frequencies above 5 kilocycles. Piston action is destroyed, the phase is shifted and the result is destructive interference.

These Electro-Voice UHF drivers solve the diaphragm deformation problem with a longer sound path from the center of the diaphragm. This restores proper phase relationship. This is important above 12 kilocycles, where sound must be taken from the center of the diaphragm *and* from the outer edge simultaneously. The diagram shows E-V's Sonophase construction.

The Hoodwin Diffraction Horn

This is the Electro-Voice development which is used in all E-V horns to disperse sound *equally in all lateral directions* from a single point source. This is especially important in stereophonic reproduction to preserve the undistorted depth and width of the original sound. Diffraction horns insure balanced levels of both right and left stereo speakers. These drawings tell the diffraction horn story:

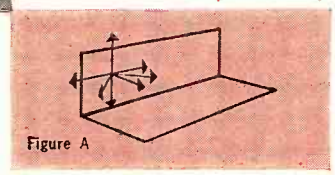
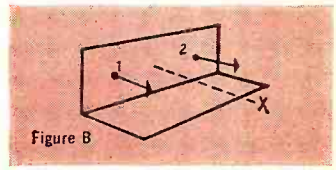
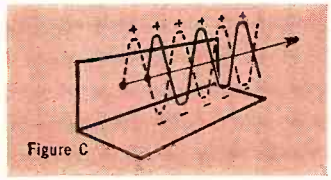


Figure A—This shows how sound disperses equally in all directions from a single point source.



In Figure B two sound sources are shown. On the axis, at point "x," double the sound power results as the resultant pressures are in phase.



But in Figure C, if the distance between the two sources is ½ wavelength or greater, the sound from the two sources will be considerably out of phase for points off the axis, resulting in decreased sound pressure.

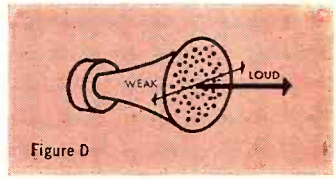


Figure D will show the deficiencies in horns of wide lateral dimensions compared to the wavelength being emitted. Any horn mouth can be considered as a group of small point sources of sound. They must beam the sound down the axis by their very nature.

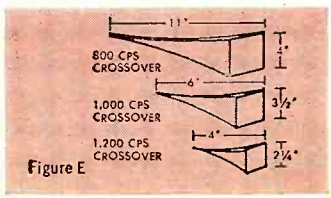


Figure E shows representative horns, illustrating that horns must have a certain length, as well as cross sectional area along this length and at the mouth to load the driver diaphragm down to the lowest frequencies to be reproduced. The lower we go, the longer must be the horn and the greater the mouth area.

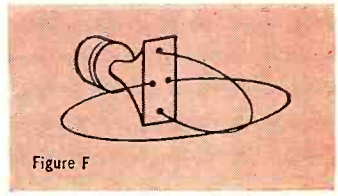


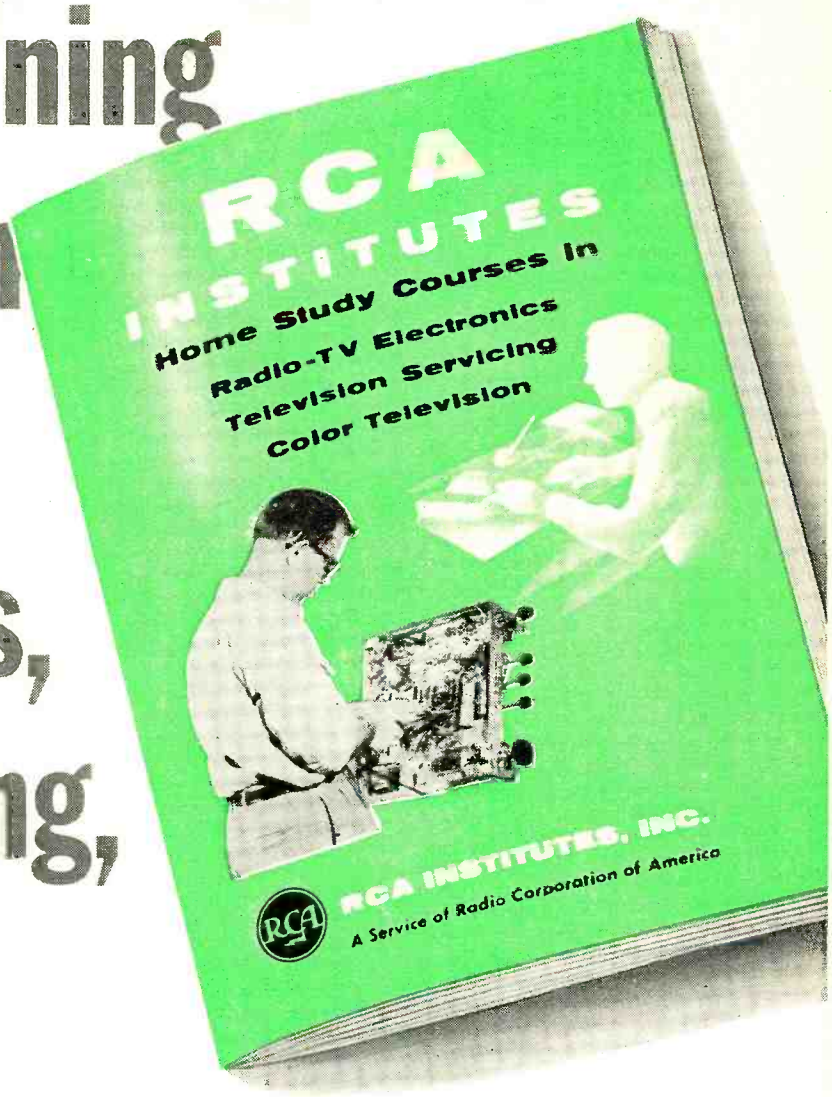
Figure F shows that narrowing the horizontal area and extending the vertical dimension of the horn mouth preserves the loading area necessary for good low end response, disperses the sound perfectly in the horizontal direction where it is so necessary, and keeps interfering reflections off the floor and ceiling.

Electro-Voice®

ELECTRO-VOICE, INC. • BUCHANAN, MICHIGAN
Export: 13 East 40th Street, New York 16, U.S.A. Cables: ARLAB

This is just one example of the 'Listeneered' superiority of Electro-Voice products which makes them easy to sell. Just one more reason why more dealers sell more E-V products at more profit than any other line. See your E-V Rep TODAY.

RCA offers you the finest training at home in Radio-TV electronics, TV servicing, Color TV



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A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.
In Canada—RCA Victor Company, Ltd.,
5001 Cote de Liesse Rd., Montreal 9, Que.

Within the Industry

ROBERT LAUB has been promoted to assistant sales manager for *Cabinart*, a division of *G & H Wood Products Company*.

His duties will include the merchandising of the company's equipment and speaker cabinet line, kits, and accessories on a national basis, as well as serving as direct sales representative with dealers in the northeastern section of the country. He will also act as liaison between the firm's contract division and OEM accounts.

Mr. Laub joined the organization in 1956. He is a graduate of Bucknell University and holds a Masters degree from Columbia.

* * *

INSTITUTE OF HIGH FIDELITY MANUFACTURERS, INC. has announced the appointment of Edwin Cornfield as executive secretary effective immediately. In addition, Sanford L. Cahn, who held the temporary offices of executive secretary and show director, will continue to serve in the latter capacity.

Mr. George Silber, president of the association, stated that the expanded promotional and educational programs now in development by the Institute make these appointments necessary.

Mr. Cornfield, who recently resigned as national sales manager of the tape recorder division of *DeJur-Amsco Corp.*, is also a former sales manager of *Pilot Radio Corp.* His new duties will include service on the various active committees of the Institute as well as correlation of the many activities of the industry.

* * *

ROBERT ARANY has been appointed sales manager of the power factor capacitor division of *Cornell-Dubilier*.

Mr. Arany has been with the company for the past 17 years. He started with the firm as a draftsman in 1940 and was later promoted to the post of sales correspondent during 1941.

After three years of service in the Air Force during World War II, he returned in 1946 as assistant to the sales manager.

* * *

HAROLD B. RICHMOND, for the past thirteen years chairman of the board of the *General Radio Company*, retired recently having reached the company's mandatory retirement bracket.

Mr. Richmond joined the organization as an engineer in 1919 and two years later was elected its secretary. He became treasurer in 1926, which position he held until his election as chairman of the board of directors. He has been director and president of the Radio Manufacturers Association (now RETMA).

During the second World War he was chief of the guided missile division of the National Defense Research Committee. For his energy and foresight in promoting continued research along these lines, he was awarded the Presidential Medal of Merit and later was chairman of the National Academy of Science's Ordnance Advisory Committee on Guided Missiles.

* * *

LOUIS R. BURROUGHS has been elected vice-president for broadcast and recording equipment at *Electro-Voice, Inc.*

Formerly chief engineer of the company, he has been with the organization since its inception in 1927. Active in microphone engineering for thirty years, he has collaborated on the design and invention of some of the firm's most important contributions to the microphone industry.

During World War II, he built the first differential or noise-cancelling microphone for military use in high background noise areas.

* * *

RADIO-ELECTRONICS-TELEVISION MANUFACTURERS ASSOCIATION now has under consideration a full scale plan of action to combat the rising tide of receiving tube counterfeiting, which already has reached an estimated $100 millions.

The proposed program is the direct outgrowth of the recent joint meetings of the association's receiving tube section, headed by George W. Keown, vice-president of *Tung-Sol Electric Inc.*, and its tube counterfeiting committee, under the leadership of L. Berkley Davis, general manager, electronic components division of *General Electric Co.*

Spearheaded by a hard-hitting motion picture dramatizing the evils of tube counterfeiting, the action plan would be backed up by public relations and advertising based on the theme, "You never get something for nothing."

Three major dangers of tube counterfeiting are the targets of the pro-

gram. Counterfeit tubes: (1) destroy manufacturers' reputations for quality; (2) nullify advertising and sales promotion; and (3) create a total market loss.

The RETMA plan is broken down into five general objectives: 1. Clarification of the status of legitimate tube reprocessers; 2. The drying up of the counterfeiters' sources of supply; 3. Depriving the counterfeiter of his markets; 4. Improving the identification of reprocessed tubes; and 5. Encouraging FTC enforcement of laws covering fraudulent tube advertising.

Release dates of the educational film, literature, advertising, and publicity will be announced shortly.

* * *

W. WILLIAM HENSLER has been elected to the new post of vice-president in charge of operations for *Howard W. Sams & Co., Inc.* In his new position, he will have under his direction all operations of the company except finance and industry relations of the firm.

He served as an electronic instructor in the Navy during World War II and became identified with the publishing firm in 1946. During this period, he served in practically all departments of the company, including engineering, production, manufacturing relations, merchandising, and sales. He is a graduate of the American Management Association's School of Management.

* * *

H. H. SCOTT, INC., Cambridge, Mass., has been awarded a Certificate of Merit by the National Federation of Advertising Agencies for outstanding achievement in product advertising.

One of the few electronic firms manufacturing consumer products exclusively, the organization directed one campaign on high-fidelity components to the layman in non-technical language and another to high-fidelity enthusiasts.

* * *

ROBERT I. MENDELS has been elected president of *Electronic Devices, Inc.,* Brooklyn, N. Y.

Mr. Mendels was formerly associated with the *Philips Electrical Industries,* The Netherlands, where he rose from a junior engineer to head of world sales for the firm's gas discharge lamp division.

During the war he served as an officer in the Netherlands Army and, after the fall of Holland, escaped to England. Subsequently he was in charge of the division of rehabilitation for the Netherlands electrical industry.

He became a United States citizen and established his own technical im-

(*Continued on page* 184)

GET IN ON THE TV BOOM!

L. C. Lane, B.S., M.A.
President, Radio-Television Training Association. Executive Director, Pierce School of Radio & Television.

TRAIN FOR A TOP-PAY JOB AS A TELEVISION TECHNICIAN

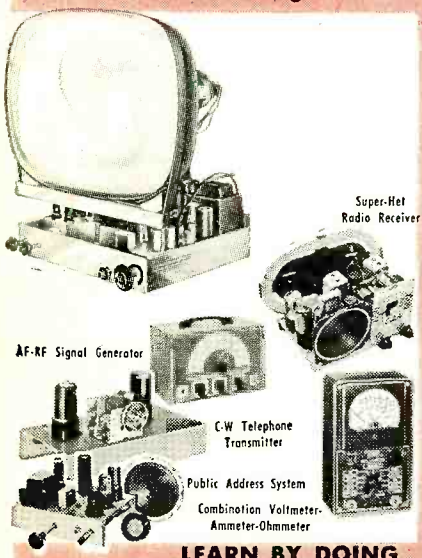
NO PREVIOUS EXPERIENCE NEEDED — study AT HOME in your SPARE TIME

Next to the atom and hydrogen bombs, the biggest noise being made today is by the booming radio-television-electronics industry.

Now, while the boom is on in full force, is the time for you to think about how you can share in the high pay and good job security that this ever-expanding field offers to trained technicians.

Just figure it out for yourself. There are more than 400 television broadcasting stations operating right now and hundreds more to be built; more than 34 million sets in the country and sales increasing daily. Soon moderately priced color television sets will be on the market and the color stampede will be on.

All these facts mean that good jobs will be looking for good men. You can be one of those men if you take advantage of my training *now* — the same training that has already prepared hundreds of men for successful careers in the radio-television-electronics field.



LEARN BY DOING

As part of your training I give you the equipment you need to set up your own home laboratory and prepare for a BETTER-PAY TV JOB. You build and keep an Electromagnetic TV RECEIVER designed and engineered to take any size picture tube up to 21-inch, (10-inch tube furnished. Slight extra cost for larger sizes.) . . . also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power supply. Everything supplied, including all tubes.

EARN WHILE YOU LEARN Almost from the very start you can earn extra money while learning by repairing radio-TV sets for friends and neighbors. Many of my students earn enough each week to pay for their entire training from spare time earnings . . . start their own profitable service business.

FCC COACHING COURSE Qualifies you for Higher Pay! Given to all my students AT NO EXTRA COST. Helps you qualify for the TOP JOBS in Radio-TV that demand an FCC license! Full training and preparation at home for your FCC license.

No experience necessary! You learn by practicing with professional equipment I send you. Many of my graduates who now hold down good paying technician jobs started with only grammar school training.

If you have previous Armed Forces or civilian radio experience you can finish your training several months earlier by taking my FM-TV Technician Course. Train at home with kits of parts, plus equipment to build YOUR OWN TV RECEIVER. ALL FURNISHED AT NO EXTRA COST!

After you finish your home study training in the Radio-FM-TV Technician Course or the FM-TV Technician Course you get two weeks, 50 hours, of intensive Laboratory work on modern electronic equipment at our associate school in New York City, Pierce School of Radio & Television.

COLOR TV TECHNICIAN COURSE—All new! Learn the latest. Be prepared for those Color TV servicing profits ahead! Contains the most up-to-date servicing data, procedures and circuits. For men with radio or TV training or experience

RADIO-FM-TV TECHNICIAN TRAINING

FM-TV TECHNICIAN TRAINING

Sylvania Now Sponsoring RTTA's Color TV Technician Course

One of the nation's largest electronics manufacturers and marketers Sylvania Electric Products Inc. in its continuing effort to cooperate with independent service dealers is now sponsoring the RTTA Color Television Technician Course. Available to Authorized Sylvania Dealers.

VETERANS!

My School fully approved to train Veterans under new Korean G. I. Bill. Don't lose your school benefits by waiting too long. Write discharge date on coupon.

YOU GET THESE *free!*

MAIL THIS COUPON TODAY!

Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSOCIATION

Dept. RT-9D, 52 East 19th Street, New York 3, N. Y.

Dear Mr. Lane: Send me your NEW FREE BOOK, FREE SAMPLE LESSON that will show me how I can make TOP MONEY IN TELEVISION. I understand I am under no obligation.

(PLEASE PRINT PLAINLY)

Name_____ Age_____

Address_____

City_____ Zone____ State_____

- ☐ Color TV Technician Course
- ☐ Radio-FM-TV Technician Course
- ☐ FM-TV Technician Course
- ☐ TV Studio Technician Course

VETERANS!
Write discharge date

Radio-Television Training Association

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NOW YOU CAN ORDER precise KITS BY MAIL...

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Precise Engineered

QUICK-TEST TUBE TESTER

Only 3 Knobs for GM, EM, Short and Gas Tests.

This is the finest *fast-check* tube tester and dollar-earning traveling companion for a Serviceman . . . or for use in the factory. You can plug in 5 tubes of the same type and check each one individually by rotating the *Tube Bank* switch. It actually checks 5 tubes in 20 seconds . . . or 4 seconds per tube. By rotating the *function-switch*, each triode of a dual triode is checked individually, each diode and the triode of a duo-diode-triode is separately tested and not lumped as in other testers . . . and a pentode is tested as a pentode—not a diode. *Transistors*, shorts, gas, life, mutual conductance and emission can be tested with this model. Includes a deeply etched panel, beautiful Moleskin covered wood carrying case and cover. Easy to carry.

Precise Model **116K** Kit Form.....**$ 79.95**
Precise Model **116W** Factory Wired **139.95**

Precise Engineered

5" SCOPE

UP to 9 mc
FLAT to 5 mc
for color work

After you've built this 'scope, you'll be amazed at its versatility. No other 'scope below a $100.00 can meet all of its specifications. Design features include push-pull vertical and horizontal . . . high sensitivity . . . 5CP1 tube with post acceleration . . . frequency compensated stepping attenuators for both vertical and horizontal . . . focus, intensity and astigmatism controls . . . and calibration output voltage. Vertical amps are flat through 5 mc ± 8 db through 9 mc. Sensitivity is 10 mv/cm. Horizontal amps within ± 6 db through 500 kc, have frequency compensated stepping attenuator input and cathode follower to assure linear horizontal trace. Hard vacuum sweep frequencies with sufficient expansion to see color bursts clearly, and a sensitivity approximately 40 mv/cm, made this instrument the exceptional buy of the year.

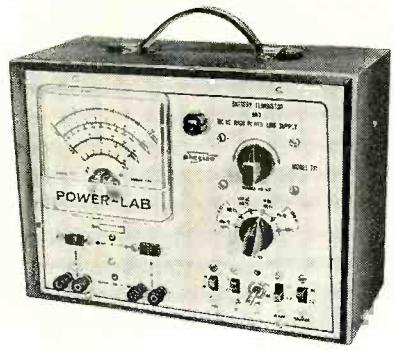
Precise Model **3151K** Kit Form .....**$ 59.95**
Precise Model **3151W** Factory Wired **109.95**

Precise Engineered **POWER LAB**

For all your electrical needs!

For the first time in the industry, one instrument takes the place of more than 11 pieces of equipment. . . . Here's what you get:

- **A BATTERY ELIMINATOR for 6v and 12v radios**
- **A BATTERY CHARGER up to 24 volts**
- **A HIGH CURRENT LINE VOLTAGE VARIAC — up to 10 amperes**
- **AN AC LINE VOLTAGE METER**
- **AN AC LINE AMMETER**
- **AN AC LINE WATTMETER**
- **AN AC LINE ISOLATION TRANSFORMER — 100w or 300w**
- **A LOW VOLTAGE, HIGH CURRENT AC SUPPLY — 24v at 10 amperes**
- **A DC LINE VOLTAGE VARIABLE SUPPLY**
- **A DC HIGH CURRENT AMMETER**
- **AN AGC BIAS BOX**



Precise Model			Isolation
711K	KIT FORM	$49.95	100w
711W	FACTORY WIRED	64.95	100w
713K	KIT FORM	62.95	300w
713W	FACTORY WIRED	79.95	300w

Mutual Conductance and Emission

TUBE TESTER

Here is a tester that actually checks a tube for its applications, not whether it is just good or bad. On the Model 111, GM and Emission are checked separately. It is the first and only device that measures 600-mil tubes on a meter. Sweeps from 0 through the normal testing range when making measurements, which gives an average evaluation for the tube over an extended range of operation. Connects test voltages to each tube element. Uses a single rotary switch to check each element against every other element for shorts, whether they're hot or cold. Measures tube bias directly on a meter. Features a no-backlash roll chart. Includes provisions for testing all prong types. Cathode-Ray tubes may also be checked with the use of an adaptor. An exceptional instrument for the shop, one that has won an impartial independent scientific survey hands down.

Precise Engineered

Precise Model **111K** Kit Form .....**$ 79.95**
Precise Model **111W** Factory Wired.... **139.95**

You benefit from faster delivery, lower price, postage savings, and the personal local service of your nearby parts distributor when you order by mail . . . if you are close enough, drop by and see the top quality parts included in each kit. Here are 8 of the many PRECISE distributors who are ready to serve you. Use the handy coupon below to order your PRECISE kit by mail.

GRAHAM ELECTRONICS SUPPLY, INC.
102 S. Pennsylvania St.
Indianapolis 4, Ind.

H. H. Thompson. . . . Creative Engineering and quality components assure customer satisfaction with PRECISE equipment.

LEUCK RADIO SUPPLY
243 South 11th St.
Lincoln, Nebraska

L. H. Soderholm. . . We have found that the advanced engineering of PRECISE kits offers design features comparable with many laboratory instruments.

RADIO ELECTRIC SERVICE CO. OF PENNA., INC.
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Albert N. Kass, vp & gen. mgr. . . . For quality and precision, we always recommend PRECISE in test equipment.

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277 N. Franklin St.
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William Hull. . . . Refreshing original design built into every PRECISE kit.

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Manuel Freeland, vp. . . . We have found that PRECISE's Nack for giving quality and value — economically — goes hand-in-hand with our pursuits.

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I would like to order the following Precise kits:

5" 'Scope	Powerlab	Tube Tester
Model	☐ Model 711K	☐ Model 111K
☐ 3151 Kit	☐ Model 711W	☐ Model 111W
☐ 3151 Wired	☐ Model 713K	☐ Model 116K
☐ Catalog	☐ Model 713W	☐ Model 116W

Please send kits COD ☐ Bill my account ☐
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Tells how you can be successful in RADIO-TV-ELECTRONICS

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This is a brand new edition of the book which has launched thousands of men on good-paying careers in radio-tv-electronics.

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This book, "Your Future in the New World of Electronics," also shows you how CREI Home Study leads the way to greater earnings in the booming electronics world.

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Growing Peninsula Co. has openings for 1st class electronic technicians to work directly with engineering in development of new products. Only those with CREI or equal training and 3 years minimum commercial experience will be considered. Top salaries to qualified applicants. Call Mr. McQueeney, DA. 4-4733 for appointment.
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CREI also offers Residence Training at 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.

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

Industry Calls for CREI training By Name . . . SO SHOULD YOU!

Here you see an actual help wanted ad from the *San Francisco Examiner*, April 1, 1956, one of many which specify "CREI or equal" training. This shows that industry approves CREI training, even insists on it.

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ECPD Accredited Technical Institute Curricula

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.

B

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

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Street .....

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

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To help us answer your request intelligently, please give the following information:

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TYPE OF PRESENT WORK.....

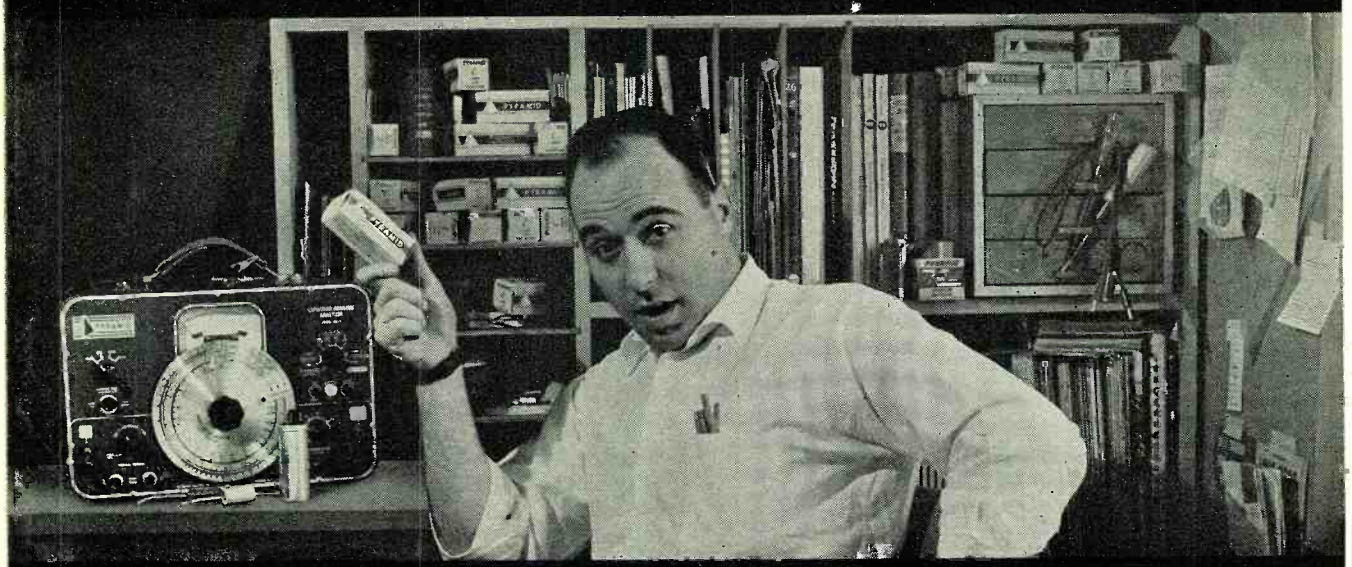
SCHOOL BACKGROUND.....

ELECTRONICS EXPERIENCE.....

IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED?

FOR DEPENDABILITY... WHICH CAPACITOR DO YOU PREFER?

BURTON BROWNE/New York



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PYRAMID ELECTRIC COMPANY

1445 HUDSON BLVD., NORTH BERGEN, NEW JERSEY

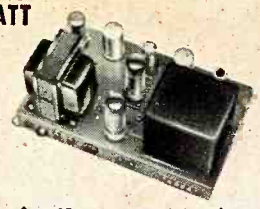
NEW! 12-WATT Williamson-type HIGH FIDELITY INTEGRATED AMPLIFIER HF12

with Preamplifier, Equalizer & Control Section

KIT $34.95 WIRED $57.95

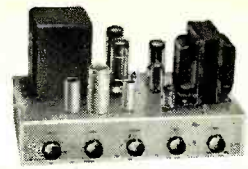
Compact, beautifully packaged & styled. Provides complete "front-end" facilities and true high fidelity performance. Direct tape head & magnetic phono inputs with NARTB (tape) & RIAA (phono) feedback equalizations. 6-tube circuit, dual triode for variable turnover bass & treble feedback-type tone controls. **Output Power:** 12 w cont., 25 w pk. **IM Dist.** (60 & 6000 cps @ 4:1): 1.5% @ 12 w; 0.55% @ 6 w; 0.3% @ 4 w. **Freq. Resp.:** 1 w: ±0.5 db 12 cps – 50 kc; 12 w: ±0.5 db 25 cps – 20 kc. **Harmonic Dist: 20 cps:** 2% @ 4.2 w; ½% @ 2.5 w; **30 cps:** 2% @ 11 w; ½% @ 6.3 w; **40 cps:** 1% @ 12 w; ½% @ 9.3 w; **2000 cps:** ½% @ 12 w; **10 kc:** 1% @ 10 w; ½% @ 6 w. **Transient Resp:** excellent square wave reproduction (4 usec rise-time); negligible ringing, rapid settling on 10 kc square wave. **Inverse Feedback:** 20 db. **Stability Margin:** 12 db. **Damping Factor:** above 8, 20 cps – 15 kc. **Speaker Connections:** 4, 8, 16 ohms. **Tone Control Range:** @ 10 kc, ±13 db; @ 50 cps, ±16 db. **Tubes:** 2-ECC83/12AX7, 1-ECC82/12AU7, 2-EL84, 1-EZ81. Size: HWD: 3⅝" x 12" x 8¼". 13 lbs. Mounts in and out of cabinet.

NEW! 50-WATT Ultra-Linear HIGH FIDELITY POWER AMPLIFIER



HF50 KIT $57.95 WIRED $87.95

Like the HF60 shown below, the HF50 features **virtually absolute stability, flawless transient response** under either resistive or reactive (speaker) load, & **no bounce or flutter** under pulsed conditions. **Extremely high quality output transformer** with extensively interleaved windings, 4, 8, & 16 ohm speaker connections, grain-oriented steel, & fully potted in seamless steel case. Otherwise identical to HF60. **Output Power:** 50 w cont., 100 w pk. **IM Distortion** (60 & 6000 cps @ 4:1): below 1% at 50 w; 0.5% @ 45 w. **Harmonic Dist.:** below 0.5% between 20 cps & 20 kc within 1 db of rated power. **Freq. Resp. at 1 w:** ±0.5 db 6 cps –60 kc; ±0.1 db 15 cps –30 kc at any level from 1 mw to rated power; no peaking or raggedness outside audio range. **All other specs identical to HF60 below.** Matching Cover **E-2 $4.50.**



NEW! 50-WATT Ultra-Linear HIGH-FIDELITY INTEGRATED POWER AMPLIFIER HF52

with Preamplifier, Equalizer & Control Section

KIT $69.95 WIRED $109.95

Combines a power amplifier section **essentially identical** to the **HF50 power amplifier** with a **preamp-equalizer control section similar to HF20 below.** Provision for use with electronic crossover network & additional amplifier(s). See HF50 for response & distortion specs; HF60 for square wave response, rise-time, inverse feedback, stability margin, damping factor, speaker connections; HF20 for preamplifier, equalizer & control section description. Hum & noise 60 db below rated output on magnetic phono input (8 mv input for rated output), & 75 db below rated output on high level inputs (0.6 v input for rated output). Matching Cover **E-1 $4.50.**

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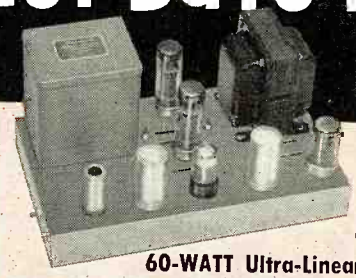
NEW

HIGH FIDELITY PREAMPLIFIER

#HF61A KIT $24.95, WIRED $37.95

With Power Supply: #HF61 KIT $29.95, WIRED $44.95

Will not add distortion or detract from the wide-band or transient response of the finest power amplifiers at any control settings. High quality feedback circuitry throughout plus the most complete control & switching facilities. Heavy-gauge solid brushed brass panel, concentric controls, one-piece brown enamel steel cabinet for lasting attractive appearance. **Feedback-type, sharp cut-off (12 db/octave) scratch & rumble filters. Low-distortion feedback equalization:** 5 most common recording curves for LPs & 78s including RIAA. **Low-distortion feedback tone controls:** provide large boost or cut in bass or treble with mid-freqs & volume unaffected. **Centralab printed-circuit Senior "Compentrol" loudness control with concentric level control. 4 hi-level switched inputs** (tuner, tv, tape, aux.) & **3 low-level inputs** (separate **front panel low-level input selector** permits concurrent use of changer & turntable). **Proper pick-up loading & atenuation** provided for all quality cartridges. **Hum bal. control.** DC superimposed on filament supply. 4 convenience outlets. **Extremely flat wideband freq. resp.:** ±1 db 8-100,000 cps; ±0.3 db 12-50,000 cps. **Extremely sensitive. Negligible** hum, noise, harmonic or IM distortion. Size: 4-7/8" x 12-5/16" x 4-7/8". 8 lbs.



NEW

60-WATT Ultra-Linear HIGH FIDELITY POWER AMPLIFIER #HF60 with ACRO TO-330 OUTPUT TRANSFORMER

KIT $72.95 WIRED $99.95

Superlative performance, obtained through finest components & circuitry. EF86 low-noise voltage amplifier direct-coupled to 6SN7GTB cathode coupled phase inverter driving a pair of Ultra-Linear connected push-pull EL34 output tubes operated with fixed bias. **Rated power output:** 60 w (130 w peak). **IM Distortion** (60 & 6000 cps at 4:1): less than 1% at 60 w; less than 0.5% at 50 w. **Harmonic Distortion:** less than 0.5% at any freq. between 20 cps & 20 kc within 1 db of 60 w. **Sinusoidal Freq. Resp.:** at 1 w: ±0.5 db 5 cps –100 kc; ±0.1 db 15 cps to 35 kc at any level from 1 mw to rated power; no peaking or raggedness outside audio range. **Square Wave Resp.:** excellent from 20 cps to 25 kc, 3 usec rise-time. **Sensitivity:** 0.55 v for 60 w. **Damping Factor:** 17. **Inverse Feedback:** 21 db. **Stability Margin:** 16 db. **Hum** 90 db below rated output. **ACRO TO-330 Output Transformer** (fully potted). **Speaker Taps:** 4, 8, 16 ohms. **GZ34 extra-rugged rectifier** (indirectly-heated cathode eliminates high starting voltage on electrolytics & delays B+ until amplifier tubes warm up). **Input level control.** Panel mount fuse holder. Both **bias** and **DC — balance** adjustments. Std octal socket provided for pre-amplifier power take-off. Size: 7" x 14" x 8". 30 lbs. Matching cover **Model E-2 $4.50.**

NEW

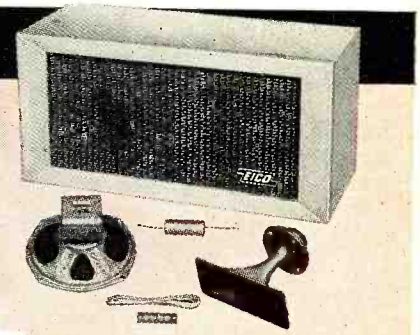
COMPLETE with Preamplifier, Equalizer & Control Section 20-WATT Ultra-Linear Williamson-Type HIGH FIDELITY AMPLIFIER #HF-20

KIT $49.95 WIRED $79.95

A low-cost, complete-facility amplifier of the highest quality that sets a new standard of performance at the price, kit or wired. **Rated Power Output:** 20 w (34 w peak). **IM Distortion (60 & 6000 cps/4:1) at rated power:** 1.3%. **Max. Harmonic Distortion between 20 & 20,000 cps at 1 db under rated power:** approx. 1%. **Mid-band Harmonic Distortion at rated power:** 0.3%. **Power Response (20 w):** ±0.5 db 20-20,000 cps; ±1.5 db 10-40,000 cps. **Freq. Resp.** (¼ w): ±0.5 db 13-35,000 cps; ±1.5 db 7-50,000 cps. **5 feedback equalizations** for LPs & 78s. **Low-distortion feedback tone controls:** large boosts or cuts in bass or treble with mid-freqs. & volume unaffected. Loudness control & separate level set control on front panel. Low Z output to tape recorder. **4 hi-level switched inputs:** tuner, tv, tape, aux; 2 **low-level inputs** for proper loading with all cartridges. **Hum bal. control.** DC superimposed on filament supply. **Extremely fine** output transformer: interleaved windings, tight coupling, careful balancing, grain-oriented steel. 8½" x 15" x 10". 24 lbs.
Matching cover **Model E-1, $4.50.**

NEW **COMPLETE with FACTORY-BUILT CABINET— 2-WAY HI-FI SPEAKER SYSTEM #HFS1 $39.95**

Genuine 2-way book-shelf size speaker system. **Jensen** heavy duty 8" woofer (6.8 oz. magnet) & matching **Jensen** compression-driver exponential horn tweeter with level control. Smooth clean bass & crisp extended highs free of coloration or artificial brilliance. **Factory-built** tuned bass reflex birch hardwood cabinet (**not** a kit) constructed to high quality standards. Neutral acoustical grille cloth framed by a smooth-sanded solid birch molding. **Freq. Resp.** measured 2 ft. away on principal axis in anechoic chamber with 1 watt input —**Woofer:** ±4 db 80-1800 cps; **Tweeter:** ±2 db 2800-10,000 cps; **Crossover Region:** 1800-2800 cps, shift in level over this region depends on tweeter level control setting. Power-handling capacity: 25 watts. Size: 23" x 11" x 9". 25 lbs. **Wiring Time:** 15 min.



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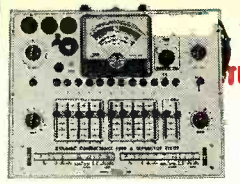


NEW! DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666

KIT $69.95 WIRED $109.95

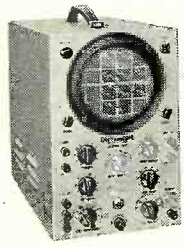
COMPLETE with steel cover and handle.

SPEED, ease, unexcelled accuracy & thoroughness. **Tests all receiving tubes** (and picture tubes with adapter). **Composite indication** of Gm, Gp & peak emission. **Simultaneous scl** 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 **inereductor** 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.

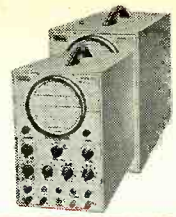
NEW! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)

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!

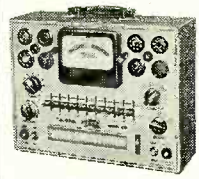
Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't burn-out circuit. 7 **non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC 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**

Sep. volt-meter & ammeter
KIT $29.95
Wired $38.95

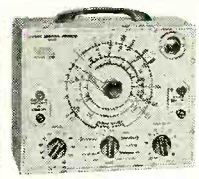
6V & 12V BATTERY ELIMINATOR & CHARGER #1050

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

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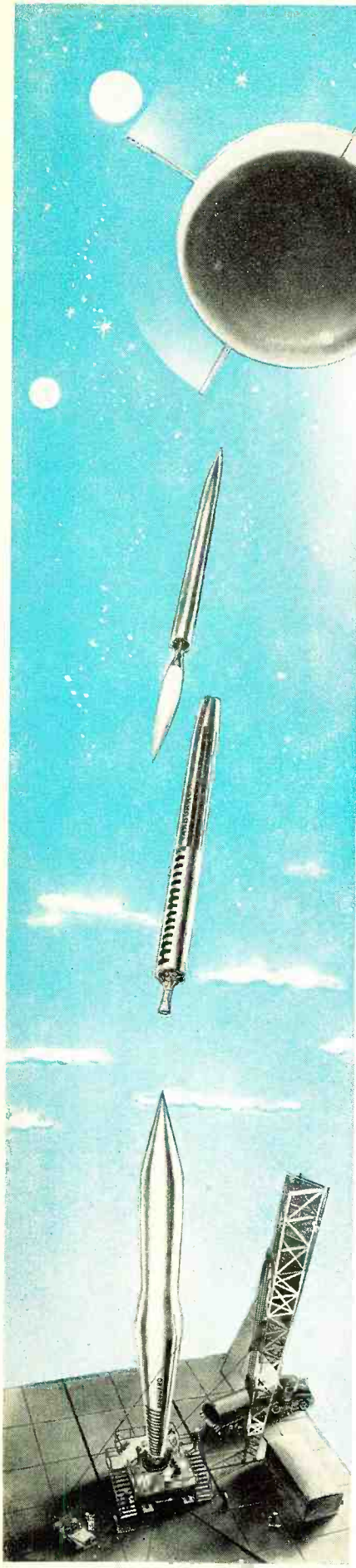


Precision Steering at 18,000 M.P.H.

By **OTTO BERGER**

Servo Section, Project Vanguard
The Glenn L. Martin Company

The vehicle that will launch the space satellite is right out of "science fiction", involving as it does the ability to "think" and cope with the problems of "spacemanship".

AT THIS moment small groups of rocketry specialists in engineering centers across the United States are pouring the full measure of their sweat and ingenuity into a project called "Vanguard." Their assignment is to design and test the rocket vehicle that will launch man's first satellite.

The date of the first launching is fast approaching. President Eisenhower has announced that the United States will attempt to launch several small, unmanned earth-circling satellites during the International Geophysical Year, July 1, 1957 to December 31, 1958.

The project is proceeding under management of the Naval Research Laboratory, supported by agencies of the Army and Air Force. The *Martin Company* of Baltimore is prime contractor, charged with responsibility for the design and manufacture of the vehicle that will place the satellite in its orbit. The National Academy of Sciences, through the Naval Research Laboratory, will provide the satellite itself and its instrumentation.

"Project Vanguard" has been hailed by scientists as a mission of great peacetime promise. Artificial satellites are destined to be man's first observation posts operating for sustained periods of time beyond the atmosphere. From them will flow an abundance of new knowledge relating to the earth and the universe.

Yet the day of the satellite would still be a long way off if it were not for the great strides made recently in rocket propulsion, structural design, and electronics. A satellite launching system draws upon these technologies to the limits of their development. "Project Vanguard" then, a forerunner of future progress, is no less a sign of present achievement.

The "Vanguard" vehicle is a three-stage rocket powerful enough to vault through the earth's atmosphere to orbiting altitude of 300 miles. If it did no more, the satellite would immediately fall back to earth. It must, therefore, be able to accelerate to the amazing velocity of 18,000 miles-per-hour —the rate that offsets the centripetal pull of gravity at that altitude, and thereby makes orbital travel possible. The 11-ton vehicle must have a means, moreover, of controlling this great lifting strength and velocity so that the satellite will follow a path that roughly parallels the earth's contour.

Three big demands are thus laid down for the satellite vehicle. It must lift the satellite to a height of 300 miles; accelerate it to 18,000 miles-per-hour; and then—at that altitude and velocity—it must set the satellite free on a path that approximates a tangent to the earth's surface. That these capabilities may be built into a single vehicle of manageable size and cost is a tribute to our state of advancement in rocketry, electronics, and allied fields.

The Three Stages

The composite vehicle, resembling a gigantic rifle shell, is about 72 feet long and 45 inches at its greatest diameter. The first two stages are powered by liquid propellants and guided by an inertial reference system. The third stage, which carries the spherical satellite, is powered by solid propellant and is maintained in fixed orientation while it is firing.

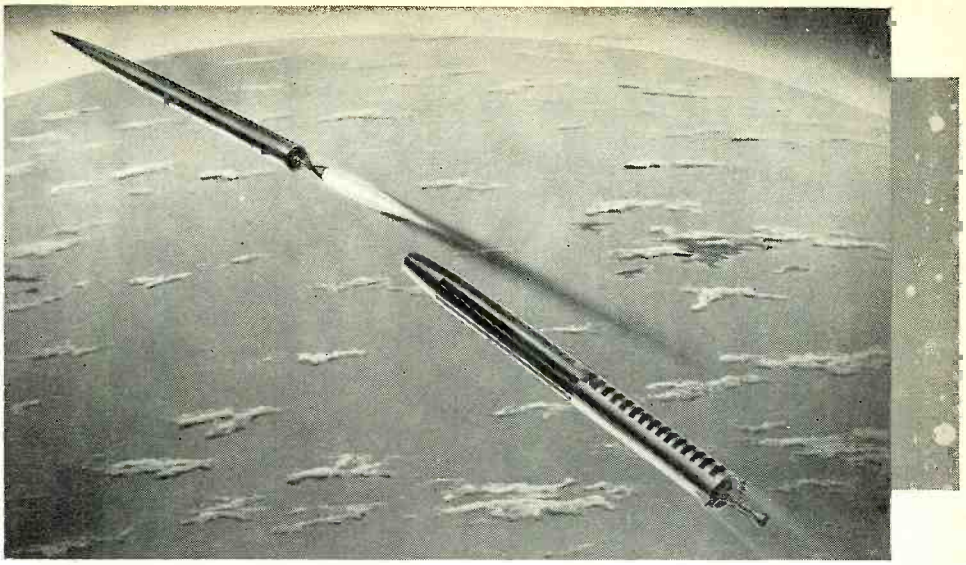
The first stage is a liquid propellant rocket similar to the "Viking" built by *Martin* for the Navy, but with substantial improvements. Serving essentially as a guided booster, it develops most of the energy to raise the remaining stages to orbital height and about 15% of the required orbital velocity. The engine, built by *General Electric Company*, delivers a thrust of approximately 27,000 pounds at sea level. The major propellants, liquid oxygen and kerosene, are contained in tanks that are integral with the airframe skin. The rocket motor is fed fuel by turbine-driven pumps. The pressurizing gas is helium. Control of the vehicle's orientation and flight

path is attained by movements of the engine which is mounted on a gimbal. In response to autopilot commands, the engine is tilted by electro-hydraulic actuators to alter the direction of thrust and thus control deviations in pitch and yaw. Roll control is provided by small auxiliary jet reactors.

The second stage of "Vanguard" carries the entire guidance and control system. In addition it supplies the remaining energy needed to reach orbital height, and about 30% of the orbital velocity. It is a liquid propellant rocket that is spliced to the forward end of the first stage. The propellants, nitric acid and unsymmetrical dimethyl-hydrazine, are fed directly to the motor from high pressure tanks integral with the airframe skin. Again the pressurizing gas is helium. The motor is gimbal-mounted, as in the first stage, and positioned in pitch and yaw by electro-hydraulic impulses. An array of jet reactors provides complete control of orientation during second-stage coasting flight. Forward of these various mechanisms, the second stage houses within its nose—which is the nose of the entire vehicle—the third stage and the satellite.

The plastic nose cone protects the delicate satellite sphere from the aerodynamic heating it would encounter if exposed during the first part of the ascent through the atmosphere. The cone is jettisoned early in the second stage burning phase, after which the atmosphere is too thin to be detrimental to the satellite.

The third stage is a solid-propellant, unguided rocket. By approximately doubling the speed attained by the end of second-stage coasting flight, it imparts the 18,000 mile-per-hour velocity required for the satellite to begin its free-flight orbit around the earth. In the absence of guidance—jettisoned at the time of second stage separation—this third stage maintains stability by being spun about its longitudinal axis in the manner of a rifled shell. While still attached to the second stage, it is mounted on a turntable, or spinning mechanism. Near the end of second-stage coasting flight, the turntable is set in motion by small solid propellant rockets. When the third stage is spinning, retro-rockets fire—retarding the flight of the second stage shell. The momentum of the third-stage—satellite combination, however, remains unchecked. Thus freed, the final rocket begins its powered flight.



The second stage of the vehicle, shown at left, contains a liquid rocket engine, designed and built by Aerojet-General Corporation. A gimbal mounting system and hydraulic actuation units similar to those employed in the first stage are used for control of the thrust vector during the second stage burning cycle.

The satellite payload, a 20-inch sphere, is attached to the forward end of the third stage, and may be separated when orbital velocity has been attained. As the third stage will reach orbital velocity, when separated from the payload, it also will become a satellite.

Orbital Characteristics

Even at altitudes of 300 miles and above there is a minute drag. Over a period of time this drag will retard the satellite's velocity and thus lower its altitude, so that it will describe a decelerating, descending spiral. When it descends to atmosphere of sufficient density, the satellite will burn and disintegrate. Based on present estimates of densities, scientists at the Naval Research Laboratory calculate that the satellite could exist in a circular orbit of 300 miles height about one year. If the height varies from 200 to 1500 miles at the lowest and highest points (perigee and apogee), the lifetime would be only 15 days. A 100-mile perigee would end the satellite's career within an hour.

The preferred orbit—a nominal circle 300 miles above the surface of the earth—could be attained only if the angle and velocity of firing were controlled perfectly. Inevitable control errors, however, will result in an elliptical orbit.

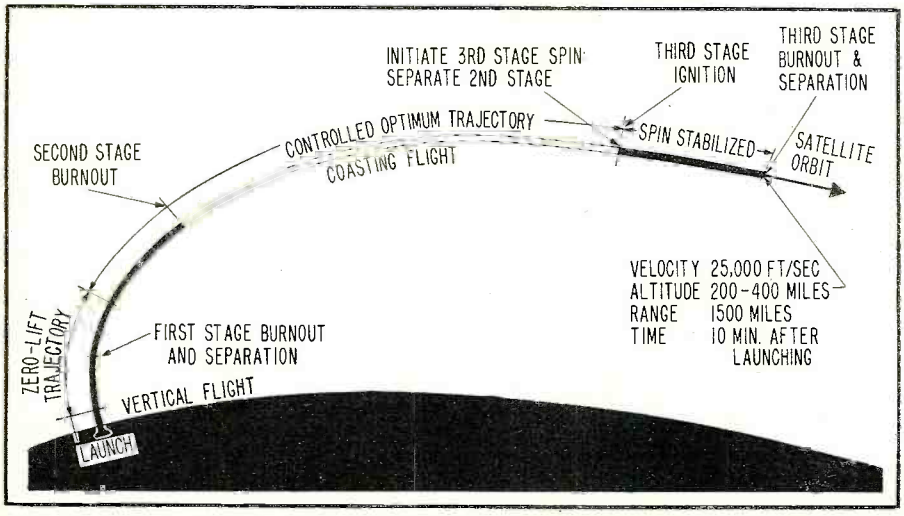
It is intended that the initial orbit will lie between 200 and 1500 miles altitude. A greater apogee would hinder optical tracking while a perigee below 200 miles would seriously reduce the life span of the man-made moon.

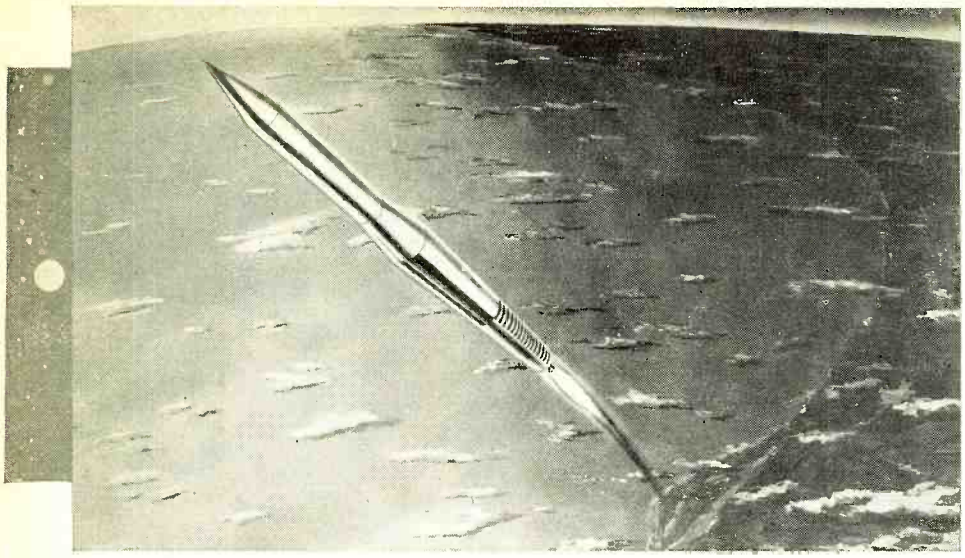
Control System

Correct angle of injection depends on correct functioning of the control system which steers the "Vanguard" vehicle over the predetermined trajectory. It employs a magnetic amplifier autopilot working in conjunction with an inertial reference guidance system. The course is set into the system before launch and played back *via* a master sequence controller which initiates each phase of flight at precisely the right moment. It is thus unlike other guidance systems that employ radar to track the rocket, issuing steering commands from the ground with the help of a computer.

All control equipment is located in the electronic section of the second stage. Heart of the guidance system is a trio of single-axis, rate-integrating gyros. One is aligned with the "yaw" axis, another with the "pitch" axis, and the third with the "roll" axis. Once set and stabilized in a particular plane, the gyros remain fixed in that plane despite contrary movements of

Artist's concept of the satellite preliminary trajectory.





The first stage (portion of complete vehicle shown at the right) is powered by a liquid rocket engine, employs liquid oxygen and kerosene as fuels. The thrust cylinder extends aft of the rocket structure. This cylinder is moved by hydraulic actuators in a gimbal system so that flight path control is possible.

the vehicle. Roll and yaw orientation are fixed, while the pitch reference is pre-programmed to establish the curving trajectory planned for the rocket.

Let's say the heading of the vehicle changes from the desired direction because of a gust of wind, sloshing of fuel in the tanks, or irregularity of the rocket engine. The deviation is sensed by the yaw gyro, which remains set on the correct course. The gyro sends out proportionate electrical signals to the autopilot, which, operating through electro-hydraulic actuators, causes the rocket controls to bring the vehicle back on course. Deviations in roll and pitch are corrected in similar fashion.

The phase lead required to stabilize the rocket is produced by operational networks that introduce a phase lag in the feedback circuit of the amplifiers.

Using the conventional equations for a feedback amplifier:

$$K_f = \frac{K}{1+BK}$$

where: K_f = gain with feedback
K = forward gain

$$B = K_b \frac{1}{1+(RCS/2)}$$

where: K_b is a function of the number of turns on the feedback winding and the values of the resistances.

On substitution we obtain:

$$K_f = \frac{K}{1+\frac{KK_b}{1+(RCS/2)}} = \frac{K}{1+KK_b} \frac{1+(RCS/2)}{1+\frac{(RCS/2)}{1+KK_b}}$$

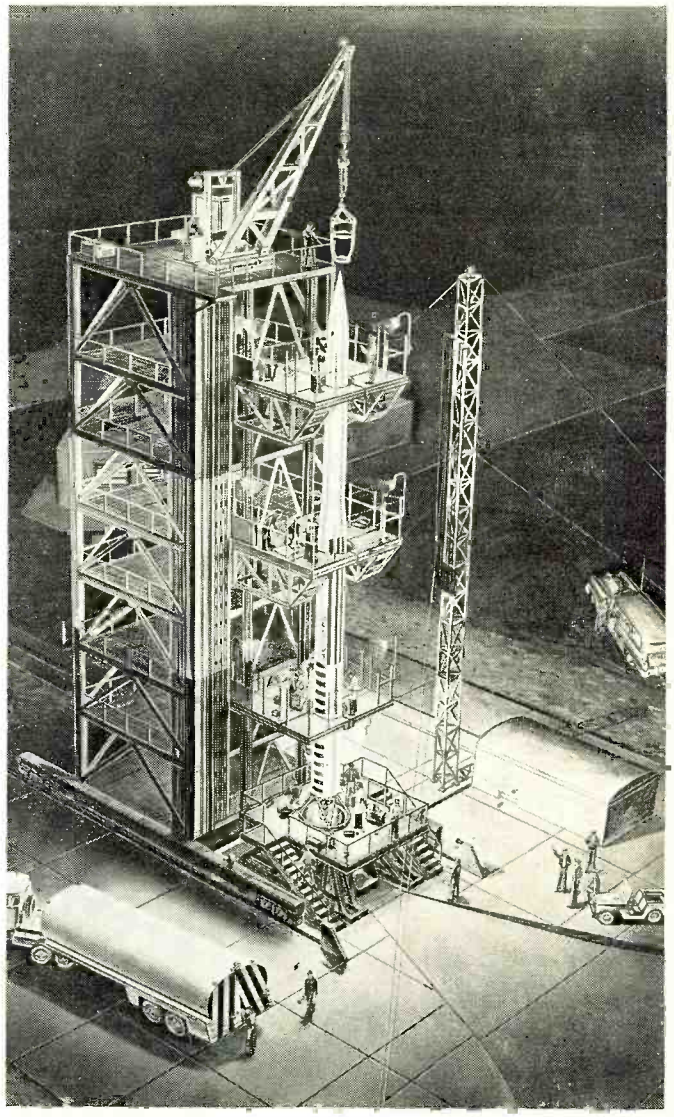
When compared with a conventional lead circuit, this equation shows that the time constant, T, is given by $(RCS/2)$ and the attenuation by $1+KK_b$.

Velocity Measurement

The all-important velocity of the "Vanguard" vehicle is measured by an integrating accelerometer installed in the second stage electronics section. The instrument senses the acceleration applied to the vehicle during flight, sums it up, and thus yields the velocity. The velocity measurement made at the end of the burning of the second stage is supplied to the unit's analogue computer, which determines how long the vehicle will coast before the third stage, carrying the satellite, is fired.

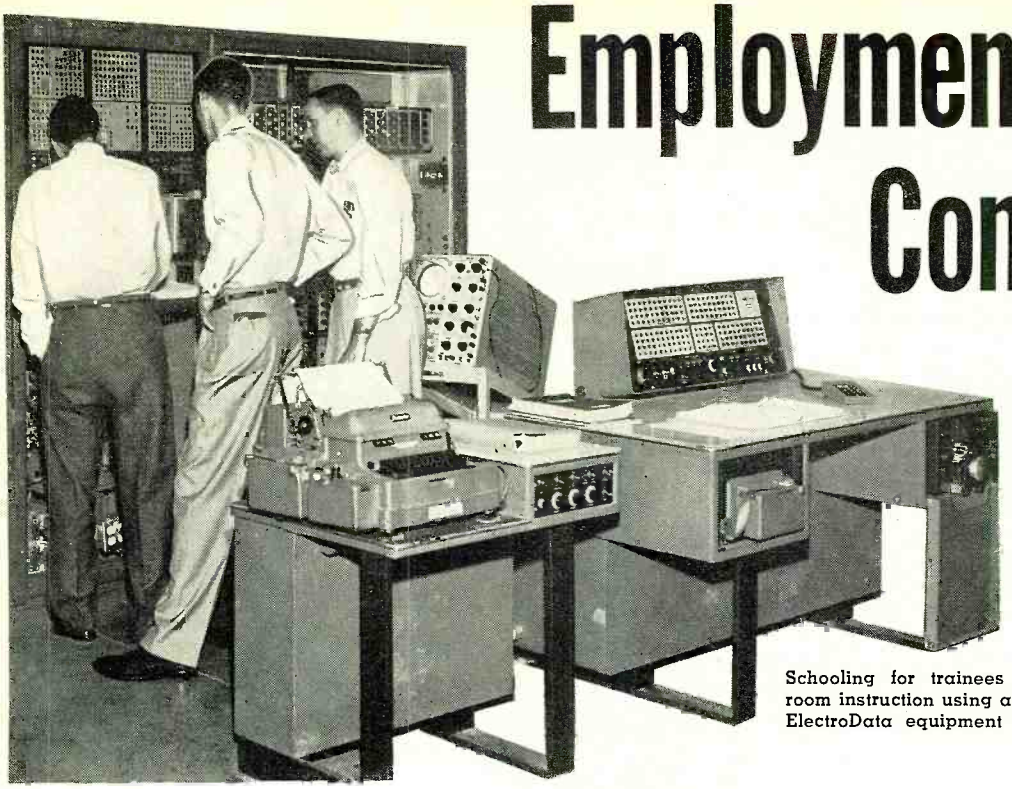
The basic component is a floated gyro. An acceleration on its sensitive axis generates a signal which, when amplified, drives a turntable which rotates the gyro about its input axis. The resulting torque is equal and opposite to the acceleration torque. Since the turntable turns at a rate proportional to acceleration, its position is proportional to the integral of acceleration, or velocity.

The relation between torque and input angular velocity depends on the angular momentum which, in turn, depends on the power frequency. There is no means of compensating for changes in frequency. Consequently, since the frequency of the 400 cps supply is not controlled accurately enough, it is necessary to generate an accurate 400 cps. This is done by means of a tuning fork whose output is amplified in a transistor amplifier to drive the gyro. —30—



This is the equipment that will be used to launch the satellite-carrying Vanguard three-stage vehicle. The structure in the background is a gantry crane used to erect and assemble the vehicle and to provide work platforms from which the field crew can test the rocket prior to launch. At the lower right is the concrete blockhouse from which the rocket operation is monitored prior to and during flight. All final tests are remotely performed by personnel locked in the blockhouse and when the rocket is ready for flight it is fired from this remote location. As seen in this sketch, the Vanguard launch stand does not include a pit to conduct exhaust gases away from the rocket but rather the vehicle itself will be elevated and steel exhaust duct provided. The rocket will be finless and stabilization will be achieved by use of a gimbaled engine. Omission of fins saves weight.

Employment in the Computer Field



Schooling for trainees includes classroom instruction using actual computers. ElectroData equipment is in use here.

By **WILLIAM D. BELL**

Careers for non-engineers in a growing industry: qualifications, background, training, and tests.

WHILE Ph.D.'s, physicists, and specially trained design engineers are necessary to develop today's electronic computers, a degree is *not* necessary to land a job as a field engineer. As a matter of fact, a technical degree is not only unnecessary but is a positive handicap in qualifying for most of these service engineering jobs. Employers do not want design engineers or research scientists to maintain equipment.

What the computer industry does want is men with a background of electronics experience who are interested in becoming field engineers to maintain the fantastic electronic data-processing machines about which we hear so much. Here is a prime opportunity for the man who has made electronics his career, but who has felt handicapped by his lack of a college degree.

You say you know nothing about computers? That's all right—if you can qualify there are companies that will give you extensive training and pay you both a good salary and living expenses *while* you're learning!

Such employment offers sound good but are even more impressive when related to the growing importance of the computer field. The use of these machines, many believe, will begin the second industrial revolution. The first industrial revolution freed man from backbreaking labor by substituting power machinery; the second will free man from mental drudgery through the use of electronic computers. These are not philosophical or theoretical statements, but a description of a future which is already upon us.

A computer can read or write 15,000 or more characters per second; in the same time a typist makes about 8 characters. Electronic circuits add 10,000 times in a fleeting second while a girl with a comptometer is trying to enter one number. These capabilities have begun to change all aspects of our business world, the way we control manufacturing, and even our ideas about national defense.

Already over 200 million-dollar computers are in use. By 1966 it is estimated that 10,000 large-scale machines will be in use plus many more smaller systems. The men who must be trained to keep these computers running will number tens of thousands.

It is this characteristic of explosively rapid growth in the computer business which makes today's job opportunities so challenging. The man who is a trainee today is a full-fledged service engineer tomorrow, and, if he is competent, soon a supervisor. The rate of growth within computer companies demands advancing good men as rapidly as possible.

Look at *ElectroData* as just one example of company growth. In November, 1952, *Consolidated Electrodynamics Corporation* set up a computer division which later became a separate corporation. In two years, the number of employees grew from 30 to 300. Today *ElectroData* is a division of *Burroughs* and has 1800 employees, of whom 445 are in the field engineering organization.

While *ElectroData* is cited to convey some impression of the growth in this field, it is by no means an isolated case. Other giants in computers include *International Business Machines* and *Sperry Rand.* The latter is the originator of *"Univac,"* probably the computer best-known to the man in the street. In addition to these, many other companies are actively engaged in computer operations.

One of the biggest hiring programs is being conducted by "Project SAGE," which is an important part of America's air defense. Gigantic "SAGE" computers will ring the country and compare radar data with available air-traffic information to guard our frontiers against surprise attack. *IBM* has a contract to maintain these "SAGE" computers, each of which requires 15 service engineers per shift and operates around the clock. Qualifications for these jobs are essentially the same as for customer engineers on *IBM*'s standard line of computers.

How to Qualify

What are employers looking for when they hire service engineers?

The most important factor is *not* electronic knowledge or technical background. Instead, appearance and personality are the first consideration. A survey indicates that 65% to 75% of all applicants are rejected for this single reason. (See "The Men We Hire," page 77.) All companies consider the service engineer first as a company representative and second as an electronics man.

Employers agree that the second requirement is the ability to think. Localizing trouble in a machine with several hundred tubes or transistors, thousands of crystal diodes, miles of

wire, and innumerable resistors and capacitors is obviously a major problem. All the circuit knowledge in the world is of no avail unless the engineer can logically analyze his problem. Hunt-and-try methods, experimentally changing tubes, and similar radio repair techniques plainly fail in the face of the sheer size of the computing monster.

The third requirement is circuit knowledge and experience in dealing with electronic equipment.

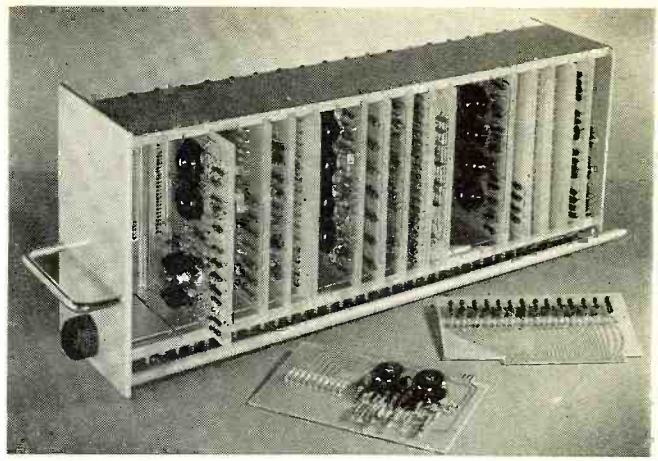
Some companies place great emphasis on mechanical ability. A computer is more than electronic circuits; there are card readers, tape punches, high-speed printers, magnetic tape units, and other mechanical contrivances. These peripheral devices may be supplied by one manufacturer for many systems, even though the computer often belongs to another manufacturer. Service engineers with both an electronic background and an aptitude for mechanical equipment are harder to find than circuit men.

As to age, employers say, "We prefer trainees between 19 and 32 years old."

Background Requirements

Most trainees have had some experience in radio and TV. Practically speaking, radio is of little value: the tuned circuits in the r.f. section and the linear circuits in the audio amplifier do not have counterparts in a computer. TV experience is better, primarily because of the sync circuits involved. The greatest advantage is knowledge of test equipment, circuit components, and general experience in dealing with electronic hardware. Companies are willing to hire service engineers whose sole electronic experience has been in the TV and radio fields—if their other qualifications are acceptable.

The majority of trainees are hired from one of two sources: ex-servicemen with military training in electronics or graduates of two-year accredited trade schools. One or two years of college is considered desirable by most employers, but, as one manager pointed out, "College experience is considered as valuable for broadening a man's personality as for the technical education."



Computers use the latest components and assembly techniques. This is a modular "building block," used in the Model 112 computer systems manufactured by Beckman Instruments for the chemical and petroleum industries.

Technical Tests

Don't get the idea, however, that employers are not concerned about technical competence at all. Most give applicants tests to check their knowledge of electricity, electronics, and, in *IBM's* case, mechanics also. All of the questions could be answered by a first-year college man studying physics and electronics, or by someone who has studied the subjects in a technical institute or has equivalent background. Some typical questions may be helpful to the prospective applicant. In one example, the series-parallel resistor network shown in Fig. 1A is given, and values are given for E_1 and R_1 through R_6. The applicant is then asked to give the voltage drop across R_6 and the value of the current through it.

In another example, the applicant is asked to identify the tube type represented in Fig. 1B.

Reasoning Test

In addition to the technical test, most employers give a quiz in logic or reasoning. Not correlated to previous training, this tests the applicant's ability to think his way through unfamiliar problems. He may be confronted with three figures such as those shown in Fig. 1C. He is then asked to draw a figure related to object "3" in the same way as object "2" is related to object "1." In another example, he is presented with the following sequence of numbers: 16, 17, 14, 15, 12. He may then be presented with the following statement and question: "Reading from left to right, this series of numbers is constructed according to some rule. What are the next two numbers in the series?"

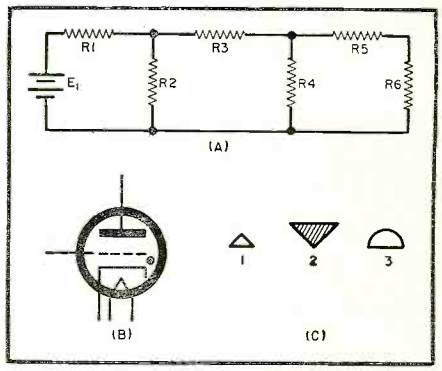


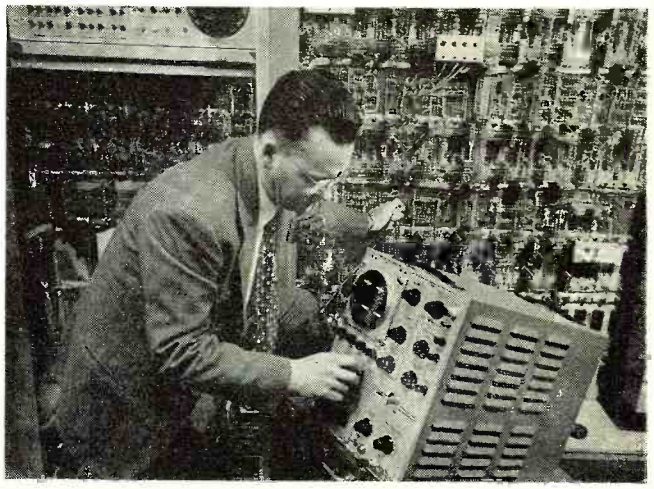
Fig. 1. Job-applicant tests involve these drawings, referred to in text.

Much more importance is attached to the logical tests than to the technical exams. A man who can think his way through a problem can learn elec-

(*Continued on page* 148)

A customer engineer, working for IBM, checks out a pair of magnetic drums that are capable of storing 80,000 digits.

A field engineer uses a scope to study pulses in a Datatron computer, made by the ElectroData Division of Burroughs.



An Electronic Turntable Drive

The Fairchild Model 412-4 turntable uses electronic circuitry, partly visible below the pilot lamp, to change its speed.

New phono turntable driven by self-contained power oscillator whose frequency is varied to change speed.

WHAT does the audiophile want when he buys a turntable for high-quality performance? Clearly the answer to this involves many factors which are dependent on such diverse considerations as personal taste and geographical location. One person wants an excellent table at low cost. Another wants synchronous speed, while another wants to be able to make slight adjustments at will. Another person may be interested in equipment which will handle LP's exclusively while still another buyer wants all four speeds. There are those who live in localities with 50-cycle current while others live on farms or distant places where current is supplied by a home generating plant which might best be described as "no cycles."

How can the needs and desires of all these individuals be met in a single unit? *Fairchild* believes it has the solution in its Model 412-4 electronic drive. This electronic control for phono turntables will operate on 50, 60, or 400 cycles or will operate from a storage battery using a vibrator supply. The a.c. voltage input may vary from 85 to 135 volts without the need for adjustments or without causing perceptible speed change.

The hysteresis-synchronous motor has positive control and individual speed adjustment of ± 5% at any speed. Recordings designed for 16⅔, 33⅓, 45, and 78.26 rpm can all be handled by this turntable. There are no mechanical gear shifting devices and no rubber wheels, idlers, pucks, or tires. Speed change is effected electronically and remote control of the operation is entirely feasible.

The long-range speed accuracy is better than ± .3% and is independent of line frequency fluctuations and line voltage changes. Wow and flutter performance equals or exceeds primary recording standards and is independent of line frequency variations. At a recent demonstration, a piano recording was played while the equipment was operated first with a storage battery and vibrator and then from the power lines and no one present realized that the change had been made.

The heart of this new electronic drive system is a self-contained power supply which drives the small and accurately balanced hysteresis-synchronous motor. The speed of the motor is determined precisely by the frequency of the current supplied to it, independent of the voltage. Since in conventional turntables only one frequency is supplied (generally 60 cycles in this country), the motor runs at only one speed. Speed changes are effected by means of pulleys of varying sizes which are alternately inserted in the drive train or by means of gears.

In the Model 412-4, however, current of varying frequency is generated "on the spot," so to speak. The speed of the motor being determined only by the frequency of the current supplied to it, the turntable speed is controlled directly. It's as simple as that —at least the concept is simple!

The basic part of the self-contained "power house" is a Wien-bridge oscillator with push-pull output, as is shown in Fig. 2. The frequency is determined by resistors R_8 and R_{10} and capacitors C_1 through C_8. Precision resistors of slightly negative temperature coefficient are used, together with capacitors having a matching positive temperature coefficient. After initial warmup, the frequency of the oscillator will not vary by more than 200 parts per million per degree C. The voltage regulator tube, V_6, regulates the plate supply voltage to the oscillator stage. In addition, the operating point is so chosen that changes in heater and plate voltages tend to offset each other and the result of all these factors is an over-all frequency stability of better than ± 0.3% with most units running as close as 0.1%.

The push-pull output of the oscillator is fed to the voltage-amplifier dual triode V_{2A} and V_{2B} and then to the cathode-follower driver V_{3A} and V_{3B}, which drives the output tubes V_4 and V_5, class B_2. These type 25DQ6 beam power tetrodes are hi-mu triodes connected by tieing grids #1 and #2 together to give the best possible plate efficiency. In fact, the plate efficiency reaches 78% (on a volt-amp basis) and the total power consumption (electronic drive and hysteresis motor) is only 90 watts maximum (at 78 rpm) and below 80 watts at 33⅓ rpm. Conventional hysteresis turntables con-

sume about 80 watts at any speed.

It will be noted that the layout described might very well be applied to a high-fidelity amplifier and indeed there is very little difference. This electronic power supply is capable of delivering 30 watts at 30 cycles with good waveform and it would probably be an excellent audio amplifier for low frequencies. Since the motor is not interested in high frequencies, however, the output transformer is designed for optimum power transfer at low frequencies and its frequency characteristic extends only to about 500 cycles.

The frequency for 16⅔ rpm is 30 cycles and the motor turns at 900 rpm. The other three speeds have proportional frequencies; thus 33⅓ rpm corresponds to 60 cycles, 45 rpm to 81 cycles, and 78 rpm to 141 cycles. Speed selector switch S_2 is marked in "RPM" and it selects the oscillator frequency which will give the proper motor speed (and turntable speed). Vernier speed control is obtained by adjusting the potentiometers R_1 through R_4. Interestingly enough, these potentiometer shafts, which are made for finger (or screwdriver) operation, are located *under* the "dress plate" since the company's engineers determined by a survey that this was more desirable than an exposed location. The cover plate is instantly removable for adjusting the speed, but for regular use, the shafts are hidden from view (and from inquisitive children's fingers, we might add).

Another interesting fact is that as the frequency of the current is increased the reactance of the motor rises and hence the voltage applied to it must be increased to put the same current through the motor. For this reason, the switch also changes the output voltage. When operating at 16⅔ rpm the applied voltage is 150 whereas on 78 rpm it is 450. This is accomplished by selecting an appropriate tap on the output transformer secondary (T_3) by means of switch S_{2C}.

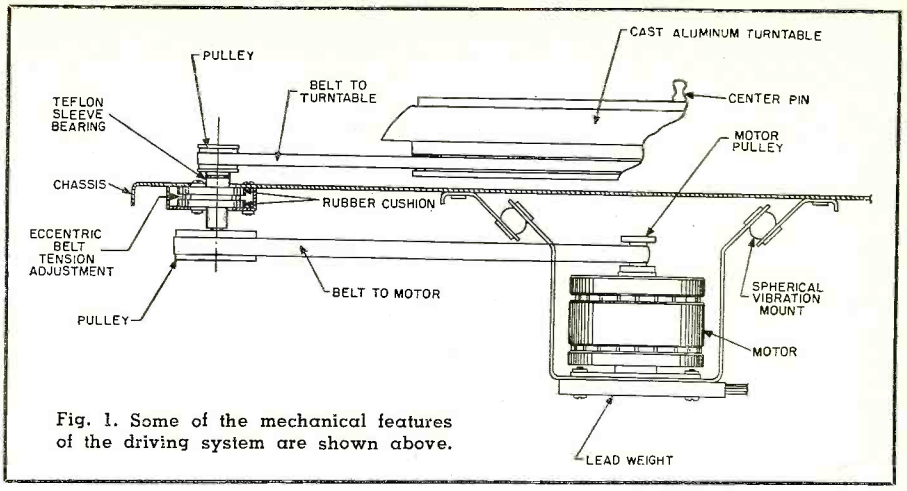


Fig. 1. Some of the mechanical features of the driving system are shown above.

There are a few new aspects of the electronic drive which may seem strange at first. It is of course necessary for the tubes to warm up before the unit becomes operative. This is comparable to the difference in operation between old-time battery radios and the later development of a.c. receivers, and by now we have all become accustomed to the 30-second time delay. However, if power is left on and the speed selector switch is turned to an intermediate position, the circuit is left in an "idling" condition, with the heaters operating but all other power off. In this case, there is no time delay for the tube warmup, although there is still a slight delay of about 3 seconds. This might be likened to selection time in another mechanism. Once the speed is selected the unit accelerates to full speed very rapidly and it does not "hunt" or "wow," but pulls in positively and quickly to synchronous speed. Obviously, this is a decided advantage in equipment of this particular type.

Another advantage of the design is that it is not necessary to turn the switch to an off position when shutting down the system. As is well known, if the pulleys, or pucks, of conventional tables are left engaged for any extended time (even overnight) an annoying "flat" is developed which bumps and thumps, permanently damaging the unit. With electronic control, none of these hazards exists and the table may be switched off and on by the main system control. In such installations, only the speed selector or knob need be used.

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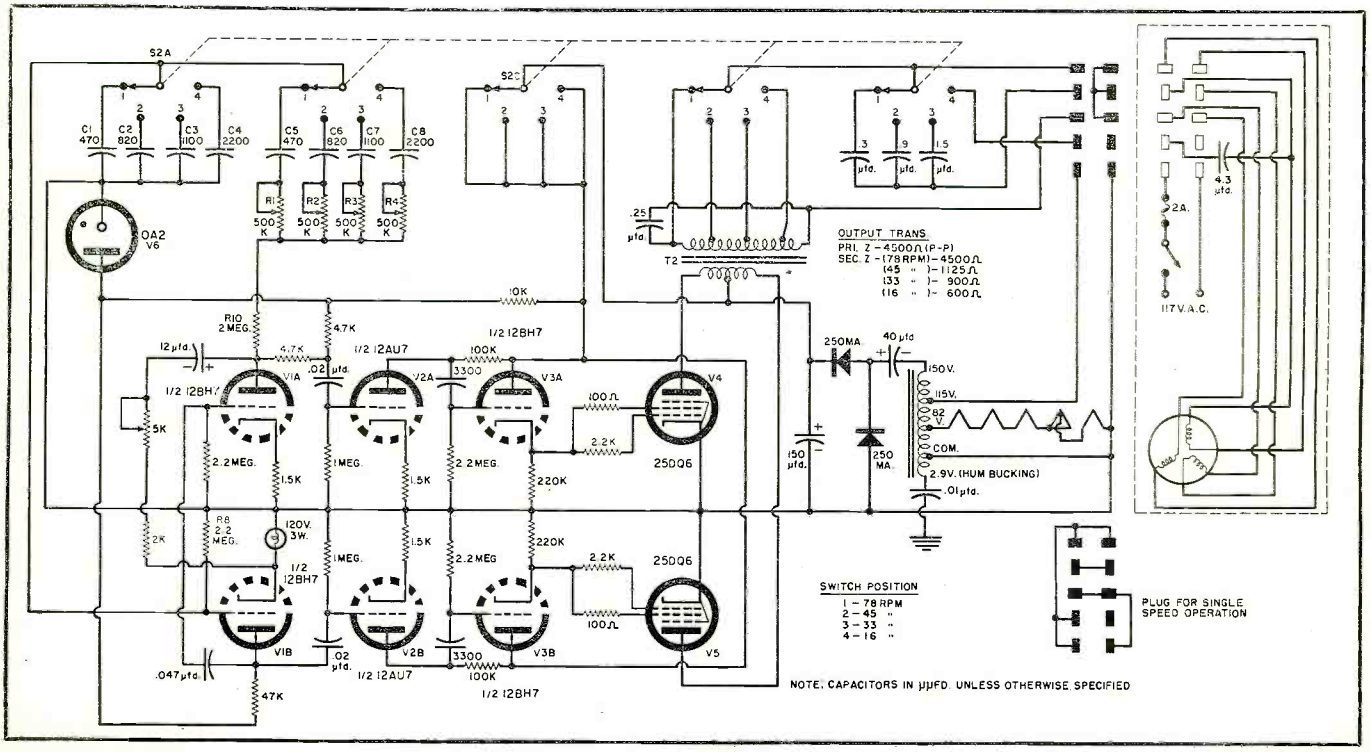
Fig. 2. Schematic diagram of the Wien-bridge oscillator and push-pull output circuitry.



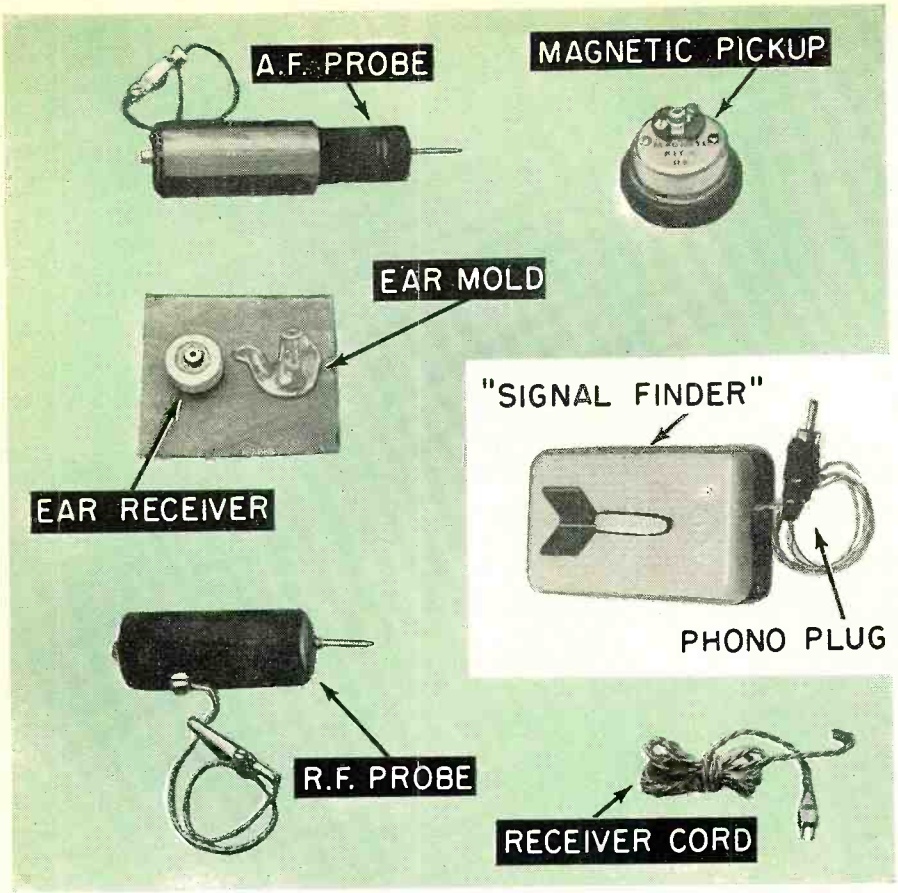


Fig. 1. The "Signal Finder" together with its accessories and connectors.

The "Signal Finder"

By
M. J. M. DUNSCOMBE

Surplus tube-operated hearing aids can be made over into portable, versatile signal tracers.

THE TECHNIQUE of signal-tracing as a troubleshooting method with radio and television receivers is so universally accepted that it requires no further selling at this time. However, the equipment usually used includes a rather bulky a.c.-driven audio amplifier, with demodulator probes. This creates no problem in the many cases where the receivers to be serviced are brought to the stationary equipment. However, there are many instances in which it would be desirable to use signal-tracing procedures at the receiver site, and the technician is then faced with the problem of bringing a mountain of equipment to Mahomet.

To overcome this difficulty, the author has put together the "Signal Finder." The instrument, which can be duplicated easily, is portable enough to be slipped into a pocket and costs less than ten dollars to build. In addition, although it is primarily intended to trace received signal through a radio or television receiver, other uses have been found for this versatile instrument. It can be used in orienting antennas, to provide a two-way intercom during antenna installations, and on certain types of work in connection with public-address systems. As use continues, new applications suggest themselves: it is also possible to check microphones and record changers for output, as an example.

The main unit in the instrument is a converted hearing aid. Now that the transistor has replaced the electron tube in such devices, some of the older tube types have gone out of fashion. As a result, there are thousands of them gathering dust on the shelves of hearing-aid dealers and they can be bought for less than five dollars in some cases. There are many makes of hearing aids, such as *Beltone, Maico,* and *Radioear,* just to mention a few. The instrument shown in Fig. 1 has been constructed from a *Maico* unit, but similar units using other makes, such as the ones just mentioned were also constructed. The basic circuitry is similar in most models, because most hearing aids are built around a two-, three-, or four-stage high-gain tube amplifier, which obtains its power from miniature "A" and "B" dry batteries.

Before describing the modifications necessary, electronic hearing aids in general should be considered. Their object is to assist a hard-of-hearing person to hear audible sounds which he otherwise would miss. To do this a microphone, mounted inside the hearing-aid case, picks up audio-frequency sounds. These signals are fed to an audio amplifier, whose output is produced in a headphone, which is called an ear receiver and is attached to the ear.

Depending on the user, different amounts of amplification (sometimes as much as 60-70 db) will be required; also the amplification may need to be different at high or low frequencies, depending on the nature of the user's hearing loss. To do this, the hearing aid will have a volume control and often both fixed and variable amounts of frequency correction. Whether a tone control knob is fitted is unimportant for our purposes. All that is needed for use as a "Signal Finder" is that the response of the amplifier should be as flat as possible. If you are in doubt about the model you select, any hearing-aid dealer will advise you on this matter. A simplified schematic of a typical hearing aid is shown in Fig. 2. It will be seen that basically the circuit is nothing more than a standard three-stage audio amplifier, using batteries.

First of all, examine the hearing aid you have chosen. On the front of the case is the microphone, behind the grille. The volume control, combined sometimes with an on-off switch and, as mentioned earlier, a tone control are usually on the sides. There is also a two-pin socket, into which the cable (called the "cord" in the hearing-aid world) to the receiver is connected. This receiver fits in the ear, as it is attached to an ear mold, which you put into the ear canal. While it is possible to get individually fitted ear molds, they are rather expensive. How-

ever dealers will sell you a stock ear mold, suitable for anyone's ear, very cheaply, and this will be quite adequate.

Now remove the case of the hearing aid. Fig. 3 shows a typical unit. At the bottom will be found the batteries, while the chassis occupies the rest of the space. On the front of the chassis is the microphone (not shown in the photograph, which is on the back of the chassis) and around it are the subminiature amplifier tubes. It is not important to have a schematic of the circuit, because the only thing that has to be done is to remove the microphone. This is usually of the crystal type, and wired across it will be found a resistor of several megohms, which is the grid resistor of the first audio stage. The rest of the circuit need not concern us.

Having disconnected the microphone and removed it, solder the ends of the receiver cord across grid-input resistor. There is one word of caution. The cord is plastic-covered litz wire and plastic with a low melting point is used, so solder the connections with a pencil-type iron to avoid damage. It is best that the ends of the litz wire be bound with fine fuse wire before trying to solder it.

Having made the connections to the resistor, lead the cord out through a suitable opening in the back of the case and close up the hearing aid. To the other end of the cord, connect an ordinary phono plug, making sure that the center pin is connected to the grid rather than the ground end of the input resistor. Of the various lengths of cord that can be obtained from a hearing-aid dealer, the most suitable is 30 inches, but 20 and 40 inches are also available. The phono plug, which you have just attached, is to connect the amplifier to either the probes or the magnetic pickup.

There are two probes. The r.f. probe is for tracing an r.f. or i.f. signal from the input to the detector of a receiver. The a.f. probe is for tracing an audio signal from the detector to the output, but also for checking the presence of sync and sweep signals in a TV receiver. The magnetic pickup, which is optional, assists a technician in following an audio signal through cabling in public address work.

The circuit of the r.f. probe is shown in Fig. 4. The probe case was constructed from a defective 6L6 tube, whose base and interior were removed. Where the tube base used to be a mounting plate to hold an ordinary phono jack has been fitted. The completed unit is shown to the left in Fig. 1. Actually any kind of housing could be used.

The a.f. probe (Fig. 5) consists of a capacitor and a resistor. The latter loads the input impedance of the first audio stage of the "Signal Finder" to reduce hum pickup, since unscreened cable was used for greater flexibility. The probe case was made up of the metal cases of a 6L6 and a 6V6 brazed together. The probe tips, both for r.f. and a.f. are made from pointed hinge pins. The construction of the probe cases is a matter of convenience and can be changed if you desire. In any event, the case should be metal to act as a shield for the components inside it. It will be at ground potential when the clip lead is grounded, which should always be done when tracing a signal. The probe tip is isolated from the case by the insulated bushing.

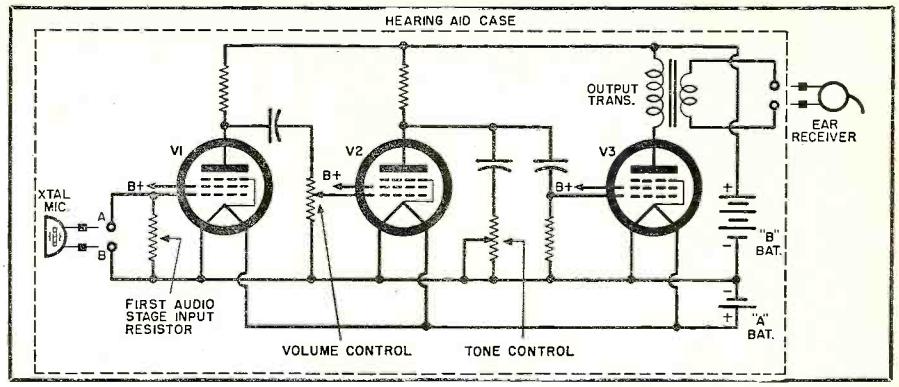


Fig. 2. A simplified schematic of a typical three-stage hearing aid.

To make the magnetic pickup (Fig. 6) an ordinary 2000-ohm earpiece from a pair of headphones is required. On removing the cap of the earpiece and the metal diaphragm, the two pickup coils will be visible. One coil and also the permanent magnet under the coils have to be removed. While this reduces the sensitivity of the device, it is necessary to make room for a phono jack on the back of the case. This lowered sensitivity is unimportant, since such a high gain amplifier is available in the "Signal Finder." The remaining coil is connected across the phono jack, one side of which is grounded to the case.

The "Signal Finder" is now ready for use. First connect the ear receiver and switch on the unit. Fit the receiver in the ear and adjust the volume to a convenient level. A rushing sound should be heard. If it is not,

(*Continued on page* 138)

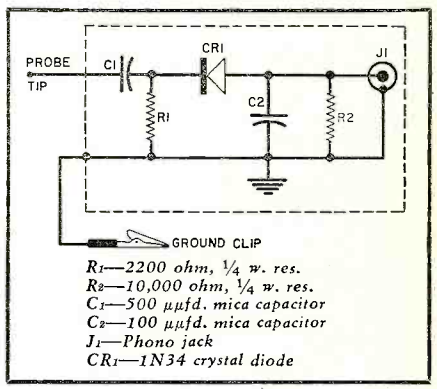


Fig. 4. The r.f. probe can be fitted inside the shell of an old metal tube.

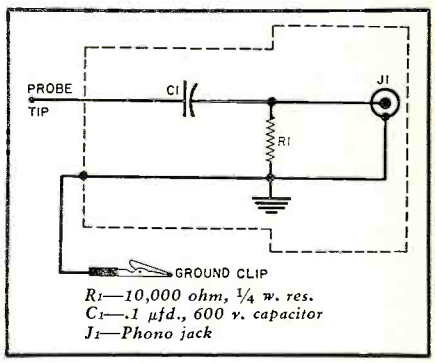


Fig. 5. Circuit for the a.f. probe.

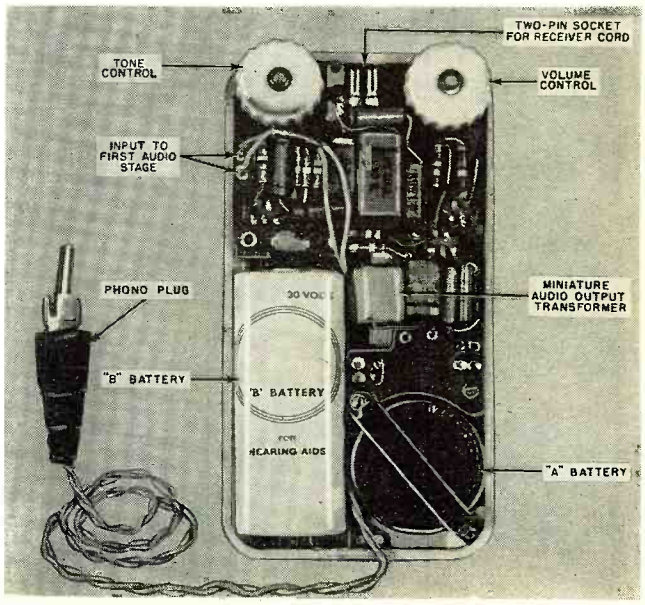
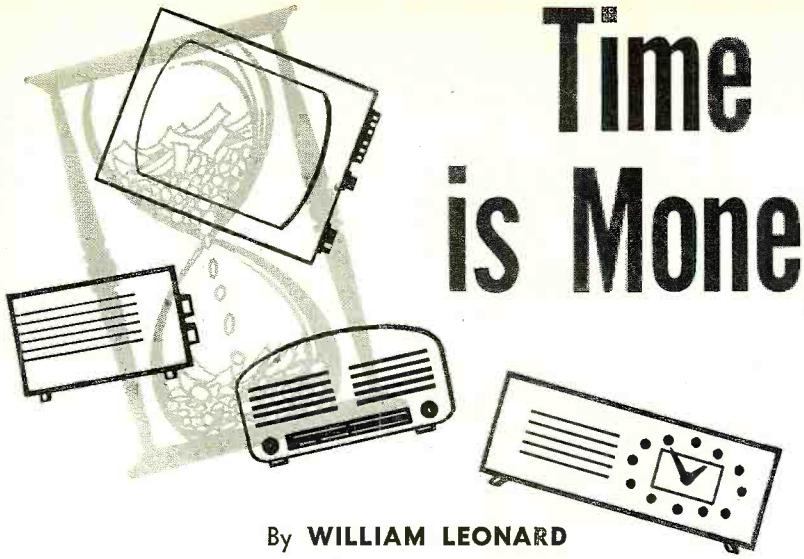


Fig. 3. After its case has been removed, the typical hearing aid will look like this. The microphone has been removed and a wire connecting to a phono plug has been connected across the input. The plug fits the jacks on the accessory probes.



Time is Money

By **WILLIAM LEONARD**

Poorly organized, non-productive hours rob service dealers, annually, of hundreds of needed dollars.

A SUCCESSFUL service dealer recently made the statement that "The biggest problem I had to whip when I went into business for myself was the proper management of my time. I found myself involved in so many non-productive details that I knew I would not make a go of my business unless I organized my time."

From a management standpoint, the operation of an independent service business is a very complex undertaking. The major products it has to sell are the intangible triad of labor, knowledge, and skill—tied to the elusive element of time.

A service business must have the consistent support of skillful but economical advertising and sales promotion. Without some regular plan for keeping the shop name before the public, the business would fade away for lack of customers.

It must have the benefit of a good record-keeping and accounting system. Tax authorities take a dim view of operating-expense deductions that are not supported by actual records. The best insurance against trouble with tax officials is to keep a systematic record of income and expenditures.

Next, there is the problem of buying and of inventory control. Without a definite inventory-control plan, a dealer may tie up a lot of his capital in stock that gathers dust on his shelves. This is especially true during the seasonal rush periods when there is a strong tendency to over-buy in the mad rush to handle all of the service calls that come in.

To enjoy continued success and prosperity, the service dealer must be a combination of technician, advertising man, sales manager, accountant, purchasing agent, and customer-relations expert. Yet, since his income will come primarily from the sale of time, in the form of labor, knowledge, and skill, he must allocate this time so that his technical income will pay for the hours necessary to give to the other essential management activities.

How do you manage time? How do you handle the necessary, pesky, time-consuming details of a business to keep the loss of productive time to a minimum?

The first step in achieving better management of time is to organize its use by pre-planning the known activities. It is common practice in the service industry to list service calls as they come in and to schedule the order in which the calls will be made to effect the most efficient routing. This type of pre-planning keeps travel time between calls at a minimum. This same type of pre-planning applied to all other activities of the business will eliminate a lot of confusion.

Many successful executives pre-plan each day's activities by making up an activity schedule for the following day at the end of the one preceding. This list of projects to be handled is actually written down. It provides them with a well-ordered schedule that eliminates confusion in deciding on what to do next. It encourages organized thinking and effort.

In addition to pre-planning his daily work, a service dealer should prepare schedules of long-range projects. These should cover the things he hopes to accomplish during weekly and monthly periods. If real growth is anticipated, it is necessary to pre-plan major projects and set up objectives on an annual basis. Of course, most owners of small businesses day-dream of the improvements they hope to make on the business premises and the objectives they hope to reach—when they can find the time and the money. But these remain only as flimsy dreams until they are written down and planned as definite projects.

An insidious but all-too-real time waster in most service shops is the lack of shop organization for effective work. Most shops are a hodge-podge of sets and equipment that have been dumped in a convenient spot until there was time to do something with them. The time never comes and the confusion gets worse and worse.

It would pay off in increased efficiency through the elimination of wasted time, if every shop owner would schedule a monthly clean-up and clean-out period for his shop as a regular project. This should include the disposal of all junk sets that have been set aside for the possible salvaging of parts—which is never done. A clean, orderly shop is conducive to orderly thinking which, in turn, leads to better management of time.

In our present highly competitive economy, survival in any type of business depends upon the effectiveness of the promotions that are used to keep one's name and facilities in the public's mind. If advertising is not carefully pre-planned it is seldom effective. If it is not done consistently it will not produce results.

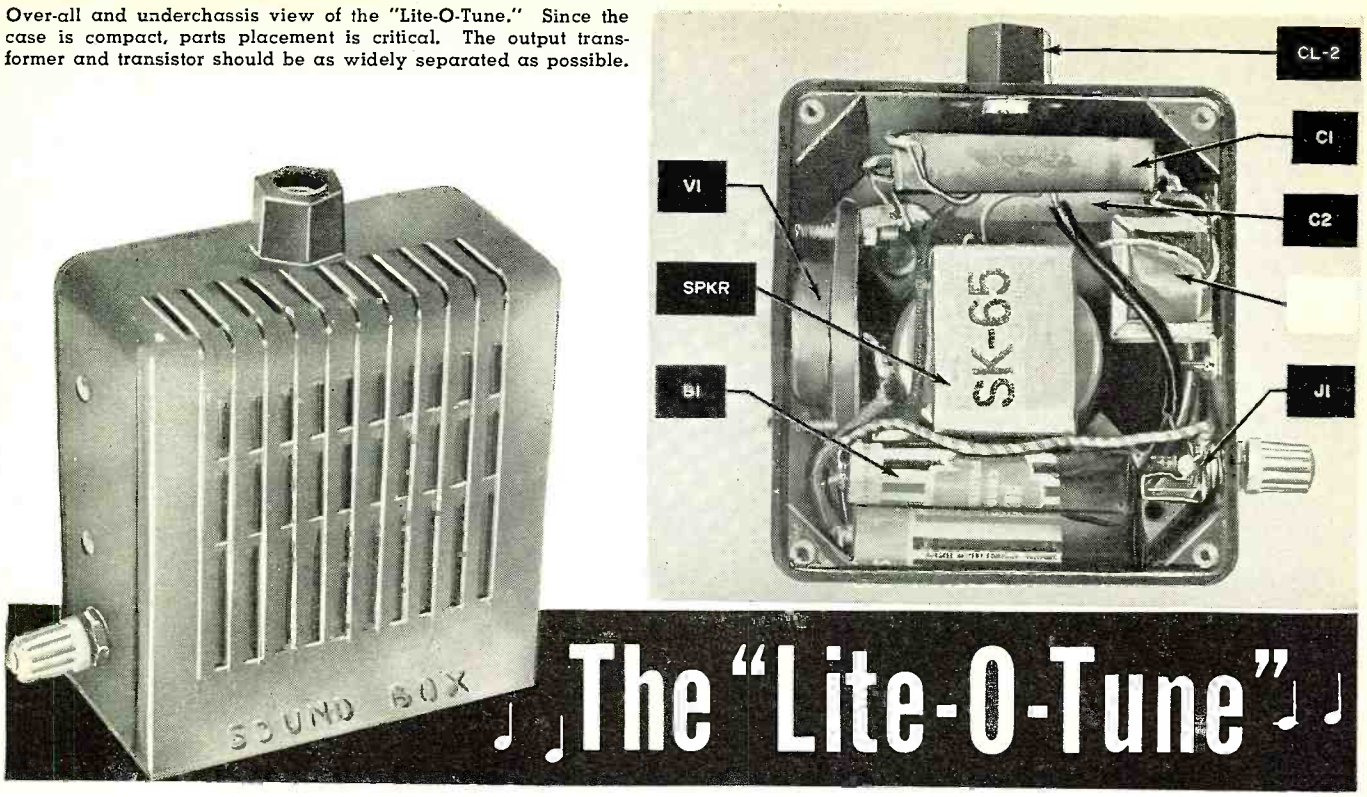
The small service dealer cannot afford to give a lot of time to planning and handling the details of a number of promotions. Yet he must have a consistent promotional program if he wants to survive in the face of steadily growing competition. The one effective solution to this problem is long-range planning of advertising. This is one facet of his business that should be planned on a yearly basis.

The first step is to determine how much money will be available during the annual period for all advertising including telephone directory, newspaper, and direct mail. Since the dealer must contract for his telephone-directory advertising on an annual basis, the time to plan an over-all advertising and promotion program would be at the time he determines the kind and extent of the advertising he will use in the telephone directory.

One small business that has had a phenomenal growth during the past four years has made very effective use of a limited promotional budget by annual pre-planning and coordinating of direct mail with its telephone-directory listings. This business takes listings under seven different headings in the directory. Copy used in the four one-inch ads they buy is carefully phrased. At the same time, an over-all schedule of promotions and advertising is written up for the entire year. This is the "working schedule" which the owner uses throughout the year. In a matter of minutes each week, he is able to handle the details of the promotion scheduled for that period. Since the copy in the weekly newspaper ads and the quarterly direct-mail pieces dovetails with the copy in the phone-directory ads, the effectiveness of this coordination is reflected in the unusual success of the business.

It is this type of pre-planning and organized effort that will enable the small dealer to keep his non-productive time at a minimum. —30—

Over-all and underchassis view of the "Lite-O-Tune." Since the case is compact, parts placement is critical. The output transformer and transistor should be as widely separated as possible.



The "Lite-O-Tune"

By **ELLIOTT A. McCREADY**

Construction details on a compact musical instrument that varies its tone in response to varying light intensities.

MOST readers will recall the "Theremin," a novel musical instrument which has made sporadic appearances on television and was described a few years ago in various technical publications. The Theremin is a very versatile instrument, although a little expensive to construct.

An instrument which operates on the same general principle, *i.e.*, variation of musical pitch with distance, has been devised by the writer and named the "Lite-O-Tune." This instrument is played by varying its distance from a light source such as a table lamp. While not as wide-range or versatile a device as the Theremin, the "Lite-O-Tune" is very simple and inexpensive to construct. It is completely self-contained and small enough to be carried in a coat pocket or purse.

The "Lite-O-Tune" is fundamentally a transistorized blocking oscillator, the frequency of which is a function of the resistance of a cadmium sulfide photocell in the base circuit of the transistor. The cadmium sulfide photocell exhibits a very large change in resistance as the light intensity to which it is exposed varies.

The output of the oscillator is delivered to a small loudspeaker and the pitch of the resulting musical tone is determined by the light intensity to which the photocell is subjected, as well as the distance of the instrument from the light source.

Increasing the size of capacitor C_1 (Fig. 1) will lower the pitch of the tone produced, and decreasing the size of C_2 will lower the volume.

A CK722 transistor may be substituted for the 2N255; however, it was found that the latter unit is much more stable in this particular circuit. With either transistor the oscillator will draw between one and five milliamperes, assuring long battery life.

All components of the "Lite-O-Tune" are housed in a 3" x 2⅜" x 1⅜" plastic case. The transistor is mounted inverted and the leads are bent slightly so they do not short against the speaker frame.

Miniature switches are a little hard to come by, so the switch for the "Lite-O-Tune" was fabricated from a miniature open-circuit jack and plug. The plug-tip was filed flat on one side so that 180-degree rotation would open or close the jack contacts.

The photocell housing consists of a ⅜" threaded control bushing mounted at the top of the plastic case and secured with a ⅜" control nut (the author used a plastic nut to dress up the instrument). The photocell is cemented inside the bushing with leads projecting into the plastic case.

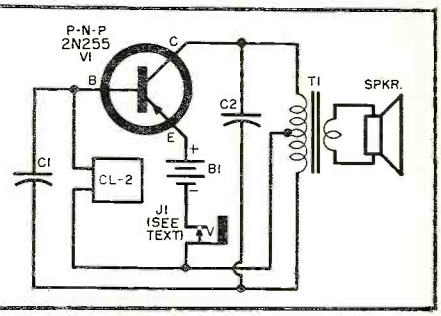
After wiring is completed and checked, turn the instrument on. A fairly loud tone of about 150 cycles should be heard with the photocell shielded from light. The pitch of this tone should increase to about 2000 cycles when the photocell is held near a 150-watt bulb.

Playing the "Lite-O-Tune" is merely a matter of a little practice and finding the proper light source. Don't try a fluorescent light as the results will be very discouraging. A combination of tilting the instrument and varying its distance from the light will be found most effective.

Incidentally, a little close harmony with three or four of these things would be a very interesting experiment —if the neighbors can take it! —30—

Fig. 1. Diagram of "Lite-O-Tune." A CK722 could be substituted for V_1, if desired.

C_1—.04 μfd., 200 v. capacitor
C_2—.1 μfd., 200 v. capacitor
T_1—Miniature output trans. (Argonne AR-119)
B_1—Four 1½ volt penlite cells, series connected (Burgess #7)
Spkr.—2½" speaker (Lafayette #SK-65)
J_1—Miniature phone plug and jack (Lafayette #MS-281 & #MS-282, see text)
CL-2—Cadmium sulfide photocell (Clairex CL-2)
V_1—Power transistor (CBS type 2N255, see text)
1—Plastic case (Lafayette #MS-315)



A Transistorized TV Bar Generator

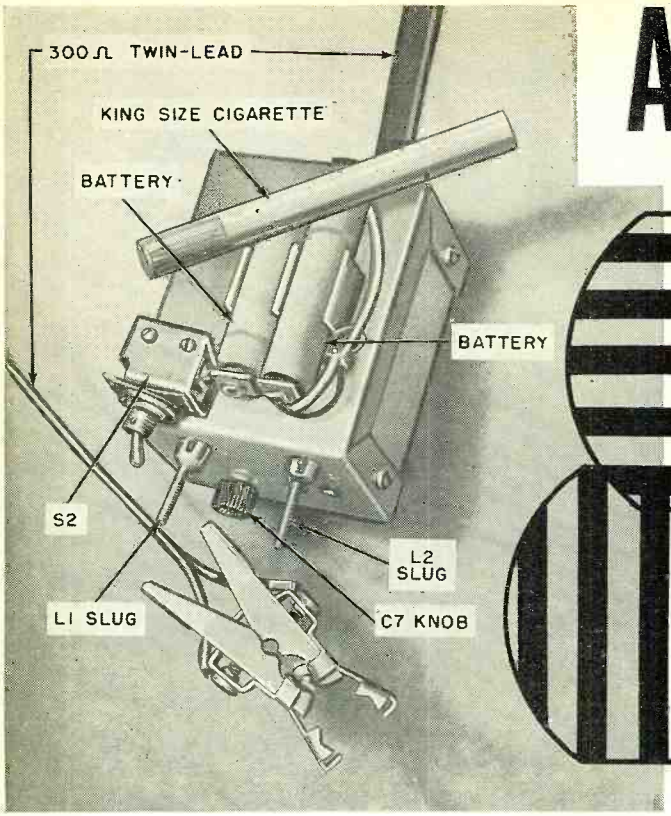


Fig. 1. The finished generator is not much larger than a king-size cigarette.

By
THOMAS G. KNIGHT

Self-powered and small, this unit is handier for home calls than conventional pattern generators.

THIS INSTRUMENT coupled to the antenna leads of a TV set, like most such generators, will provide horizontal or vertical bars for linearity adjustment of the picture-tube deflection circuits. However, unlike other such units, it is compact and completely self contained, using only two transistors and powered by two penlite cells. The output is tunable across channels 2 and 3 (48 to 64 mc. total range), permitting use in any location. Signal output is more than ample to lock the TV receiver's sweep circuits.

Transistor performance at these v.h.f. frequencies is obtained through use of the *Philco* SB-100 surface-barrier transistor as the v.h.f. oscillator. Modulation is accomplished in the emitter circuit of the SB-100 by a low-cost *General Electric* 2N107 transistor which oscillates at approximately 150 kc. for the vertical bar pattern and at approximately 500 cps for the horizontal bar pattern.

The finished unit, shown in Fig. 1, is constructed in a miniature aluminum case 2¾" x 2⅛" x 1⅝".

The SB-100 surface-barrier transistor is not only able to operate at v.h.f. frequencies—it can also do so on extremely low voltage. It is an "*n*" type transistor—that's right, not *p-n-p* or *n-p-n*. The base material is a slab of *n*-type germanium with emitter and collector metal terminals plated directly to the *surfaces* of the base. Other germanium transistor types, such as point-contact and junction, have emitters and collectors consisting of small points or areas of *p* or *n* germanium alloys placed on the base slab. The SB-100, by placing the emitter and collector terminals on the actual crystal surface of the base material and making the base thickness approximately .0002 inch between emitter and collector, is able to obtain high ratios of hole current to electron current at very low voltages. (See the article "Amazing Surface-Barrier Transistor" in the August 1957 issue of this magazine.) That's what counts when low-voltage, high-frequency performance is desired.

The circuit is shown in Fig. 3. The v.h.f. oscillator V_2, is a conventional grounded-base circuit with C_7-L_2 making up the tuned circuit in the collector lead and a center-tap on L_2 providing feedback to the emitter through C_6. Output is obtained through a two-turn loop of insulated hookup wire wound loosely around L_2 which, in turn, feeds through a piece of 300-ohm twin-lead to a clothespin type antenna-terminal clip.

L_2 is a center-tapped coil. It may be made by winding 15 turns of #16 enameled copper wire on a ¼" rod. Winding length should be approximately one inch. After winding, the rod is removed and the coil is then self supporting. Scrape off the enamel from the middle of the center turn and attach a flexible lead for the center-tap. On the unit shown in Fig. 1 a slug-tuned TV front-end coil form was used for L_2, allowing fewer turns to be used. Channel-tuning capacitor C_7 may be any type of variable with approximately a 1.5 to 15 $\mu\mu$fd. tuning range. An air trimmer was used in the unit shown. Likewise, C_6 may be any type with the required range of 5 to 20 $\mu\mu$fd.

Emitter modulation is applied to the SB-100 through RFC_1 and a 1200-ohm resistor R_3. RFC_1 prevents the modulator from loading down the V_2 emitter feedback circuit, while R_3 performs two functions: It limits emitter current and also prevents the low impedance of the emitter circuit from shunting the modulator emitter circuit. The 1200-ohm resistor, R_4, in the SB-100 base lead provides the proper bias for the v.h.f. oscillator.

L_1 is an ordinary ferrite antenna coil with a 40-turn winding over the original winding to provide feedback for 150-kc. modulator operation. The 500-cps modulator transformer, T_1, is a *UTC* SSO-3 "Sub-Subouncer" unit. Its black leads connect to L_1 and C_5. The other winding (red and blue leads) connects across C_3.

Switch S_1 selects either horizontal or vertical bars. The 2N107 modulator, V_1, is another grounded-base oscillator, with inductive feedback from collector to emitter. Both the V_1 and V_2 emitter returns go through the modulating transformers, thus providing for modulation of the v.h.f. oscillator.

The 40-turn feedback winding on the ferrite antenna coil is not critical: almost any size insulated wire may be used. On the unit shown, #24 enameled wire was used. The proper anten-

na feedback winding connections must be selected to cause oscillation. Simply reverse the feedback leads if oscillation does not occur in the vertical bar position. The 500-cps horizontal oscillator should work with the connections shown. If it does not, simply reverse the black leads of T_1. Oscillation of the 500-cps oscillator may be checked by listening to an earphone (or loudspeaker) inserted in the battery leads. Oscillation of the 150-kc. oscillator may be checked by placing the antenna lead of a broadcast receiver, tuned to 600 kc., near L_1. The 4th harmonic of the 150-kc. oscillator should be heard. A receiver with a b.f.o. will simplify this check.

Operation of the modulator circuit should be established, in the manner just noted, before the v.h.f. oscillator is checked out. Once it is known that the low-frequency oscillators are working, test for functioning of the v.h.f. stage becomes simple. It is a good idea to make the modulator check with the high-frequency oscillator disabled. This may be accomplished simply by removing V_2 from its socket. Once this has been done, it is an easy matter to connect the completed unit to the antenna input of a TV receiver tuned to channel 2 or 3, with the antenna lead-in removed, to determine whether the v.h.f. portion is working.

Component layout is not especially critical. Fig. 2 may be of assistance to those who wish to follow the author's disposition of parts. The leads to C_6, C_7, and L_2 should be kept as short as possible and they should also be dressed well away from the chassis. Short leads should also be used for V_2—they should be clipped to about ¼". For this reason, a socket will be convenient for mounting this surface-barrier transistor.

In assembling the unit do not omit any of the bypass capacitors, particularly in the v.h.f. oscillator and across T_1. The v.h.f. operation will be erratic without proper bypassing, while the 150-kc. oscillator will not function unless the 500-cps modulation transformer is bypassed to r.f. While exact layout is not critical, it may be of some assistance to check the underchassis view of Fig. 2.

To check operation of the v.h.f. oscillator after wiring has been completed, tune a TV receiver to channel 2 and attach the output clip of the 300-ohm output twin-lead to the receiver's antenna terminals, making sure to disconnect the set's antenna. Set feedback capacitor C_6 approximately midway between minimum and maximum capacity. Insert batteries and turn on the bar generator. Set modulator switch S_1 to "Horizontal Bars." Now tune C_7 through its entire range; look for horizontal bars on the picture tube while doing this. If bars appear during the tuning of C_7, the v.h.f. oscillator is functioning. If no bars or indication of signal appear, try other settings of C_6 until results are obtained.

Now try channel 3 on the TV set, retuning C_7 for a pattern. If none appears, re-adjust C_6 until a pattern is obtained. Generally C_6 will be approximately ¼ meshed for proper operation on both channels 2 and 3. Once set, C_6 should need no further adjustment, and all future v.h.f. tuning is done with C_7 alone. Too much capacity in C_6 will reduce the high end of the v.h.f. range of V_2. A range of 48 to 64 mc. should be easily obtained. The turns of L_2 may be squeezed or extended to provide the desired tuning range.

After getting the v.h.f. oscillator to function properly, switch S_1 to the vertical position. If the bars are not properly vertical, adjust the slug in the ferrite antenna coil to correct this condition. Normally the antenna core is screwed in approximately three-quarters the entire way.

Note that only the 3-volt lead is switched on or off by power switch S_2. The 1½-volt lead feeding the base of the SB-100 is not switched because of the minute base current drain (0 to 1 microampere) of the SB-100 when S_2 is open. In fact, drain through both cells is only 1⅓ ma. when the unit is operating. The power switch is therefore optional: the unit can be turned off by removing the batteries, if desired. —30—

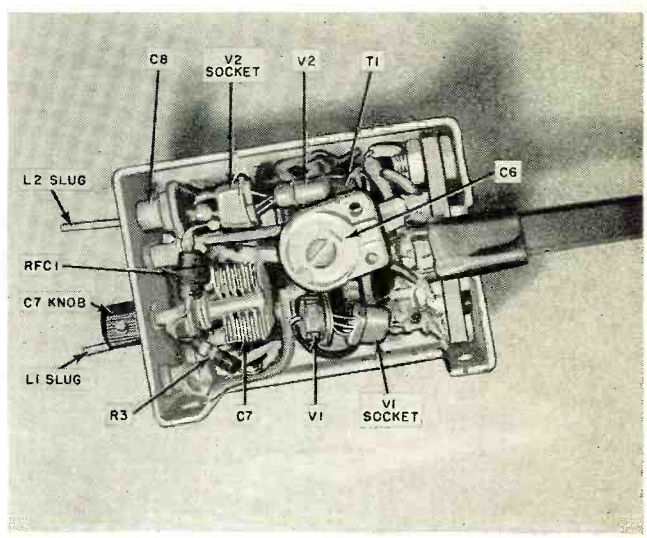
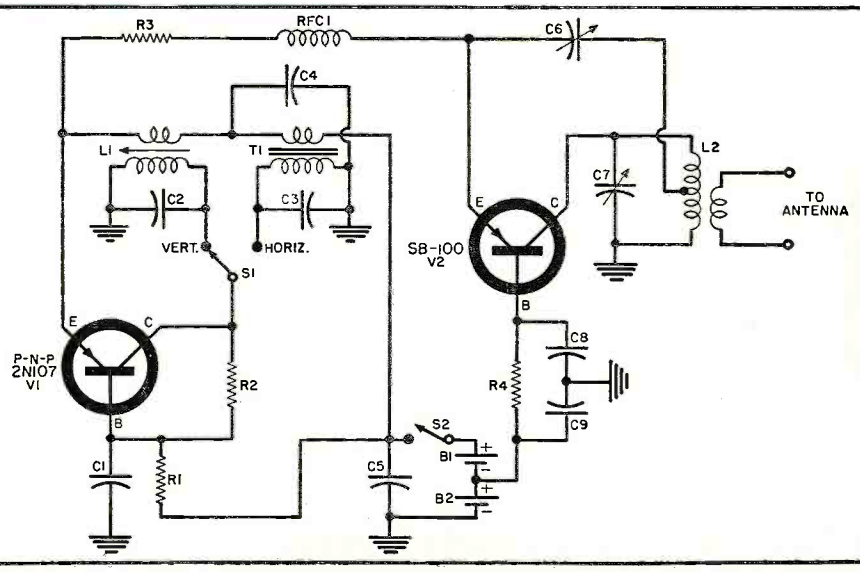
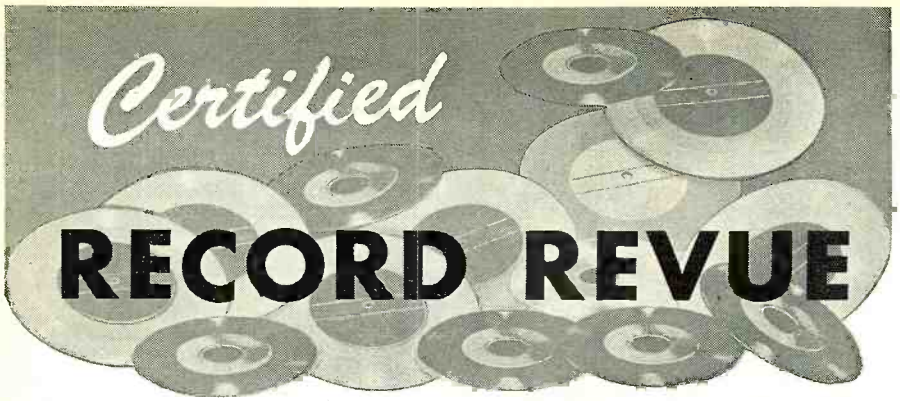


Fig. 2. This view of the completed unit, looking into the chassis from underneath, will be of assistance to constructors who wish to follow the author's general layout. Note the transistor sockets. They are used because it was found advisable to clip the transistor leads very short.

Fig. 3. Complete circuit for the television pattern generator, using two transistors and other readily available parts.

R_1—12,000 ohm, ¼ w. res.
R_2—220,000 ohm, ¼ w. res.
R_3, R_4—1200 ohm, ¼ w. res.
C_1, C_3, C_4—.005 µfd. disc ceramic capacitor
C_2—.0047 µfd. disc ceramic capacitor
C_5, C_8, C_9—.001 µfd. button-type silver mica capacitor (Erie)
C_6—5-20 µµfd. trimmer capacitor
C_7—1.5-15 µµfd. trimmer capacitor
L_1—Ferrite antenna coil (Miller #6300 or equiv. See text for details on additional winding)
L_2—15 t. #16 en. wound on ¼" rod, 1" winding length. After winding, rod is removed and coil becomes self-supporting. Center-tap (see text)
RFC_1—50 µhy. r.f. choke (National R-33, Millen 34300-50, or equiv.)
T_1—Plate-to-line trans., 10,000 ohms to 25,000 ohms (UTC SSO-3)
S_1—S.p.d.t. switch
S_2—S.p.s.t. switch
B_1, B_2—1½ volt penlite cell
V_1—"p-n-p" transistor (G-E 2N107)
V_2—Surface-barrier transistor (Philco SB-100)





By BERT WHYTE

IT IS pleasant to note that with this issue this column is entering its fourth year. I haven't the space for fond reminiscences, but I can tell you it's been great fun and quite fascinating too, as many of the things about which we have surmised and speculated have come true. The outstanding thing, of course, has been the amazing advances in recording techniques and the tremendous burgeoning of the LP record market. Never before in history have so many people had the opportunity to enjoy great music. And never before have so many people assiduously devoted themselves to musical reproduction, otherwise known as *hi-fi*.

It goes without saying, that in the dynamic field of hi-fi we shall reach levels of perfection in the reproduction of music beyond our wildest dreams. A step in that direction is the monogroove stereophonic disc. As you have noted I have been trying to get the particulars on the stereo disc introduced by *A. R. Sugden and Co.* at the recent London Audio Fair. Well believe me, friends, delving into the secret of the H-bomb can't be any worse. I have been able to elicit some information, but with many questions left unanswered. Perhaps in time we will get the full story.

For the present this is the situation. *Sugden,* in essence, picked up the stereo disc ball where *Western Electric* had dropped it in 1931. *W.E.* had envisioned a system where a single stylus could be made to pick up two signals. Unfortunately, at that time *W.E.* ran into mechanical difficulties in cutting the dual signal and in reproducing it. One trouble was the pickup weight necessary for accurate tracking, which was on the order of half a pound! This was further compounded by the relatively tremendous mass of the stylus, the low reactance, and lack of compliance.

Now in this era of microgroove and ultralight weight pickups with highly compliant styli *Sugden* claims to have overcome the difficulties in the basic idea. They have been able to cut records with the usual side-to-side lateral signal simultaneously with up-and-down or "hill and dale" vertical signal. One of the problems of the old *W.E.* system was stylus vectoring . . . a condition of interaction between the vertical and lateral signal which hit null points and therefore effectively cancelled the dual signal. *Sugden* has evidently spent a lot of time improving the quality of vertical recording, this being a requisite for proper stereo operation. They have developed two separate cutting systems, one for the lateral and one for the vertical signal. In some ingenious manner, these cutters have been mechanically coupled so that they will impress a composite signal on a disc and yet be relatively free from interaction! *Sugden* claims to have achieved channel separation of 25 db which, contrary to popular opinion, is quite sufficient for stereo use. Studies have shown that as little as 8 to 10 db separation will allow for stereo effects.

To play back discs cut with these dual signals, *Sugden* has developed a pickup of extremely light weight. An output of approximately 20 millivolts is derived from both the vertical and lateral and mechanical coupling is so arranged as to allow frequency response up to 13,000 cycles. There are no filtering or other signal modifications necessary, the outputs of the pickup going directly into two standard amplifiers and two speakers.

One of the big features of this scheme and this pickup is that the pickup is compatible with dics having ordinary lateral recording and will play them with complete fidelity. This, then, is the monogroove system and from all reports it seems to work very well. The drawbacks at present are cost of the cutter, reputedly somewhere in the neighborhood of $5000, and the fact that in order to successfully play stereo with this system, you must have a turntable which is virtually free from rumble. By deliberately making the pickup sensitive to vertical motion so as to pick up the vertical signal, the rumble problem has been greatly exaggerated. Acoustic feedback must also be reduced to the vanishing point. Such turntables are available, but at a pretty fancy price. No doubt all the problems will soon be resolved and then we can only hope that the record companies will shell out the moola for the cutter so we can begin to build a stereo disc reportoire. I'll leave you with this intriguing thought. . . . Strong rumor has it that *RCA Victor* will soon import the necessary equipment for these new monogroove stereophonic discs!

FALLA
THE THREE CORNERED HAT (BALLET)
TURINA
SINFONIA SEVILLIANA

Orquesta Nacional de Espana conducted by Ataulfo Argenta. London LL-1688. RIAA curve. Price $3.98.

London has just issued a spate of recordings in a new series known generically as "The Music of Spain." This is an ambitious project embracing, as it does, a very large cross-section of the Spanish musical idiom. Indeed, it goes further by including several of the better-known examples of Iberian-inspired works by "foreign" composers, such as Rimsky-Korsakov's "Capriccio Espagnol" and Chabrier's "Espana." This particular record is Volume Three of the series and, all things considered, it is probably the most outstanding of the group.

Argenta has recorded the "Three Cornered Hat" several times previous to this and earned well-deserved accolades from the critics for his brilliance. This is a brand new recording and as different from his older recordings as night is from day. The intervening years have been productive of technical advances in recording and the sound quality on this disc is far beyond that which was afforded Argenta in his earlier efforts with this score. More than that, Argenta has grown and matured musically; his conducting has that assurance and confidence that come with the mastery of his idiom.

His performance of the "Three Cornered Hat" is truly inspired. Here is combined passion and fire and the distilled essence of the Spanish dance. Yet it is leavened with wry wit and sardonic humor. Argenta imbues the work with a very Spanish feeling of excitement and abandon, but never oversteps the bounds of musical taste. His tempi are firm and he keeps a strong hand on the orchestral reins. One might expect that a Spanish orchestra, performing Spanish music, under the baton of a Spanish conductor of stellar rank would be a happy combination that would produce some memorable music . . . and here this is true. In spite of this, one is quite unprepared for the sheer brilliance of the performance and the stunning virtuosity of the orchestra. This is not merely good music-making . . . it is that splendid stuff from whence come "definitive" performances.

The "Sinfonia Sevillana" is not of the high order of musical inspiration that produces a "Three Cornered Hat," but is quite interesting nonetheless. Except for a few moments your attention never wanders and the music abounds in the characteristic color and atmosphere that makes Spanish music so popular.

Soundwise this disc is one of the most beautifully balanced recordings *London* has ever issued. The string choirs are smoothly sonorous, woodwinds have superb delineation, bass is that crisp, punchy, bright kind favored by the Spanish, and the percussion is outstanding for articulation and accuracy. In these highly flavored scores, the hi-fi fan has a zestful treat of transients awaiting—with plenty of cymbal and triangle, tambourines, and many other struck high percussives. Lovers of the big bass drum will find a king-sized variety giving forth with splendid whumps of great power in both scores, with the "Sinfonia" most liberally endowed in this respect. Frequency and dynamic range were very wide, with nary a hint of transient distortion to mar the transport of music from disc to ear. Spacious acoustics are combined with highly detailed orchestration for maximum "presence effect." Exciting music, great performance, magnificent sound . . . this all adds up to an irresistible buy.

TCHAIKOVSKY
SYMPHONY #3 ("POLISH")

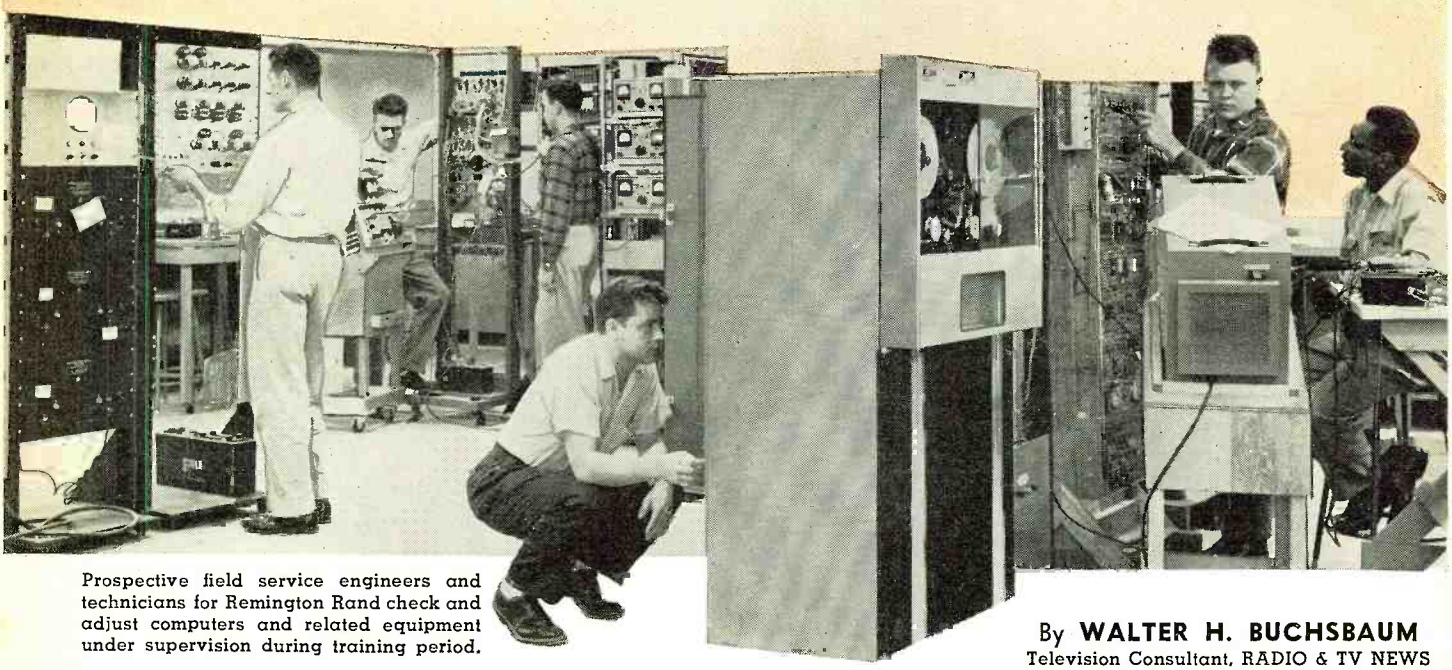
London Philharmonic Orchestra conducted by Sir Adrian Boult. London LL-1442. RIAA curve. Price $3.98.

This is perhaps the least known and least-played of all the Tchaikovsky symphonies. The LP era is now entering into its 10th year and many an obscure work has been recorded. Yet this work of the most popular symphonist who ever lived has been thoroughly neglected. This is the fourth recording of the work to appear (in contrast to the 20 or more versions available of each of the later symphonies) and, quite frankly, it is really the first modern recording and the only one which does the work justice. Oddly enough, in spite of its relative obscurity, one of its firm champions has been Sir Thomas Beecham. Whatever his affections for the score, he has not committed his interpretation to record.

This disc, then, should be welcome news for Tchaikovsky buffs. Sir Adrian gives a rousing, powerful reading, his tempi firm, his beat inflexible. The London Philharmonic follows his urgings with considerable verve and gratifying precision. (*Continued on page* 119)

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.

Career Opportunities in Electronics



Prospective field service engineers and technicians for Remington Rand check and adjust computers and related equipment under supervision during training period.

By **WALTER H. BUCHSBAUM**
Television Consultant, RADIO & TV NEWS

Unprecedented openings for non-engineers result from industry growth and shortage of skilled men.

THE most serious obstacle to the current expansion of our technology is the shortage of technically skilled people. Educators, industrialists, and government officials are continually deploring the lack of engineers and scientists, especially in those fields which have grown most rapidly. The electronic industry has developed so fast since World War II that the manpower problem is now quite acute.

In this field, the shortage of trained personnel is further aggravated by the rapid growth of the industry and its branching out into so many diversified fields. In 1938 the radio-receiver manufacturers were the major employers of electronic engineers and technicians. Today aircraft companies, business-machine manufacturers, and others dominate the employment advertising columns.

It is difficult for one not actively engaged in this gigantic, many-faceted field to realize the tremendous variety of work going on. Some old-time radio amateurs are amazed when they see a *K*-band radar unit or an industrial heat-sealing machine and realize that, basically, these devices are related to their own rigs. Hi-fi enthusiasts are often surprised to learn that amplifier characteristics, similar to those in their home music systems, are also measured in computing amplifiers, servo systems, and radar display devices.

The current shortage of technical personnel in the electronics field cannot be solved overnight by any magic formula. It *can* be relieved gradually by increased emphasis on science teaching in elementary and high schools, by an increase in various scholarships, and, of course, by further improvement in the salary scale of both professional and non-professional people. Engineering salaries have been increased considerably during the past five years and the wages of technicians have risen similarly. The trend has shown no signs of petering out.

Much has been written recently about steps taken to increase the supply of engineers. One of the most practical steps proposed has been the use of the available engineers in the type of work for which they are particularly qualified and only in those positions. This means that posts have to be created for engineering aides, technicians, and other personnel—people who have *some* but not necessarily all of the technical qualifications of the engineer. Many companies have instituted re-organizations in this direction. The "help wanted" ads in this magazine are witness to this trend.

It is not enough to upgrade or relocate technicians and engineers already employed in the industry. Rather, *additional* personnel is needed. Some new employees are often recruited from the graduating classes of technical schools on various levels, but a great source of skilled, competent personnel still lies untapped. The circulation of this magazine, for example, exceeds 250,000 copies a month. In this vast group alone there will be some qualified individuals who are not yet employed in the electronics industry. There may be many others who are working in some branch where their skills are not fully realized. Those who have some technical knowledge, but for one reason or another, are working outside the industry; those who are dissatisfied with their present positions in the industry; those who want to get ahead; those who are thinking of entering the electronics field will all find some helpful information in this article.

In the accompanying table, we have tried to show the variety of career opportunities open to non-graduate personnel in the electronics industry. Engineering graduates today are in a favorable position but technicians have generally been wooed much less vigorously and only by a small segment of the industry. For that reason many qualified non-engineers feel that their services are not in demand or that only such popular fields as TV servicing and hi-fi work are open to them. The table presented here should serve to show the true possibilities for a career in electronics for other than graduate engineers.

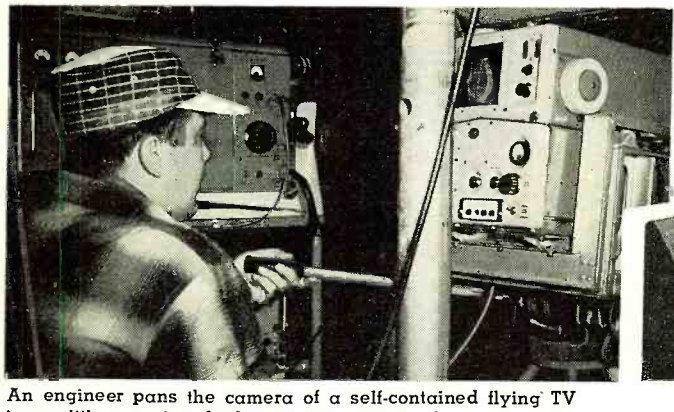
By common understanding, a graduate engineer is a person having at

FIELD	POSITION AND DUTIES	QUALIFICATIONS (Grade)	TRAINING	SALARY RANGE
Electronic Equipment Manufacturers	Design Engineer	8	Technical Inst. or 2-yr. College	$ 7-10,000
	Product Engineer	8	Technical Inst. or 2-yr. College	7-12,000
	Test Engineer: Plan procedures	7	Technical Institute	6-9500
	Quality Control Engr.: Supervise inspectors	7	Technical Institute	6-9500
	Assistant Engineer	7	Technical Institute	5.5-8000
	Junior Engineer	6	Technical Institute	5-7000
	Lab Technician: Build and test	4	Technical School	4.5-7000
	Field Engr.: Coordinate service	6	Technical Inst. or 2-yr. College	5.5-8000
	Field Repairmen: Maintain and repair	4	Technical School	5-7500
	Draftsman	3 plus	Technical School-Drafting Course	5-8000
	Foreman	3 plus	Technical School	5.5-9500
	Tester: Production Testing	3	Technical School	4-6000
	Inspector: Parts & Product Testing	2	Company Training	3-5500
	Assembler	1	Company Training	2.4-5000
Radio and TV Station	Transmitter Engineer: Adjust. equip.	5 plus FCC ticket	Technical School	6-12,000
	Technician: Repair & maintenance	3	Technical School	4.5-7000
	Camera Man	Special	Technical School	7.5-12,000
Communications Companies	Transmitter Engineer	6 plus FCC ticket	Technical School	6-8500
	Technician: Maintenance	3	Technical School	4.5-7500
	Lab Technician: Construct & test	4	Technical School	5-7500
Airlines	Radio Operator	4 plus FCC ticket & special training	Technical School & Company Training	5.5-9000
	Technician: Installation & maintenance	5	Technical School	5-7500
Business Machine Companies & Computer Firms	Field Service Engr.: Installation	5 plus	Technical School & Company Training	5.5-9000
	Programmer: Plan machine operation	5 plus	Technical School & Company Training	6-9500
	Field Service Technician	4	Technical School	4.5-6500
	See "Electronic Equipment Manufacturers" for additional positions			
Industrial Control Manufacturers	Field Engineer: Installation	6	Technical Inst. or 2-yr. College	6-8000
	Field Technician	4	Technical School	4.5-6500
	See "Electronic Equipment Manufacturers" for additional positions			
Component Manufacturers	Junior Engineer: Test Parts	5	Technical School	5-7000
	Field Engineer: Customer Contact	6	Technical Inst. or 2-yr. College	5.5-8000
Nuclear Instrument Co.	See "Electronic Equipment Manufacturers" for positions			
Technical Manuals	Technical Writer: Prepare data, manuals	6 plus writing	Technical Inst. or 2-yr. College	5.5-10,000
	Draftsmen	3 plus	Technical School-Drafting Course	5-8000
Radio and TV Manufacturer (Including hi-fi gear)	Field Engr.: Contact distributors	6	Technical Inst. or 2-yr. College	6-9000
	Field Repairman	4	Technical School	5.5-7500
	See "Electronic Equipment Manufacturers" for additional positions.			
Radio-TV Distributor	Service Technician	3	Technical School	5-7500
Radio-TV Dealer	Service Technician	3	Technical Schoo	5-7500
Community TV Company	Installer	2	Technical School	4.5-5500
	Service Technician	3	Technical School	5-7500
Fire, Police Municipal Governments	Operator: Adjust & transmit	4 plus FCC ticket	Technical School	5.5-7500
	Mobile Installation Technician	3 plus FCC ticket	Technical School	5-7000
Truck & Taxi Fleets	Operator: Adjust & transmit	4 plus FCC ticket	Technical School	5.5-7500
	Mobile Installation Technician	3 plus FCC ticket	Technical School	5-7000
Public Utilities	Transmitter Engineer	4 plus FCC ticket	Technical School	5.5-7500
	Installer & Repairman	3 plus FCC ticket	Technical School	5-7000
	Technician: Microwave maintenance	5	Technical School	5.5-7500
Phone Companies	Technician: Equipment maintenance	2-6	Technical School & Company Training	4.5-8500
Sales Organization	Field Engineer: Technical liaison	5	Technical School	5-9000
	Sales Engr.: Sells technical items	3 plus	Technical School & Sales Training	6-15,000
Military Electronics (Civilian Contractors)	Technical Repr.: Liaison with military	5 plus	Technical School & Military Service in Electronics or Administrative work	6-10,000
	Field Service Engr.: Installation	6 plus	Technical Institute & Company Training	6-8000
	Field Service Technician	3 plus	Technical School & Company Training	5-7000
	See "Electronic Equipment Manufacturers" for additional positions			
Military Electronics (Civil Service & Armed Forces)	Civil Service: Grades GS-5 to GS-14	3 plus	Technical School & Special Courses	3670-12,000
Other Govt. Electronics (Civil Service, NBS., FCC, CAA, etc.)	Civil Service: Grades GS-5 to GS-14	3 plus	Technical School & Special Courses	3670-12,000

TV broadcast technicians and cameramen, as part of their training, use mobile equipment during a practice pickup.

Pre-flight check of air electronic gear.

A technician in a naval radio station operates code perforating gear.



An engineer pans the camera of a self-contained flying TV transmitting station built into the cabin of a helicopter.

A sound technician, at work in a studio control booth, is adjusting program material on a broadcast audio console.

least a bachelor degree in electrical engineering or some related field. In the table, we have considered only those jobs which do *not* require any college degree and which can be filled by persons with less knowledge and experience. (In some positions, an engineering degree is preferred but equivalent experience is acceptable. Such jobs have not been included.) The table of career opportunities presented here is based on average earnings and average ability. We know of many instances where non-graduates have achieved high engineering status by practical knowledge, experience, and outstanding ability, and now hold top positions in the electronics industry. The same holds true for civil service, where tests are often substituted for college education.

Qualification Grades

To give some idea of technical knowledge and its value in a job, we have selected eight arbitrary levels of competence. It is assumed that the knowledge or skills of lower levels are possessed by a person rated at a higher competence level. When a technician is capable of simple circuit design, for example, we assume he knows how to solder, how to read the color codes, and understands basic radio theory.

← This chart indicates the wide variety of career opportunities open to technicians with electronics background and experience but without degrees. Numbered grades are explained in text.

Naturally the list cannot fit each individual exactly, nor are the grades shown under "qualifications" in the table fixed. Often a person of lower qualifications is accepted for a job because he shows promise or is concurrently engaged in some study which will increase his knowledge.

Despite the fact that no absolute classification of qualifications can be applied in every single case, the following eight-grade breakdown for electronics personnel who do not have engineering degrees will be extremely useful in most instances:

Grade 1—Knows wiring and assembling; can operate simple machine tools.

Grade 2—Understands circuit diagrams; knows electrical components, units, and systems of measurement.

Grade 3—Knows radio theory as taught in trade schools; can service equipment according to detailed instructions.

Grade 4—Can construct and test simple devices from circuit diagrams.

Grade 5—Can design simple circuits from technical texts; knows algebra and trigonometry.

Grade 6—Has graduated from a 2-year course at a technical institute.

Grade 7—Has 5 or more years experience as a technician in lab work or servicing or has equivalent military experience.

Grade 8—Has 3 or more years experience as a junior engineer in the industry.

The grade into which an individual falls at this time is not necessarily a permanent limitation to how far he can go: there are many ways in which he can improve his qualifications while working at a particular level so that he may pass on to higher positions, especially with prevailing conditions in the industry. Many of the larger manufacturing and developing firms conduct schools for technicians which, after a few years' work, lead to better positions and even recognition as engineers. Most electronics companies grant time off with pay for employees attending evening school. *Lockheed Aircraft,* for example, permits qualified technicians to attend college during two days a week while working the remaining time at regular pay. Tuition for relevant courses is paid for entirely by many employers, while others pay a portion of it.

Positions Not Listed

The positions listed in the table are by no means all that are available in the industry, but rather the most common and most accessible jobs have been selected. There is an entire range of jobs open in the electronic sales field, for example. Here the important qualifications include sales ability and some technical knowledge of product. The salesman for a parts distributor will have to know something about

EDITOR'S NOTE: Readers of this article will also be interested in "Employment in the Computer Field" and "The Men We Hire," which appear elsewhere in this issue.

electronics in order to understand, at least roughly, what the various parts are. When selling relays, the salesman should really know something about relays as well as sales. Usually an alert person can learn enough about a product in a short training period and, if he has sales ability, can do very well.

Another area in the electronics industry in which many chances occur is that involving various clerical and administrative functions. In each instance, a knowledge of at least some branch of electronics is helpful, but the major qualifications are of a different nature. The expediter or general office worker who has some background, say, in amateur radio, will easily fit into the puchasing, administrative, or stock-control department of an electronic firm. Such positions generally pay slightly better than general office work but, since they are not really of a technical nature, we have omitted them from the table. We have also omitted those positions which are found in any other manufacturing or servicing firm, such as accountants, office managers, carpenters, painters, machinists, and electricians.

In the table we have listed most of the active fields in the electronics industry and have shown what positions, duties, and approximate wages are offered in each. We have used the field of "Electronic Equipment Manufacturer" to illustrate in some detail the various positions available with companies making such specialized electronic equipment as business machines, radio, hi-fi equipment, etc. The "Electronic Equipment Manufacturer" may be a firm specializing in making test equipment for other manufacturers, an aircraft firm now engaged in developing its own electronic flight control equipment, or a division of a locomotive factory engaged in making railroad electronic gear. It is impossible to list all types of firms which have some electronics department, but it is a safe bet that almost every sizable manufacturer in any field either has or soon will have one. We know of textile firms which have electronic labs and cigarette manufacturers, glass makers, lumber companies, food processors, breweries, and practically every other industry have connections with electronics today. In addition to the fields listed in the table, any other company which has an electronics department will have jobs for technically qualified personnel, but usually those companies cannot offer the inexperienced person as much training or advancement as the type of organization listed in the table.

A few words might be said about the annual income given in the table for various positions. These figures are average and do not take into account regional variations, overtime, travel pay, relocation allowances, and other benefits. In general, the fringe benefits offered are very similar throughout the industry. Hospitalization policies, insurance, vacation, and sick leave are universal. In many places, tuition, retirement funds, and additional insurance are provided.

There are two important occupations which require some knowledge of electronics, but also lean heavily on other talents. One is that of the technical writer, who is presently in short supply. This position requires some technical knowledge and an ability to write factual accounts. Straight forward exposition is more important than ability at fiction or poetry. The other is that of draftsman. This usually requires that the person has taken a course in drafting, at least. Some background in mechanics often is helpful to obtain promotions from draftsman to designer, a job usually performed by mechanical engineers in most manufacturing setups.

George Bryan demonstrates an experimental model voice-operated radio transmitter at the Signal Corps Engineering Laboratory. The impact of the sound waves from a speaker's voice powers the electronic signal. Jobs involving interesting new equipment such as this transmitter are open in various branches of government service.

How to Get Training

Enticing as the various career opportunities in the electronics industry are, they cannot be achieved without some training. In general it is safe to state that the more training a person has, the better his job and the higher his pay will be. It is, as was shown before, often possible to get additional training while working in the industry. However, in order to start, some previous background is important. We know of one young man who started 12 years ago as an assembler, being taught on the job how to use a soldering iron, and gradually, through correspondence school and, later, evening college, obtained a master's degree. He now is a department head at a large military electronics firm. Such careers are open to the ambitious and able person in almost any field, but the rapid growth in the electronics industry tends to encourage such advancement.

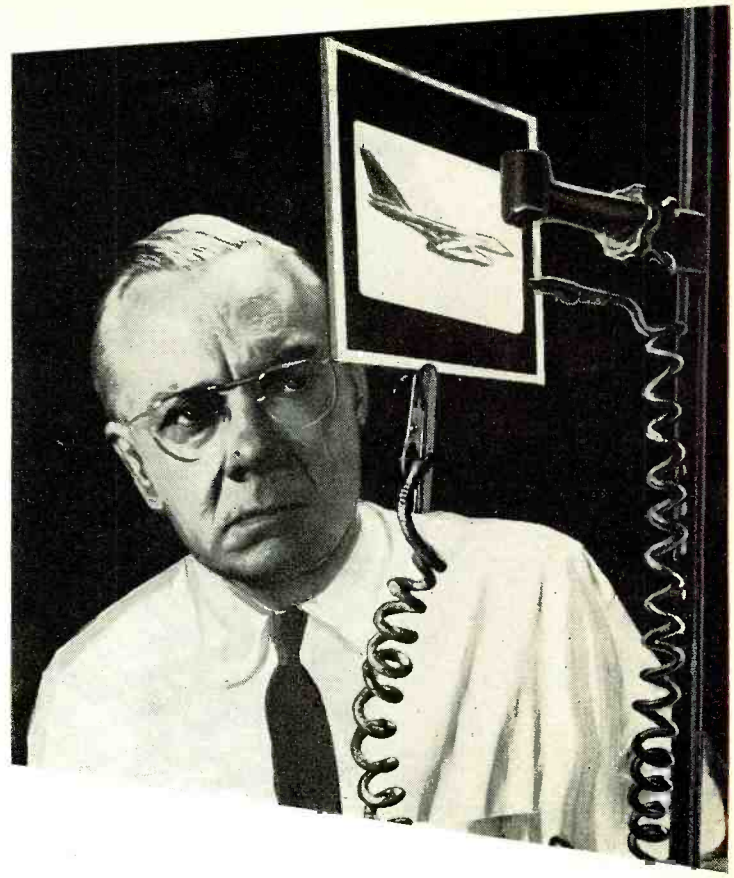
To young people of high-school age we would advise, if possible, attendance at a vocational high school. If this is not feasible, at least take as many physics and mathematics courses as possible in the school you are attending. Correspondence courses in radio and TV theory are invaluable in getting started in this field, although they are of less value to an employer if the applicant does not have any practical experience to go with the theory. Today many firms realize that a person who takes a correspondence course and then actually starts servicing radio and TV sets shows not only technical ability but aptitude and determination which recommend him for further training. Such courses are a good start for an electronics career, but should be backed up with practical experience as soon as possible.

An alternative to correspondence courses or supplementary to such training is attendance at a trade school teaching some branch of electronics. At the present time, there are a number of technical schools that offer a six-month course in radio and an additional three-month course in TV, coupled with construction and testing of actual receivers. Such courses are particularly valuable for the person who did not graduate from high school or whose aptitude for any form of mathematics is slight.

Technical institutes offer, in addition to shorter courses, a full two-year course which is equivalent to at least two years of college work. This type of education is just a little short of an actual engineering degree in that it gives the student sufficient theoretical background to understand almost all engineering literature and permits him to use manuals and references for actual design of electronic equipment.

(*Continued on page* 129)

Pictures on a Flat Panel



Dr. Keith Butler, manager of the engineering laboratories where the "Sylvatron" devices were developed, looks on as one of them is put through its paces during the course of tests in the laboratory.

Sylvania gives a public demonstration of pictures in motion on a flat, electroluminescent screen.

IN A "PROGRESS REPORT" and demonstration attended by hundreds of representatives of the press, other manufacturers, and research laboratories throughout the nation, the Lighting Products Division of *Sylvania Electric Products* exhibited three types of electroluminescent panels on which images of various kinds could be produced and/or stored. On one, a moving picture of good definition was shown, with a motion-picture projector as the source providing the excitation.

Although *Sylvania* representatives made no suggestion concerning the eventual use of their developments in producing picture - on - the - wall TV, there was considerable speculation in this direction by those in attendance on just this prospect. The manufacturer is presently more interested in certain applications in military and industrial electronics that show promise of more immediate realization. Under questioning, the belief was expressed that, although there are no permanent, inherent obstacles to use of panels similar to the ones shown for TV image production, much time and many dollars would be required. At least five years were seen as being necessary before such a prospect could be realized.

It is the belief of the editors of RADIO & TV NEWS that we will see TV pictures, developed from current standard signals, satisfactorily reproduced on electroluminescent panels before two years are up—although this does not mean that commercially practical receivers will be available at that time. We also believe that the demonstrated developments will have far-reaching consequences in the field of color TV. Before exploring future possibilities, a consideration of the *Sylvatron* panels in their present form is in order:

Type I is a square of glass (or metal) coated with parallel, horizontal conductive strips. A layer of electroluminescent material is coated over the strips, and over this layer is another pattern of conductive strips. The latter group of strips runs vertically, however, at right angles to the first set. With a.c. applied to any horizontal strip and to any vertical strip, the point where they intersect will glow while all other portions of the panel remain dark. In the form demonstrated, this panel has 16 conductive strips per inch. A panel two inches square therefore has 1024 squares which can be individually lit.

Type II is a display panel that can store light. A piece of conductive glass is coated with electroluminescent material, on top of which are cemented sets of miniature columns each of which is about $\frac{1}{32}$ inch square. The arrangement gives a waffle-iron effect. Black glass is used to fill in the fine spacing between columns. Each column has a conductive coating on top and bottom; and a conducting layer is placed over the top conductive caps, connecting them together. With a.c. applied to the two outer conducting layers and a momentary spot of triggering light applied to any column, the electroluminescent dot under the column lights up. The feedback of light into this column is enough to keep the dot lit long after the triggering light is turned off.

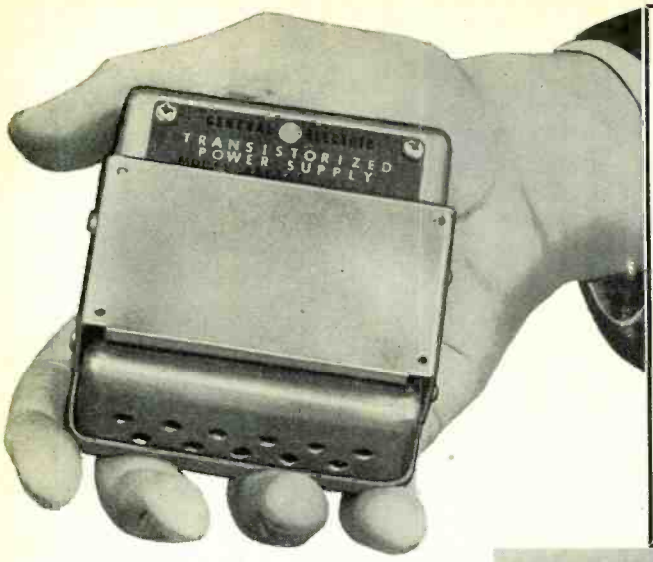
Type III consists of a flat screen of conductive glass with three coatings: an electroluminescent layer, a photoconductive layer, and an electrically conductive layer. With a.c. applied to the conductive material and a light image applied or projected to the back of the screen, the picture is reproduced at the front of the screen with good definition. In its present form, this panel reproduces pictures optically, rather than by electronic stimulation.

Combinations of the present types are possible. One already known to *Sylvania* is a "combination of Types I and III which could electronically reproduce motion pictures."

The largest panels now being made are four inches square. Light output is so low that the panels are best viewed in a darkened room. Neither of these deterrents is considered to be long term, with panel size already being considered merely a matter of production facilities. Present panels have been made to glow in single colors, chiefly blue and green, but *Sylvania* points out that various colors

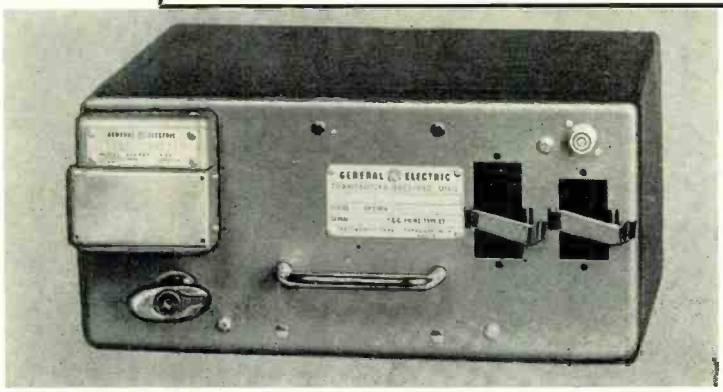
(*Continued on page* 103)

Transistorized Supply For Mobile Radio



Size comparison of new G-E supply. Unit measures 3½ inches square, 1¾ inches deep. It weighs about 8 ounces and it may be employed on any 12-volt vehicle.

New power supply may be mounted on existing two-way radio cabinet as shown here. ⟶



By **JACK NAJORK**
Communication Products Dept.
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First transistorized power supply for commercial mobile radio equipment delivers 195 volts at 100 ma. with 70 per-cent efficiency. Suitable for ham use.

MOBILE radio communications is today a vital service. Law enforcement agencies, public utilities, commercial users—all are continually seeking new ways of economically improving communication efficiency and dependability. Manufacturers of radio equipment have responded by investing heavily in research and development programs aimed at advancing the state of the art to the highest possible level. One of the most significant steps in this direction is the emergence of the transistor which promises worthwhile improvements in mobile communications units in the years ahead.

Although the transistor has not yet been developed to the degree where it can economically replace vacuum tubes in all v.h.f. applications, there are areas where transistorization can offer distinct advantages over existing techniques. The communications industry has made considerable progress in these newer areas. But, of necessity, design emphasis has been centered on transistorized equipment which is compatible with the many millions of dollars worth of two-way radio devices already in use, so that the problem of over-rapid obsolescence of existing units may be readily overcome.

One of the newer products introduced in the past several weeks with this engineering objective in mind is a transistorized power supply which can be adapted easily not only to original equipment but to equipment already installed at a user's location. With the newly announced transistorized power supply, the goal of progress without obsolescence is helped considerably. Mobile communications systems can now be up-graded for better performance without wholesale scrapping of existing equipment.

Practically all of these equipments use the conventional vibrator power supply which, for years, has been the standard method of developing "B+" voltages for automobile broadcast radios and other vehicular electronic equipment.

While many improvements have been made in the basic vibrator supply since its inception, it has long been recognized that the vibrator itself is one of the limiting components in the design of high-reliability mobile communications power supplies. There certainly exists the possibility that a high-reliability electronic power supply of greater initial cost may well prove more economical on a long-term investment basis.

Before the advent of the vibrator, the only other commercially feasible method of generating "B+" voltages was the dynamotor supply. While extremely rugged, the dynamotor represents a high initial investment, to which must be added the expense of periodic lubrication, brush replacement, and commutator undercutting. Because of these factors, the use of dynamotors in commercial communications equipment is now limited almost entirely to very-high-power mobile transmitters whose power input demands exceed the capabilities of most ordinary vibrator-type power supplies.

Low-, medium-, and high-power mobile equipment is now powered almost exclusively by heavy duty vibrator supplies which use one or more vibrators. In the receiving position, one vibrator must obviously run continuously and it is this continuous duty which restricts the life of the vibrator supply. On the other hand, most modes of mobile communications require only short-duration transmitting cycles and in this type of operation, the life of the vibrator is many times that found in the receiving condition.

In view of these duty cycles, elimination of the vibrator supply for continuous duty receiving purposes should improve the reliability of the over-all mobile system. The degree of improvement which can be expected is highlighted by the fact that the life expectancy of the transistorized mobile power supply is equal to the life of the

equipment itself! The use of transistors in place of the vibrator results in a completely electronic power supply which is smaller and lighter than its predecessor and which will do the same job, year in, year out, without attention.

Aside from reliability, the transistor power supply brings with it several important benefits although at a higher initial cost. To better appreciate these advantages we might examine, briefly, the characteristics of the vibrator-type supply.

The conventional vibrator is basically a current-switching device which converts a steady-state d.c. voltage into square waves at a low frequency rate (generally around 100 cps). Since the interruption of a fairly substantial current by mechanical means produces damped oscillations, *i.e.*, sparking at contacts, the associated circuits must be well shielded and filtered to prevent radiation of "hash" which can be picked up by the receiver's front-end and thereby cause a reduction in signal-to-noise ratio.

A second problem peculiar to vibrator supplies operated in automobiles and trucks stems from the large voltage drop which occurs across the battery circuit when the vehicle's starter motor is engaged. The resultant loss of voltage at the vibrator can cause the driving mechanism to slow down to the point where there is a possibility of contacts welding together. (EDITOR'S NOTE: *This possibility has been largely minimized by more recent vibrator contact design which also results in materially increased contact life.*)

The transistor supply neatly sidesteps both of these problems. As shown in the schematic diagram of Fig. 1 two triode power transistors operating as a flip-flop oscillator are used in place of the vibrator. This form of oscillator is essentially a square-wave generator but since mechanical limitations are no longer present, the frequency of operation can be increased from approximately 100 cps to 3500 cps thereby reducing the size and weight of associated transformers and filters. Whereas the vibrator supply requires an iron core transformer with materials and construction similar to 60-cycle equipment, the transistor transformer, operating at 3500 cps, becomes a small assembly weighing but a few ounces. "Hash" filtering and shielding can be reduced because current switching in the transistors is now all-electronic rather than mechanical. While it is true that the generated square waves are a prolific source of harmonics, the techniques of suppressing these undesired components are not so difficult as those imposed by vibrator hash.

Rectification of the stepped-up voltage appearing at the secondary of the transformer takes place in a bridge circuit using four silicon diodes. Ripple filtering is accomplished in a conventional *RC* network following the rectifiers. Power output of the transistor supply shown is approximately 195 volts at 100 ma., which is sufficient to power a 15-tube FM communications receiver. Over-all efficiency of the supply is 70% which is approximately the efficiency realized with a vibrator supply employing a non-synchronous vibrator and selenium rectifiers.

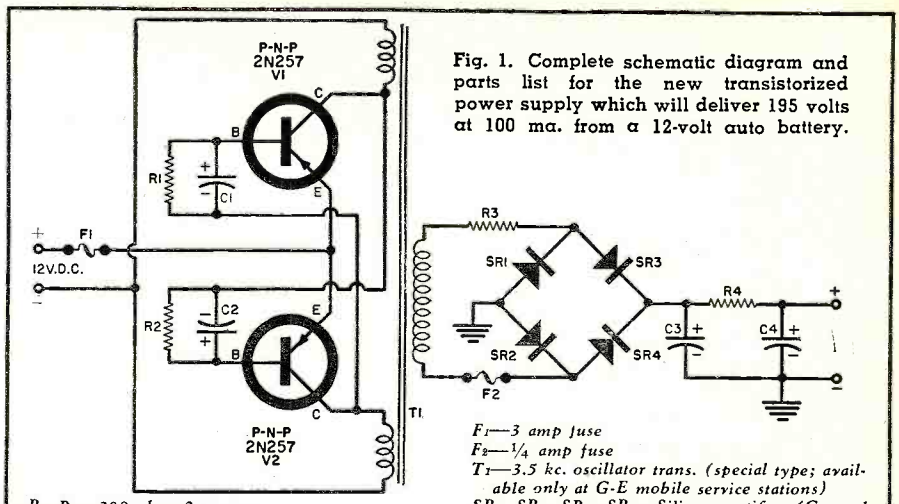


Fig. 1. Complete schematic diagram and parts list for the new transistorized power supply which will deliver 195 volts at 100 ma. from a 12-volt auto battery.

R_1, R_2—390 ohm, 2 w. res.
R_3—5.6 ohm, 2 w. res.
R_4—33 ohm, 2 w. res.
C_1, C_2—10 μfd., 25 v. elec. capacitor
C_3, C_4—20 μfd., 250 v. elec. capacitor
F_1—3 amp fuse
F_2—¼ amp fuse
T_1—3.5 kc. oscillator trans. (special type; available only at G-E mobile service stations)
SR_1, SR_2, SR_3, SR_4—Silicon rectifier (General Electric 4JA4CX15; for non-commercial applications the germanium type, G-E 1N93, would be suitable)
V_1, V_2—"p-n-p" transistor (2N257)

All components of the supply, except the transistors, are mounted on a small printed circuit board which, in turn, is enclosed in an anodized, drawn aluminum case. Since the anodized finish is a good insulator, the transistors are mounted directly on the outside surface of the case which acts as a "heat sink." A protective bracket covers the transistors but still permits free-air circulation around the heat sink to maintain the transistors within the recommended operating temperature.

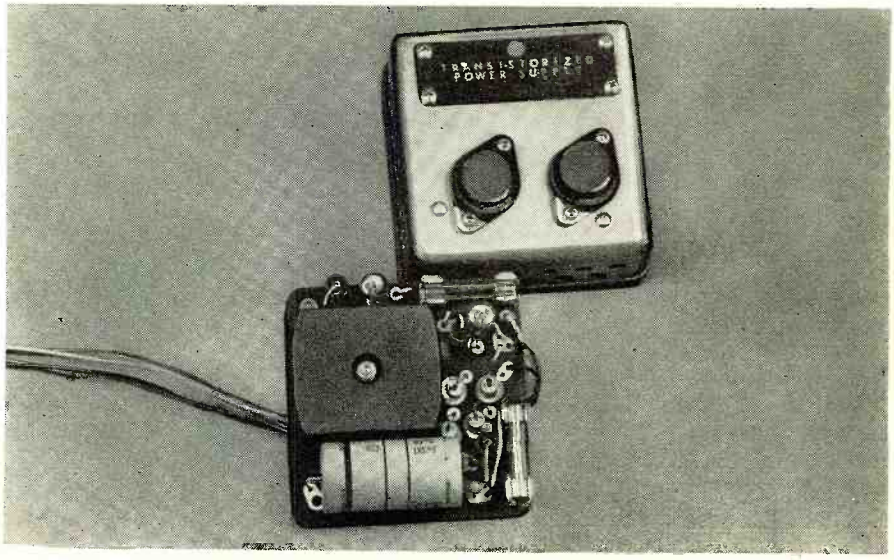
Battery polarity must be observed with the transistor supply but no damage will occur if the polarity is accidentally reversed because the transistors will draw negligible current in this condition.

Good immunity to humidity is achieved by "potting" the transformer in a resin compound and since the transistors and rectifiers are hermetically sealed, they offer no problems in this respect.

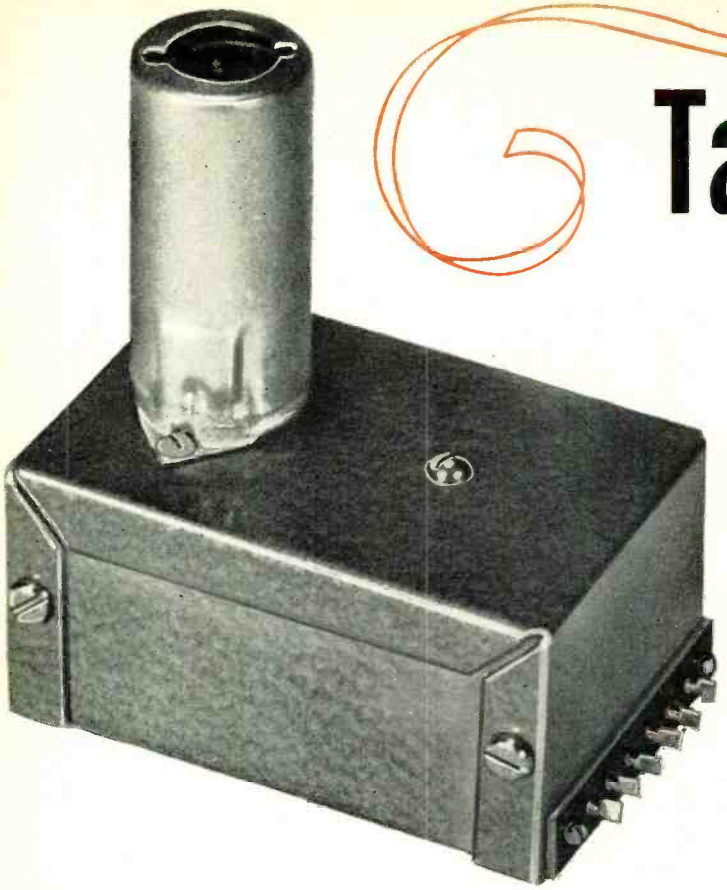
The transistorized supply we have discussed may be supplied as an optional kit for external mounting on existing 12-volt mobile communications equipment and will also be available on new equipment. In these applications, the existing vibrator supply will be used to power just the transmitter portion of the communications equipment.

Although the capacity of this transistor supply limits its use to powering receivers and/or transmitter exciter stages, it is reasonable to assume that continuing advances in transistor development will eventually see the complete replacement of the electro-mechanical mobile power supply by all-electronic transistorized units. —30—

Interior and exterior views of mobile radio equipment power supply. Note that the 2N257 power transistors are mounted on the outside of the case of the new unit.



Tape Recorder Bias-Erase Oscillators



Home-constructed push-pull bias-erase oscillator.

By HAROLD REED
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Analysis of circuits along with complete design and constructional data for experimenter or audiophile.

AUDIO experimenters and home recordists have made great strides in acquiring knowledge of the design and construction of audio circuitry and operation in connection with high-fidelity amplifiers and recorders. Abundant literature is available for guidance and on construction practices.

With tape recorders, there is one segment of the system, the bias-erase oscillator, which is not, generally, as well understood. This is probably because the bias-erase system is not, strictly speaking, audio circuitry. Frequencywise, its operation lies in the supersonic range between the upper extreme of the audio band and the lower extreme of the radio-frequency spectrum.

Today, separate tape transports are sold as purely mechanical assemblies. Suitable amplifiers are available and amplifier kits can be obtained which may be adapted to a recording system and, of course, there are plenty of construction articles telling how to build your own.

A bias-erase oscillator as a separate complete unit or in kit form is not listed in electronics catalogues nor are coils offered for building your own. Data presented in this article should give the constructor a better understanding of this part of the recorder system with the realization that it is not difficult to design and build an oscillator. Before considering workable circuits we should discuss some of the aspects of this part of the recorder system.

Tape Bias Considerations

The high-frequency oscillator must supply the proper bias current during recording. In high-fidelity recording, high-frequency bias is necessary during the recording process to hold distortion of the recorded audio signals to a low value. This bias provides for operation in the linear portions of the magnetic B-H curve. It may be considered similar to the biasing of an electron tube for operation over the linear part of the tube characteristic curve. The bias frequency must be considerably higher than the highest audio signal to be recorded since beat frequencies between the oscillator and harmonics of the audio signal, in the audible range, may result, which will be recorded on the tape. It would seem, then, that the higher the bias frequency, the better. But other problems then arise. Oscillator frequencies above, say, 100,000 cycles result in greater radio-frequency radiation, requiring more extensive shielding to prevent interference to other electronic devices. Also, wiring becomes critical and circuit leads must be extremely short. Oscillators are usually operated in the range between about 30,000 and 100,000 cycles. A good compromise between the two problems just mentioned is in the frequency range between 60,000 and 80,000 cps and, generally, a frequency in this range is selected. Since the purpose of the high-frequency bias is to reduce distortion of the recorded signal, it is essential that good waveform of the oscillator output be obtained. Poor oscillator waveform will result in distortion and noise during recording. Value of the bias current will be discussed in a later paragraph.

Tape Erasure

The high-frequency oscillator may also furnish the erasure current necessary to erase, or remove, previously recorded signals from the magnetic layer of the tape so it may be used again and again. Good waveform from the oscillator is also essential when used for tape demagnetization. Unsymmetrical magnetic flux, if produced as the result of poor oscillator waveshape during erasing process, will cause increased noise level on the tape due to residual magnetization. Erasing current value runs higher than the bias current and this, too, will be discussed later.

Oscillator Design—Construction

Let us now consider some of the problems involved in building a high-frequency bias-erase oscillator without benefit of the commercial coils as used in today's recorders. A single-ended circuit with a 6C4 tube, which has been used extensively in many types of oscillator circuits, is shown in Fig. 1. This is a plate-tuned oscillator. The operating frequency is determined

mainly by the inductance of the coil L_2 and the capacitance of C_3. Feedback to sustain oscillation is provided by coil L_1. Negative grid bias for the tube is provided by the grid leak resistor, R_1, and the grid capacitor, C_1. Bias voltage value also varies with the amount of feedback introduced. Output is taken from the plate circuit through capacitor C_4.

Feedback voltage is a most important factor of the circuit. With insufficient feedback voltage and incorrect RC time-constant in the grid circuit, oscillation may not be stable. Too little feedback voltage may also give too little output. Excessive feedback voltage will give poor waveform due to increasing harmonic generation. Too much feedback also produces high grid current. This useless power loss in the grid circuit results in lower efficiency and, therefore, lower oscillator output. The chosen circuit components, as given in Fig. 1, provided optimum operating conditions. There was no instability, waveform was very good, and output was more than required to supply bias and erase currents to ordinary commercially available tape recorder heads.

L, C, and Frequency Equations

For the reader interested in mathematical derivations, a few equations for inductance, capacitance, and resonant frequency are included. Readers not interested in these may disregard them and still construct the coils. The resonant frequency for certain values of L and C, that is, inductance and capacitance, may be found by solving the equation, $f_r = \frac{1}{2\pi\sqrt{LC}}$, where f_r is the resonant frequency in cycles per second, 2π equals 6.28, L is the coil inductance in henrys, and C the capacitance in farads. This equation can be solved if we know the values of L and C. Another useful equation concerns the LC constant and may be employed when the operating frequency has been first chosen. Thus, $LC = \frac{25{,}330}{f_r^2}$, where L is the inductance in microhenrys, C the capacitance in micromicrofarads and f_r the resonant frequency in megacycles. It follows, therefore, that $L = LC/C$ and $C = LC/L$. In these equations we have not considered tube or stray wiring capacitances and inductance. Since we are not concerned with a certain critical frequency, these will normally be considered to be negligible.

Winding the Coils

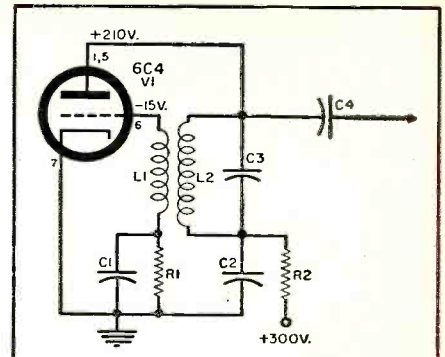
The coils were wound on a ⅜-inch diameter Bakelite rod. Two Bakelite discs, 1¼ inch in diameter, were slipped on the form, spaced ⅝ inch apart and cemented in place. L_2, consisting of 800 turns of #28 enamel wire, was then scramble wound between the discs. A strip of electrical tape was placed over L_2 and L_1 wound directly on top. L_1 has 175 turns of the same wire and is, of course, wound in the same direction as L_2. The rod was drilled and tapped at one end for mounting to the chassis. This could be cemented to the chassis if desired. Also, the end discs could be thin square pieces cut from any scrap plastic. It may seem like a lot of turns to wind but scramble winding does not take too long. If the constructor has an electric motor equipped with a chuck, the rod may be held by the chuck and the motor run at slow speed by the use of a variable power control in the 117-volt leads to the motor. If a power control is not available, ordinary lamp bulbs placed in series with one of the motor leads will slow it down. The lower the wattage rating of the lamp, the slower the motor speed. In this way the oscillator transformer can be wound rather quickly, in fact in a matter of minutes.

The inductance of the plate coil, L_2, as measured on a *General Radio* bridge, was 5 millihenrys. The mathematically inclined reader may apply this inductance value and the capacitance value of C_3 given in Fig. 1 to the resonant-frequency equation previously given and find the resonant frequency to be 71,420 cps. The operating frequency with the oscillator transformer wired into the circuit measured 70,000 cps, a difference of only 1420 cycles. Also, if the LC constant equations are solved it will be seen that at the 71.42 kc. resonant frequency, the L and C values as given will be the values required. The operating frequency may be altered by changing the value of C_3. A smaller capacitance value will raise the frequency while a larger value will lower the frequency.

Checking and Testing

Four test instruments are required for complete checking and testing of a tape recorder high-frequency oscillator. A vacuum-tube voltmeter should be used to read d.c. operating voltages. A sensitive audio-frequency voltmeter is used to indicate output signal level. An oscilloscope permits visual checking of the waveform and the scope and an audio-frequency oscillator together will allow checking the oscillator frequency. Although not absolutely essential, a d.c. milliammeter in the plate circuit will give indication of plate current, which can rise to a relatively high value when the circuit is not oscillating. A block diagram of the test setup used by the author is shown in Fig. 2.

With the output of the high-frequency oscillator connected to the audio voltmeter and the vertical (Y) input terminals of the oscilloscope, with the scope set for internal sweep, apply the d.c. supply voltage. The



R1—4700 ohm, ½ w. res.
R2—5600 ohm, 1 w. res.
C1, C3—.001 μfd., 500 v. mica capacitor
C2—.01 μfd., 500 v. capacitor
C3—250 μμfd., 500 v. mica capacitor
L1—175 t. #28 en. (see text)
L2—800 t. #28 en. (see text)
V1—6C4 tube

Fig. 1. Circuit diagram of single-ended plate-tuned oscillator (frequency 70 kc.).

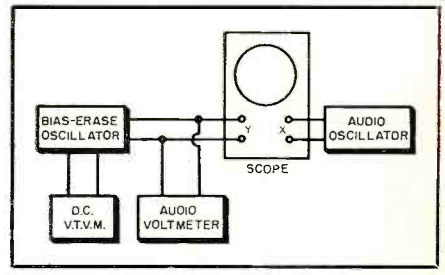
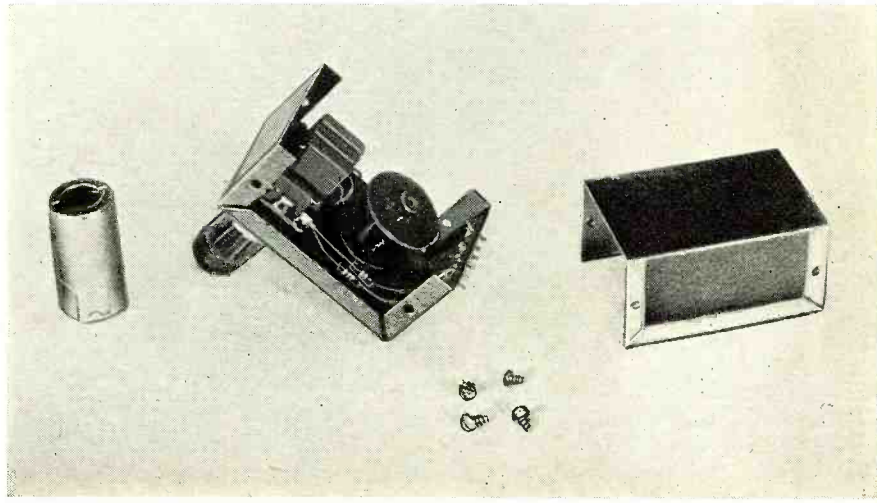


Fig. 2. Block diagram showing the test setup that may be employed in order to check the operation of the oscillator.

Photo showing inside of metal case with coil mounted on underside of the case top.



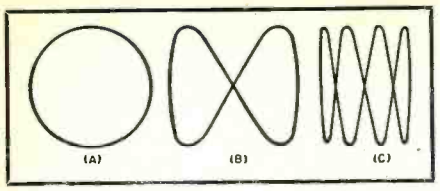


Fig. 3. Lissajous figures described below.

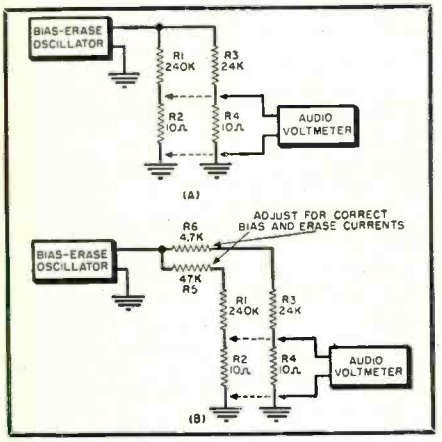


Fig. 4. (A) Method of checking bias-erase current. (B) Adding series dropping resistors in order to adjust the currents.

scope will indicate if the circuit is oscillating and a reading should be obtained on the audio voltmeter. Check the d.c. plate and negative grid voltages to see if they are near the values given in Fig. 1. If a plate milliammeter is used it will indicate about 8 ma. when the circuit is oscillating. If the circuit does not oscillate, remove the supply voltage and reverse the leads of either L_1 or L_2, but not both.

When oscillation has been obtained, its frequency may be determined. With the oscillator output still connected to the vertical input of the scope, set the scope for external sweep and feed the output of the audio-frequency oscillator to the scope horizontal (X) input terminals. If the audio oscillator has a range beyond 70 kc., slowly vary its frequency above and below 70 kc. and adjust the scope gain controls to obtain about the same input levels to both vertical and horizontal inputs. When a circle pattern appears on the scope screen, the frequency of the high-frequency oscillator is then equal to the frequency of the audio-frequency oscillator as read from its dial. See Fig. 3. An audio oscillator with a lower upper-frequency limit may also be employed. For instance, in this frequency check, if the audio oscillator is set to 35,000 cycles, that is, one half the frequency of the high-frequency oscillator, the pattern on the scope screen will appear as in Fig. 3B. Wave pattern (C) is for an audio-oscillator frequency of 17,500 cycles. It can be seen that the audio-oscillator frequency multiplied by the number of wave peaks on the scope will give the operating frequency of the high-frequency oscillator.

Measuring Bias-Erase Current

The oscillator output current available for bias and erase can now be measured. The example to be given is based on the use of a *Brush* Model BK-1090 record-reproduce head and Model BK-1110 erase head, but the procedure may be applied to other high-impedance heads when their characteristics are known. With the following procedure we may make adjustments for the approximate value of currents specified for the heads without actually placing them in the circuit, thus avoiding possible head damage.

The inductance of the BK-1090, as given by the manufacturer, is 550 millihenrys, resistance 100 ohms, and recommended bias current 0.60 ma. Again, the reader may disregard the following equations and, if similar heads are used, measure current as shown in Fig. 4, simply using one form of Ohm's Law. The inductive reactance, X_L, of the BK-1090 at the oscillator frequency, 70 kc., is $X_L = 2\pi fL$ or 242,000 ohms, where 2π is 6.28, f is 70,000 cps, and L is 550 millihenrys. The impedance of the head is $Z = \sqrt{X_L^2 + R^2}$. Since R is only 100 ohms, its value for this purpose is negligible and we may consider $Z = \sqrt{X_L^2}$. Fig. 4A shows a 240,000-ohm resistor, R_1, connected in place of the head, this value being close enough to the head impedance for this test. Measurement is then made across the low resistor, R_2, with the audio voltmeter. The bias current is $I = E/R$, that is, the voltage measured across R_2 divided by the resistance of R_2. We may now adjust the bias current by adding a series resistor, R_5, as shown in Fig. 4B. The value of this resistor is selected to obtain a voltage of 6 millivolts across R_2. 47,000 ohms was found to be about right for the circuit shown. This gave a bias current of 0.60 ma., that is, $I = .006/10$.

The inductance of the erase head, Model BK-1110, is 55 millihenrys, resistance 58 ohms, and recommended erase current 5 to 8 ma. Using the same equations and procedure just outlined, the BK-1110 impedance at 70 kc. is approximately 24,000 ohms. Substituting a 24,000-ohm resistor, R_3, Fig. 4A, in place of this head and using a series dropping resistor of 4700 ohms, R_6, Fig. 4B, 60 millivolts appeared across R_4 and the erase current was 6 ma., or, $I = .060/10$. Preferably, resistors R_2 and R_4 should be of the non-inductive type when the bias and erase currents are rechecked under operating conditions with the heads wired in the circuit. Deviations from the recommended currents after the heads are wired into the circuit may be corrected by altering the values of the series dropping resistors, R_5 and R_6. Variable resistors may be used here so that adjustment of the currents can be made at any time. It is to be understood that the 10-ohm resistors are not part of the oscillator circuit but are inserted temporarily to make the current measurements.

Push-Pull Recorder Oscillator

Both single-ended and push-pull oscillators are being used in recorders. The single-ended type was presented first because it is the easiest to build and adjust. It is known that push-pull oscillators give very good waveform. The circuit of a unit constructed by the author is given in Fig. 5. Coil construction is the same except for the number of turns on L_2 and the center-tap on L_1. All the data and test procedures already given apply to this circuit except for two important differences. First, feedback is provided by capacitors C_2 and C_3 instead of a grid coil. The main frequency-determining capacitor is C_1. However, if the value of the feedback capacitors is altered to introduce more or less feedback voltage, the operating frequency will also change. This shift in frequency can be compensated by changing the value of capacitor C_1. Second, the oscillator output is obtained inductively by means of L_2 instead of capacitively from the plate circuit as before. Output is increased as the number of turns on L_2 is increased. Too many turns on L_2 can cause loading of the oscillatory circuit and can cause a shift in frequency. 275 turns of #28 enamel wire over the 800 turns of L_1 seemed right for this circuit. With the component parts values given in Fig. 5, the operating frequency was 75,000 cps.

The oscillator shown in the photographs is constructed as an individual, completely shielded unit in a miniature aluminum case. It may, of course, be built on the recorder amplifier chassis with the oscillator transformer shielded. Close shielding of the coils decreases inductance and causes energy loss in the coils. It is recommended that the shield be no closer than half the diameter of the coil on any side and no closer than the coil diameter on either end. —30—

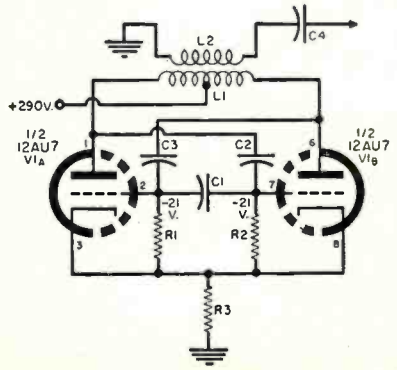
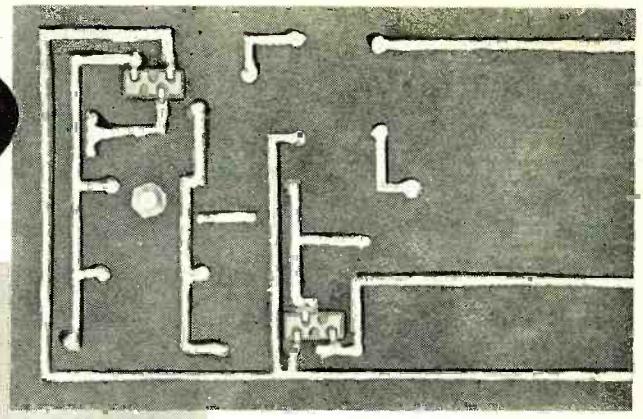


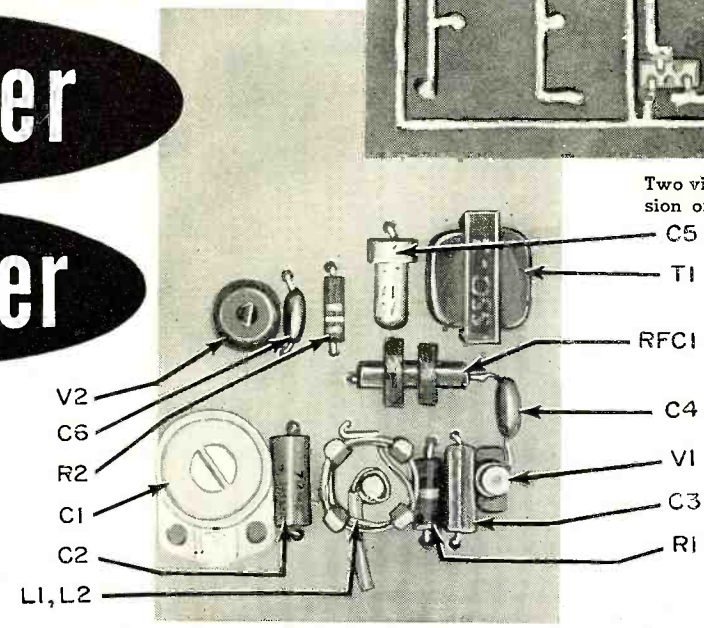
Fig. 5. Circuit diagram and parts list for the push-pull oscillator shown at the beginning of article. The operating frequency of this oscillator circuit is 75 kc.

R_1, R_2—27,000 ohm, ½ w. res.
R_3—560 ohm, ½ w. res.
C_1—500 μμfd., 500 v. mica capacitor
C_2, C_3—.002 μfd., 500 v. mica capacitor
C_4—.001 μfd., 500 v. mica capacitor
L_1—800 t. #28 en., center-tapped (see text)
L_2—275 t. #28 en. (see text)
V_1—12AU7 tube

A Transistorized 10-Meter Receiver



Two views of the printed circuit version of the 10-meter ham receiver.



By
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Goodyear Aircraft

The availability of the SB-100 surface-barrier transistor makes possible this compact and inexpensive ham receiver.

WITH the availability of the relatively inexpensive *Philco* SB-100 high-frequency transistor, a transistorized 10-meter receiver becomes a piece of gear most amateurs can afford. The entire receiver, with the exception of the headphones, can be built for about $15.00. This article will describe its construction and performance.

Since the superregenerative detector offers not only simplicity and sensitivity but also a reasonable selectivity, it was a natural choice for this receiver. The usual r.f. amplifier ahead of the detector was omitted mainly in the interests of economy; however, radiation from the receiver is still no problem since the input power to the superregenerative detector is only about 2 milliwatts.

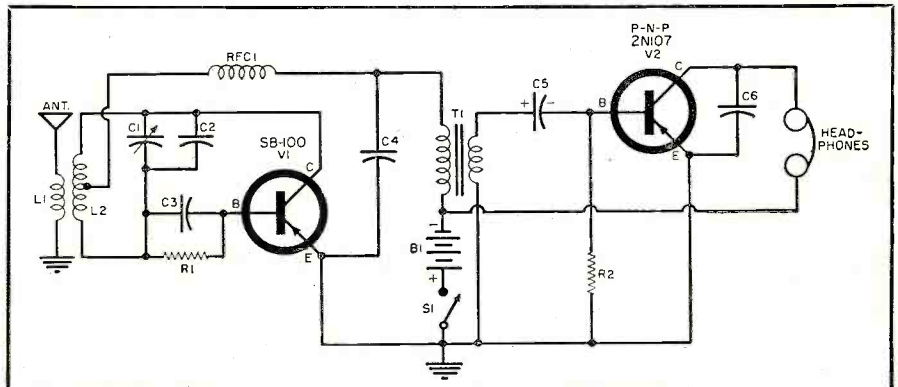
The circuit diagram of the receiver is shown in Fig. 1. The SB-100 transistor operates as a superregenerative detector in a common emitter configuration. Bias for the SB-100 is obtained through R_1. The 2N107 transistor, also operating in a common emitter circuit, supplies the audio power necessary to drive the headphones. Transformer coupling between the detector and audio stage was used because of its high efficiency. No volume control is required since the power output of the audio amplifier is very low. The load for the 2N107 is supplied by the headphones, which should be of the 2000-ohm magnetic variety.

The authors constructed this receiver, using two different assembly methods. The first is the standard one using a piece of insulating material, such as phenolic or Lucite sheet, measuring 1½" x 4" x 1/16". The parts are mounted by drilling holes through the board and passing the component leads through the holes. All components, with the exception of C_2, are mounted on the same side of the board. The whip antenna was made from a piece of 1/16" brazing rod about three feet long. Slightly better performance can be obtained from the whip by the addition of a base loading coil to make the antenna resonant, while an 8-foot piece of wire can also be used with excellent results.

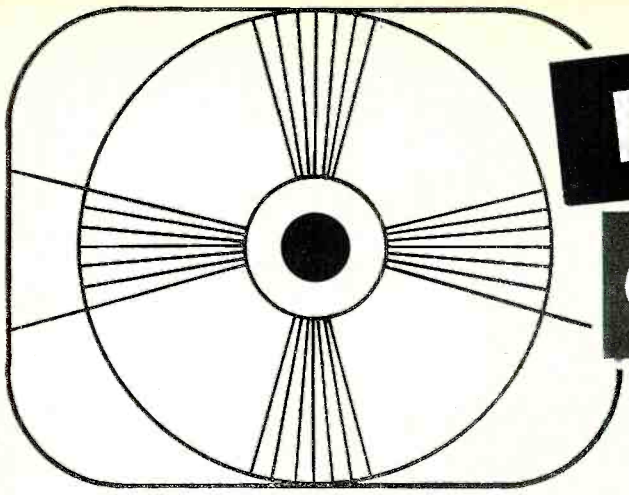
Coupling from the antenna to the detector is achieved by means of L_1, an 8-turn coil spacewound on a 5/16" diameter form. This coil is placed inside L_2 and moved in and out until the point of strongest regeneration is reached. This is determined by listening for the loudest rushing noise in the headphones. Once this point is found, the coil can be cemented in place. Care

(*Continued on page* 163)

Fig. 1. Complete circuit diagram of the 10-meter receiver. Authors offer choice of two construction methods, standard and printed circuit, both for the home builder.



R_1—1 megohm, ½ w. res.
R_2—110,000 ohm, ½ w. res.
C_1—1.5-7 μμfd. midget var. capacitor (Erie TD2A-1.5 or TS2A-1.5 "Ceramicon")
C_2—7 μμfd. ceramic capacitor (see text)
C_3—56 μμfd. mica capacitor
C_4, C_6—.002 μfd. ceramic capacitor
C_5—10 μfd., 200 v. elec. capacitor
L_1—8 t. coil (see text)
L_2—13 t. coil (see text)
RFC_1—750 μhy. choke (National R-33)
S_1—S.p.s.t. switch
B_1—6-volt battery
T_1—Plate-to-line trans. (UTC "Sub-Subouncer" SSO-3)
V_1—Surface-barrier transistor (Philco or Sprague SB-100)
V_2—"p-n-p" transistor (G-E 2N107)



Practical Color TV for the Technician

By **KEN KLEIDON**
National Color TV Manager
Hycon Electronics

Part 2. What service practitioners should know about the components of the color video signal.

THERE ARE four areas of information, as stated in the preceding article, with which the service technician must become familiar if he is to service color receivers successfully. These areas cover all aspects of the transmitted color signal, the special color circuits used in the receiver, the new type of picture tube used at the receiving end, and the special service techniques and procedures required. This article will be primarily concerned with the signal.

Because of the compatibility requirement, a monochrome receiver must be capable of receiving a color transmission and of reproducing directly from it a picture in black-and-white without modifications or additions to that receiver. To facilitate this requirement, the same transmission standards imposed on monochrome signals apply equally to color signals. The latter must contain, at least, all the information provided by a black-and-white broadcast and the same specifications must apply, including the 6-mc. bandwidth for the channel, placement of the sound carrier at 4.5 mc. above the picture carrier, and so on.

When the transmitted monochrome signal is analyzed from the standpoint of the service technician, it is found to consist of three component signals —one relating to video information, another to sound information, and a third to synchronizing information. A color transmission must carry each of these, but it also includes separate, additional information relating to color. Since this added intelligence must be contained within the same 6-mc. bandwidth that is allotted to the monochrome transmission, this color-signal content has been devised in such a way that it will not interact or interfere with the monochrome signal and that it will not affect operation of the circuits in a receiver designed for black-and-white reception only.

As a result of this seemingly odd relationship between these separate but related monochrome and color signals, the manner in which a color TV picture is processed and reproduced in the receiver is quite distinctive. First the monochrome signals are processed by circuits similar to those in conventional monochrome receivers to produce a black-and-white picture. Then the color signals are separately processed by additional circuits especially designed to respond to them. The resultant color-producing information is then superimposed over the monochrome picture to produce an image in color.

That this manner of producing the end result is indeed used can be demonstrated in a practical way without going into technical details, if a properly adjusted color receiver is tuned to a color TV broadcast. If the color (or chroma) control is rotated to its minimum position, a black-and-white picture results. This is what has happened: turning down the chroma control has had the effect of discontinuing operation of the special color-processing circuits, or at least of preventing their output signals from reaching the picture tube. The separate monochrome circuits continue to operate, however, and a black-and-white picture results.

A practical analysis of the transmitted color signal reveals that it includes five components. Three of these —video, sound, and sync—are identical to those found in monochrome transmissions. The other two are incorporated to permit the addition of color. Since the sound signal is virtually a separate transmission on a separate, although related, frequency and since it is not affected by the fact that we are dealing with either a monochrome or color broadcast, we can put it aside. The video (or brightness, or luminance) information, which provides variations in light or dark, is interwoven with the sync signal in standard monochrome practice. The purpose of the latter signal is simply to make sure that the variations in light occur in the right places on the screen of the receiver.

In dealing with color information, we have a somewhat similar situation: the chrominance signal, one of the two new components in the transmission, carries variations in color; while the color-burst or color-synchronizing information, the second of the two added signals, helps the receiver establish and separate the colors from the chrominance information provided, and makes certain that the right colors are being fed to the picture tube at the right time and in the right places.

With the help of Fig. 1, we can see how the chrominance signal is squeezed into the limited bandwidth available. Actually it co-exists with already present video information occurring at the same frequencies. Everything that appears in solid line pertains to the

signals with which we are already familiar in the case of monochrome transmissions. A color subcarrier at 3.579545 mc., usually referred to as 3.58 mc. for convenience, is shown in broken line. The extent of its modulation sidebands are also shown in broken line.

Actually, in order to describe a full range of color variations electronically, we need two signals, not one. If both of these can be varied over a wide range, and the final color produced is the result of the combination of these two, then we have an almost infinite range of possible combinations. This gives us a wide potential for representing different hues (red, green, blue, etc.) and different degrees of color intensity, or saturation.

Since the limited bandwidth available for any channel makes it difficult enough to squeeze in even one additional carrier (at 3.58 mc.), both of the signals required for chrominance information are ingeniously modulated onto this single carrier in such a way that they do not interfere with each other. It is as though two subcarriers at exactly 3.58 mc. were used. One, however, although it is at exactly the same frequency, is 90 degrees out-of-phase with the first. Hence, these two are said to be in quadrature. In this way, if we can adjust circuits in the receiver to be sensitive to the difference in phase between these two signals, we can have the effect of separate signals in the set.

Since these chrominance signals are added in the form of amplitude modulation and since the 3.58-mc. frequency at which they occur falls within the 4-mc. bandwidth within which black-and-white video information also occurs, we have an additional problem. Because the receiver's video detector is designed to respond to amplitude modulation at this frequency, the color-carrying 3.58-mc. signal will show up as a rather fine-grained beat interference, marring the monochrome picture. To avoid this, the subcarrier that has been so carefully devised to provide us with desired additional information is filtered out and discarded at the transmitter! Its effect is not lost however: its modulation sidebands continue to be transmitted; and provision is made for re-inserting the carrier in the receiver itself, safely away from the monochrome circuitry, so that it may once again be presented effectively with its sidebands. In a conventional black-and-white set, of course, no such re-insertion is made.

The second new element added to the transmitted signal for use by color-receiver circuits is shown in Fig. 2. In solid line, we see the familiar horizontal blanking and synchronizing pulse, with video (luminance) signal visible just to either side of it. Inserted on the back porch of this pulse are 8 cycles of sine-wave signal at exactly 3.58 mc., as indicated by the broken lines. Although this color-burst signal, as it is known, has no noticeable effect on the operation of the sync and deflection circuits, it is picked up by certain added circuits in the color set that make important use of it.

It is principally used to synchronize a subcarrier reference oscillator built into color sets, tuned to 3.58 mc., in a manner that may be compared to that in which the 15,750-cps pulse is used to synchronize the horizontal oscillator in all TV receivers. In this way, the transmitter tightly controls the receiver's reference oscillator in phase as well as frequency. Thus the reference oscillator provides a reliable substitute for the subcarrier that has been filtered out at the transmitter and permits establishing the accurate phase relationship that is necessary to distinguish between the two quadrature signals that make up the chrominance information.

At this point we would do well to summarize our knowledge of the signal. The monochrome transmission has three separate components, relating to video, sound, and sync. Two more are added, for a total of five, to make up the complete compatible color signal. One of these, the chrominance signal, can be regarded as the color video signal. The other, the color burst, is another sync solely for use by the special color circuits. It is used to synchronize a 3.58-mc. reference oscillator in much the same way as the horizontal sync pulse is used to control the horizontal oscillator.

If we follow the course of these signals inside of a color receiver, we note that all five of them—the video (V), the sound (S), the sync or deflection (D), the chrominance (C), and the color burst (B)—enter the antenna and proceed through the tuner and i.f. amplifier stages together, as shown in Fig. 4. From this portion of the set, the 4.5-mc. sound i.f. carrier may be separated and sent directly on to the conventional sound circuits.

The remaining signals go to the video circuits (detector and video amplifier). The sync or deflection signal is taken off for feeding to the sync circuits, which operate the horizontal and vertical oscillators. In addition, sync pulses are generally used to operate the keyed-a.g.c. circuits found in color sets. Video information is amplified and supplied to the picture tube. The color-burst and chrominance signals are applied to and processed by

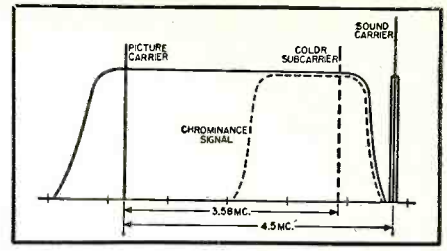


Fig. 1. Chrominance signal (broken line) squeezes into channel bandwidth.

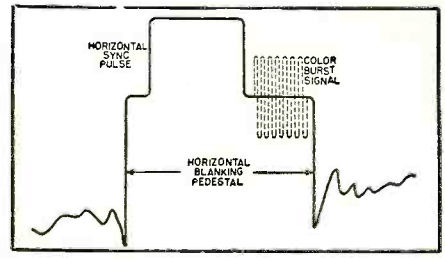


Fig. 2. Color burst (broken line) is added to horizontal pulse's back porch.

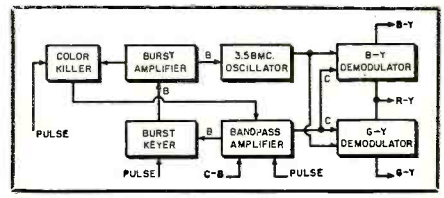


Fig. 3. Expansion of block in Fig. 4 labeled "color circuits." This is one system in popular use, but others exist.

the color circuits. The resulting color video information is applied to the picture tube, where it is added to the existing monochrome image.

The same system for processing color intelligence is not used in all receivers. However, as a starting point, the block marked "color circuits" in Fig. 4 has been separately expanded in Fig. 3 to correspond to one of the popularly used color systems.

Since the color burst occurs during horizontal sync-pulse time, many circuits in the color-processing section take the pulse, in one form or another. It is applied, for various purposes, to the color killer, the burst keyer, and the bandpass amplifier. Also applied to the latter section are the chrominance signal and the color burst. After amplification, the burst is separated by the keyer, applied to the burst ampli-

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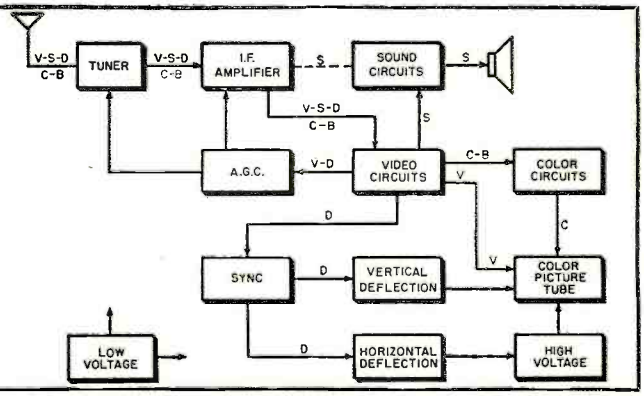
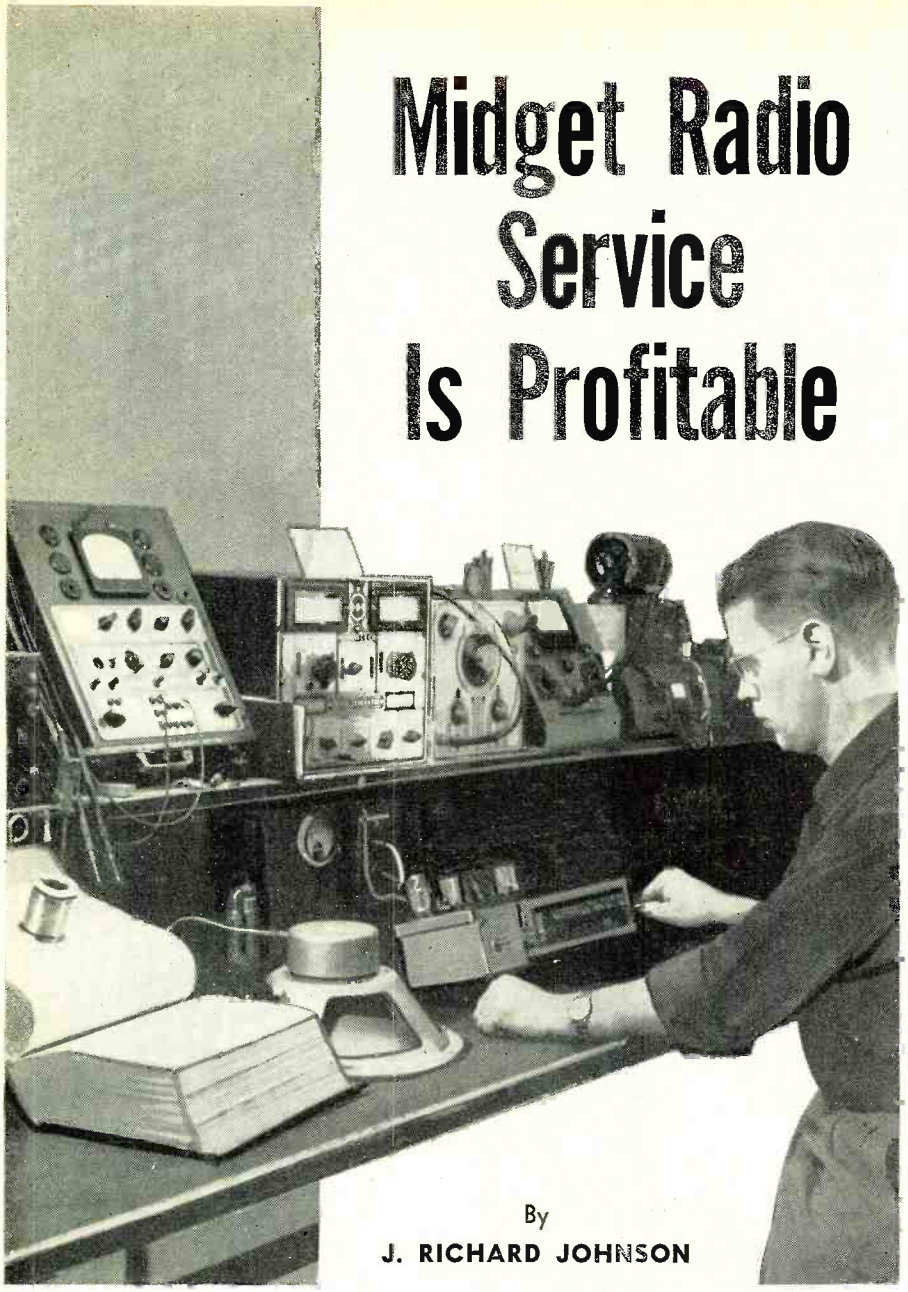


Fig. 4. In this block diagram of a color TV receiver, the five basic components of the signal transmitted (identified in text) are shown in the various paths they follow through various receiver circuits. Except for the color block, note basic similarity to monochrome circuitry.

Midget Radio Service Is Profitable



By
J. RICHARD JOHNSON

With radios still outnumbering TV sets, don't neglect the income in relatively easy repairs.

WHEN television caught the public's fancy and established itself as an entertainment medium, many members of the service fraternity either forgot that radios existed or at least pushed them into the background. At one time, good technicians were pressed to keep up with the more challenging and more profitable work needed on TV receivers; many tended to grow rusty as far as the simpler, smaller radios were concerned.

In addition to this, many technicians who were drawn into the field after the advent of TV bypassed radio completely. Although the background and theoretical training may have been there, many who went on to become crackerjack television service technicians simply did not have enough experience with radios to know which end of the radio is up. As a result, in this era when one hears calls for diversification from all sides, many people in service are still missing the boat on radio. Actual figures tell us that just as many radios are being sold right now as TV sets, which tends to indicate that radio will be around for a long time to come.

Another thing: a vast number of the radio sets in use are of the small table-model variety. They nearly all fit into the same pattern and succumb to the same servicing approach. This means that, with minimum frustration and at good profit, you can do quality servicing on these receivers on a production basis. What a welcome thing to turn to after some of those tough TV cases. Let's review the highlights of these little a.c.-d.c. boxes.

Don't Get Electrocuted

One of the first things to remember with a.c.-d.c. sets is to avoid getting knocked for a loop or starting a fire. Remember the chassis is hot. We all realize that "B—" and one side of the power line are connected together; if it's the hot side of the power line to which "B—" happens to go, you'd better not get between the chassis and a good ground—or even a poor ground!

There are several ways to protect yourself. One is to use an isolating transformer. The secondary floats and therefore protects you. The rating doesn't have to be much because a.c.-d.c. sets don't draw more than 50 watts tops. Another way is to connect a small 115-volt bulb between the receiver chassis and a good ground before plugging in the receiver. When you plug it in and turn it on, if the bulb lights you know enough to reverse the plug in the receptacle.

Heater Circuits

Typical heater circuits are shown in Figs. 1 and 2. Three factors have practical significance in series-heater circuits: 1. Higher-voltage heaters take longer to heat than lower-voltage heaters (of the same current rating). 2. The hotter the heater, the greater its resistance. 3. The greater the relative resistance of a heater, the greater its relative proportion of the voltage drop in the heater string. Result: during warm-up, the lower-voltage-rating tubes tend to be overloaded. Accordingly, heater burnouts are something to watch for, and in a dead receiver, tubes should be tested right away.

Heater-Cathode Shorts

Probably the most common of all basic causes of heater-cathode shorts is the voltage stress placed between heater and cathode of some tubes in this type of receiver. The reason for this stress is shown in Fig. 3. The cathodes of the tubes all return to "B—" (either directly or through a resistor and bypass capacitor). But "B—" is also common with one terminal of the power line. The other terminal of the power line is connected to the first heater in the string, putting full line voltage between this heater and the cathode of the same tube (usually the rectifier).

The next tube in the string in this example, is subjected to approximately 86 volts between heater and cathode, the next to 36 volts and so on. It should be noted that these are a.c. voltages, and the corresponding peak values are 161, 120, and 50 volts respectively (1.4 times r.m.s. value).

Heater-cathode shorts can occur in any of several ways. Frequently one tube near the low-potential ("B—") end of the string shorts, placing full line voltage across the heaters of the tubes between this one and the high-

potential end of the string, as illustrated in Fig. 4. These tubes operate at considerably more than normal current because their total resistance across the power line is relatively low. The abnormally high current causes these tubes to glow over-brightly; the tubes across whose heaters the short exists show no light at all.

If you know what the order of the heaters in the string is, you can spot the guilty tube quickly. Heater order can be determined from service literature; if such literature is not available, the order can be traced in the receiver itself.

Cycling

Sometimes a heater-cathode short or a heater break "cycles," that is, it alternately makes and breaks at a regular rate while power is on. This happens with heater-cathode shorts because the short is made when the tube is cold and breaks open when the heater gets hot.

This kind of trouble is not limited to heater-cathode shorts but is even more frequently encountered in just the heater of a tube. In such a case the heater opens when hot. When power is first applied the heater is cold and passes current which warms it up. Then, when warm, it opens.

Of course, remedy of any of these troubles is replacement of the guilty tube—but first you must find out which one it is. This is not always as simple as it may seem. Suppose the trouble is a steady heater-cathode short. Some of the heaters are lighted more brightly than others. You can locate the short if you visualize the situation shown in Fig. 4.

A cycling short within a heater is not as easy to find. When cold, the bad heater is continuous and tests OK with the ohmmeter. The whole heater string lights up and goes out as a unit so observation of the heaters does no good for spotting the bad tube. One way to solve the problem is to take out all the tubes and test each one. However, this is somewhat time-consuming and there is another danger: sometimes the heater is physically critical and the condition may change to one of complete open or temporary continuity as a result of handling of the tube. The latter condition would be hard to find.

The best way to detect a cycling heater condition is to connect an a.c. voltmeter (a.c. range of v.t.v.m. or v.o.m.) successively across the different heaters and note the voltage variation of each during cycling. When the heaters of the receiver go out the voltage across each good heater goes to zero because it is a continuous resistance without any current. However, the voltage across the bad heater (which is open in this part of the cycle) goes to full power-source value of 117 volts.

Thus, the bad tube shows approximately normal voltage during the "on" time and full line voltage instead of zero during the "off" time. The frequency of cycling is different in different cases and may be anything from a cycle in five or ten minutes to several cycles per second.

Hum Troubles

One of the most frequent complaints in midget receivers concerns hum troubles. Sometimes it's just a background-noise effect, sometimes it intermodulates the sound, causing distortion and garbling effects. It has been found in actual practice that there are two outstanding causes for this kind of trouble in the a.c.-d.c. type of receiver: 1. defective filter capacitor; 2. cathode-heater leakage in the audio output tube (50L6, 50C5, and others).

A filter capacitor can be the source of hum trouble if its capacitance has dropped to considerably below rated value. This may happen even though the leakage through the capacitor has not become excessive. In such a case, the trouble is detected by bridging a filter capacitor known to be good, and of similar capacitance rating, across the suspected component's terminals. If the hum is greatly reduced, the indication is that the capacitance of the component in the receiver is too low. (As mentioned later in this article, low capacitance can also cause howling and instability.)

Excessive leakage through a filter capacitor can also cause hum. The extra current through the capacitor overloads the remainder of the filter circuit and makes ripple severe. If such is the case, *bridging doesn't help,* because it doesn't stop the leakage through the guilty capacitor. Disconnect the old capacitor and temporarily connect in one known to be good, after bridging has failed. If the hum disappears, you have found the trouble.

There are several types of capacitor testers on the market. Many permit capacitors to be tested while they are still connected in the receiver circuit. If you have one of these, bridging and replacing are not necessary and you can speed things up.

A. F. Output Tubes

Heater-cathode trouble can be encountered in almost any tube, but the audio-frequency output tube is the most frequent offender, probably because it is near the high-potential end of the heater string. If the sound is modulated and garbled by hum, the output tube is very likely the trouble. Substitution with a tube known to be good is the best bet.

Howling and Motorboating

Now and then we encounter a midget receiver which emits a steady howl, or "motorboats." Or it may just break into whistles and squeals on peaks of the sound signal. This is often accompanied by hum. The cause is lowered capacitance in the output filter capacitor. This capacitor, besides its function as a power filter, also provides decoupling. That is, it makes the impedance between "B+" and "B—" very low to a.c. signals down through the a.f. range. If the output capacitor deteriorates and loses its capacitance, the a.f. impedance of the power supply gets high enough to allow excessive feedback, resulting in howling, distortion, and whistling. This condition can also be detected by bridging.

This recital of complaints originating in a.c.-d.c. receivers is by no means exhaustive. Not a word, for example, has been said on alignment problems, which are worth discussion as a separate subject. However, the most common troubles arising in these sets have been covered. —30—

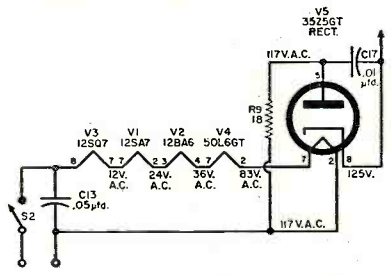


Fig. 1. Heater string wiring sequence for a typical 5-tube a.c.-d.c. radio.

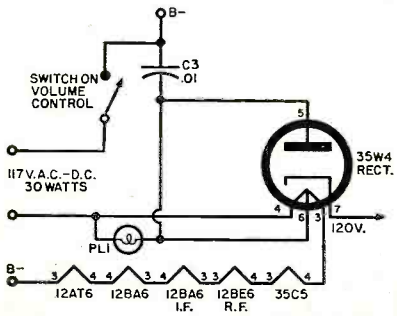


Fig. 2. Another 5-tube string, using miniature tubes and also a pilot light.

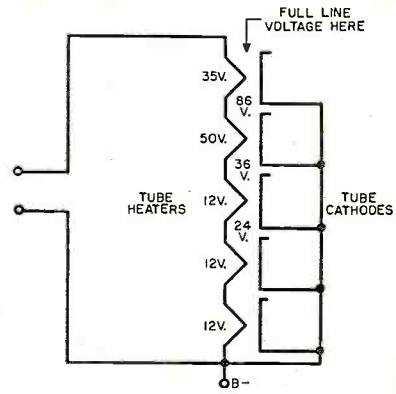


Fig. 3. Heater-cathode stress results with heaters placed across a.c. line.

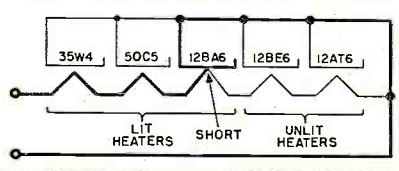
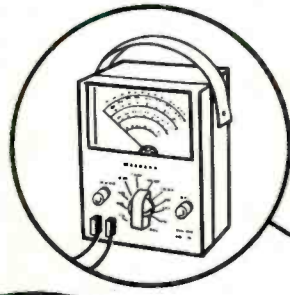
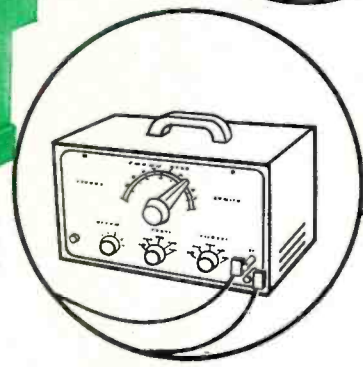


Fig. 4. A heater-cathode short may result in some heaters becoming unlit while others in the set glow brightly.

All About Audio and Hi-Fi





Checking Speaker Performance

Impedance curves of speaker systems, such as this Briggs sand-filled 3-speaker corner enclosure, may be readily taken with a simple audio generator and high-Z meter.

By **G. A. BRIGGS**
Managing Director
Wharfedale Wireless Works Ltd.

Part 5. More information on speaker listening tests and impedance measurements in evaluating performance.

AT THE end of Part 4 reference was made to the vent output from a 9 cubic foot corner reflex enclosure and the difficulty of including this in the main response curve. In order to see what comes out, one of these cabinets was turned upside down and the curve of Fig. 17A was the result. (Fortunately, sound waves do not know when they are upside down.) As it was impossible to prevent some of the sound waves from the front of the cone reaching the microphone, the vent was then sealed off and the curve of Fig. 17B was taken. The output from the port is therefore that of Fig. 17A minus Fig. 17B.

Mr. Cooke informs me that the most difficult part of the test was turning the cabinet upside down. It is made with sand-filled panels and weighs some 272 pounds.

It is interesting to note that the dip in response around 200 cps which is shown in Fig. 18A is replaced by a peak in the vent output of Fig. 17A. This may account for the fact that the dip looks worse on paper than it sounds to the ear.

Ear vs Microphone

Having stated that a listening test is more important than a response curve as the *final* arbiter of speaker performance, there must be instances where the two are in conflict, and where the pure technician would choose one system or modification but a keen listener would choose another. There can be little doubt that loudspeaker design is not purely a technical problem; it is an art as well as a science.

An almost perfect illustration of this point now follows. It is some seven or eight years since we built our first corner brick enclosure at a cost of about £2. (As we built it ourselves we did not have to pay union rates!) We naturally tried damping and padding the inside and fitting felt partitions to remove standing waves, etc., but we soon decided that the benefits were outweighed by a loss of brilliance and "life" in the reproduction, so out came the trimmings. (Absorbents in smaller and/or rectangular enclosures are usually essential.)

The theoretical benefits of absorbent linings are clearly shown in the curves of Figs. 18A, 18B, and 18C, which were taken in the open air with a microphone distance of 4 feet. The speaker is a 15" foam surround unit.

The dip at 200 cps is due to top-to-bottom standing wave effect inside the cabinet (distance 35½" $\approx$ half a wavelength at 200 cps). In the reproduction of music the human ear does not notice a sharp dip on music as readily as it registers a peak. This dip is partially eliminated by the treatment of Fig. 18B, and more so by the extra padding of Fig. 18C which also removes minor irregularities between 500 and 2000 cps. The microphone is superior to the ear in noticing small variations in response.

As the 15" unit is normally used in the enclosure with a crossover at 1000 cps or lower, the dip at 1200 cps can be taken as a blessing in disguise.

Now to the question of choice. I would wager the proverbial little apple that nine technicians out of ten would plump unhesitatingly for the treated cabinet of Fig. 18C, but I still prefer the livelier performance of the untreated cabinet of Fig. 18A, and so do the majority of listeners. A treated enclosure is always available for test and comparison purposes and we raise no objection if users like to apply the treatment at home.

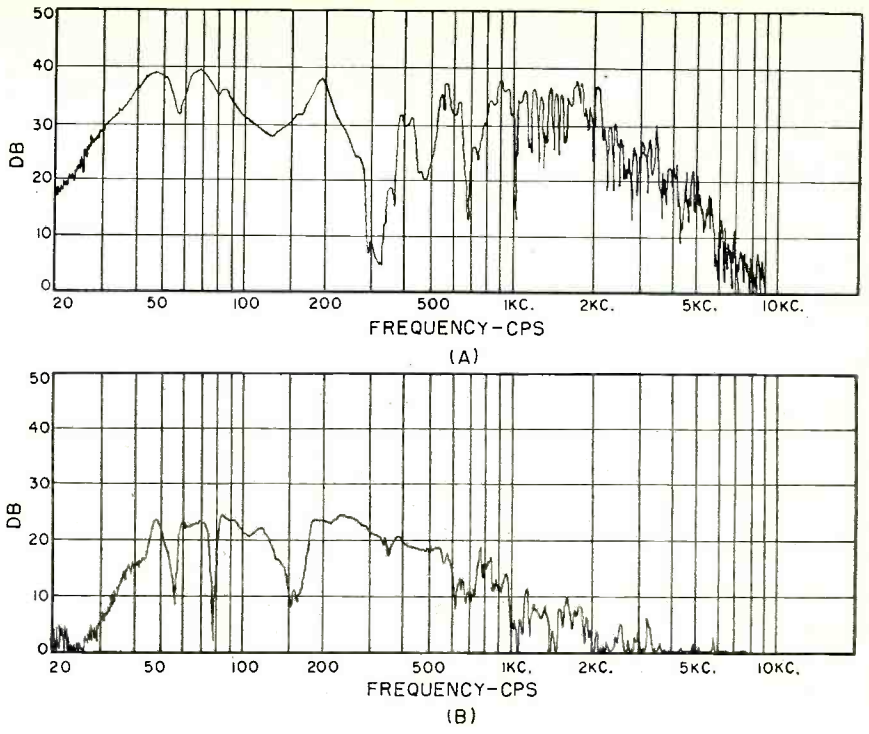
It is worth noting that folded corner horns constitute a form of enclosure free from absorbent linings and many listeners like the reproduction in spite of irregularities from reflecting surfaces, which show up on a response curve but do not necessarily distress the ear.

Home Tests—A Warning

Before leaving the subject of tests and response I should like to issue a word of warning about the use of variable frequency records for home tests of loudspeakers. Many test records with frequency bands going down to about 30 cps are being sold, but they can be rather dangerous and very misleading in use.

They are dangerous because they are used with power amplifiers. A speaker which will handle, say, 15 watts input on music might suffer very badly with 15 watts at a spot frequency in the 30-100 cycle region. Only theater-type speakers could be expected to stand up to such punishment. A reasonable do-

Fig. 17. (A) Open air response curve with microphone close to vent of 9 cu. ft. corner reflex cabinet. Input 1 watt at 400 cps. (B) Same setup as described for part A of figure except port closed to show the stray radiation from front of cone. ⟶



mestic limit would be 3-5 watts, according to size of speaker and type of enclosure.

Most frequency records are misleading for many reasons: in fact, no self-respecting engineer would waste time trying to test speakers with such doubtful material; he would use a first-class b.f.o. Pickup and tone arm resonances are still prevalent and rule out any accurate assessment of speaker performance.

But, in any event, it should be stressed that frequency tests of loudspeakers always require experienced interpretation, because misleading buzzes and rattles often arise. A cotton bag over the speaker may vibrate and cause a rattle at one frequency, but not on music; a piece of mesh may do the same. A panel of wood or an object in the room near the speaker may vibrate and sound exactly like a speaker fault. The cone in a loudspeaker with the very desirable attribute of free suspension can move such a big distance with large input at its resonant frequency that it might actually hit the fabric or mesh placed over the speaker opening; many amateurs would mistake this for a fault.

A noise resembling severe frequency doubling at low frequency may occur with a speaker placed in one position in the room, but may disappear if the speaker is moved a couple of feet, especially with open baffle types known as "doublets."

As regards assessing actual frequency response at the extreme ends of the audio spectrum, the human ear is obviously most unreliable.

In writing the foregoing, I do not seek to deter users from making tests; I only wish to advise extreme caution, with a warning that 3 watts at 1000 cps may sound very loud, but below 100 cycles it begins to sound softer and softer due to the ear, and it is foolish to try to make 40 cycles sound as loud as 1000 by stepping up to 20 watts or more.

It is also most important to remember that it may be misleading to judge the performance of a speaker by its power handling capacity; it must be judged by what comes out—not by what goes in. After all, nobody praises a meal in a restaurant simply because it was expensive. It is clear that acoustic enclosures—especially small

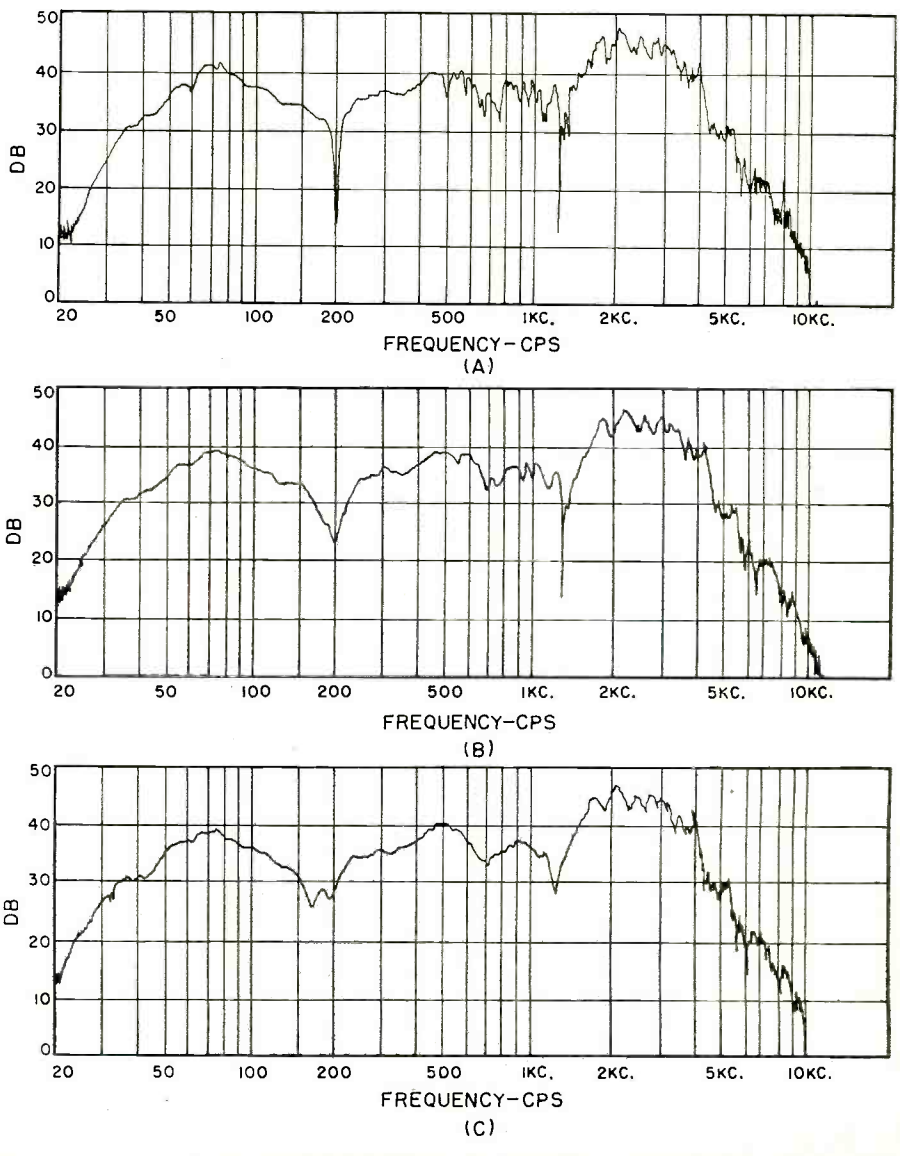


Fig. 18. (A) Open air response of 9 ⟶ cu. ft. corner enclosure made with sand-filled panels. No absorbent lining was used here. The input was 2 watts at a frequency of 400 cps. (B) Same conditions as for part (A) but with glass fiber scattered on the bottom of cabinet. (C) Same as for two previous tests but with sides, top, and bottom lined with 1 inch cellulose wadding and fitted with Wharfedale acoustic filter.

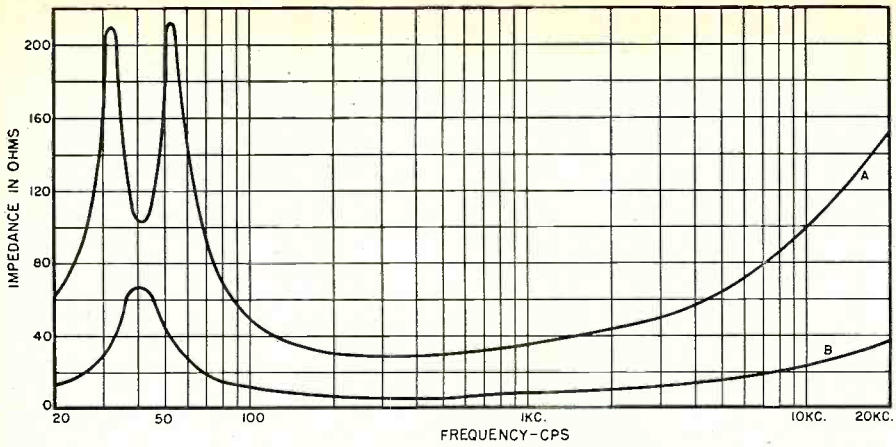


Fig. 19. The above impedance curves show the difference between series (A) and parallel (B) connections of the same two speakers having different cone resonances.

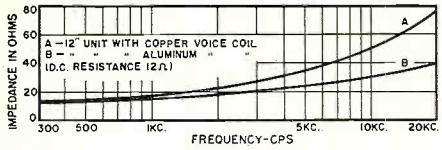


Fig. 20. Impedance curve of a 12-inch speaker unit fitted with a copper voice coil (A) compared to a unit fitted with an aluminum voice coil (B).

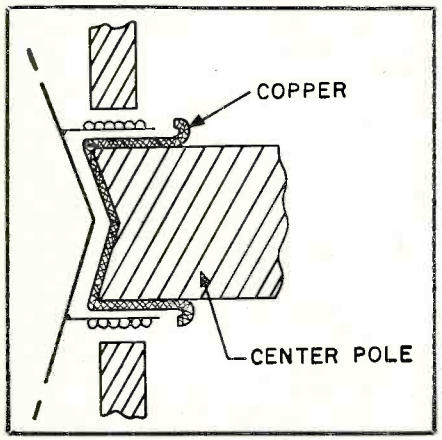
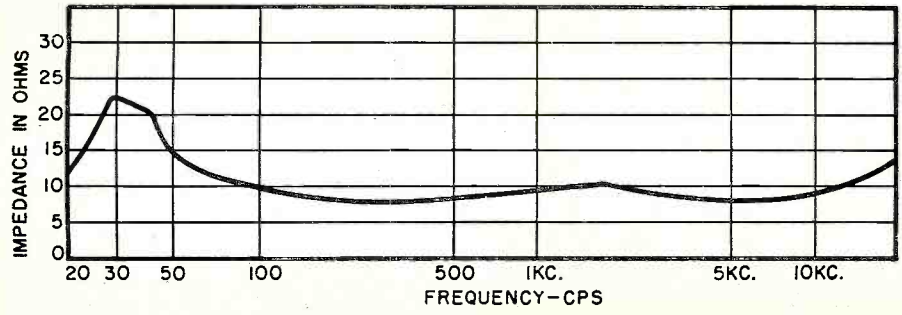


Fig. 21. Copper damping cap adopted by Philips to reduce voice coil inductance and improve the performance obtainable at the higher frequencies.

ones—usually restrict cone movement and make it possible to pump 10 or 15 watts into a speaker which might knock badly at some low frequency at 5 watts on open baffle, where the cone is free to move as it listeth. Any assumption that the enclosure is therefore two or three times as good as the open baffle would be a fallacy, because it is obvious that restricting cone movement reduces output and results in much waste of energy in small infinite baffles. Helmholtz resonators and exponential horns do, of course, help to push the low-frequency sound waves into the room where they are wanted, but even these devices are not always as efficient as is generally believed. There is room for further investigation here and we are hoping to deal with the question in some future article in this series. Directional effects are mainly responsible for the so-called efficiency of horn loading, and an open baffle is probably no less efficient in an average listening room (down to cut-off frequency due to size of baffle) because all the sound generated by the cone on both sides is used. The only way to increase such sound is by resonance and nobody wants to hear induced speaker resonances above 60 cycles.

To sum up on the question of home tests, my advice would be: (*a*) Always start frequency tests with the volume control in the minimum position and turn up cautiously, (*b*) judge low frequency performance by purity of sound rather than amount of noise, (*c*) do not expect too much below 40 cycles (Happy is he that expecteth nothing.), (*d*) move about when listening, as position in room makes a big difference in what is heard at various frequencies, and (*e*) remember that pickup and tone-arm resonances still exist, and if one of these coincides with a speaker resonance quite hefty effects may be produced.

Fig. 22. The impedance curve of the three-speaker baffle system described in text.



This brings us to the end of the section dealing with response tests.

For furnishing a quick and reliable picture of the status of different speaker systems, an impedance curve is almost *sine quâ non*. Proud owners of multi-speaker systems with six woofers, six squawkers, and a battery of tweeters might well produce a level impedance curve as evidence of good performance.

The impedance curves of Fig. 19 show the difference between series and parallel connection of two speakers with different resonances. Parallel working always helps to smooth out irregularities and is preferable to series connecton for the practical reason that one speaker continues to work if the other breaks down, and because series connection destroys much of the benefit of the high damping factor of the modern amplifier (there is virtually a resistance in series with each speaker).

Two basic faults of the moving coil speaker have always been the rise in impedance at fundamental cone resonance and at frequencies above 1000 to 2000 cps. The effects of the bass resonance have been largely counteracted by the high damping factor of the modern amplifier, and the steep rise in impedance with frequency has been reduced by the use of aluminum voice coils and other devices. The effect produced by an aluminum coil is clearly shown in Fig. 20.

The lighter weight of the aluminum coil improves performance at high frequencies but this is also helped by better load matching to the amplifier. If the impedance of the speaker rises to double the output impedance of the amplifier at high frequencies, about half the available power is wasted in the mismatch.

One advantage in using two or more speakers with or without a dividing network is that a more uniform impedance/frequency characteristic is possible. This is clearly shown in Fig. 22, where the impedance of a three-speaker baffle system (referred to in the article on listening rooms) is shown to be virtually flat apart from the bass resonance in the 20-50 cycle region where it is taken care of by the damping factor of the modern amplifier.

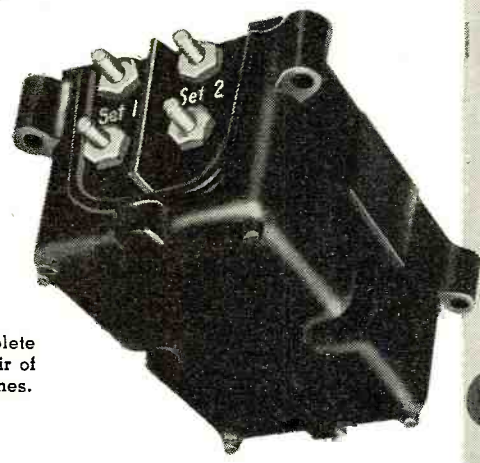
By using three speakers with voice coils of different resistance it is possible to vary the current flowing through each speaker and so obtain a balanced over-all performance. In the set-up in question, the voice coils vary between 7 ohms and 17 ohms d.c. resistance and are so arranged that the big unit does most of the work at low frequencies, but the tweeter takes precedence at the other end of the scale through a 4 μfd. capacitor. The middle speaker is not allowed to make a nuisance of itself in any region—it merely helps to smooth the results. All this is done without the cost—in decibels and dollars—of a dividing network, which is usually essential with reflex and horn loading.

(*Continued on page* 104)

A Diplexer Two-Set Coupler

By **HAROLD HARRIS**

Vice-President,
Research and Engineering,
Channel Master Corp.



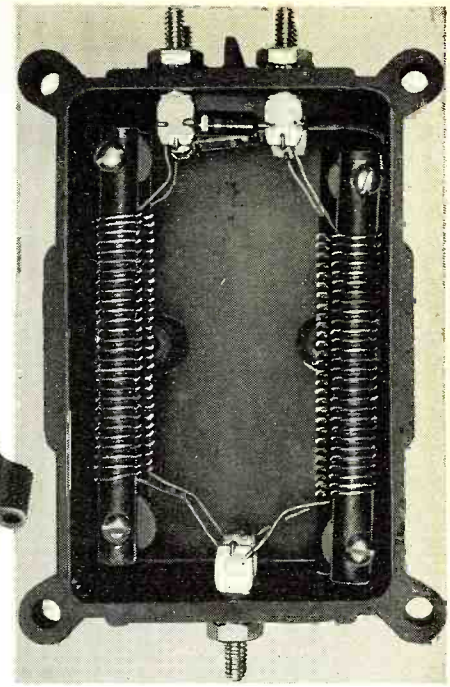


Fig. 1. Two views show the complete enclosed coupler and the two pair of coils that simulate two tuned lines.

A design principle not employed previously in TV couplers is used to overcome performance problems.

IN MANY areas, sales of second TV sets account for as much as 40 percent of all new receivers sold. With the second-set home becoming an established pattern, there is the constantly increasing problem of holding installation costs to a minimum. A similar problem exists where both a TV receiver and an FM tuner are used in the same household. The logical answer is a two-set coupler which will enable use of the existing antenna installation.

The purpose of any such device is to provide the strongest possible signal power equally and simultaneously to both receivers with a minimum of interaction between the sets. The five prerequisites for a good coupler, over those frequencies it must handle, are:

1. *Good impedance match:* A 300-ohm match must be maintained at the terminals of each receiver and also at the antenna's terminals. With good matching, lead-in lengths will not be critical. Poor impedance matching results in high insertion losses and ghosts due to ringing.

2. *Low insertion loss:* The theoretical minimum power insertion loss of any 2-set coupler is 3 db (½ signal power to each receiver). Hence, a good coupler should limit this loss to the inherent 3 db or a small fraction above it.

3. *High signal isolation between receivers:* This is the property that prevents any signal from one set from interacting with the other set. The insertion loss will itself provide part of the isolation but, since such loss should be kept to a minimum for the sake of signal strength, the isolation should be provided in other ways. Poor isolation aggravates the tendency toward interference and other annoying reception problems on either or both receivers when both are in use.

4. *High impedance isolation between receivers:* The input impedance of most receivers varies from 300 ohms as they are tuned through the various channels they can receive. This variation is often quite high. Also, when a receiver is turned off, the input impedance of its r.f. amplifier goes up substantially. This change is reflected back through the antenna-matching circuit. Without high impedance isolation between the receivers, the tuning or on-off condition of one set can have considerable effect on signal level at the other.

5. *Equal division of signal:* In some designs, signal is fed directly to one receiver from the antenna with a network being used to tap off a fraction of this signal for the second set. This can result in satisfactory pictures on one with inferior quality on the other.

Since the engineers in *Channel Master's* research and development team felt that existing types of couplers did not offer fruitful approaches for meeting the five prerequisites, they sought to achieve a new type of design. It was finally agreed that the answer lay in adapting the diplexer principle. This system is used in radar, TV transmission, and amateur transmission and reception. With tuned lines of suitable length, carriers of different frequency (*i. e.,* the video and sound carriers in TV) may thus be coupled to the same antenna without mutual effects; or transmission and reception (as in amateur radio) may be carried on through a single antenna, even at different frequencies, without undesirable effects.

The use of "*Q*" sections—or quarter-wave impedance transformers, as they are also called—is not an unfamiliar one in antenna work, where it is necessary to match impedances. Lines that are a quarter-wavelength, or odd multiples of a quarter-wavelength, are used in this application. Accordingly, the new coupler begins with two sections of transmission line feeding from the antenna lead-in (see Fig. 2), each going to one of the two receivers. Each leg is cut to be a quarter-wave at 65 mc., which is near the electrical center of the low v.h.f. band, 54 to 88 mc. The third harmonic of this frequency is 195 mc., which is near the electrical center of the high v.h.f. band, 174 to 216 mc. In this range of frequencies, where the line is an odd multiple of a quarter-wavelength, it will have essentially the same characteristics as it does in the range of frequencies centered about 65 mc.

The exact impedance of the quarter-wave sections can be set by adjusting the spacing between the conductors—once the desired impedance to which they should be adjusted is known. The specific problem is to match two 300-ohm receivers to a 300-ohm transmission line and antenna. The equivalent circuit is shown in Fig. 3. To match

(*Continued on page* 176)

Fig. 2. Two quarter-wave transformer stubs are used for set-to-line match.

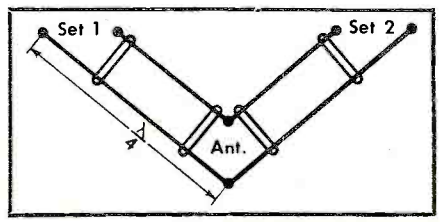
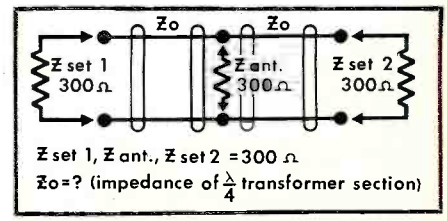


Fig. 3. This sketch shows the relationships of impedances to be matched.



By **ROBERT BURDETTE**

Chief Electronics Engineer
Los Angeles County Fair
Owner, Station KOWL, Lake Tahoe

Electronics at the L. A. County Fair

This elaborate p.a. set-up at the race track insures sound coverage for the over 21,000 people who gather here for races and other special events staged at Fair.

Sound is the unifying factor at the gigantic, rambling L. A. County Fair—using newest gear and techniques.

THE handling of over a million people in a seventeen day period always presents a challenge to the many phases of the electronic industry, yet this is done successfully each year at the Los Angeles County Fair which is America's largest.

Covering over five hundred acres, it becomes a virtual city within a city. The location for this operation is in the City of Pomona which is situated in Los Angeles County approximately 32 miles from Los Angeles. Connected by a new freeway system, it is a matter of 30 minutes until you reach the vast Fair Grounds and come into contact with the very important part that electronics plays in the operation of this huge County Fair.

The first thing that you hear is the continuous music interspersed with special announcements that greet and direct you to many activities. The giant public address system stems from the heart of the electronic operation which is located in the master control room in building 7A.

A large rack containing four *Newcomb* 50-watt booster amplifiers supplies feeder circuits to the main parts of the Fair Grounds. Since some of the cable runs were in excess of 3000 feet, a combination of specially wound line-matching transformers built by *Triad* plus a wire size over that of calculated requirements allowed sound to be evenly distributed to the *University* loudspeakers. A *Newcomb* mixer-preamplifier supplies audio signal to the four booster amplifiers and a *Browning* AM-FM tuner receiver supplies the music received from various Los Angeles FM radio stations. Several of these stations transmit a "beep" signal which cuts off any voice transmission, allowing only music to be released.

Located in another part of the building is an announcer who has a special control unit that allows announcements only or announcements with background music to emanate from the public address system. When this special control unit is not in operation, continuous uninterrupted music covers the Fair Grounds.

The next main installation covers the entire race track area, which accommodates over 21,000 people. A rack containing four *Newcomb* 50-watt booster amplifiers supplies sound to all sections of the race track including the main grandstand area, pari-mutuel wagering areas, and the infield. Two *Newcomb* mixer-preamplifiers allow the use of 10 microphones for the entertainment that is supplied daily between races. At night the grandstand is used to seat the many people viewing special shows that are presented on a stage erected in front of the race track.

These two systems can be linked together to give complete coverage for over 128,000 people at a time for such events as jet plane fly-overs. The "program" consists of a two-way conversation between an Army plane located on the Fair Grounds and another Army plane flying low directly overhead at a speed in excess of 600 miles per hour. Such an event happens so fast that it is almost over before it begins, however it does give the public an idea of what electronics can do when they hear a conversation from a plane they can not see at that moment, then hear a swoosh, and the pilot telling them that he has just passed over the Fair Grounds and is heading back to his base.

There are many public address systems in operation throughout the Fair Grounds. They are used for stock judging, to call the jockeys to their mounts, or to call the children in a large play and recreation area.

The main function of the master control room is to release the hundreds of programs that originate either live or by tape recording to the various radio stations in and around Los Angeles. This control room is equipped with two studios for live interviews and news releases. Strategically located throughout the Fair Grounds are local telephone lines that terminate in a patch bay in master control. This allows remote broadcasts to originate in many outside areas and be sent direct to the radio station releasing the program. At the same time the program can be tape recorded in master control for release at a later hour or over another radio station.

One of the important roles played by tape is the actual recorded running of the daily races which is compiled into a 30-minute program for

release over a radio station each evening.

The master control room is equipped with an *RCA* console, four turntables, and two *Ampex* tape recorders. The local channels located throughout the Fair Grounds and the two studios offers complete flexibility in operation which allows as many as five simultaneous programs to be sent to Los Angeles radio stations or tape recorded for later release. Another combination can consist of Studios A and B releasing two programs to two different stations at the same time plus a third station receiving a previously tape-recorded program. This arrangement would still allow another program to be tape recorded on the remaining machine. One of the most important means of obtaining programs at a moment's notice and at any place on the vast Fair Grounds is by means of the portable electric "Autoettes" which have been specially equipped with *Berlant* tape recording units. One such unit is equipped for single microphone pickup which can travel any place to tape record interviews on the spot, such as the millionth visitor entering the Fair Grounds. Another unit is completely equipped to do remote tape recording and uses four microphones to record for delayed release.

The newest and most complete remote portable tape recording unit consists of an *Ampex* model 601 tape recorder and 620 playback monitor amplifier plus a *Stephens* wireless microphone. These units are mounted on a special electric "Autoette" which is customarily used by radio station KOWL, Lake Tahoe but is on temporary duty at the Fair. The outstanding feature of this tape recording unit is the *Stephens* wireless microphone which consists of a frequency modulated transmitter capable of operating at a distance of 1000 to 1500 feet from the tape recording unit. A chrome steel quarter-wave telescopic "whip" antenna is coupled to the highly sensitive receiver, which is located with the *Ampex* tape recording equipment on the "Autoette" and is direct-coupled to the tape recorder input thus insuring high-fidelity sound pickup and recording. This outstanding wireless microphone is smaller than a package of cigarettes and has a frequency response of 30 to 17,500 cps ± 3 db. Total weight of the microphone / transmitter unit is four ounces. A small battery pack weighing ten ounces and the same size as the transmitter unit will operate for two hours continuous duty or three to four hours intermittent duty. A larger battery, which is slung over the shoulder much the same as a small field camera carrying case, contains a heavy-duty pack weighing two pounds which operates 20 hours continuous or 30 to 40 hours on intermittent duty. It is a common practice with the wireless microphone-tape recording unit to drive to a suitable place near the designated area where the tape recording is to be made, then have the announcer or master of ceremonies walk into the crowd for the interview or program to be tape recorded at a distance of from 500 to 1000 feet from the recorders. Many times the announcer and his tape equipment are out of sight of each other and the recording is started by a verbal cue. The simplicity of such an operation does away with cumbersome microphone cables and allows second and third floor interviews while the tape recording equipment and engineer remain on the ground floor. It also allows complete freedom of movement and does not restrict a person to the small area in front of a stationary microphone or require use of a hand microphone. The wireless microphone, when clipped in the breast or shirt pocket, affords equal sound pickup from both the interviewer and interviewee.

The "heart" of the Fair's elaborate sound system is located in Building 7A. The amplifiers, turntables, tape recording equipment, "beeped" FM receiver, preamps, mixers, etc. are of the latest design to provide coverage of the 500-acre site.

As a matter of added interest, the electricity consumed in a single evening at the Los Angeles County Fair is in excess of two million watts with a demand load of 540,000 watts per hour. This amount of power is equal to that consumed by the entire business district of Pomona. The Fair Grounds have their own hospital, fire department, police department, and radio station. They have two base transmitting stations and eight mobile transmitter-receiver units which, coupled with the vast public address system, allow the safe handling of over a million visitors within a seventeen day period.

Genial Fair Manager, C. B. Afflerbaugh, ably assisted by P. D. Shepherd, is constantly bringing new educational and informative projects to the thousands of Fair-goers. This year they have constructed a new "Do-It-Yourself Hobby Building" which will contain many exhibits that show various electronic kits that may be constructed at home. Many of the items on display will be familiar to readers of this magazine and POPULAR ELECTRONICS. Another new addition this year is the "Photography Building" which will exhibit the many phases of photography including sound motion pictures made optically and magnetically. Many similar features found in POPULAR PHOTOGRAPHY will be on view.

Anyone visiting the Los Angeles County Fair in September is cordially invited to stop by the master control room in building 7A to say "hello." We will be only too happy to explain any phase of the operation that is of particular interest to the visitor. A similarly cordial welcome awaits visitors to station KOWL in Lake Tahoe. We will be happy to show anyone through this modern, remote-control-operated broadcasting plant. -30-

This Month's Cover

ONE of this year's unique and interesting developments, the Stephens wireless mike, will be very much in evidence at the L.A. Fair. Used to gather "on the spot" interviews, the wireless mike feeds into a sensitive receiver which is coupled to an Ampex tape recorder mounted on an electric "Autoette." This speedy little car transports sound engineers around the extensive grounds, enabling them to pick up interesting highlights for delayed transmission. Use of the wireless mike allows the announcer to move freely through the crowds, conduct interviews at other than ground level, and obtain more spontaneous reactions from interviewees. (Photo by Burton Frasher, Frashers, Inc.)

By **JOHN T. FRYE**

COLOR, CONELRAD, AND CLUES

THE calendar said it was September, but the thermometer apparently had not heard, for the air-conditioner in Mac's Service Shop was going full blast. Barney was working on a little a.c.-d.c. receiver while his employer was studying some sort of an instruction book.

"Hey, Mac, you've had that color set going at your house for better than three months now," Barney suddenly remarked; "how are you doing with it? Have you reached any world-shaking conclusions about fringe-area color reception?"

"Nothing world-shaking," Mac said with a grin as he tossed the booklet on the bench. "In one respect, that color set has been most uncooperative: it has refused to break down. You know I particularly wanted to see if color sets gave lots more trouble than black-and-white receivers and to learn what sort of failures could be expected. During the three months that set has been in operation, it hasn't so much as burned out a dial lamp. We've been giving it a hard time, too. Our black-and-white set has been unplugged and the color set has been used for all reception. That means it has been going an average of about five hours a day. While I know many TV receivers are on more than this, I feel it is a good average for summer-time watching.

"Actually, though, I think the time of year in which the set has been operating has put more of a strain on it than would be imposed by being turned on for a lot of hours. We had an extremely wet early summer here this year and the humidity has been terrific. We both know from experience what havoc hot, humid weather can work on electronic equipment. Then, if ever, transformers break down; moisture gets into capacitors with poor seals and causes them to become leaky or short out altogether; high voltage arcs appear; increased ambient temperatures take their toll of tubes, resistors, etc. That makes it all the more surprising nothing failed in the color set during this period.

"I'm not, though, foolish enough to draw a general conclusion from this single instance and decide color sets never give more trouble than black-and-white receivers. Because of the circuit complexity and greater number of components used in color sets, to expect that would be illogical. A person would naturally expect a little more trouble with an electric ironer than with a stove-heated flatiron."

"Still, your experience certainly makes some of those wild tales about how much service a color set requires sound a little silly," Barney observed.

"I never believed those anyway. I noticed they always came from non-color-set owners and probably were tinged with jealousy and a reluctance to part with the cost of a color receiver. Of course, there is no doubt but that a perfectionist could drive himself and the service technician crazy by trying to have an absolutely perfect picture at all times. But he could do the same thing with a black-and-white set. We know that we never see a picture but that we, as technicians, can pick some small defect in it. It may be that vertical or horizontal linearity is off just a trifle; a trace of a ghost may be present; we may see a little tendency to 'ring' or smear if we look closely enough; interlace may be just short of perfection; the full gray scale may not be quite all there, etc., etc. These defects are so small they are not noticed at all by the average viewer and they do not detract from the enjoyment of the reception. But there are a few warped individuals who get more pleasure out of finding tiny flaws in the picture than in enjoying the TV program. The dealer who sells one of these people a color set, a radio, a hi-fi installation, a watch, an automobile, or anything else is going to regret it."

"Have you found any one thing to be especially important in fringe-area color reception?"

"Well, I've decided that all the time and effort spent on the antenna system is well worth while. Every effort should be made to deliver enough signal to the receiver so that the a.g.c. system will have something to work on. If the signal strength is too low for the a.g.c. system to go into action, fading will be much more annoying in color reception than in black-and-white. This is because variation in signal strength in that range will have a marked effect on the saturation of the colors. Of course, even in black-and-white reception it is well worth while to try and give the receiver sufficient signal to bring the automatic gain control action into play."

"What practical steps can you take along that line?"

"Make sure you have the best high-gain broad-banded antenna you can get. Put it high enough in the air and away from other objects so that it can do the best possible job. Use a low-loss lead-in that comes directly to the set by the shortest possible route. Employ high quality lightning arresters."

"As a ham, I know what you mean about the importance of a good antenna. Time and again I've seen one hundred watts working into a good antenna outdo a kilowatt working into a mediocre antenna. But why is the lead-in so important?"

"Under dry conditions, probably one lead-in is about as good as another, but the attenuation of a flat ribbon line when wet is much higher than that of a good tubular line. I had this demonstrated over and over during summer thunderstorms. Quite likely a properly installed open-wire line would be still better in this respect, especially if there was a long run from the antenna. When you are trying to squeeze out the last microvolt of signal strength, as you are in fringe area color installations, the slight extra cost of the tubular lead-in is well worth it. But that's enough of that. What are you supposed to be doing?"

"This little receiver is one a ham friend converted to operate as a Conelrad warning device. He followed the same method I use in the conversion, but he says his will not work. I've just found out why."

"Well, why?"

"The method used is a very common one in several different versions of the same basic idea: the a.v.c. voltage is used to cut off an audio stage until the station carrier disappears. When this happens, a feedback circuit turns the audio amplifier into an audio oscillator. Naturally, if this is to work as it should, the receiver must be in good operating condition to start with. This one wasn't. Not only were the i.f. stages quite a bit out of alignment, but one of the a.v.c. bypass capacitors was leaky so most of the a.v.c. voltage was shorted to ground. Even the local station could only develop a volt or so, while normally a strong station from a hundred miles away will develop three or four volts."

"I'll bet there is a lot of that," Mac commented. "Many fellows will try to use a discarded radio or one that has been lying around for a long time for

(*Continued on page* 162)

FM Tuner Alignment Problems

By
HERMAN BURSTEIN
and
HENRY C. POLLAK

Detailed analysis of the various compromises that must be made with respect to frequency response, low distortion, and signal-to-noise ratio to obtain maximum performance from an FM tuner. Correct alignment is also discussed.

ALTHOUGH a good deal is heard about distortion in various audio components—amplifiers, preamplifiers, cartridges, speakers, tape recorders—rarely is the subject mentioned in connection with FM tuners. One can go through a long list of specifications for various tuners and come across relatively few references to distortion. Do these omissions mean that distortion is negligible? Not necessarily. This depends on the tuner and how well it is aligned.

In audio, every electronic component is a compromise among three conflicting performance requirements: good frequency response (wide and uniform), low distortion, and high signal-to-noise ratio. Cost is a fourth consideration. Performance can be improved in any one respect usually only by a sacrifice in others. FM tuners are no exception to this rule of compromise.

Because the range of FM reception is usually less than that of AM, the designers of FM tuners must give especially careful attention to sensitivity, as well as to signal-to-noise ratio. Almost every set of specifications states that for so many db "quieting," which denotes signal-to-noise ratio, the tuner requires a certain number of microvolts signal input. However, in striving for high sensitivity, care must be taken at the same time to keep distortion acceptably low.

In broadcast FM, full modulation (maximum volume) corresponds to a frequency deviation of 75 kc. from either side of the carrier, as established by FCC standards. With the highest audio frequency required at 15 kc., the modulation index is 5, and the required bandwidth is then 240 kc.[1] With this bandwidth all significant sideband frequencies, that is those having amplitudes greater than about 1 per-cent of the unmodulated carrier, will be passed. To allow for possible oscillator drift, an additional 40 kc. should be added so that a total bandwidth of 280 kc. is needed to fulfill the most severe requirements. At lower audio frequencies, say 7.5 kc., or at a lower frequency deviation, say 50 kc., which is about average, the bandwidth just indicated would not be required. In either of these cases just referred to, a total bandwidth of about 200 kc. or less would be adequate.

The tuned r.f. and mixer stages in an FM tuner are much broader than 200-280 kc. and ordinarily do not present a bandpass problem. However, the i.f. and detector stages usually are designed for a bandwidth fairly close to 200-280 kc. or less, although some detectors have appeared with a bandwidth of one megacycle or more. If these stages are tuned so that their over-all response characteristic is much less than 200-280 kc., frequencies representing loud signals fail to get through, resulting in distortion of these signals. This is the "breakup" observed during peak passages on a poorly designed or misaligned tuner or one not exactly tuned to the station.

Alignment must frequently be a compromise between low distortion and high sensitivity. Sensitivity should be sacrificed to the extent necessary to assure sufficient bandwidth so that the tuner operates with satisfactorily low distortion at high modulation levels when signals of normal strength are received. Such alignment can probably best be performed by the so-called visual method, employing a sweep-signal generator that produces the r.f. and i.f. frequencies encountered in FM, an oscilloscope, and a d.c. vacuum-tube voltmeter which can be adjusted to read zero at mid-scale. As indicated in texts, manufacturers' service notes, instrument manuals, and elsewhere, the alignment procedure in broad terms is as follows:

1. With the FM generator properly connected to the tuner and set to produce a swing of roughly 500 kc. about the i.f. frequency (usually 10.7 mc.), and with the scope properly connected for viewing the i.f. response curve, the i.f. transformers are adjusted so that the curve has maximum gain consistent with required bandwidth.

2. With the FM signal fed to the i.f. stages, and the scope connected to the detector output, the detector transformer is adjusted to give a symmetrical "S-curve," shown in Fig. 1. This alignment can be checked and touched up by feeding in an *unmodulated* i.f. signal, adjusting the primary for a maximum d.c. voltage reading at a designated test point, and adjusting the secondary for a zero voltage reading at another test point.

3. An *unmodulated* r.f. signal is fed to the antenna, the oscillator is aligned for correspondence between the signal and the dial setting, and the r.f. and mixer stages are aligned for maximum gain as measured by the d.c. vacuum-tube voltmeter at a designated test point.

4. A check of over-all performance is made by feeding to the antenna an r.f. signal with 500 kc. modulation and observing the symmetry of the S-curve

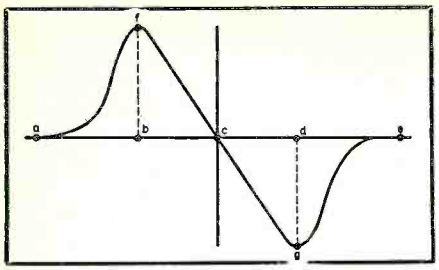


Fig. 1. "S"-curve produced by detector.

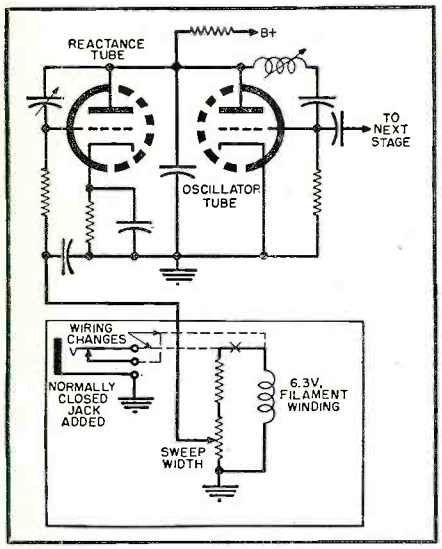


Fig. 2. Circuit modification to permit external modulation of the FM generator

produced on the scope, which is connected to the tuner output.

The foregoing description of alignment procedure leaves much unsaid, particularly if the objective is to align a tuner "to the hilt," extracting the best possible performance that its design permits. On the other hand, it is difficult to present a detailed description of an alignment procedure that will fit all tuners. A suitable way out of this dilemma is to present, in detail, the actual steps followed by the authors in aligning a typical high-quality FM tuner possessing a tuned r.f. stage, oscillator, mixer, two i.f. stages, two limiter stages, and a Foster-Seeley discriminator type of detector. The following discussion will also indicate the alternative procedures that would be employed if a tuner with a ratio detector and no limiters were being aligned.

Equipment Used

The following instruments were used for alignment.

1. *Oscilloscope:* The scope has a sensitivity of 10 millivolts for one inch deflection; a variable-phase 60-cycle signal, covering a range of nearly 180°, which can be fed to the horizontal amplifier; a ruled screen, with 10 squares to the inch, which is necessary for easy and accurate alignment.

2. *FM signal generator:* The modulation control knob is calibrated to indicate amount of frequency deviation. The instrument originally had no provision for external modulation. Such provision was added by installing a normally closed phone jack, which allows an external voltage instead of the internal 60-cycle voltage to be applied to the FM modulator when a phone plug is inserted. This modification is shown in Fig. 2.

3. *V.T.V.M.:* A necessary feature, found in most such instruments, is a control and dial calibration which permit setting the pointer so as to read zero volts at mid-scale.

4. *Intermodulation distortion tester:* This instrument employs the SMPTE method, which utilizes a low frequency and a high frequency respectively in 4:1 ratio and measures the extent to which the low frequency and its harmonics modulate the high frequency.

Prior to and during alignment, a number of precautions were observed in the use of the instruments:

1. All instruments and the tuner were allowed to warm up for one hour before use.

2. A 68-ohm resistor was placed across the terminals of the FM generator in order to match its impedance and thereby prevent uneven frequency response due to standing waves.

3. A .01-μfd. isolating capacitor was placed between the FM generator and signal injection point. Similarly a 100,000-ohm isolating resistor was placed between the scope probe and test point; the scope already contains an isolating capacitor at the input.

4. During alignment, the scope was continually checked, and adjusted if necessary, for vertical and horizontal drift. Accurate vertical and horizontal centering with reference to the scope's grid screen is important. Similarly, the v.t.v.m. was periodically checked for drift from zero setting.

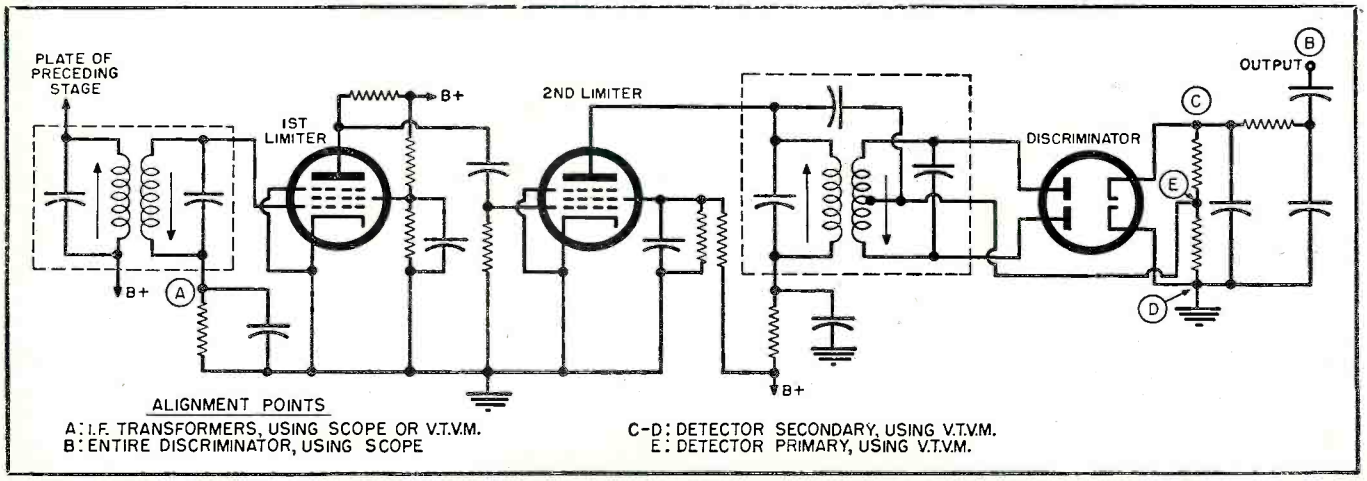
5. In order to assure good linearity of response curves displayed on the scope, neither vertical nor horizontal deflection was allowed to exceed 3 inches on the 5-inch screen.

6. During alignment, generator input to the tuner was kept low to avoid possible overloading and because accurate alignment is most important for weak station signals. The amount of signal input used was just large enough to provide a scope trace fairly free of noise. On the other hand, an input level so low as to have a substantial accompaniment of noise would not correspond to normal use of the tuner.

I.F. Alignment

To prevent the tuner oscillator from possibly affecting i.f. alignment, it was killed by carefully wedging a small screwdriver between the oscillator stator and the tuning capacitor frame. This shorted the high side of the oscillator coil to ground. The a.f.c. was turned off in accordance with the manufacturer's instructions. The generator, tuned to 10.7 mc. and with sweep at 500 kc., was connected to the grid of the last i.f. tube. The scope, with its horizontal amplifier switched to the internal 60-cycle phase shift circuit, was connected to the high side of the grid resistor of the first limiter, point A in Fig. 3. Gain of the scope was adjusted so that tuner noise, with no signal input, produced a deflection of about one-quarter inch, relatively small compared with a signal input sufficient to produce a deflection of about three inches on the scope. Fig. 5 is a block diagram of the hookup. In the event that a tuner with a ratio detector and no limiters were being aligned, instead of one with a discrim-

Fig. 3. The test points to be used in the alignment of an FM tuner. Refer to text for full discussion.



inator and limiters, the test points for viewing i.f. response would, in most cases, be as in Figs. 4A and 4B; or elsewhere, in accordance with tuner design and manufacturer's instructions. As shown in Figs. 4A and 4B, it is necessary to disconnect the detector capacitor in order to see the i.f. curve on a scope. For alignment of the detector, the capacitor must be resoldered.

The hookup of Fig. 5 results in a more or less U-shaped frequency response curve appearing on the screen of the scope. The curve is inverted because the signal is negative-going at the test point grid, and the oscilloscope employed here is one that produced a downward deflection for negative-going signals. A phase difference between the generator's 60-cycle modulating voltage and the scope's 60-cycle sweep causes two traces to appear on the scope, one representing a sweep from the low end to the high end of the i.f. passband and the other a sweep in the reverse direction. The phase shift control of the scope was therefore adjusted so as to superimpose the two traces. (Some FM generators make their 60-cycle modulating voltage available for connection to the scope.)

The primary and secondary of the last i.f. transformer were then tuned to produce maximum output consistent with the so-called flat-top curve shown in Fig. 6. Most i.f. transformers used in FM tuners today are of the double-tuned, over-coupled type, which produce the curve of Fig. 6A when properly adjusted. Occasionally, single-tuned transformers are used to produce the simple curve of Fig. 6B. Either the curve in Fig. 6B is broad enough at the "top," really the bottom as seen on the scope, or the various i.f. stages are stagger-tuned to slightly different frequencies in order to achieve the necessary bandwidth, as shown in Fig. 7.

Aligning the overcoupled transformer is not oversimple, although the knack comes with practice. Due to overcoupling, the primary and secondary affect each other's influence upon the i.f. response curve. Therefore, it is necessary to make a series of small alternate adjustments in order to obtain a flat-top curve with proper width and symmetry. The third (last) i.f. transformer of the tuner was aligned in this manner. In order to check whether the flat-top was broad enough, or possibly too broad, the generator sweep was reduced to 75 kc. This left virtually only the flat-top showing on the scope, as should be the case. This is illustrated in Fig. 8. If bandwidth were excessive or insufficient, the respective traces of Figs. 9A and 9B would appear. In these instances, further attempts at alignment of the i.f. transformer may or may not give better results. If transformer coupling, "*Q*," or loading is incorrect, alignment is not the answer to the problem.

With sweep width returned to 500 kc. and strength reduced so as to maintain the same amount of scope deflection, the generator was connected to the grid of the first i.f. tube. The scope remained at the first limiter grid resistor. The second i.f. transformer was aligned in the same manner as the third, and the generator was then moved to the grid of the mixer tube to permit alignment of the first i.f. transformer. This completed the i.f. alignment.

After going through the procedure just described, sometimes it may be found that the shape of the over-all i.f. response curve, with signal fed to the mixer grid, can be brought nearer to the ideal contour of Fig. 6A by a slight touch up of the second or third i.f. transformer. In this event it is advisable to again check each individual stage for proper waveform, because an over-all waveform with compensating errors is not apt to be as symmetrical as one based on correct alignment of each stage.

It should be noted that in some tuners, as one moves from the last i.f. stage to the first, the flat-top curve of Fig. 6A may give way to the round top curve of Fig. 6B due to circuit loading. Adequate i.f. bandwidth can be maintained by keeping the top broad during alignment. With sweep reduced to 75 kc., the response curve which remains should be similar to that shown by the solid portion of Fig. 8.

Detector Alignment

Inasmuch as the detector has to be aligned to the i.f. frequency, care should be taken not to disturb the FM generator setting unless the generator frequency must be changed in order to center the i.f. curve on the screen of the scope. Centering the i.f. curve just prior to detector alignment is important because it establishes this curve's center frequency, with respect to which the receiver's detector must be aligned.

With sweep at 500 kc., the generator was left connected to the mixer grid. The scope was moved to the audio output jack, point B in Fig. 3. The primary and secondary of the detector transformer were alternately adjusted to produce the S-curve of Fig. 1, having the following characteristics as nearly as the eye could see: $ac = ce$; $bf = dg$; fg straight and of maximum length; and c passing through zero (center of scope). This provided a

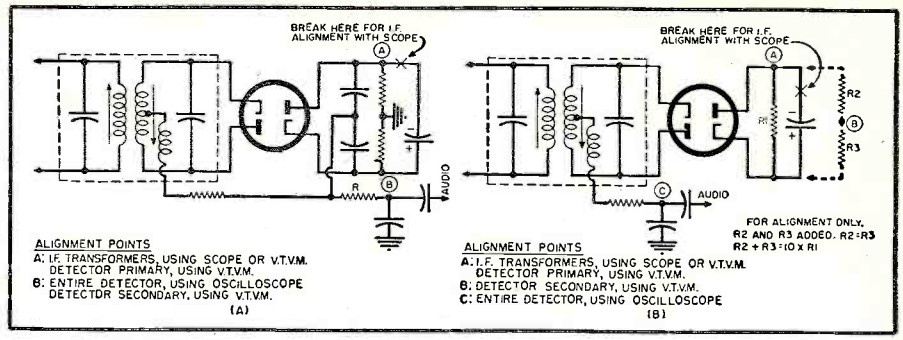


Fig. 4. Ratio detector test points for two typical commercial circuits. See text.

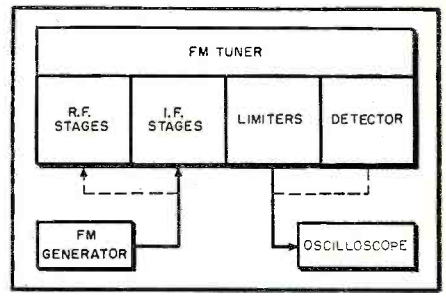


Fig. 5. One recommended test equipment set-up suitable for the visual alignment of an FM tuner. Technique is discussed in text.

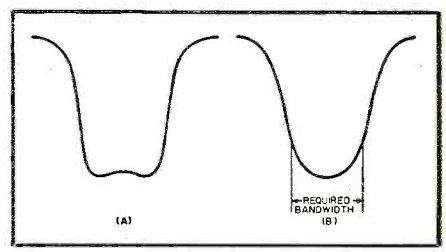


Fig. 6. (A) An ideal overcoupled, i.e., a "flat-top," i.f. response curve (shown inverted) and (B) a single-tuned intermediate frequency response curve (inverted).

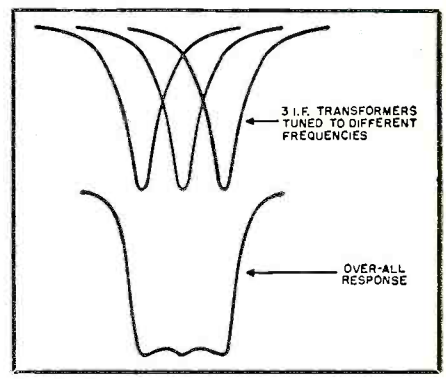
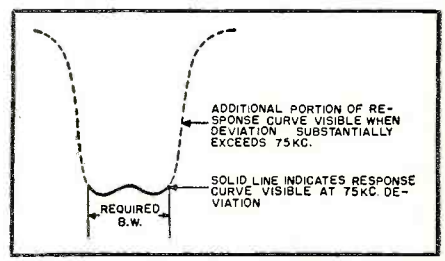


Fig. 7. A stagger-tuned i.f. response curve.

Fig. 8. An overcoupled intermediate frequency response curve at a deviation of 75 kilocycles. The subject of overcoupling is fully discussed in article. See text.



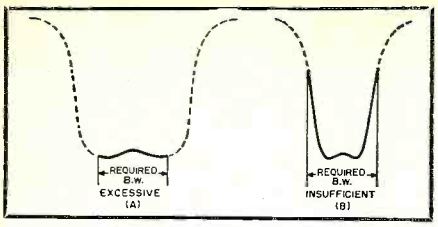


Fig. 9. Examples of excessive (A) and insufficient (B) i.f. bandwidth. See text.

preliminary alignment of the discriminator.

The d.c. vacuum-tube voltmeter, set to read zero at mid-scale, was connected directly across the audio output of the discriminator, specifically between the two cathodes (points C and D in Fig. 3). If ratio detectors of the type shown in Figs. 4A and 4B were being aligned, the zero voltage test points would be as indicated in those diagrams. With the signal generator connected to the converter grid and *no sweep,* the v.t.v.m. should read zero. The secondary of the discriminator was adjusted slightly to obtain this zero reading. With sweep restored at 500 kc., the primary was then touched up to assure maximum amplitude and linearity of portion *fg* of the S-curve (Fig. 1). Because of interaction between the primary and secondary, several alternate touch ups were required to simultaneously obtain zero voltage on the v.t.v.m. at zero sweep and a properly shaped S-curve at 500 kc. sweep.

To insure optimum alignment of the detector, a further step may be necessary. It must be realized that the dual diodes used in the detector may not be perfectly matched; that the upper and lower halves of the detector secondary may not be perfectly balanced; and that the human eye is not a perfect instrument for judging linearity of the S-curve. Therefore, an intermodulation analyzer was used to check IM distortion and, if necessary, touch up the alignment of the detector transformer. Although such touch-up has little or no effect at low modulation levels, it can considerably reduce distortion at levels approaching 100% modulation.

Fig. 10 shows the hookup for checking IM distortion. Signals from the intermodulation tester were used to modulate the 10.7 mc. signal supplied by the generator to the mixer grid. Audio output from the tuner was connected to the IM meter for a distortion reading. With generator sweep set at 75 kc. for distortion measurements, the detector's primary and secondary were touched up for minimum distortion.

Here a caution is in order. The distortion reading apparently drops when the primary is tuned away from the i.f. frequency, because the amount of signal fed to the meter is reduced. However, by keeping an eye on the portion of the S-curve visible on the scope, detuning of the primary can be avoided.

Adjustment of the primary affected alignment of the secondary, so that the v.t.v.m. no longer read zero at reduced sweep. Therefore the secondary was retuned for zero reading. This, in turn, required another slight adjustment of the primary for minimum distortion. Several alternate adjustments of this type were required.

Distortion at 75 kc. deviation was reduced to about 1%, using a signal sufficient to produce substantial quieting, freedom from noise, as seen on the scope. Distortion was then checked at two lower deviation levels, about 35 kc. and 10 kc. sweep. In both instances distortion was well under 1%, and detector alignment was considered complete.

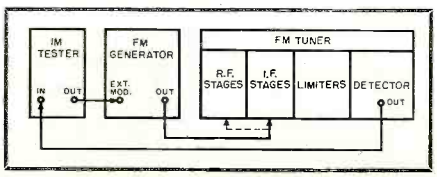
R. F. Alignment

The oscillator was rendered operative by removing the short between stator and ground. The generator, set at 105 mc., with 500 kc. sweep, was loosely coupled to the tuner by attaching it to a short insulated antenna lead. With the scope connected to the audio output, the tuner dial was turned until an S-curve appeared on the scope. However, the tuner dial pointer, which had first been correctly positioned, read 103 mc. instead of 105 mc. This signified insufficient inductance in the oscillator coil or insufficient capacitance in the oscillator capacitor. The oscillator trimmer was tightened slightly, increasing its capacitance, so that correct tuning took place at 105 mc. on the dial. Alignment at the low end of the dial was postponed until alignment of the tuned r.f. and mixer circuits had been completed.

Using an *unmodulated* signal of 105 mc. and with the tuner set at 105 mc., the trimmers of the tuned r.f. and mixer stages were adjusted for maximum tuner output, using the v.t.v.m. to read negative voltage at the first limiter grid resistor, point A in Fig. 3 (or at point A in Figs. 4A and 4B in the case of ratio detectors). The mixer tuned circuit sometimes loads the oscillator somewhat, so that mixer alignment affects oscillator frequency. Therefore in aligning the mixer for maximum response, the tuning knob was at the same time rocked back and forth to assure that the oscillator frequency remained within the range necessary to tune in 105 mc.

The dial was re-checked for calibration at 105 mc., and further slight adjustment of the trimmer was found necessary. Then calibration was checked at the low end, where the dial read 89 mc. for a signal of 90 mc. Adjustment was made by slightly squeezing the turns of the oscillator coil.

Fig. 10. Test equipment setup for measuring the IM distortion of an FM tuner.



The high end of the dial was checked again and another slight adjustment made to the trimmer. A few more alternate adjustments of the coil for low end calibration and of the trimmer for high end calibration resulted in satisfactory indication of station frequency across the dial.

In the same manner as previously described, a test was made of IM distortion in the entire tuner, including the r.f. section. It was found that maximum distortion at normal signal strength remained about 1%, and the entire alignment was considered complete.

Summary

There are faster ways than that described for aligning an FM tuner. For example, one rapid method of i.f. and detector alignment relies entirely on the S-curve. An i.f. signal with about 500 kc. swing is injected between the last i.f. stage and the detector, and the detector transformer is aligned for a symmetrical S-curve. The signal is then moved back one stage at a time, each stage being aligned so as to maximize amplitude and symmetry of the S-curve. However, such a procedure does not assure the optimum compromise between high gain and low distortion. Often only painstaking procedures of the sort previously described can enable an FM tuner to yield its full potential for pleasurable sound. In this way, IM distortion as great as 15 or 20% at high modulation levels can be greatly reduced to 1% or less if tuner design permits. Not that careful alignment is sufficient to make a high-fidelity performer out of any tuner whatsoever, but it can effect a substantial improvement in performance.

For many owners of tape recorders, the FM tuner is an important source of program material. In such use it is all the more necessary that distortion be kept at a minimum. Although tuner distortion and recorder distortion may individually be below the threshold of discernibility, the two combined can be great enough to be objectionable.

The well-aligned FM tuner sounds clean, assuming that what comes over the air is of good quality. Sour program material transmitted by the station cannot sweeten in the tuner. However, when live broadcasts or recordings free from distortion are delivered intact by a good tuner, even the most modest of respectable amplifier and speaker systems can provide captivating sound.

An FM tuner gives evidence of correct alignment not only by quality of sound but also by ease of operation. For tuners lacking a.f.c., or with a.f.c. shut off, tuning is less critical. Given a well-designed and properly aligned tuner, stations virtually float in and out as one dials through the FM band.

REFERENCE

1. Langford-Smith, F.: "Radiotron Designer's Handbook," Fourth Edition, page 1038, 1952

30

Applicant's first step is to complete a brief, introductory resumé.

The Men We Hire

By **W. R. GRAVES**
Director of Recruiting
International Business Machines Corporation

Frank discussion of the nontechnical qualifications sought by a leading firm offering careers in electronics.

WITH THE accelerated pace of scientific and engineering progress in all types of industry today, more and more companies are seeking ways to upgrade technicians into jobs for which an engineering degree might have been considered essential in the past. The results: companies make better use of expensive engineering talent; the engineers use their abilities to a fuller degree; and technicians are finding ever-widening opportunities for further advancement and greater achievement.

IBM is deeply involved in these scientific advances, not only in the development and production of our own products, but also in the application of these products to scientific developments in other fields. Our company is experiencing a tremendous surge of growth, and our long-range program is constantly increasing in size and scope.

To meet current needs and insure successful continuation of this program, we offer technicians a variety of opportunities. As we must invest thousands of dollars in the men we select, we make every effort to recruit those who have the prerequisites to help them grow with their organization.

Let us consider the case of a young man who has read an *IBM* advertisement for, say, "Computer Units Field Engineers," and decided that he would like to apply. In this job, he will become a member of a team responsible for maintaining a "SAGE" computer, a key unit in our nation's air defense network.

EDITOR'S NOTE: *Prospective applicants for positions in the many expanding areas of electronics, after having appraised their technical qualifications in terms of the openings available (see pages 40 and 51), still ask, "Am I the kind of man they want for the job? What personal traits are considered desirable?" To get the answers, we have gone to the other side of the personnel interviewer's desk. The recruiting director of one of the large firms sponsoring an active program for enrolling personnel on all levels of technical competence presents the employer's objectives frankly and authoritatively.*

This man's formal educational background may be two years of technical school, or equivalent experience. Many of the young men we hire have gained the necessary knowledge as radar operators or electronic technicians in one of the armed services, or even through experience as amateur radio operators.

Beyond this, we are looking for attitudes and personal qualities that are also important factors in our decision to hire a man. These characteristics might well be grouped under five major headings: Maturity; Attitude; Initiative; Leadership; and Manner and Appearance.

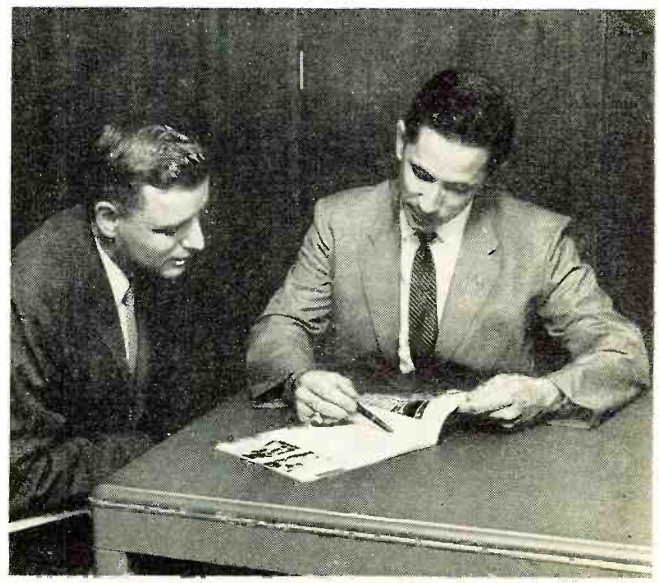
We want stable, responsible men, who know their own occupational goals and are able to discern whether the prospective *IBM* job fits in with those goals. While we offer a wide variety of benefits, we believe that the man with the greatest potential for us is one who recognizes the importance of long-term prospects, and is interested in these as well as a good starting salary. We want men who will stay with us and develop with the company.

Among other important determining factors is this: has the applicant, in his school life, previous work experience, and other activities, demonstrated the ability to work well with other people? Many of our technicians work in teams, and cooperative attitudes are just as

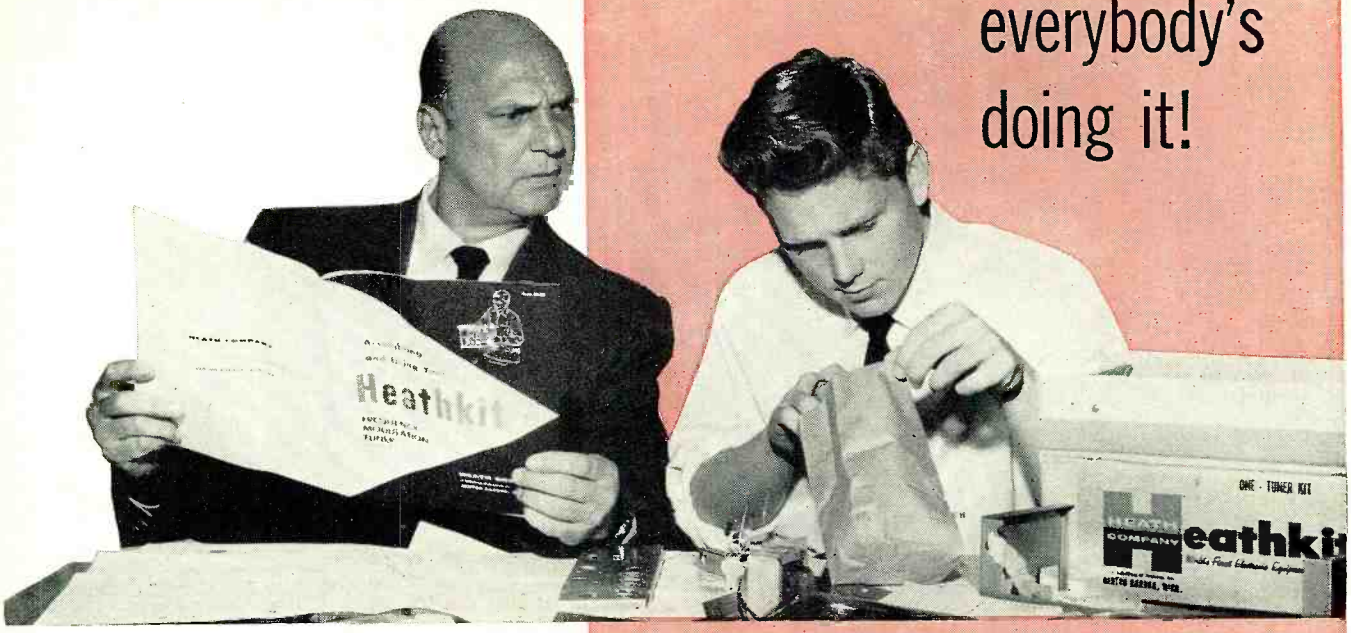
(*Continued on page* 132)

John S. Renfro (right), of IBM's Recruitment Office, reviews an applicant's resumé in the first stage of the interview.

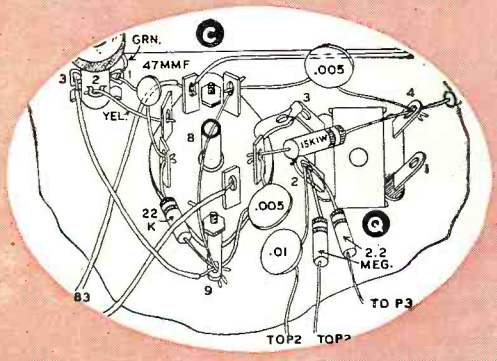
Francis Gleason, Jr. (right), of IBM's Recruitment Staff, explains the various opportunities available to an applicant.



everybody's doing it!



Motion picture and TV personality, Jackie Coogan, looks on with unbelieving interest as his 14-year-old son, Anthony, prepares to assemble his latest Heathkit, a hi-fi FM tuner. The Coogans have found out about the fun and savings of building their own electronic equipment the Heathkit way . . . so why don't you?



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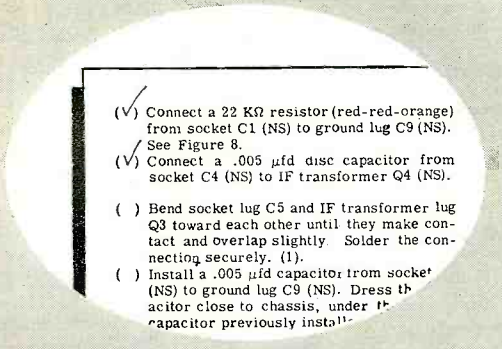

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The Heath Time Payment Plan was designed for your convenience. Now, you can order the kits of your choice, and pay for them in small monthly installments. Write for full details.

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

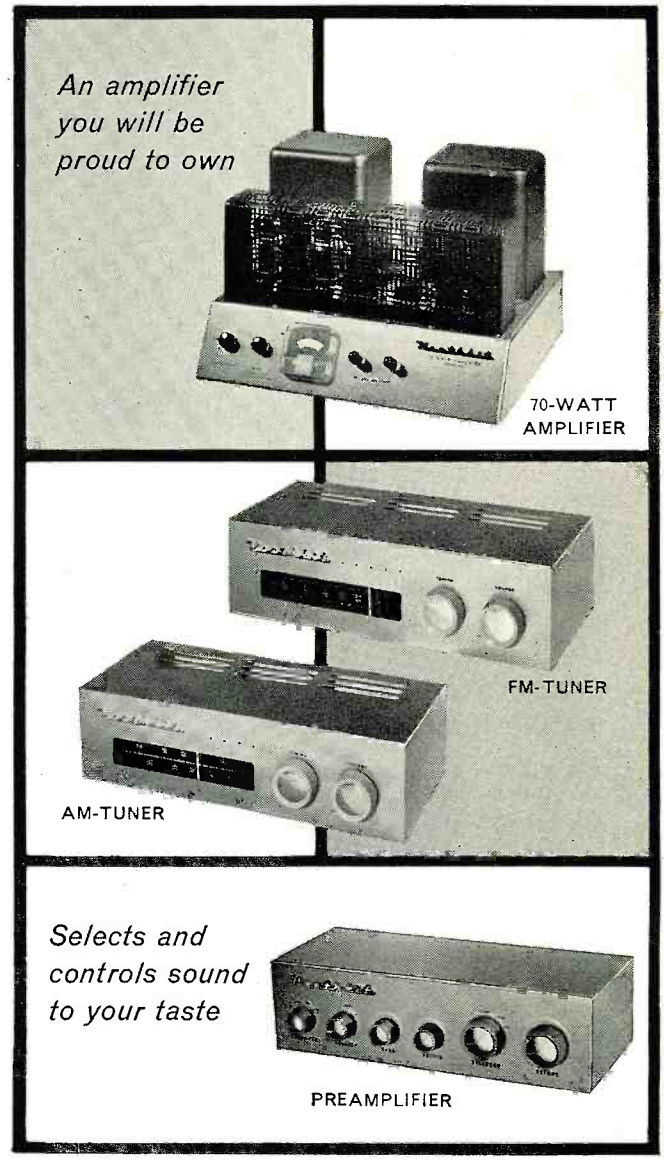
$25.95 (with cabinet)

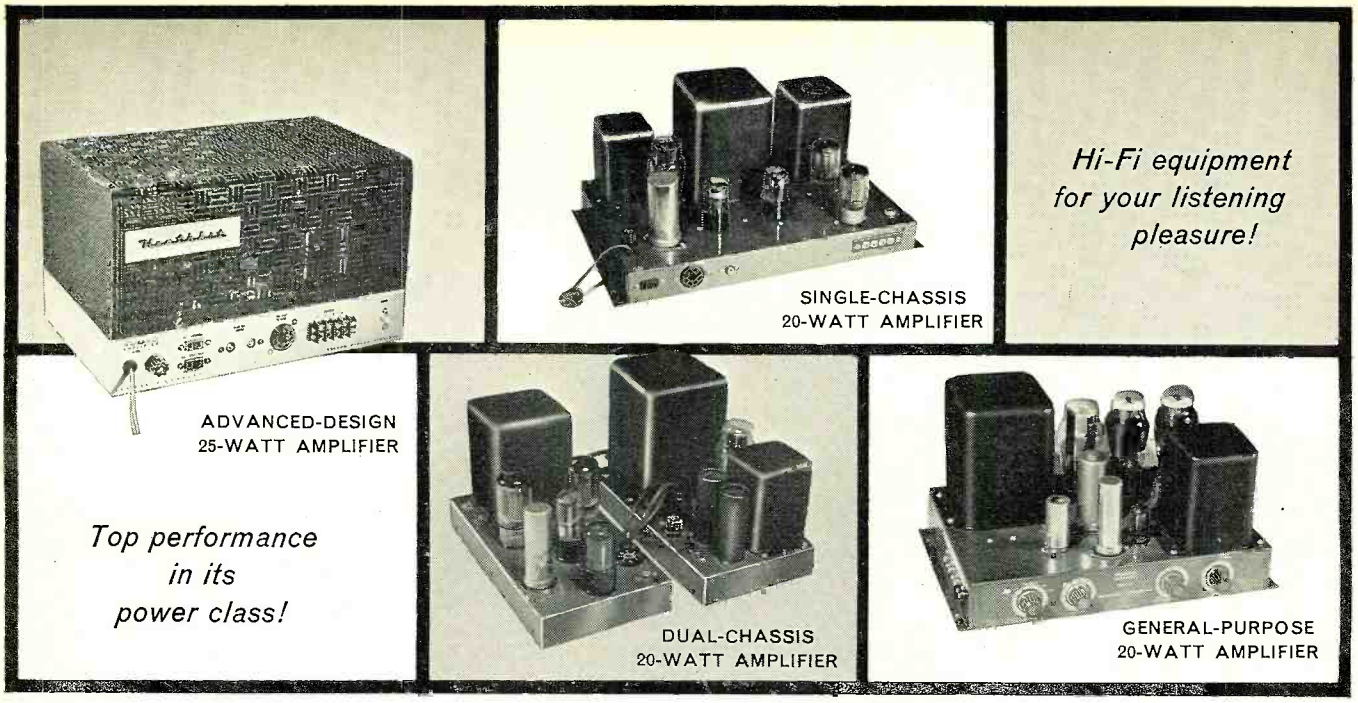
HEATHKIT MASTER CONTROL PREAMPLIFIER KIT

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

MODEL W-5M
$59.75

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

MODEL W-3AM
$49.75

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

MODEL W4-AM
$39.75

Heathkits...

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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

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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.

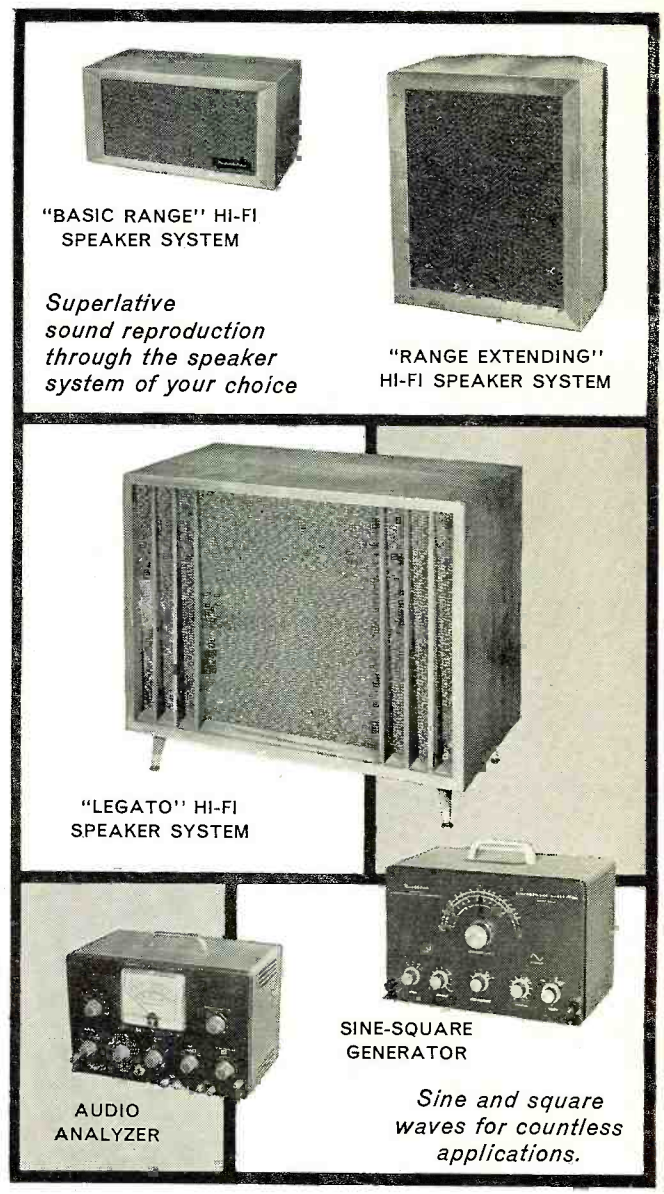
MODEL AA-1
$49.95

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
$325.00 EACH



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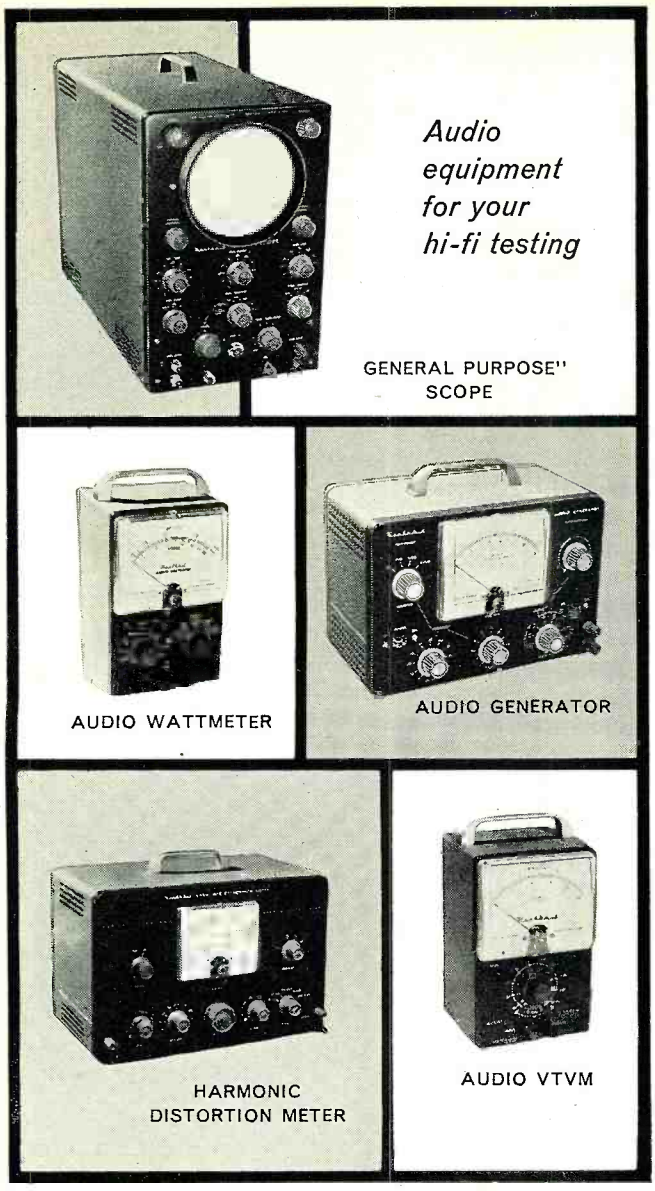

HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

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-2
$42.50

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...

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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

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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-11
$69.50

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

$14.50

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

$22.50

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

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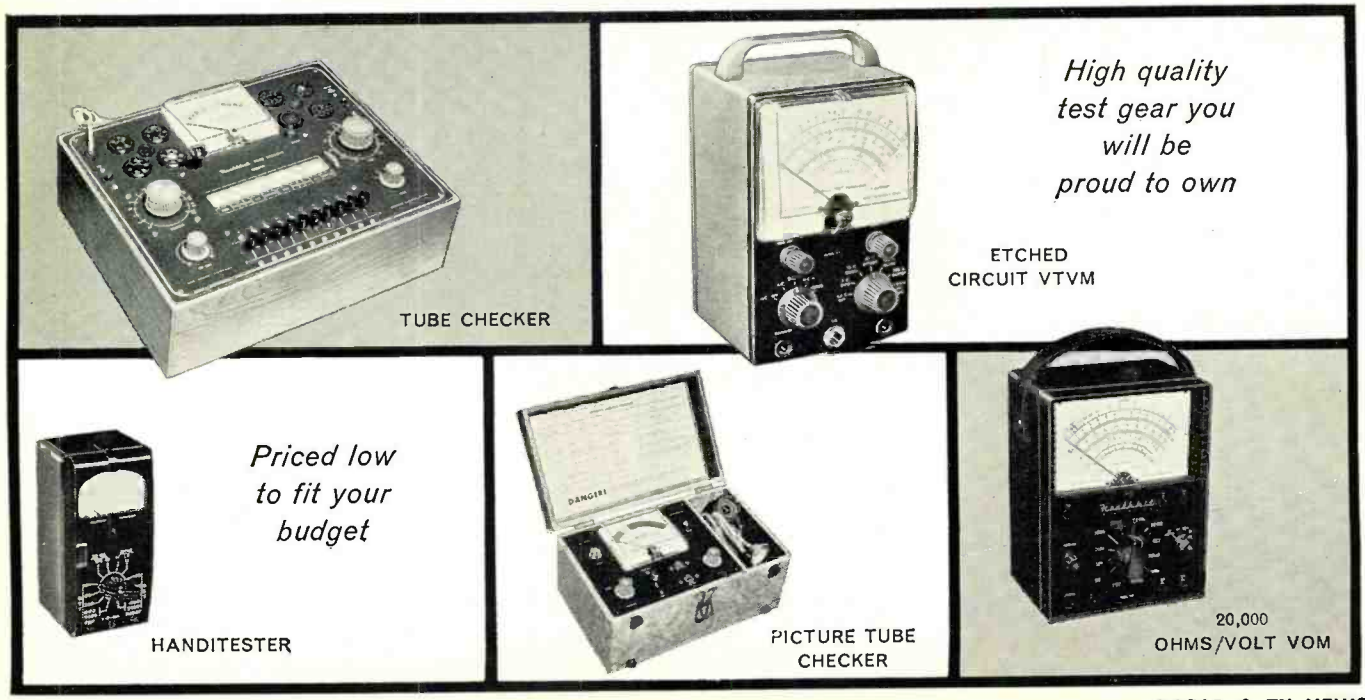
let you fill your exact needs from a wide variety of instruments

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

$29.50



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

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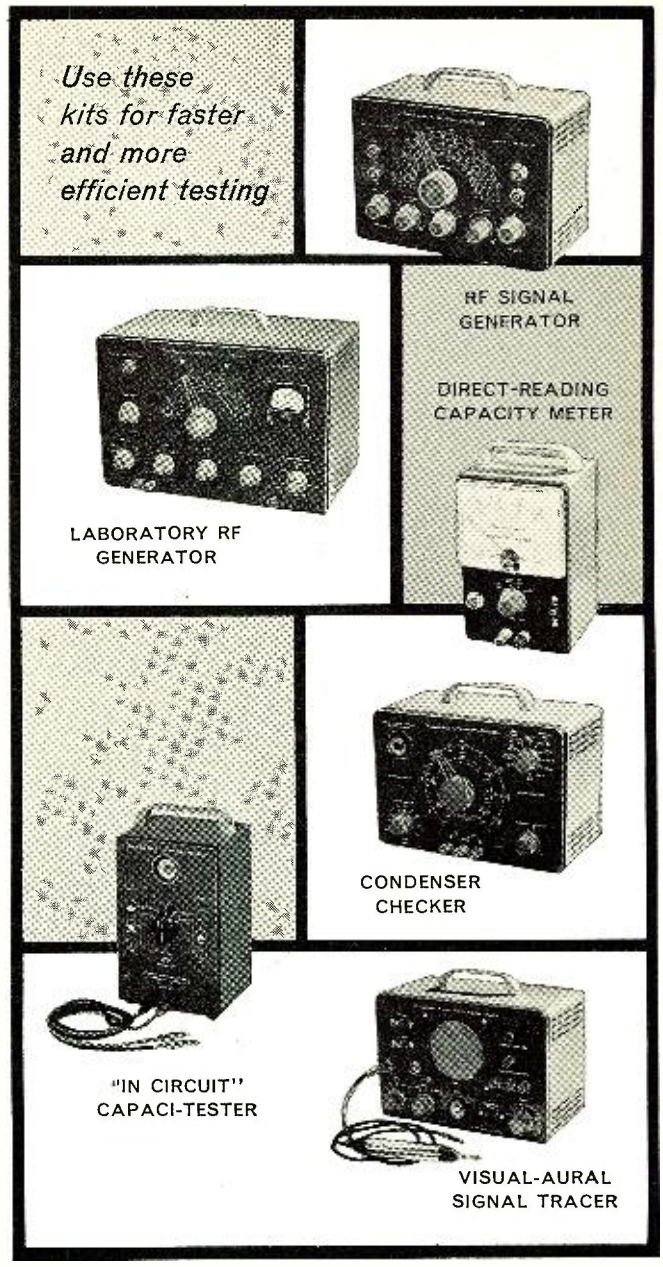
are educational
as well as functional

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

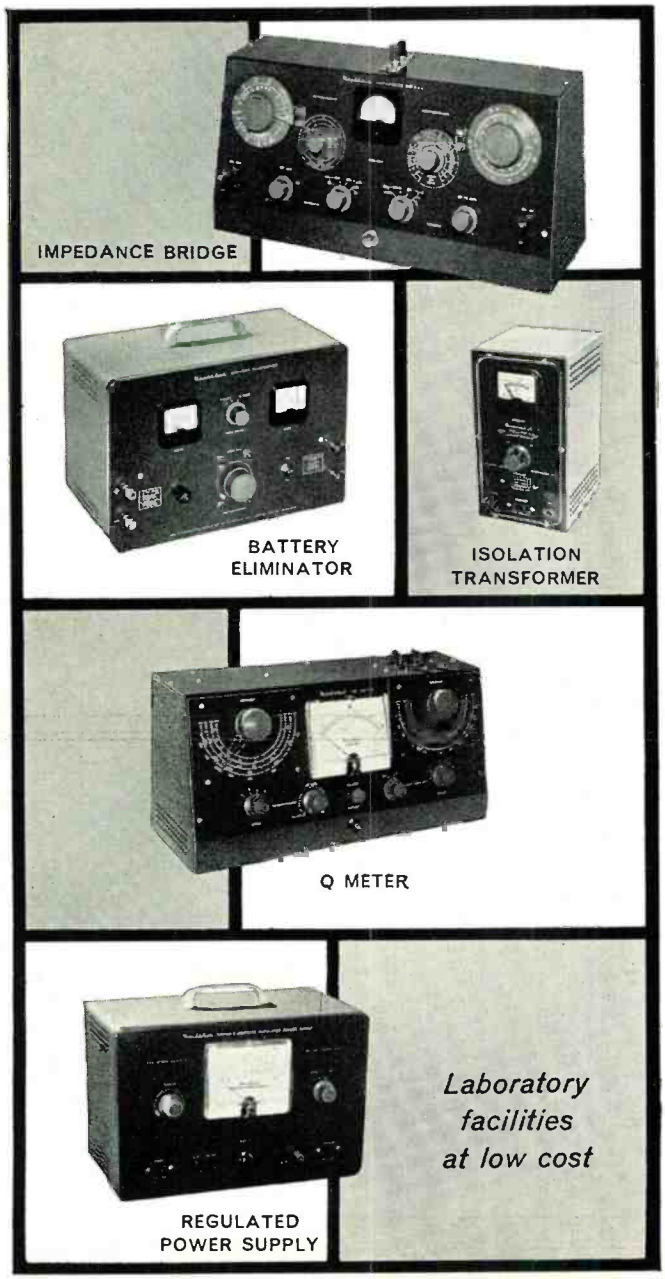
$39.95

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

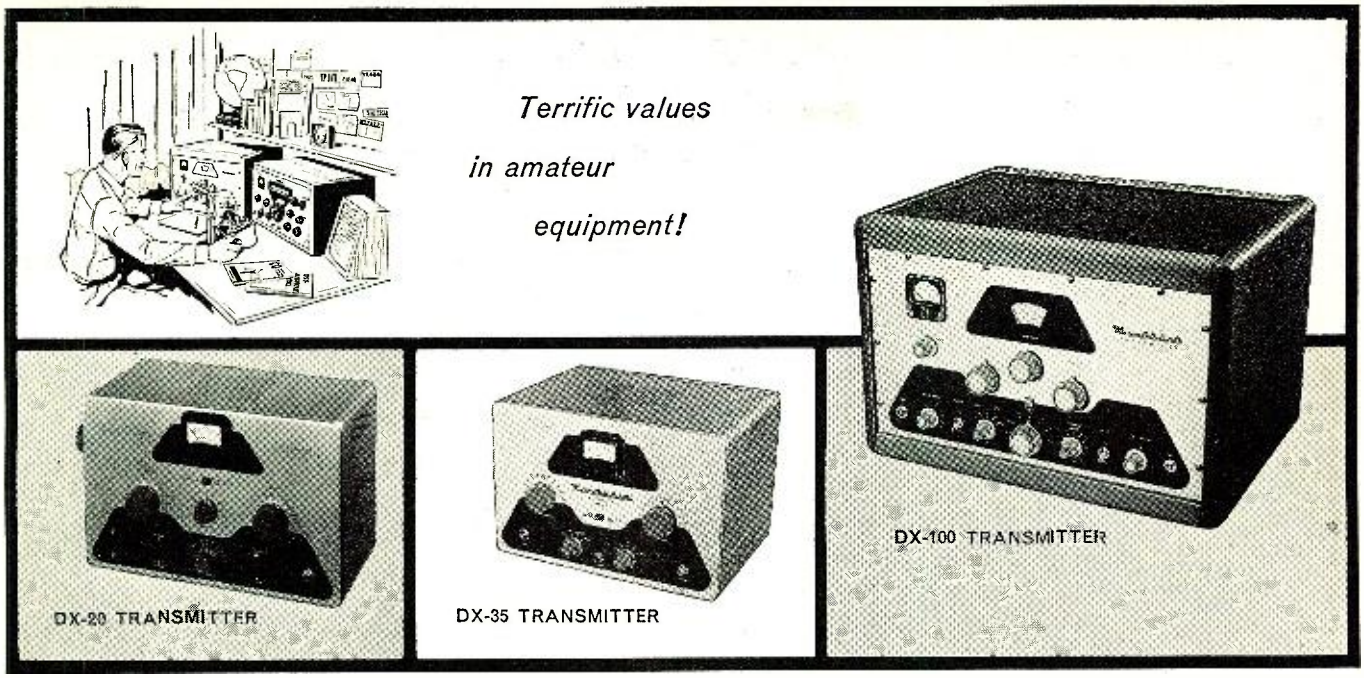
$44.50

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



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-35 PHONE AND CW TRANSMITTER KIT

The DX-35 transmitter can be thought of as the "little brother" of the DX-100. It features both phone and CW operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 65 watt plate power input on CW, or controlled carrier modulation peaks up to 50 watts for phone operation. Modulator and power supplies are built right in and single knob band switching 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. Back panel control provides convenient switch selection of three different crystals, reached through access door at rear of cabinet. A most remarkable power package for the price. Complete step-by-step instructions with pictorial diagrams to assure your success in assembly. Shpg. Wt. 24 lbs.

MODEL DX-35
$56.95

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.

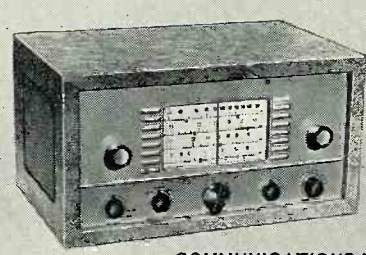
HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

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
$19.95

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

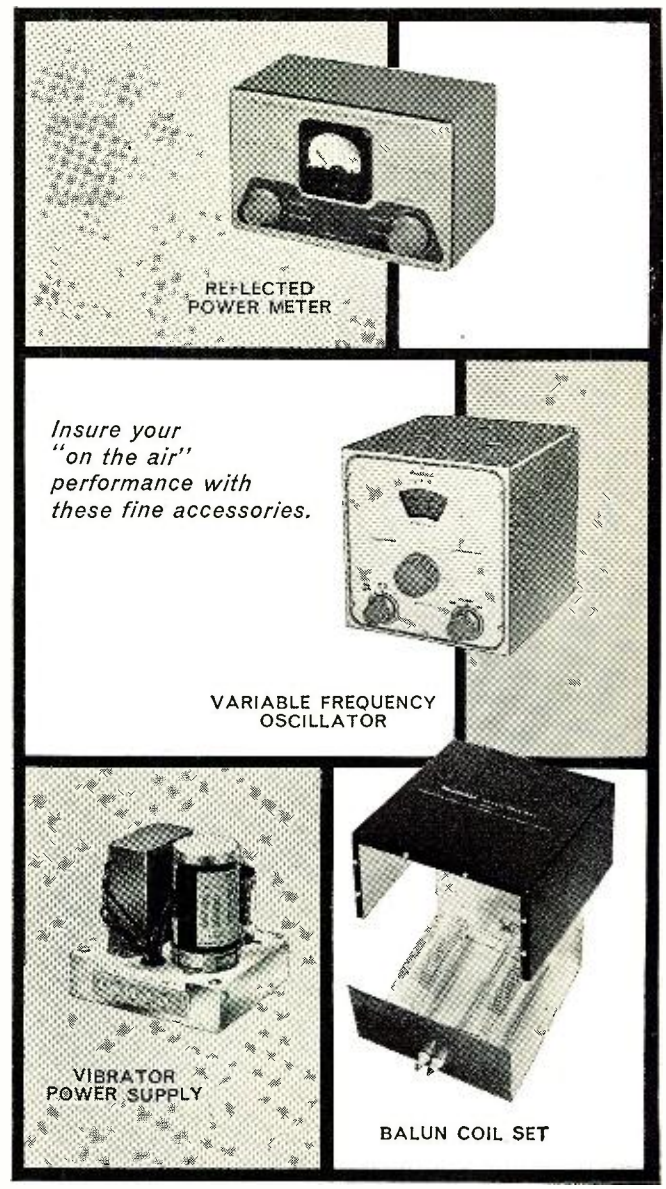
$8.95

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

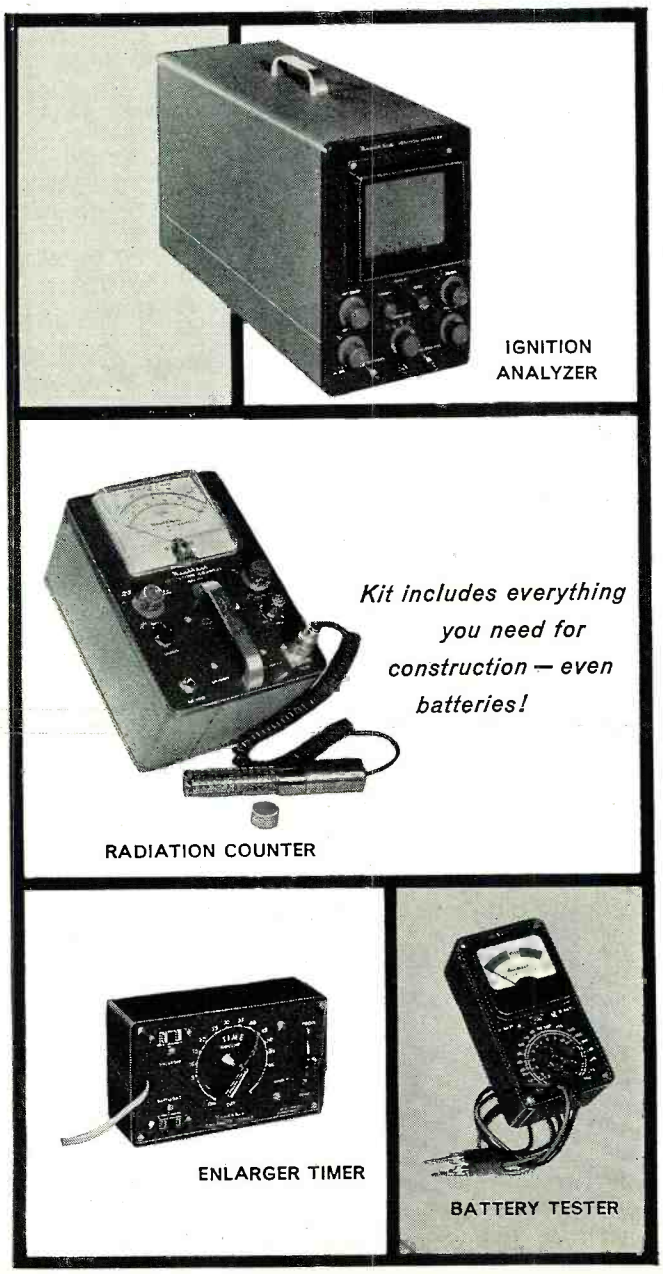
Previous electronic experience is not necessary to build this fine ignition analyzer. The construction manual supplied has complete step-by-step instructions plus large pictorial diagrams showing the exact placement and value of each component. All parts are clearly marked so that they are easily identified. 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

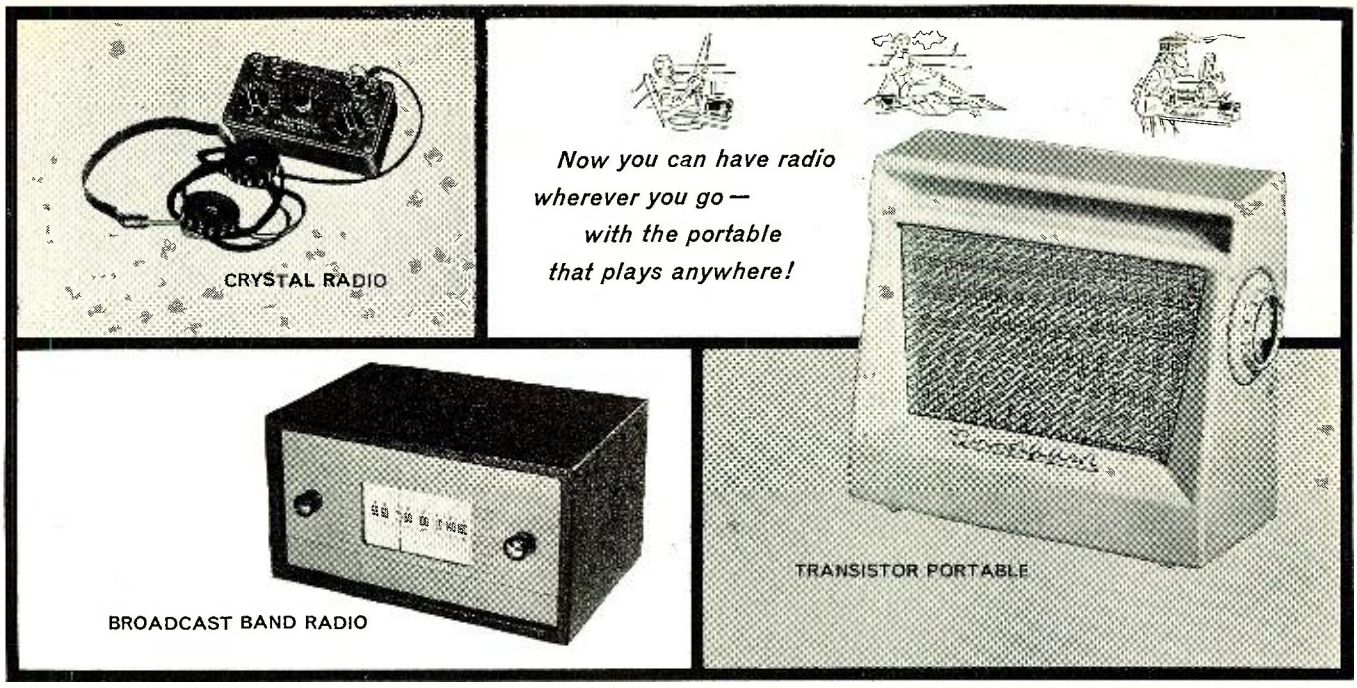
The ET-1 is an easy-to-build electronic device to be used by amateur or professional photographers in timing enlarger operations. The calibrated dial on the timer covers 0 to 1 minute, calibrated in 5-second gradations. The continuously variable control allows setting of the "on" cycle of your enlarger, 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

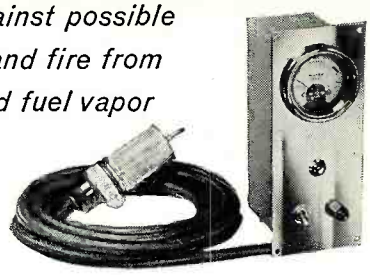
This table-model broadcast radio is fun to build, and is a fine little receiver for your home. It covers the standard broadcast band from 550 to 1600 kc with good sensitivity and selectivity. The 5½" PM speaker provides surprisingly good tone quality. High-gain IF transformers, miniature tubes, and a 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.**

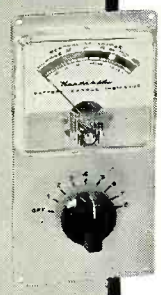
protects against possible explosion and fire from undetected fuel vapor



FUEL VAPOR DETECTOR

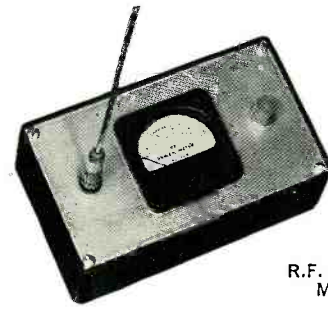
detects electrolysis currents which cause deterioration of underwater metal fittings on your boat

ELECTROLYSIS DETECTOR



indicates condition and charge of batteries for safe cruising

BATTERY CHARGE INDICATOR



R.F. POWER METER

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

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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

$49.95

(Available after November 15)

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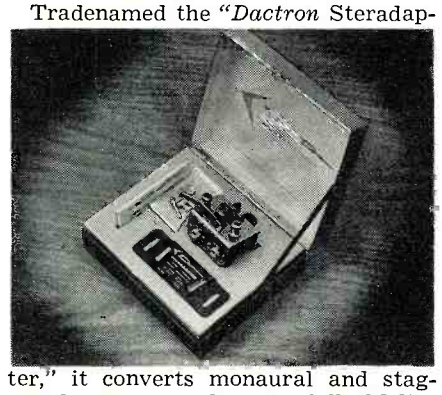
Hi-Fi-Audio Product Review

STEREO CONVERTER KIT

International Magnetic Electronics Co., P.O. Box 987, Minneapolis 1, Minn., has developed an ingenious, inexpensive in-line stereo tape recorder conversion device which mounts on the side of most tape recorders.

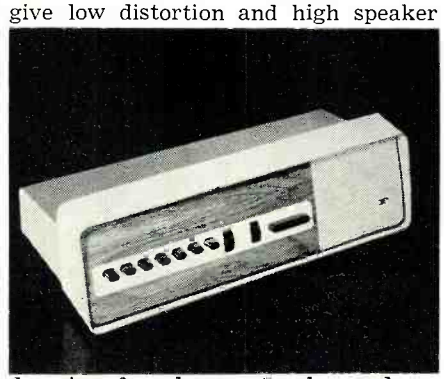
Tradenamed the "*Dactron* Steradapter," it converts monaural and staggered tape recorders to full fidelity playback of in-line stereo tape recordings. It is designed for quick and easy installation. The "Steradapter" is simply slipped into a bracket which may be mounted permanently onto the recorder. The tape is then threaded directly from the supply reel through the unit's tape guides over the capstan to the take-up reel.



The manufacturer suggests that one channel can go through the recorder's audio system and the second channel to a radio, phonograph, TV, or other amplifier with phono jack.

NEW INTERCOM SYSTEM

Fisher Berkeley Corporation, 5633 Grove St., Oakland, Calif., is now marketing a new intercom system which features a special feedback circuit to give low distortion and high speaker damping for clear natural sound reproduction.



The complete system is available in either 6 or 12 station masters with remotes, with intermixing of master and remotes for innumerable arrangements. The masters may be set for conference calls, dictation, or talk-listen. Contemporary styling allows the system to fit into any office or home decor.

Other features of the system include a.c. operation, completely balanced 45-ohm lines throughout for noise-free operation, push-buttons, printed circuits, optional handset for privacy, and feedback noise cancellation circuit for lower background noise.

An illustrated brochure on this new system is available from the manufacturer on request.

"EYEGLASS" HEARING AID

Dictograph Products, Inc., of Jamaica, N. Y., has introduced a new "eyeglass-type" hearing aid which has two entirely separate sound channels powered by a single battery.

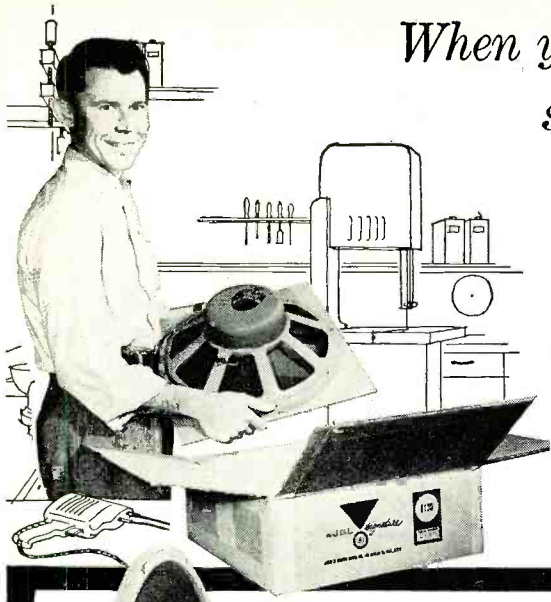
Each temple of the unit contains a microphone, a transistorized audio amplifier, volume control, and receiver. The left temple contains a single on-off switch, which is an integral part of the volume control, and a single mercury battery which powers both units. The right temple has space for a spare battery.

Each amplifier contains four transistors, eight subminiature capacitors, twelve resistors, and two audio transformers. The receiver is being offered in ten different types, each with a specific frequency response and peak amplification frequency. The receiver selected is based on the hearing loss of the individual. The mercury battery is rated a 160 ma./hr. The drain of each amplifier is 2 ma. per hour and the life of the battery is estimated at 40 hours. Operation cost of the unit is approximately ¾ cent an hour.

NEW BASE AND COATING

Affton Industries, Valley Park, Mo., has announced the introduction of a new type of recording base and oxide coating. According to the company the base is stronger than the plastics formerly used and has better weathering characteristics than standard base.

The new oxide is fortified with a



When you build your High Fidelity sound system, use THE VERY BEST LOUDSPEAKERS YOU CAN GET

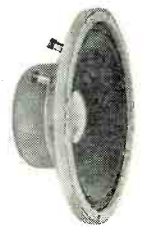
You are planning to build, or improve, your high fidelity sound system. Unstintingly, you will pour out your enthusiasm, time, and energy to get the finest music reproduction you can bring into your home. Get a loudspeaker that will do full credit to your handiwork . . . Install a JBL Signature Extended Range Loudspeaker, or two-way speaker system, in your enclosure.

JBL Signature Loudspeakers are made with the same careful craftsmanship, the same precision forming and fitting that you yourself would use if you set out to make the finest loudspeaker the world had ever heard. JBL Signature precision speakers are the most efficient loudspeakers made.

With a JBL Signature Loudspeaker in your high fidelity system, you can exhibit your components with pride, confident that those you have made yourself are being demonstrated in the most effective way possible.

MODEL D130—15" extended range loudspeaker The only 15" extended range speaker made with a 4" voice coil is the world-famous JBL Signature D130. The large voice coil stiffens the cone for crisp, clean bass; smooth, extended highs. Your basic speaker, the D130 works alone at first, later becomes a low frequency driver when you add a JBL Signature high frequency unit and dividing network to achieve the ultimate excellence of a JBL Signature two-way system.

MODEL D123—12" extended range loudspeaker With outstanding "presence" and clean response throughout the entire audio spectrum, the D123 features an unusual shallow construction. Only 3⅝" deep, it is designed to mount flush with the wall, between studding, in any standard wall or partition. Frequently, the D123 is used in multiples in "infinite baffle" wall installations. In this case the JBL Signature 075 is a logical high frequency unit to add when you advance to a two-way system.



MODEL D208—8" extended range loudspeaker A precision transducer in every sense of the word, the famed JBL Signature 8" D208 is made with the same care and precision as the larger units in the James B. Lansing Sound, Inc., line. If space and cost are major considerations, the D208, properly enclosed, provides the most lastingly satisfactory sound you can get. It is widely used in top quality systems where extension speakers are desired for areas other than the main listening room.

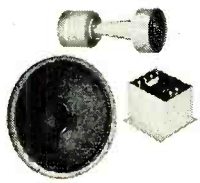
MODEL 175DLH high frequency assembly The acoustical lens is only available on JBL Signature high frequency units. The 14 element lens on the 175DLH disperses sound within the listening area over a 90° solid angle, smoothly, with equal intensity regardless of frequency. The acoustical lens is the greatest contribution to lifelike high frequency reproduction in 20 years, and it was developed for use with high fidelity equipment by James B. Lansing Sound, Inc. In addition to the lens, the 175DLH consists of a high precision driver with complex phasing plug and a machined aluminum exponential horn. Designed for crossover at 1200 cycles with the JBL Signature N1200 Network.

MODEL 075 high frequency unit Another exclusive for James B. Lansing Sound, Inc. is the ring radiator in the JBL Signature 075 high frequency unit. A ring, rather than a diaphragm, radiates into the annular throat of an exponential horn. The result is high frequency reproduction of unmatched smoothness and clarity, absolutely free of resonances and strident peaks. The horn is beautifully machined from aluminum, the entire unit a gratifying, solid piece of fine craftsmanship. Designed for crossover at 2500 cycles with the JBL Signature N2500 Network.

JBL Signature two-way systems are available as kits

086 KIT This two-way system is made up of units which have been acclaimed by impartial authorities as the finest available anywhere today. Included in the kit are the 150-4C Low Frequency Driver, N500H Network, 375 High Frequency Driver, 537-509 Horn-Lens Assembly. These are the same units—including the serpentine acoustical lens—which are used in The Hartsfield . . . units designed originally for installation in the most modern theaters in the world.

002 KIT Including some of the newest speakers made, the JBL Signature 002 Kit includes a D123 for low frequency reproduction, N2500 Network, 075 High Frequency Unit. The 002 Kit is moderately priced, yet gives the user all the advantages of a two-way system made with independent drivers.



001 KIT Probably the most popular high quality two-way system on the market, the JBL Signature 001 system consists of a 130A Low Frequency Driver, N1200 Network, 175DLH High Frequency Assembly. The D130 may be substituted for the 130A without disturbing the balance or coverage of the system.

There are many more kits and loudspeakers in the JBL Signature line. Whatever your needs, you will find exactly the right unit or system in the complete JBL Signature catalog. Send for your free copy. A limited number of technical bulletins are also available. Please ask only for those in which you are vitally interested.

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magnetic catalyst that allows for greater sound absorption and improved output. Dept. A of the company will supply full details and prices on request.

"MINITROL" UNIT

Radio Corporation of America has announced a revolutionary combination talk-hear-control unit which is designed to take "desk clutter" out of

mobile radio base station installations.

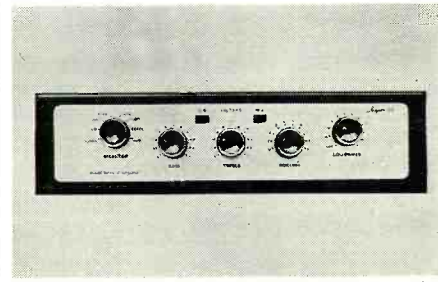
Known as the "Minitrol," this miniaturized transistor unit combines in a single compact case the microphone, speaker, and controls necessary for station operation of two-way radio system. The unit can be mounted on an adjustable arm over the dispatcher's desk, can be pre-set for hands-free operation; and provides a foot switch for transmitter operation.

The "Minitrol" measures approximately 6″x2½″x2″ and is only a fraction of the size and weight of conventional radio desk equipment which it replaces.

NEW BEAM-ECHO LINE

Majestic International Sales Corp., 25 W. 57th Street, New York, N. Y. is handling the U. S. distribution of a complete line of high-fidelity equipment being imported from England and made by *Beam-Echo Limited.*

The line includes amplifier-preamps, stereo amplifiers, AM-FM tuners, stereo tape decks, and various speaker



systems. One of the outstanding units in the line is the "Super 21" (Model PL6) a 21-watt combination amplifier-preamp which retails in the moderate price class.

Power output is 15 watts minimum from 30 to 20,000 cps with frequency response (at 400 cps) .1% total at 10 watts. IM distortion at 40 and 10,000 cps (4.1 ratio) is 1% at 10 watts and 2% at 14 watts.

The input selector control has seven settings covering tuner, three different

If you buy Newcomb or sell Newcomb, you profit from Newcomb's *proven* dependability. First of all, Newcomb products earn their place in the sun by their superior sound. But the quality that accounts for Newcomb's position as probably the largest independent manufacturer in the field is *dependability*. The user owns equipment that is always ready to operate, ready to go to work from the minute it is installed. The dealer is not plagued with a series of profit-eating service calls. And, he gains the invaluable asset of a satisfied customer. Newcomb dependability is the result of highly-refined conventional circuitry, quality parts, thorough testing, and meticulous reworking until Newcomb products meet Newcomb standards—the highest in the audio industry. The tried and true conventional circuitry found in Newcomb products not only adds to their dependability, but also is readily understood by the maintenance technician. "Dependability" is a characteristic that cannot be established by a simple assertion. Dependability must be proved over a period of time. In twenty years Newcomb Audio Products Co. has proved its ability to deliver maximum dependability combined with superior sound... *consistently.*

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DEPENDABLE NEWCOMB PUBLIC ADDRESS AMPLIFIERS

are designed for continuous heavy duty, safety, simplicity of operation. Although specifically designed for use in school and civic auditoriums, their flexibility and dependability have led to an impressive variety of applications—in radio and television stations, government projects, sports events... The Newcomb Custom KX-50 shown here is the finest public address amplifier ever offered—without equal at any price. A 50 watt unit with less than 3% distortion, full remote control, double-acting separate bass and treble controls, bandwidth selector, dual electronic eye volume and overload indicator... Write for free catalog containing complete description.

dependability

DEPENDABLE NEWCOMB HIGH FIDELITY COMPONENTS

are noted for their exceptional, continuous reliability and brilliant performance. Newcomb has concentrated on the qualities of sound reproduction most desirable for home entertainment, reduced distortion and hum to the vanishing point, increased the flexibility of control, achieved outstanding beauty in appearance. Finest of all compact-styled units are the flexible Newcomb Compact 1020 preamplifier-control unit-power amplifier and the sensitive, stable Newcomb Compact 200 AM-FM Radio Tuner.

DEPENDABLE NEWCOMB RECORD AND TRANSCRIPTION PLAYERS

have earned an unchallenged reputation for reliability and safety in many of the leading public school systems throughout the nation. Ruggedly built, with excellent audio quality, they represent the greatest value available in this field today. Newcomb Record Players have gained wide acceptance for church activities and Sunday schools, in dance schools, and among square dance callers. Only American made parts are used in this equipment. All Newcomb products bear the Underwriters Laboratories labels.

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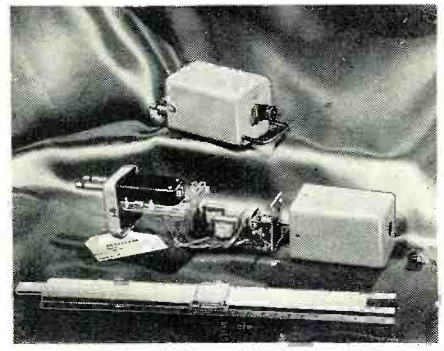
equalization curves, auxiliary, 7.5 ips tape and 3.75 ips tape. A loudness compensator is included for adjustment to suit individual tastes. The bass control has 18 db boost and 12 db cut in relation to 1000 cps level and 19 db boost and 20 db cut with the treble control at the same level.

For complete information on the "Super 21" and other units in this new British line, write the U. S. distributor direct.

INTERCOM AMPLIFIER

Transval Engineering Corporation of Culver City, Calif. is now in production on a transistorized intercom amplifier which weighs only a few ounces.

Designed especially to boost headset volume level in intercom systems, the



Model 7003 can be used in both mobile and fixed base interphone circuits. The new amplifier is suitable for applications where either weak signals or high noise levels impair intelligibility of communications. It can be supplied to operate at any voltage between 6 and 50 volts d.c.; can be plugged into the standard interphone headset jack; has an output of 150 mw.; and is equipped with a manual volume control.

The device meets applicable MIL specifications.

NEW PENTRON LINE

Among the many new units being offered by *The Pentron Corporation,* 777 S. Tripp Ave., Chicago 2, Ill. is a series of tape transport mechanisms for custom installations.

Designated as the Models TM-1, TM-3, and TM-4, all of the mechanisms include professional quality heads with easily changed pole pieces; "Finger-Flite" single rotary control for "drive", "fast forward", and "fast rewind"; "Quik-Flip" speed change lever for either 7.5 or 3.75 ips speeds; less than .4% flutter; automatic self-energizing differential braking; four standard pin jack outputs; and gray and gold housings.

Complete details and specs on these new tape drives will be supplied by the company on request.

RACON 18" WOOFER

Racon Electric Co., Inc., 1261 Broadway, New York 1, N. Y., is now marketing the Model 18-HW, an 18" low-frequency speaker which can be driven by normally sized amplifiers.

Although capable of a continuous power input of 25 watts, any conventional 10 to 20 watt amplifier can be used. A patented design of floating cone results in low fundamental resonance, high compliance, and low mass. The plastic foam surround which supports the cone provides pneumatic self-damping without recourse to special amplifier output circuitry. Useful response is 10 to 1500 cycles.

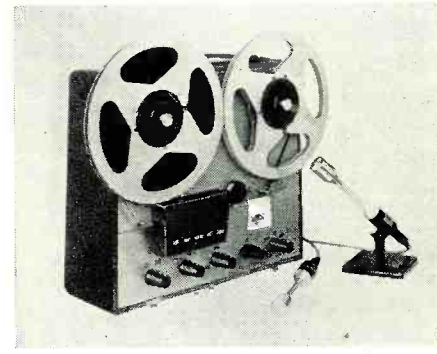
The basket is a massive aluminum casting. The magnetic structure uses a chemically pure 20-pound iron "keeper" which encloses a 5-pound *Alnico* 5DG slug magnet. Fundamental resonance is 19 cps and net weight is 38 pounds.

For free literature which includes typical enclosure and circuitry for two-and three-way systems using the 18-HW as a woofer, write the manufacturer direct.

AUDIO-VISUAL TAPE UNITS

Designed especially for the requirements of the audio-visual field, the Audio Division of *American Electronics, Inc.,* 655 W. Washington Blvd., Los Angeles 15, Calif. is now marketing a line of tape recorders to meet the need.

The "American Series AV 100" units are lightweight recorders of die-cast construction with three integral motors—one for tape drive and two for take-up. With push-button operation and safety erase interlock, the recorders accommodate reel sizes up to 10½" and are built to operate in either a



vertical or horizontal position. Speaker and amplifier units may be added to the basic recorder to provide a single case record and playback machine.

All of the recorders are designed for standard 3.75 and 7.5 ips, 60 cycle operation although 50-cycle models are available on special order. The line now includes four models, all designed on the principle of unit construction. Thus, by the addition of accessories, one model can be easily converted to any of the other three in the series.

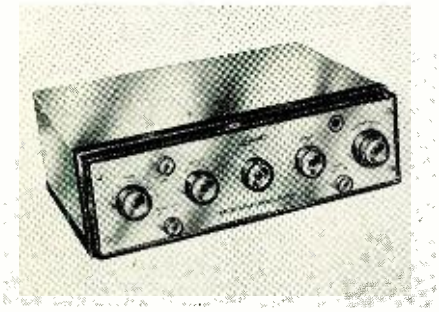
MASTER CONTROL CENTER

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. is now offering a new master audio control unit in both kit and wired form.

Functionally designed to keep pace with binaural conversion of existing sound systems, the new circuit features d.c. on all filaments for minimum hum and negative feedback. The IM distortion is below .09% at 1 volt

and harmonic distortion approximately .25% at 5 volts. There are dual cathode-follower output stages and 24 positions of equalization.

There are seven inputs on the unit to handle every type of cartridge, tuner, or tape input. Sensitivity is 54 db on magnetic input, 14 db on tuner, tape, and auxiliaries. The noise level is 80 db below 3 volt output at full gain and better than 50 db below program level at full gain with a 10 mv. input.



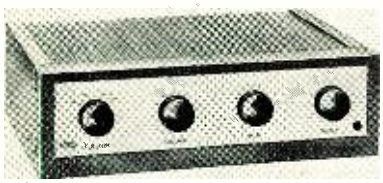
In kit form the unit is catalogued as the KT-300 and as the LT-30 in wired and tested form.

12-WATT AMPLIFIER KIT

Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City, N. Y. has added a 12-watt Williamson-type amplifier to its line of kit and wired audio instruments.

The Model HF-12 comes complete with preamplifier, equalizer, and control section which makes it applicable for any medium-power hi-fi system application. There are two low-level inputs for magnetic phono (RIAA) and tape head (NARTB); two high-level inputs for TV, tuner, or crystal ceramic cartridges; unused inputs are shorted for zero crosstalk. The d.c. superimposed on all filaments eliminates cathode-heater leakage as a source of hum.

The amplifier will handle 12 watts continuous and 25 watts peak. Frequency response is 25 to 20,000 cps ± .5 db at 12 watts. Damping factor is above 7 from 20 to 15,000 cps. Connections for 4, 8, and 16 ohm speakers are provided. The chassis measures 3⅝" x 12" x 8¼" and weighs 13 pounds.



ADJUSTABLE TONE ARM

Garrard Sales Corp., Port Washington, N. Y. has recently introduced a new transcription tone arm which is said to be the first to be completely adjustable as to length, tracking angle, stylus pressure, and height.

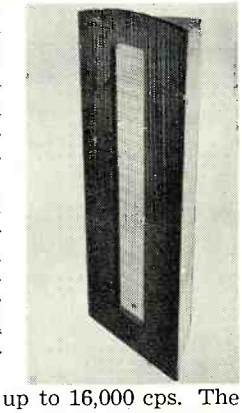
The Model TPA/10, finished in chrome and white enamel, includes a special patented protractor which lays out the recommended angle on which to align the cartridge for any arm length being used. The removable head will take virtually any type phono cartridge.

One of the key features of this tone arm is the use of the smallest possible number of pivots to reduce traversing friction to an absolute minimum. This advantage is achieved through spring-loaded, cone-type ball bearing pivots. The vertical pivot is a specially designed bearing, combining the features of a ball bearing journal suspended on a single ball thrust.

Department K-28 of the company will supply further details on request.

CORNER SPEAKER SYSTEM

Reeves Equipment Corp., 10 E. 52nd Street, New York, N. Y., is handling the U.S. distribution of a new four-cubic-foot corner loudspeaker system recently introduced by *Tandberg*.



The Model 165BK incorporates an 8-inch dual-cone speaker and tweeter with built-in crossover network to reproduce frequencies up to 16,000 cps. The unit is light enough to be mounted at ceiling level, if desired.

Available in Norwegian hand-rubbed mahogany, the cabinet measures 40" high by 21" wide by 9½" deep and weighs 27½ pounds. The rear of the corner enclosure is constructed of a one-piece ¾" plywood that features a 90 degree corner bend.

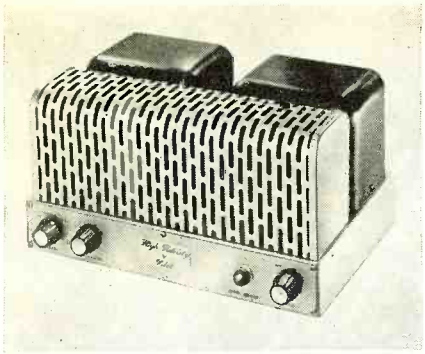
Both speaker and tweeter are driven from the same 1" voice coil. To provide high frequency response at full energy, the air gap of the magnet features a copper ring which reduces the self-inductance of the coil. The cone, which is constructed of special long fibers, is designed with a metal diffusion grille to radiate the high frequencies at a wide angle.

PILOT 40-WATT AMPLIFIER

Pilot Radio Corporation, 37-06 Thirty-sixth St., Long Island City 1, N. Y. has added a new basic high-fidelity amplifier, the Model AA-908, to its line of audio components.

Designed to furnish optimum quality of performance from all high-fidelity speaker systems, the new amplifier is rated at 40 watts continuous and 80 watts peak with harmonic distortion of .5%. Constructed on a sturdy, brushed brass finished chassis with complete tube enclosure, the unit measures 6¾" x 12⅜" x 9¼".

Frequency response is 20 to 20,000 cps ± .1 db with the speaker compensation switch in the "flat" position. IM



distortion is .9% at 40 watts, .4% at 20 watts, and .15% at 10 watts. Hum level is 90 db below 40 watts. Output impedances of 0, 8, and 16 ohms are available and a choice of damping factors (6, 2, and 1) is offered.

A data sheet covering this new unit is available without charge from the manufacturer.

CALBEST AMPLIFIER

Calbest Electronics, 4801 Exposition Blvd., Los Angeles 16, Calif. has developed a new 15-watt amplifier which is being marketed as the Model 7615.

Among its features are an integrated built-in preamp; magnetic and tape head equalization; separate turnover,

roll-off, bass, treble, and loudness controls; and adjustable five-step contour control.

Also included in the circuit are noiseless deposited carbon resistors in the preamp, a rumble filter and hum balance adjustment, and negative feedback loops over every stage. The printed circuit chassis is floating and shock-mounted.

The unit is housed in a tilt panel, brushed brass-finish, all-metal enclosure which is mounted on mar-proof rubber feet.

AUDIO CATALOGUES

"FIDELITONE" CATALOGUE

Permo, Inc., 6415 N. Ravenswood Ave., Chicago 26, Ill. has just released copies of its 1957-58 "Fidelitone" catalogue covering a complete line of phonograph needles and accessories.

A "Key" section of the catalogue uses the principle of recognition to assist the customer in selecting his new needle. It includes photographs which highlight the outstanding feature by which each needle can be identified. In addition, the catalogues carries a model number listing with direct reference to the right needle for each, a cartridge-to-needle section, and a cross reference listing, as well as a

cataloging of conventional needles and accessories.

"AUDIO FREQUENCY EQUALIZERS"

Cinema Engineering, 1100 Chestnut St., Burbank, Calif., has just released a new 16-page catalogue entitled "Audio Frequency Equalizers."

The publication includes product illustrations and two dozen charts showing response characteristics, dialogue and variable equalizer diagrams, etc. The units described provide networks which, in simplified and flexible arrangement, may be used to build up almost any type of a.f. response characteristics.

Principal use of the items covered is in the fields of industrial and scientific research, telecommunications, TV and radio broadcasting, sound recording, and motion pictures.

When requesting a copy of this new catalogue, please address letters to Manager James L. Fouch of the company.

SPEAKER DATA

Quam-Nichols Company, Chicago, Ill. is now offering copies of its new speaker catalogue listing 114 replacements, outdoor, p.a., intercom, and hi-fi speakers and rear-seat speaker kits.

Eighteen types are illustrated and the catalogue lists complete specs, including numbers, type, field, power handling, dimensions, and list prices on each unit.

"TAPE NOISE"

The problem of noise in magnetic tape recordings is covered in Bulletin 34 of "Sound Talk" now available from *Minnesota Mining and Manufacturing Company,* Dept. M7-181, 900 Bush St., St. Paul, Minn.

This five-page technical bulletin, illustrated with graphs and line drawings, tells what "tape noise" is and how it is diagnosed on a tape recorder. Among the points covered are frequency - modulation noise, drop - out noise, modulation noise causes, and erasure problems.

The brochure is available without charge.

STEREO EQUIPMENT

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. has released a four-page sheet listing the stereo equipment and accessories it stocks for audiophiles.

Pictured and described are the firm's own stereo tape playback system with *Viking* tape deck; a stereo conversion component kit, a complete binaural FM-AM radio and tape system, stereo tape playback system with binaural amplifier, individual stereo recording components, stereo recorded tapes (*RCA Victor, Westminster-Sonotape, Bel Canto*), conversion kits, tape demagnetizers, complete stereo tape recorder models, and binaural amplifiers and FM-AM tuners.

Write Dept. SA-63 of the company for a copy of this new flyer. —30—

Pictures on a Flat Panel

(*Continued from page 55*)

can be used: "The only limitation is the color of the phosphors used." Present development of the *Sylvatron* panels has been carried on as a co-operative project by the General Engineering Laboratories of the manufacturer, located in Salem, Mass., and the Lincoln Laboratories of the Massachusetts Institute of Technology. With samples of the panels being made available to other interested manufacturers and laboratories, the opportunities for further developments are increased many times.

If some form of these panels is eventually evolved for use in monochrome TV receivers, the complete task will not end with the availability of the panel itself. Receiver circuitry, particularly with regard to presently used deflection methods, will have to undergo radical alteration. It is not expected that the panels will lend themselves to use with devices akin to present deflection yokes.

Among observers at the demonstration not connected with the *Sylvania* organization, there was considerable speculation on how presently transmitted synchronizing pulses could be used to provide scan across an electroluminescent panel. The feeling was that there are several methods to pick from, but whichever one was chosen would have to undergo considerable circuit development.

In one method, the electrically conductive horizontal strips coated on the back of an electroluminescent panel would correspond roughly to the raster lines. The vertical deflection voltage would be applied to a graduated delay line, which would be a vertical strip along one side of the panel (or two such strips, one on either side of the panel). In this way, the horizontal strips would be successively excited from the top of the screen to the bottom, in step with the video information transmitted for each line. In like manner, horizontally placed delay lines at the top and bottom of the panel would control a series of vertical strips running from left to right across the flat screen, and horizontal deflection across the panel would thus be obtained.

To produce color pictures, a technique similar to that used in the single-gun *Lawrence* tube might be successful. Alternating horizontal color-phosphor strips could be controlled by a series of electrically conductive strips behind the screen. The latter series of strips would replace the grid-wire structure now used for post-acceleration deflection.

Although application to flat-screen TV must remain speculative for the present, *Sylvania* foresees early use in radar displays, air-traffic control boards, tracking devices, computer memories, and computer readouts.

—30—

All About Audio

(*Continued from page* 68)

Apart from mass, it is the inductance of a voice coil which causes the rise in impedance as the frequency goes up. For a given resistance, the inductance of an aluminum coil is about 30% less than copper. It was shown by Dr. Olson that the inductance in the voice coil can be reduced by covering the center pole of the magnet with copper. *Philips* has recently produced an interesting 8" speaker with a center pole design as shown in Fig. 21.

With this arrangement there is some loss of flux density as it is obviously necessary to reduce the diameter of the center pole to make room for the layer of copper. If this is .010" thick the magnet gap must be increased accordingly. On a 1" center pole with a given magnet this would reduce a 13,000 gauss magnet to about 12,000 gauss.

Another method of avoiding undue rise in impedance is to use a powerful magnet and saturate the pole tip; this is costly but it retains the benefits of high flux density, and has been adopted in one model by *Goodmans*.

Table 1 shows the rise in impedance between 400 and 15,000 cps with the various systems which have been discussed; broadly speaking, the improvement is in each case related to cost, but the aluminum coil is by far the cheapest device.

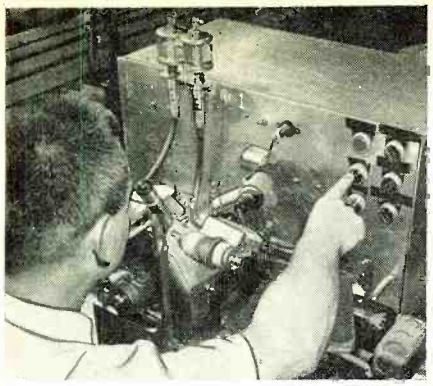
It is nearly ten years since I wrote the following in a little book:

> "Whereas response curves vary enormously according to the method of taking them, and may even require a pinch of salt to aid digestion, an impedance curve at a given volume level can be accepted as a statement of fact."

These words are just as true today as they were then. A perfect loudspeaker would be one which looks like a pure resistance at all audio frequencies. The basic weakness of the electrostatic device is that, from the point of view of matching the amplifier, it looks like nothing on earth. Before Messrs. *Janszen, Pickering, Leak,* and *Walker* draw their revolvers and start shooting, I hasten to add that I am not insinuating that good and proper transfer of power is impossible; I only say it is a pity it is not easier and simpler to do. As it is not just a question of impedance, I have asked my colleague Mr. Cooke to draw up a summary of the problems involved, so that we can open Part 6 in the select company of the electrostatic speaker. *(To be continued)*

Table 1. Impedance of speakers discussed.

TYPE	IMPEDANCE (at 400 cps)	IMPEDANCE (at 15,000 cps)
8" (copper coil)	13 ohms	63 ohms
8" (aluminum coil)	8 "	18 "
12" (copper coil)	14 "	61 "
12" (aluminum coil)	14 "	33 "
8" (copper ring)	6.3 "	10 "
8" (less copper ring)	6.3 "	28 "
8" (saturated pole)	16.5 "	24.5 "



Diamond grinding machine automatically forms and polishes cone-shaped styli.

Diamond Needles Produced Automatically

Mass-production techniques result in 40% price cut.

THE first process for automatic manufacture of diamond phonograph styli was announced recently by *Walco Products, Inc.,* East Orange, N. J. The effect of the "push-button" process is an immediate national retail price cut of 40 per-cent on the company's diamond needles. Because of the price reduction, it is expected that an increased market will exist, particularly in medium priced hi-fi assemblies. Quality of the needles is also said to be noticeably improved by the new process, which steps up production by 20 times and almost completely eliminates rejects.

The key to *Walco's* new process, which makes automatic finishing possible, is a technique of bonding the diamond tip to a steel shank. The electronic fusing method used eliminates the possibility of motion or slippage once grinding begins. Next, the shank is inserted in a grinding machine which shapes the point. Here a push-button operation replaces the old hand operation, increasing accuracy and reducing wear on the diamond polishing wheel. The machine adjusts to the proper pressure automatically. Each tip is microscopically examined by the operator at the completion of this step.

In the final step, a third push-button machine takes over for the final polishing operation. Here use is made of ultrasonics to produce finished diamond needle tips that are held to their final radii within one ten-thousandth of an inch accuracy.

Price reductions from other manufacturers of diamond phonograph styli are also expected to increase the sale to hi-fi enthusiasts. —30—

Electronic Turntable Drive

(Continued from page 43)

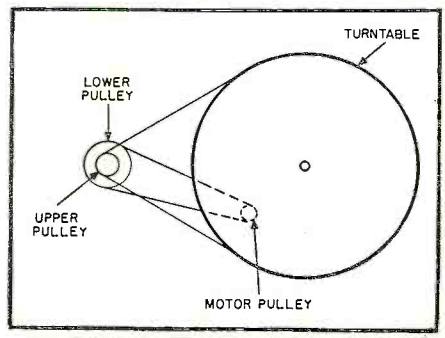
Fig. 1 shows some of the features of the turntable drive itself. The casting has been designed for the greatest possible dimensional stability through the use of a 5-part webbing. The space between the I-beam-type webbing is filled with "Densite," which serves the double purpose of providing additional mass for greater flywheel effect and of eliminating objectionable turntable ringing.

Many of the mechanical features are worth noting. The motor is suspended in a cradle by extremely flexible mounts. These mounts are spherical and by the selection of proper mass for the motor mounting, the natural frequency of the motor suspension is brought down to about 6 cps. This low natural frequency, together with a choice of mounting angles to counteract the principal modes of motor vibration, results in an over-all reduction of vibration transmission of 40 db. This very effectively isolates the motor from the frame and since the motor vibration itself is of a very low order, rumble due to this cause can be said not to exist for all practical purposes.

The motor is connected to the table through two belts; one of which is a special elastomer-impregnated belt whose properties are so chosen that it maintains correct tension and serves as another stage of vibration isolation. The last vestiges of vibration (which means "rumble" to the user) are removed by the elastic mounting of the idler pulley bearing. Through such design practices, rumble is so low that if any rumble is heard the chances are very good that it is on the *record itself*, not in the table. Even specially made experimental "patched" belts running over this system did not produce any audible effects.

The two-belt system also makes possible the use of a driving pulley of adequate size at the motor shaft. Since the speed of the turntable and motor are in direct ratio to the sizes of the flywheel and motor shaft, it will be seen that for an 1800 rpm motor and 33⅓ rpm turntable, the ratio is 54:1. This means that if the flywheel had a diameter of 10 inches, the diameter of the capstan would have to be less

Fig. 3. A two-belt system is employed between the motor pulley and turntable.



than ⅛ inch. Such a small diameter is very difficult to hold to accurate tolerances and is too small for good driving properties. With the arrangement shown in Fig. 3, the speed reduction is accomplished in two steps, hence the driving pulley can be 0.5 inch in diameter. The adhesion of the belts for these pulley surfaces is so great that there is no slippage in the ordinary sense of the term.

The main bearing is of Babbitt, rifle drilled. The bearing in the intermediate pulley is of Teflon, well known for its remarkably low coefficient of friction and for smoothness of operation. Adjustment of belt tensions is done by rotation of the eccentric mount of the intermediate shaft and pulley assembly.

There is, of course, always the hazard with any electronic gear that a tube or component may fail, and this is equally true of this equipment. However, the design provides for operation at 33⅓ rpm with a 60-cycle source and in case of tube failure it is possible to operate the table directly from the power line by changing an easily accessible plug. In such cases the operation is just as accurate, but of course only one speed is available and this speed is synchronous and non-adjustable.

The turntable construction resembles amplifier design practice in that it is built on a heavy steel chassis. This chassis supports the main bearing well in a very rigid manner and is made even more rigid by having the main bearing shaft end screwed firmly to the bottom plate. This construction, in addition to the re-inforcement at various points, results in an extremely strong structure, resembling a truss or unitized automobile's structure, and exhibiting no resonances which could be excited by motor vibration. Because of this and the very large amounts of isolation provided, it is impossible to feel any vibration in the frame while the turntable is in operation.

The introduction of this new table means that everybody can have hi-fi sound, including people in remote places; in parts of Europe and other countries where line frequency is not very dependable; owners of yachts or large boats who have their own generators or must use a storage battery; people living in a d.c. area (a motor-generator or other type of a.c. converter is needed for 110 or 220 volts d.c.) and many others who at present are unable to enjoy the advantages of modern high-fidelity equipment. It is the first turntable which can be taken to any part of the world and operated on any frequency without adjustment or modification of any kind. For conventional use, it provides excellent performance, with a rated maximum flutter content of 0.1% r.m.s. and a maximum rumble content of 45 db below 7 cm./sec. peak recorded velocity at 500 cycles, measured according to professional standards as specified by NARTB. —30—

Scientists Watch and Listen to the Sky

Summary of parts played in the IGY program by four agencies of the Department of Commerce.

DURING this International Geophysical Year scientists of the Department of Commerce will seek answers to many questions, particularly about what goes on in the 93 million miles between the earth and the sun.

Is the world getting gradually warmer because the proportion of carbon dioxide in the air is increasing? Are there electric streams high above the earth similar to the jet streams that aviators encounter in the lower atmosphere? And what shape do they take? What can be learned from the "whistlers" and the frog-like "dawn chorus" in radios? Can television and FM broadcasts be bounced off a lofty layer of electrified air to distant points? Just how do sunspots and their opposites, solar flares, affect magnetic storms?

The United States National Committee for the IGY, which was organized by the National Academy of Sciences, will look to three scientific bureaus of the Department of Commerce for substantial contributions on three of the earth sciences to be studied during the year. These are: the Weather Bureau, for meteorology; the National Bureau of Standards, for ionospheric physics; and the Coast and Geodetic Survey, for geomagnetism.

The Weather Bureau is interested in the part of the lower atmosphere that is dense enough to be called air. The National Bureau of Standards and the Coast and Geodetic Survey look at the electrical phenomena induced by activity of the sun, but examine them from different points of view.

In their observations, the three bureaus will cooperate with many other U.S. agencies and with scientists of over 60 foreign countries.

Of the $39 million appropriated by Congress for the IGY, the National Academy of Sciences has made available more than $5.9 million to the three bureaus. Like other government agencies, they will also contribute existing equipment and part of the time of hundreds of regular employees.

A fourth agency in Commerce, the Civil Aeronautics Administration, will transmit IGY messages over its domestic and foreign circuits.

Weather Around the World

United States studies of meteorology during the IGY will center in the Weather Bureau. Through its regular organization and at IGY stations near both Poles, it will examine what the air is made of and how it moves.

Meteorologists are interested primarily in the lower atmosphere, rather than in outer space. High altitude balloons will gather data for 15 or 20 miles above the earth's surface. Rockets will probe even higher—up to 80 or 100 miles.

Some scientists believe that the earth's climate is gradually warming because the amount of carbon dioxide in the air is increasing. At Little America air samples collected in glass flasks at various stations will be analyzed to see how much carbon dioxide they contain. Ozone is another substance to be measured in Antarctica and elsewhere.

The Weather Bureau is running a "weather central" at Little America and has observers at five other antarctic stations. Some of the work will be done jointly with the U.S. Navy and with meteorologists of other countries. The upper air will be explored every twelve hours by high-altitude balloons equipped with "rawinsonde" — little transmitters that report pressure, temperature, humidity, and the speed and direction of the wind. These are capable of reaching average heights of more than 80,000 feet.

One important Weather Bureau project is the taking of observations at the Mauna Loa observatory, Hawaii, 11,134 feet above sea level. Three men, to be on duty there throughout the geophysical year, will take advantage of the clean, dust-free air and the elevation to study solar radiation and the chemical make-up of the air. They will also collect micrometeorites—metallic particles smaller than grains of sand.

It is planned that all 105 stations equipped with rawinsonde will send up the balloons twice a day. The network includes arctic stations operated jointly with Canada, eight national hurricane research project stations in the Caribbean, and all the others in the United States, Alaska, and the Pacific.

NBS and the Ionosphere

The National Bureau of Standards, through its Boulder (Colo.) Labora-

tories, is aiming its instruments at the ionosphere, a region of electrically charged gases from 25 to 250 miles above the earth. The ionosphere serves as a reflector for radio waves, making possible long distance transmission between such points as New York and London.

The NBS will also operate the IGY World Warning Agency from its radio forecasting center at Fort Belvoir, Va.

The Bureau has long studied the ionosphere in order to issue its regular predictions of radio "weather" for the information of broadcasters, aviators, mariners, and the armed forces.

Careful observations of the ionosphere will be taken during the IGY from Antarctica, where they have rarely been made before. Scientists are particularly curious as to the composition of the ionosphere over the South Pole, where the sun's rays—which are believed to create it—are absent during the long antarctic night.

Sometimes television and FM signals are reflected spasmodically and erratically back from highly ionized patches in the ionosphere, over distances of more than 1000 miles. This phenomenon is called *sporadic-E* from its uncertain nature and the fact that it is reflected from that layer. To study sporadic-E, NBS will operate circuits in the Far East, South America, Caribbean, and the United States.

With the cooperation of South American laboratories, NBS will experiment across the magnetic equator with a form of such reflection called *forward scatter*. The broadcasting industry is interested in the possibility of sending TV and FM for long distances in this way. Experimental signals have been ricocheted off the E and F layers for as far as 1200 miles.

Seven very-high-frequency radio stations have been set up for the study. They will transmit northward toward Central and North America and eastward across South America.

Forward scatter has been studied at arctic, sub-arctic, and temperate latitudes, but never before near the equator. The magnetic equator does not coincide with the geographical equator, but roughly parallels it.

Near Boulder, NBS has stretched a steel cable for 3400 feet over Four Mile Creek Canyon, under 9000 pounds' tension. This will serve as an enormous antenna to catch radio noises known as *whistlers* and the *dawn chorus*. Whistlers are weak signals originally generated by lightning and reflected back and forth between the northern and southern hemispheres. The radio wave is a mixture of tones that arrive at different times and create a descending whistle effect. They travel at heights up to 25,000 miles.

Other radio chirps that ascend in pitch, resembling the sound of small frogs, earned the name of "dawn chorus." NBS will operate two whistler stations in the world-wide chain of 26.

NBS has set up sixteen *radio noise* recording stations around the world.

In continuous operation, they will listen to the crackling of the 50,000 thunderstorms that occur every day on earth and to some man-made sounds.

The Boulder Laboratories and a chain of cooperating foreign and domestic stations will record the intensity of airglow, a faint night sky luminescence that is believed to be related to the aurora. It is so dim to the human eye that it is rarely seen. Telescopic photometers developed at Boulder have shown that airglow consists of infrared, red, and green light emitted by oxygen atoms and yellow emitted by sodium atoms. The Bureau will operate two stations and has supplied five photometers to others in the American chain of thirteen stations.

Scientists of the NBS and others in many countries will keep a special watch on the sun for flashes of sunspots that may create disturbances in the atmosphere. Part of the watch will constitute a radio noise patrol of the sun.

From the *World Warning Agency* at Fort Belvoir, Va., messages will radiate throughout the world to notify scientists of periods of unusual activity in cosmic rays, aurora, earth magnetism, and radio disturbances. At such times, more intensive simultaneous observations will be made at many points on the earth.

Coast and Geodetic Survey

The Coast and Geodetic Survey will conduct most of the United States magnetic studies for the IGY. Since 1843 it has made observations of the earth's magnetism in order to show on mariners' and aviators' charts how the direction of the compass needle varies. The strongest forces making up the geomagnetic field come from deep in the earth, but it is the hourly and daily fluctuations caused originally by the activity of the sun that are the subject of the IGY studies. Special attention will be given to the wide disturbances known as magnetic storms and the relationship between magnetic effects and weather will be examined. Observers will also accumulate data bearing on the nature of an electric "jet stream" that appears during daylight hours in the region of the magnetic equator.

CAA Communications

The Civil Aeronautics Administration will put the alerts and notifications of "special world intervals" on its domestic and overseas circuits. The CAA and Weather Bureau stations on the domestic teletype circuits (the recipients total 500) will relay the messages to those IGY observation posts that do not receive them directly. By CAA radio, the messages will go as far as the Azores, Peru, and Australia, whence they may be passed on wherever the foreign receiving stations think advisable.

All in all, this joint scientific effort is a tremendous undertaking which will increase man's knowledge of his world and what surrounds it. —30—

Sound on Tape

By BERT WHYTE

FOR the last couple of months I've been trying to dig out certain data on stereophonic sound, and have I had a hard time! The confusion and lack of integration in stereophonic literature is most disheartening for any would-be researcher in the field. It seems apparent that stereophonic music reproduction is finally "getting off the ground" and in view of this and with an appreciation of the great potential of this medium, it is high time the stereo house was "put in order." There should be a general compilation of all pertinent data in the stereo field and the establishment of a reliable and efficient cataloguing system and last, but hardly least, the data should be readily available. Who is going to do this? I dunno, pal, but stereo is as yet such a stripling and there is still such a great deal of work to be done, that some form of integrated stereo information is fast becoming a necessity. Thus having rid myself of this gripe, I can tell you that I managed to cull enough material to begin the promised series of articles on stereo.

Before getting into the heart of the matter, however, we would like to set the scene, so to speak. By common consent these days, the word "stereo" is being used to designate two-channel sound which is reproduced over two separate amplifier-speaker systems. The term "binaural," on the other hand, has been more or less reserved for use in referring to two-channel sound which is reproduced through headphones. Actually, the term "binaural" (literally "two ears") applies to both forms of two-channel listening but to distinguish the two, let's have a tacit understanding on the terminology. If we have gotten that much agreed upon, on to the not-so-unanimous area.

In dealing with something as complex as stereo perception, you must understand that much of the material is highly controversial. A great deal of the theory of stereo perception was based on empirical observation and comparatively little by demonstrable experiment. In this lamentable situation, what is bluntly refuted in one school of thought is just as eagerly accepted in another, and *vice versa, ad nauseam*. So, faced with this, we must perforce generalize and take what seems to be a reasonable cross-section of opinion.

Stereophonic sound has been with us much longer than most people think. The first and some of the finest experiments with stereophonic and binaural sound were the famous *Bell Telephone Laboratories* series in the

early 1930's. In cooperation with Leopold Stokowski and the Philadelphia Orchestra, *Bell* scientists transmitted, over specially equalized lines, *3-channel* stereophonic sound from Philadelphia to an audience in Washington, D. C.! The *Bell* people spared nothing in obtaining full frequency response in their system. Special microphones and amplifiers were constructed . . . in Washington were three gigantic speakers capable of reproducing the full frequency and dynamic range of the music. The affair was a howling success!

One would think that in view of this success, we should have had stereophonic sound in our homes for many years. After all, that was nearly 25 years ago! Surely, it could have been brought from the experimental stage to a product for home use in all that time. Alas and alack! In those days there was no reproducing medium capable of multi-channel transmissions. No AM/FM combos, no magnetic tape and even the bright boys at *Bell* gave up on the mechanical difficulties of a vertical/lateral monogroove stereo disc. And there was the question of money. That little Philadelphia-Washington stereo transmission cost a cool $50,000!

Other *Bell* experiments were undertaken, one of the most interesting being "Oscar," the binaural dummy. This was a full sized dummy or manikin in which they placed a microphone in each ear. Each microphone was connected to its own separate amplifier and separate earphone. Thus wherever "Oscar" was placed, his two separate microphones became an extension of the listener's ears and, in the acoustic sense, you were literally "sitting" wherever "Oscar" was sitting. This binaurality of hearing, simulated by the microphones and earphones, allowed for the precise localization of a given sound or sounds, allowed aural discrimination among multiple sound sources, allowed one to "hear the air" around an orchestral sound, to pick up in their proper aspects the combined effects of hall reflection and reverberation. "Oscar" was placed on exhibition at the Chicago World's Fair and the public was invited to don earphones to hear what "Oscar" was hearing.

Yessir, binaural sound 16 years before *Magnecord* burst on the scene with a practical binaural recorder. One interesting and significant result of the "Oscar" experiment was that when people were invited to listen to music through "Oscar's" binaural ears and were also allowed to hear loudspeaker binaural, almost all of them preferred the earphones! There is no denying the fact that earphone binaural sound is still the closest approach to "concert hall realism" and I personally feel that there is a large potential market for binaural sound awaiting proper exploitation and promotion.

Much was learned from the *Bell* experiments and they contributed

mightily to subsequent workers in the field. I have had the pleasure of meeting Mr. Chester Snow, one of the *Bell* engineers in the original experiments and his discussions on stereo were both fascinating and enlightening. As he pointed out, experiments are generally not for the sake of publicity, but an effort to find out the whys and the wherefores. Out of the *Bell* experiments and the welter of subsequent experimentation, observation, and theorizing, there has emerged this general view. The phenomenon of stereo perception seems to be a combination of: 1. Differences in time arrival or phase relation at each ear from a given sound source. 2. The differences in sound intensity measured in decibels at each ear from a given sound source. 3. Frequency bandwidth and transient response. This latter point has become increasingly important and next month I will give a detailed report on it and its relation to the other two phenomena.

Mercury's long anticipated entry into the recorded stereo tape market, was official as of the 15th of July. It is generally felt that as the second major company to enter the field, *Mercury* will act as sort of a catalyst and the other big boys will soon follow suit. *Mercury's* initial release is quite impressive. Six reels are devoted to the pop/jazz category and another six reels of classical works from its famed "Olympian Series." *Mercury* was kind enough to furnish me with advance copies of the classical tapes and I can tell you that sensational is a very mild term for them. They are nothing short of astounding and I can safely predict that these tapes will have as profound an effect on the stereo tape market as the first "Olympian" disc, "Pictures at an Exhibition," had on the record market. These tapes are deserving of detailed analysis and since space is short this month, I'd rather postpone my reviews until next month. So watch for reviews of such mouthwatering plums as Dorati conducting Kodaly's "Hary Janos." Paray conducting the "Carmen Suite" and L'Arlesienne Suite #1, Hansen conducting Carpenter's delightful, "Adventures in a Perambulator," Barbirolli conducting Strauss Waltzes, Weldon conducting the terrifying "Night on Bald Mountain" and the "Gayne Ballet," and, last but not least, the thunderous roar of the world's biggest ballroom organ at Atlantic City!

LISZT

PIANO CONCERTO #2 IN A MAJOR Alfred Brendel, pianist with Pro Musica Symphony, Vienna, conducted by Michael Gielen. Phonotapes stereo S-702, 7" reel, 7½ ips. NARTB tape curve. Price $11.95.

Phonotapes makes its long-anticipated entry into the stereophonic recorded tape field with this brilliant version of Liszt's 2nd piano concerto. Let me say right from the start, that if all subsequent stereos from *Phono-*

tapes are as good as this one, we are in for some wonderful musical treats. Believe me, one listen to this tape and you'll know why stereo makes any true music lover literally flip! I haven't the foggiest notion about the background or reputation of either the pianist or the conductor. Frankly, I don't care. Perhaps at a less emotional time, I shall reflect that the pianist was a bit heavy-handed and that the conducting was somewhat mechanical. However at this precise moment, having just listened to the tape, I can do nought but bubble with enthusiasm. No matter how great a performance of this work you can find on a monaural disc, it can't possibly match the excitement generated by this stereo.

At first listen, one is certain that the recording is overbalanced in favor of the piano. Then when more of the orchestration makes itself obvious, you realize that there is nothing wrong with balance but that the sound projection is very much forward. The engineers have accomplished the neat trick of combining spacious hall reverb with a maximum of instrumental definition. This is the biggest-sounding piano you have ever heard . . . especially in the piano bass where it resounds and resonates as if it were in your listening room. It spite of its power it is ultra-clean, liquidly beautiful in tone, sharply and brightly percussive when the score demands. With all the startling clarity, there is no transient harshness nor ringing and, amazingly enough, even the hammer-action noise is subdued. All other orchestral elements, brass, woodwind, and percussion are sharply etched and clean-sounding, with the strings taking a special bow for their smoothness on one hand and their crisp incisive bite when needed. If you want to hear some string sound with almost unbelievable "presence," listen to the first 10 or 12 bars of the *listesso* tempo, which is the second part of this one-movement concerto.

Directional effects here were good with the piano just "left of center" most of the time. I say this because this tape was subject to that strange and not fully explained phenomenon, wherein solo instruments like the piano and violin occasionally wander from their "fixed" position and are heard in the right-hand speaker. Some people feel this is a phasing problem in multi-speed tape duplication. Whatever the cause, it is an infrequent happening and not too disconcerting. An exceptionally wide dynamic range adds to the realism of this tape and as played through my *Ampex* I could not discern any wow or flutter, and it conformed perfectly with the NARTB recorded tape playback equalization standard.

Phonotapes has a cute gimmick at the start of the tape before the music begins . . . they have recorded a 250-cycle tone which is a convenience in obtaining the proper balance between the two speakers. The only trouble is that the duration of the tone is but 10

seconds, and brother, even movin' like a ball o' fire, it jest ain't long enough! All in all, a mighty impressive stereo tape and an auspicious debut for *Phonotapes*.

FRANCK
SYMPHONIC VARIATIONS
P. Entremont, pianist, with Netherlands Philharmonic conducted by C. Bamberger.

GERSHWIN
VARIATIONS ON "I GOT RHYTHM"
Sondra Bianca, pianist, with New Symphony Society Orchestra conducted by Walter Goehr. Concert Hall stereo CHT/BN-31, 7" reel, 7½ ips. NARTB tape curve. Price $11.95.

Concert Hall Society made a big splash in the stereophonic tape field some time ago, announcing a large and varied catalogue that excited the interest of many stereophiles. Unfortunately, like many new ventures, there were bugs that cropped up and *Concert Hall* really had its teething troubles. The main problem seemed to be tape duplication, for whoever did their first batch pulled some horrendous booboos. This Franck/Gershwin tape is one of a number of newly mastered, newly dubbed tapes sent to me by *Concert Hall* and after having listened to it and most of the others, I think they can, as a general rule, be considered good stereophonic tapes. I say "general," because unhappily, in one of the tapes the old problems persisted. It is entirely possible of course, that somehow one of the old troublemakers was included in the new batch of tapes.

In the Franck "Variations," young Philip Entremont gives a sparkling, scintillant reading, displaying the facile techniques, beauty of tonal production, and forthright musicianship which prompted *RCA Victor* into signing him to a recording contract. They are touting Entremont as one of the most polished and accomplished of the younger generation of piano virtuosi, and after hearing him on this tape I have no reason to disagree. Bianca, the pianist in the Gershwin "Variations," is not of the stature of Entremont, but she gives us a fine idiomatic reading of the "Variations." She has a flair and a feeling for the jazzy complexities of the score and, praise be, never sounds stodgy and mannered as many Europeans do when they encounter Gershwin.

Good forward projection of the sound in both works, generally very clean, with spacious acoustics and finely etched detail. The Gershwin "Variations" are scored in a fashion that makes for some sensational display of directionality as well as having much interesting writing for percussion. Piano sound in both works is smooth and bright, with pristine transients and no noticeable wow or flutter. The orchestral elements are equally well recorded and hi-fi fans will delight in the rousing brass and percussion of the Gershwin "Variations," augmented in realism by the very wide dynamic range. There was

some tape hiss present but not to an annoying degree.

BRAHMS

SYMPHONY #4 IN E MINOR
Frankfort Opera Orchestra conducted by Carl Bamberger. Concert Hall stereo CHT/BN-33, 7" reel, 7½ ips. NARTB tape curve. Price $11.95.

Carl Bamberger seems to be a good competent conductor, who gives us a fairly straightforward, unmannered, no-nonsense performance of the Brahms 4th. His orchestra is not one of the world's great ensembles, but they play with admirable precision and commendable zeal. In other words, this is not a performance of the Brahms 4th symphony that is earth-shaking. It certainly could not displace the Toscanini or Walter or several other performances in our affections. Now having made those statements, let me tell you that in spite of these handicaps, the stereo has worked its usual magic and this is about as big and exciting a Brahms 4th as you could want. Admitting that a critic's perception is surely dulled by the intoxication of the stereo, until a great conductor and great orchestra gives us a great stereo performance, I'll favor this tape over any of the versions on disc. True, with repeated listening may come some disenchantment, but as of now I'm enjoying it immensely!

The sound throughout is very big, very clean, and wide in dynamic range. This is a hugely rich, concert hall sound, recorded at the right perspective where spaciousness and detail are in happy balance. If you are looking for directionality, this kind of repertoire is not very productive in that respect. I repeat again that while directionality as a function of the scoring adds its own particular fillip of realism, it is not the be-all end-all of stereo reproduction. The beauty of stereophonic sound in the classical repertoire is its innate ability to sharpen detail, to clean up instrumental definition, especially with many scores which are very thick-textured and turgid.

This, then, is a fine stereophonic recording which preserves the essential solidity of the orchestration, while spicing it with sparkling detail almost impossible to find in any disc version.

MOZART

SYMPHONIES #18 AND #21
Philharmonic Symphony of London conducted by Erich Leinsdorf. Sonotape SWB8018, stacked stereo, 7" reel, 7½ ips. NARTB tape curve. Price $11.95.

This is early Mozart and played the way it should be . . . light, airy, ebullient, never heavy-handed. This is a remarkable tape for a study of Mozart. The stereo opens and reveals facets of orchestration impossible to perceive in a disc recording. It all sounds so simple and refreshing, but the probing stereosound gives heightened appreciation to the subtle delicate tracery of detail in string passages, nuances of bowing, the clever phrasing, the immaculate instrumen-

tal balance. This is Mozart lucid, understandable. This is Mozart for people who say they do not like Mozart. All orchestral elements are clean and brightly articulate. Acoustic perspective is that seemingly impossible blend of close-up, detailed recording with sufficient hall reverb to lend roundness and presence. Stereo spreads the orchestra nicely, adds a *soupçon* of directionality here and there for sparkle. No appreciable "hole-in-the-middle-effect" and good signal-to-noise ratio were added virtues. Altogether an outstanding job. —30—

STEREO DEMONSTRATION TAPE

TWO of the most difficult problems which face the user of stereo tape equipment are head alignment and correct volume level balance between the two separate amplifier-speaker systems. Despite factory balancing and alignment, every now and then the over-all performance of the system has to be checked for quality. The only way this can be done satisfactorily is by use of one of the commercially available test tapes.

One such tape, recently introduced to the market, has been issued by International Magnetic Electronics Company (IME) specifically for test purposes. Although the company emphasizes that it is intended for use in aligning its magnetic head conversion units, the tape can be used with any make of stereo head. It is a 7½ ips tape whose running time is relatively brief. It includes a 5000 cps tone for head alignment. The head is then adjusted for maximum output.

The tape also includes a means of determining the two separate channels, left and right. At the same time it supplies a tone that is used to obtain a proper balance between the two sections in the system. The tape concludes with a short musical selection played by the Chicago Symphony Orchestra.

The reel is $2.50 at jobbers or direct from IME, P. O. Box 987, Minneapolis 1, Minn. —30—

FREE ADVISORY SERVICE

BECAUSE of the complexity of modern music systems and the various modes of tape operation, Viking of Minneapolis has come to the rescue of the harried audiophile by establishing a "Customer Service Department" which will provide specific information as to equipment recommended and the interconnections possible to permit use of Viking tape equipment to best advantage with existing or projected music systems.

Customers using this service should include with their queries complete information as to the model and year of their preamplifiers, mixers, tuners, power amplifiers, etc. and state the types of tape operation desired, i.e., monaural recording and playback, stereo play, stereo play and monaural erase-record, etc. It is requested that, wherever possible, rough diagrams showing electrical connectors (inputs and outputs) to preamplifiers, tuners, and power amplifiers be included along with the inquiry.

Requests for this assistance should be addressed to Viking of Minneapolis, c/o Customer Service Department, 9600 Aldrich Ave., South, Minneapolis 20, Minn. The service is free but the information requested must apply to the company's tape equipment. —30—

Standard Frequency Broadcast on 60 kc.

Permits measurements of extreme accuracy and may lead to improved standards.

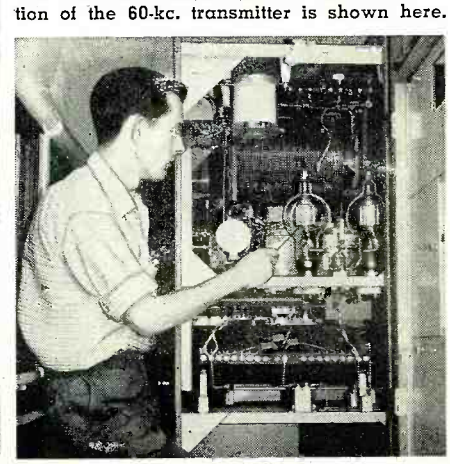
AN EXPERIMENTAL 60-kc. standard frequency broadcast from the Boulder (Colorado) Laboratories of the National Bureau of Standards, is opening up several interesting applications, some of which are already in use. The station is operating under the call sign KK2XEI.

The low-frequency signals are not subject to the limitations of the regular standard broadcasts at high frequencies (2.5, 5, 10, 15, 20, and 25 mc.) which are susceptible to changes in frequency as they travel away from the transmitting antenna. These changes, caused by disturbances in the propagation medium, are sufficient to make the high-frequency broadcasts unsuitable for many applications, including rapid drift measurements of precision quartz resonators, comparison of frequency standards, and accurate time measurements at two widely separated points.

Several investigators, among them Prof. J. A. Pierce at Harvard University, have shown that for frequencies below 100 kc. and for distances of over 3000 miles it requires only about 10 minutes to compare local frequencies with standard frequency transmissions to within 1 part in a billion. This is an improvement of more than 100 over what can be obtained at high frequencies. Prof. Pierce has determined that a high-accuracy standard frequency service can be given for all the world on a single very low frequency from a single high-power transmitting station.

Tests with the experimental low-frequency standard broadcast will probably lead to possible ways of improving the already existing standard frequency broadcast services. —30—

The 2000-watt output power amplifier portion of the 60-kc. transmitter is shown here.



Certified Record Revue

(*Continued from page 50*)

Soundwise this is hugely proportioned, with superb clean strings, woodwind of full and rich intonation, brass of deep sonority and heavy brazen tongue, percussion sharply etched and of great impact. Recording is close-up for sharpness of detail, yet the acoustics were spacious and afforded a fine sense of liveness. For a prime example of this technique, listen to the first bassoon writing in the second movement. This is exciting Tchaikovsky, full of the devices (and clichés, if you must) that have endeared his music to so many. In this brilliant reading and resplendent recording, this work should gain many new supporters.

DVORAK
CELLO CONCERTO
FAURÉ
ELEGIE FOR CELLO AND ORCHESTRA
Janos Starker, cellist, with Philharmonia Orchestra conducted by Walter Susskind. Angel 35417. RIAA curve. Price $3.98 (standard package).

This incredibly beautiful concerto is the goal of all cellists. Mastery of this work does not come easily and few cellists have been afforded the honor of recording the score.

This latest offering by *Angel* may well be the most satisfactory ever issued. It has Janos Starker as cellist . . . that amazing virtuoso whose great rich tone and impeccable technique made recording history with the Kodaly "Sonata" some years ago. Since then Mr. Starker has been first cellist with the Chicago Symphony and has concertized extensively. This is a dedicated artist whose loving perusal of this score makes of it a thing of lambent beauty. The lush richness of his cello speaks to us with the deepest expression. Here is the true artist completely *en rapport* with the wishes of the composer. Competition he has from the great Pablo Casals and Fournier for these, too, are great artists as warm and as human, but Starker goes them one better in his understanding of the score and in his lucid exposition of this interesting work.

The appreciation of his tonal productivity is heightened by the superb sound Starker is afforded. Here his cello is vibrantly alive, a soaring clean tone without buzz or rasp. High frequencies he produces smoothly without protesting rosin squeal, low frequencies are dark throbbing, hugely resonant outpourings of pure tone. Susskind furnishes a sympathetic accompaniment and elicits some splendid playing from the Philharmonia Orchestra. The balance favors the cello somewhat but not seriously and the recording is close-up . . . so much so that you can hear the bow strokes "pre-echo" before the tone is actually produced. Ultra-realism and some people probably won't like it. Acoustics have been made spacious to offset this somewhat and to lend liveness. Wide frequency and dynamic range and quiet surfaces were notable.

The Fauré is intensely brooding and melancholy, another fitting vehicle to display Starker's remarkable talents. If you are a cello enthusiast you can't afford to miss this one!

PARAY
JOAN OF ARC MASS
Frances Yeend, soprano; Frances Bible, mezzo; David Lloyd, tenor; Yi-Kwei-Sze, bass, and The Rackham Symphony Choir. Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50128. RIAA curve. Price $3.98.

No, you're not seeing things . . . Paul Paray

is indeed both conductor *and composer* of this work. Thus is revealed to us another facet of Paray's astounding talent. He is, of course, not the first man to combine conducting and composition. However, as a general rule, the output of most conductors who write is of trifling consequence. In sharp contrast Paray essays the musical complexities of a full-blown commemorative Mass! And what a glorious and magnificent work Paray has given us! It is all things a good Mass should be . . . very tender and touching, poignantly beautiful, wildly exciting, serene and peaceful. Although the Mass is a contemporary work, there is no "modernism" as such employed, the harmonic structure being largely on the romantic side.

This recording is the first to be made in the new home of the Detroit Symphony, the new Henry and Edsel Ford Auditorium. With the large forces employed, this has been the most severe test of *Mercury's* single mike pickup. In the "Gloria" and "Sanctus" sections where there is maximum utilization of voices, choir, and orchestra, it is a tribute to the engineers that a splendid balance is maintained and all elements are quite articulate, with choral/orchestral "fusion" and blur at a minimum.

The soloists are well-known in the fields of oratorio and the Mass and they sing persuasively and with obvious relish. Frances Yeend is outstanding for the beautiful floating ease of vocal projection and her high sense of drama. As you might expect, dynamic range in this work is extreme and owners of big speaker systems will be awed by the grandeur of the massed voices and full orchestra in the "Sanctus." In matters of acoustics the engineers have managed to imbue the work with the "feeling" of a lofty cathedral, without loss of any important orchestral detail.

All in all, this "Joan of Arc Mass" is an imposing work and a monument to Paul Paray's musical genius. This work was also recorded stereophonically and in this medium should be nothing less than overwhelming!

BEETHOVEN

PIANO CONCERTO #3 IN C MINOR Wilhelm Kempff, pianist, with Berlin Philharmonic Orchestra conducted by Paul van Kempen. Decca DL9898. RIAA curve. Price $3.98.

One of the finest readings of the 3rd concerto available, challenged only by the Backhaus and Serkin recordings. Kempff is getting on in years, but this has diminished but little the wiry dexterity of his hands. His playing is quite unexceptionable for the most part, a swooping into certain phrases and a glossing over of a few notes his only sins. His performance is not as refined as the Backhaus nor does it have the cold brilliance of the Serkin reading. It is rather roughhewn, vigorous, and brings to the work an earthy robustness that is quite refreshing to the jaded palate.

If the performance is less important to you than quality of sound, this is without question the version you'll want. The piano tone here is big, full-bodied, very clean of line and transients. In the climactic parts there is none of the annoying "buzz" and ringing encountered in so many piano recordings. Wow and flutter were not present. Orchestral accompaniment was superbly realized, with the balance between soloist and orchestra just slightly favoring the piano. Van Kempen presided over the orchestra with commendable results and maintained a happy collaboration with the pianist.

As usual with *Deutsche Grammophon* recordings this favored big, concert-hall acoustics and, therefore, softer sonic contours. This is a sort of compromise between the phoney-fi mike-in-the-piano technique and the formless, fuzzily detailed, distant pickup. Quite effective

and easy on the ears. Try this disc for a different approach to the 3rd Beethoven concerto.

HARTMANN, K. A.
SYMPHONY #6 FOR LARGE ORCHESTRA
EGK, WERNER
FRENCH SUITE AFTER RAMEAU
RIAS Symphony Orchestra of Berlin conducted by Ferenc Fricsay. Decca DL9861. RIAA curve. Price $3.98.

This is a sampling of contemporary German music from two of the most outstanding post-war composers. The Egk piece is highly stylistic, quite lyrical in spite of the composer's avowed taste for dissonance. The allusion to the music of Rameau is barely justified. It is certainly not derivative of Rameau, but rather in a small way, is implied. The Hartmann holds the main interest on this disc and is a truly astonishing work. This is a work of violent contrasts and Hartmann's musical language is strong and pungent. There is much dissonance and a plentitude of atonality. Hartmann, however, assumes a sort of diatonic "home base" to which he keeps returning the musical thought, and thus the work has direction and form. This is complex, tremendously massive scoring, which will be hard going for many at first hearing. Later, everything sorts itself out and the score becomes most stimulating and provocative. I can promise you that even if understanding comes slowly, from the standpoint of sheer sound this is terrifically exciting. The orchestration calls for a huge array of percussion and augmented brass, etc. Throughout the score you can hear the pile-driver accent of tympani, the cannonading of bass drum, the frenetic activity of brass, woodwind, and strings. Very sharp, highly detailed recording, with all elements clean and articulate. Dynamic range is very great here and, in general, the work will be heard to best advantage over the larger speaker systems. This is probably the most consciously hi-fi recording we have had from *Deutsche Grammophon* and proves they are capable of this type of recording if they so desire.

Fricsay seems an eminently suitable conductor for these works and the Berliners respond to his urgings with playing of breathtaking precision. Off the beaten track, but definitely worth your attention if you are interested in the unusual.

Jazz Corner

CALYPSO
"Lord Foodoos" and his Calypso band. Elektra-127. RIAA curve. Price $3.98.

I don't profess to be an expert in Calypso, but I do know that I can remember it long before it became the current rage. There is nothing really new about it, although many have tried to give it a new twist. In fact this record is refreshing because it is the unadulterated, the real McCoy . . . genuine Jamaica Calypso. This is no phoney hybrid freak-form of music put out by the fast-buck boys. "Lord Foodoos" is a facile-tongued, highly accomplished practitioner of Calypso and utterly fascinating to hear. Many of the numbers are totally unknown to me, others like "Stone Cold Dead in the Market," and "Peas and Rice" are old friends. Foodoos' band really can whoop it up in the best approved Calypso style and with all the various bongos, drums, maracas, and other assorted hardware in full career, this is a regular hi-fi hoe-down. Splendid recording throughout and a most enjoyable disc of its type, if you like the type.

That covers the current batch of records on hand but with the usual Fall spurt of releases we should have a good crop of discs to offer next month for your edification, enlightenment, or plain enjoyment! —30—

What's New in Radio

LIMITER-EXPANDER

Electronics Systems Engineering Co., 903 Cravens Building, Oklahoma City, Okla. is currently offering a new automatic audio control amplifier with background noise squelch which has been tradenamed the "Limpander" (limiter-expander).

The Model LE-2 is a new high speed, non-feedback, automatic audio gain control amplifier with a background noise squelching system. A high impedance input preamplifier provides sufficient gain to produce 30 db of low

distortion limiting. High speed squelching operates between words without syllable clipping.

Limiter attack time constant of 50 microseconds and release time constant of 20 milliseconds produces consonant amplifications for high intelligibility in recording and communications.

The unit may be used as an a.g.c. system for tape recorders or for recording unrehearsed conversations and conferences where it is impractical to use conventional gain monitoring techniques. The 600-ohm output has sufficient power to drive a speaker directly. Noise suppression capabilities make 60 db of automatic audio control practical.

COLOR SCOPE KIT

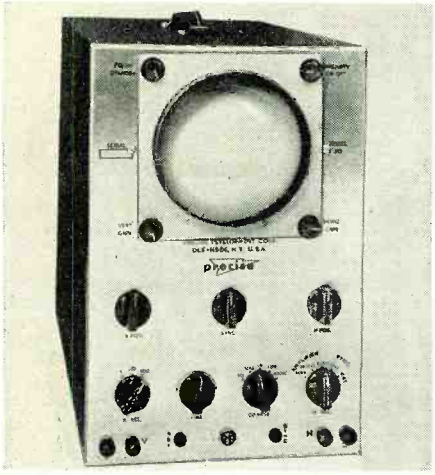
Precise Development Corp., 2 Neil Court, Oceanside, N. Y. is now offering a new oscilloscope, in either kit or wired form, which has been especially designed for color television service work.

The Model 3151's vertical amplifiers are flat through 5 mc. and ± 8 db through 9 mc. Sensitivity is 10 mv./cm. and there are frequency compensated stepping attenuators in the input and push-pull pentodes in the output.

The horizontal amplifiers are within ± 6 db through 500 kc. and feature push-pull output. Frequency attenuated stepping attenuators in the input and a cathode follower assure a clean

linear horizontal trace. It uses a hard vacuum sweep with sufficient expansion to see color bursts clearly. Horizontal sensitivity is approximately 40 mv./cm.

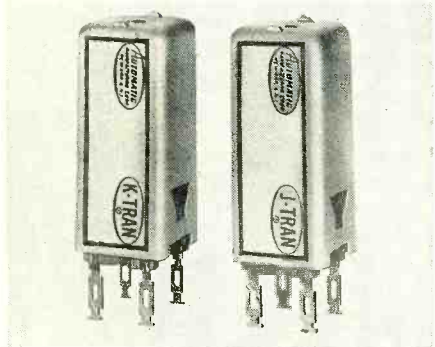
The entire unit measures 13¼" x



8¾" x 18½" and is housed in a heavy steel cabinet. In kit form the scope is designated as the 3151K while factory wired and tested it is known as the 3151W.

PRE-PEAKED I.F.'S

General Instrument Corporation's Automatic Manufacturing Division, Beckley, W. Va. and Newark, N. J. has recently introduced a line of precision "pre-peaked" i.f. transformers which completely eliminate the need for the set makers' assembly line oper-



ators to adjust the transformers to the exact frequency required.

Available at no increase in price for all radio sets using printed circuit wiring panels, the new pre-peaked units have been made possible by a new type of test equipment developed by the firm's engineering group.

Write the manufacturer direct for full details on this new line.

TV SET FOR TRAINING USE

Transvision, Inc., New Rochelle, N. Y. has recently introduced a new 27" television receiver which has been specifically designed for use in industrial training programs.

The set is a dual receiver which functions as a regular TV set or as a closed-circuit video monitor. The 27" screen is 72" above floor level for good visibility from all parts of a large room. A three-speaker audio system directs through a 180 degree sound distribution pattern which gives equal

sound intensity in all parts of the room or auditorium. Room echo, one of the common sound problems in large rooms, is minimized by an echo control which alters the frequency response of the audio system to suit the room being used.

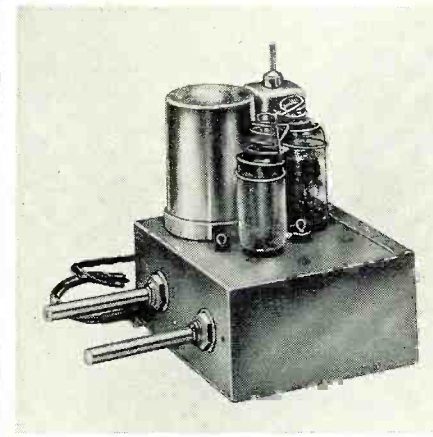
The entire receiver can be moved easily by means of the large swivel casters on which the set is mounted. The receiver has an auto-ignition type lock to prevent unauthorized operation of the equipment.

Complete details on this equipment are available from the Educational Department of the company.

B&K "AUDIO-SCAN"

B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill. is currently marketing two new accessories designed to add color and sound to its Model 1000 "Dyna-Scan" video generator.

The Model S16 "Audio-Scan" adds FM sound transmission exactly like a TV station, 4.5 mc. above the video



carrier, with modulation from any available audio source. The unit permits speech or music to be combined with the video display. The Model S16 comes assembled as a separate "package" which can be installed on the chassis of the "Dyna-Scan."

A second unit, the Model C15 "Color-Scan," adds crystal-controlled full color rainbow display to the basic model.

Bulletin C15-S16, which includes complete specs and full details on both units, is available without charge.

AEROVOX "E-Z-CODE"

Aerovox Corporation of New Bedford, Mass. has introduced a new easy way to learn code—an instrument which has been tradenamed "E-Z-Code."

Consisting of a combination of modern printed wiring circuitry, an electric pencil, and a completely new technique for learning code, this inexpensive unit can be used by hams preparing for their Novice license exams or by licensed amateurs wishing to improve their sending and receiving speeds.

The code is printed on a phenolic base by the copper etch process and then plated for added durability. Each letter of the code appears in vertical

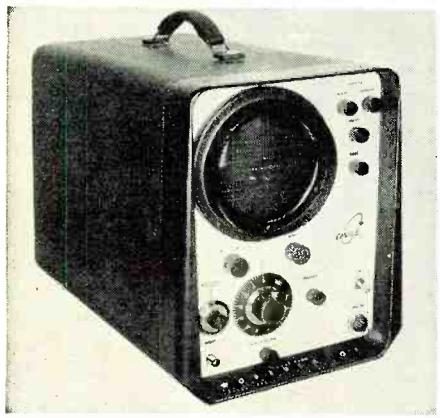
slots with wide and narrow bars of printed wiring acting as the dashes and dots respectively. Each dot and dash of the code is wired to the high-frequency buzzer in the plastic housing. As the user draws the electric pencil down each slot, the electrical circuit is completed and sounds the buzzer for audio transmission. A simple switching arrangement allows the user to practice visual transmission through a built-in lamp, serving as a blinker light.

The "E-Z-Code" unit comes complete with a professional-type telegraph key, high-frequency buzzer, bayonet socket lamp, and electric pencil. The entire assembly is mounted on a sturdy base with non-marring, non-skid feet. Two flashlight batteries are all that is needed to start learning code. The company's distributors are handling this item.

WOBBULATOR SIGNAL GENERATOR

Canoga Corporation, 5955 Sepulveda Blvd., Van Nuys, Calif. is now offering an improved version of its wobbulator signal generator which incorporates several new and unusual features.

The Model 7200 is an integral unit which combines a swept frequency signal generator with a built-in oscilloscope. The unit permits the visual display of the gain or loss *vs* frequency response of amplifiers and networks in the range from 2 to 1000 mc. A swept frequency range of 2 to over 55 mc. centered anywhere in the 2 to 1000 mc. range allows rapid, accurate gain and frequency measurements with built-in visual display. The effect of component or adjustment changes on gain and frequency response is instantly pictured on the CRT as a



gain (or loss) *vs* frequency characteristic.

The company will supply complete specs and prices on the Model 7200 upon request.

CUSTOM BUTTON MICAS

Erie Resistor Corporation, Erie, Pa. has annouced that it is prepared to custom build its high temperature button mica capacitors for continuous operation in the 350 degree C range.

According to the company, test results over a range of −50 to +350 degrees C shows average change in these units of less than 4% in capacitance and power factor. These new units

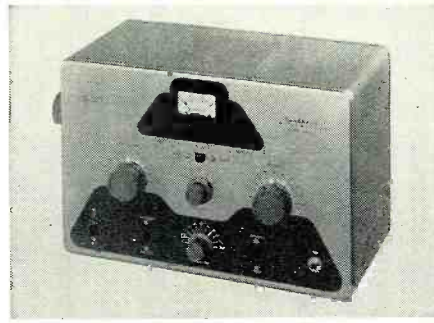
have been designed especially for high altitude missiles and aircraft applications hence are usually custom-designed for a special application.

The company invites inquiries regarding specific circuit requirements.

C.W. TRANSMITTER KIT

Heath Company of Benton Harbor, Mich. has recently introduced a new transmitter which was designed exclusively for c.w. work.

The Model DX-20 kit has a plate



power input of 50 watts and uses a 6DQ6A in the final amplifier stage. A 6CL6 serves as oscillator with a 5Y4GB rectifier.

The unit is ideally suited for both the novice and advance-class c.w. operator. Single-knob bandswitching is featured to cover 80, 40, 20, 15, 11, and 10 meters. The circuit is designed for crystal excitation but may be excited by an external v.f.o. The pie-network output circuit matches various antenna impedances between 50 and 1000 ohms and reduces harmonic output.

The circuit is completely TVI-proofed and is easy to build from the detailed step-by-step instructions which accompany the kit. Write the company for full details and prices.

INTERMITTENT ANALYZER

Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa. is now in production on a new TV and radio test

instrument which has been specifically designed to effect faster troubleshooting in intermittent circuits.

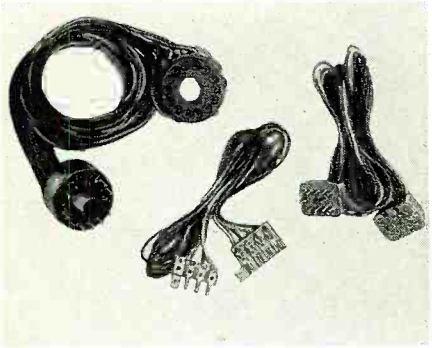
The "Win-Tronix Model 828" uses a new principle which makes TV or radio receivers supersensitive to intermittent and pre-intermittent noises caused by capacitors, resistors, tubes, coils, chokes, and other components. The sensitive amplifier and intermittent tracer probe pick up and localize the noises produced by borderline components without waiting for actual breakdown to occur.

Phantom probe attachments provide signal pickup from tubes and wiring without making actual circuit connections. A built-in line voltage step-up transformer provides a high line-voltage supply to make intermittents easier to locate.

The company will supply a data sheet on the Model 828 to those writing direct.

TV HARNESS KITS

Eby Sales Company of N. Y., 130 Lafayette St., New York 13, N. Y. is now marketing a new line of color TV harnesses especially developed for



use in servicing the newest color TV receivers. They are designed to give fast, efficient servicing and testing.

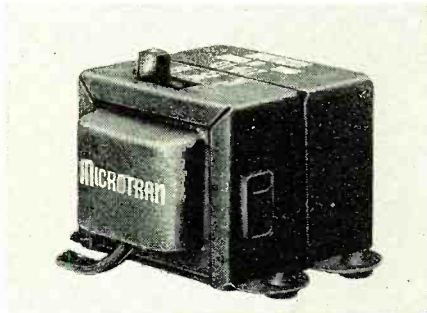
The K-312 color harness kit includes a color CRT extension, a high-voltage extension, and the 56-6H and 49-9H extensions. The larger kit, K-314, includes not only the previously mentioned items but a tuner extension and convergence extension as well.

Write the company for a data sheet covering these new harness kits.

LINE VOLTAGE ADJUSTER

Microtran Company, Inc., 145 E. Mineola Ave., Valley Stream, N. Y., has introduced an "Up-Down" line voltage adjuster, the Model LVB-10.

The new unit has a 250 watt, 100 to



130 volt, 50-60 cps rating. It has a four-position switch with 10 volt boost, 10 volt drop, straight-through, and "off" positions.

The adjuster measures 3" x 3" x 3" and weighs 2 pounds. It is housed in a case with an oven-baked finish.

MINIATURIZED POTS

Clarostat Mfg. Co., Inc., Dover, N. H. has effected a further refinement in its Series 49M miniaturized wire-wound potentiometers in the form of still higher dielectric strength.

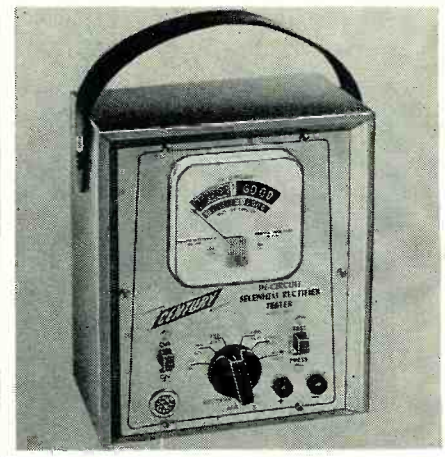
A new molding material, green in color, is now used in these miniatur-

ized potentiometers. This feature, together with design refinements, results in exceptionally low electrical leakage in operation. The pots are ¾" in diameter and ½" deep and are rated at 1½ watts, 4 to 20,000 ohms.

The Industrial Sales Division of the company will supply further details.

SELENIUM RECTIFIER TESTER

Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y. is currently marketing an in-circuit selen-

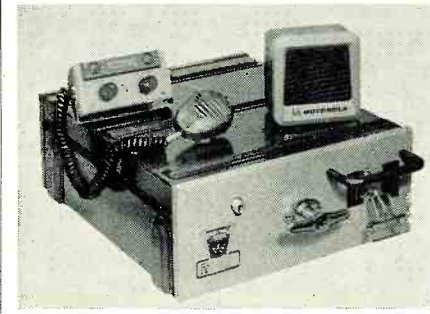


ium rectifier tester which has been designated as the Model SRT-1.

The new unit will check all power rectifiers whether in or out of the circuit. Tests can be made for quality, fading, shorts, opens, arcing, and life expectancy. Accurate readings are obtained, without disconnecting the rectifier from the circuit, on a large multi-color 3" meter. Special circuitry incorporated in the SRT-1 prevents any damage to the instrument, nor will a line fuse blow, even when connected to a dead short. In addition, the rectifier being tested cannot overheat or be damaged.

"PRIVATE LINE" EQUIPMENT

The Communications and Electronics Division of *Motorola Inc.,* 4501 W. Augusta Blvd., Chicago 51, Ill. has announced a new 450-470 mc. "Private



Line" radio which will shut out communications from other users operating on the same channel.

This new equipment transmits a continuous, sub-audible tone along with every voice transmission. Receivers "open up" for listening only when the proper tone is transmitted so that reception is cut out except when transmissions are being originated by the dispatcher or other mobiles operating in the same system.

The design of this radio incorporates several unique features of particular interest to a wide range of two-way radio licensees. For complete information on this new gear, write Dept. PL, Technical Information Center of the company.

MINIATURE TUBE FOR TV

The Electron Tube Division of *Radio Corporation of America,* Harrison, N. J. has announced the development of a general-purpose, multi-unit tube of the 9-pin miniature type which contains a medium-mu triode and sharp cut-off pentode in one envelope.

Designed especially for a wide variety of applications in black-and-white and color TV receivers, the new 6CU8 tube has a 6.3 volt/450 ma. heater with controlled warm-up time to minimize voltage unbalance during starting in TV receivers employing a series heater-string arrangement.

The pentode unit, featuring high transconductance and low grid #1-to-plate capacitance may be used as an i.f. amplifier, video amplifier, automatic gain-control amplifier, and reactance tube. The triode unit, which has a relatively high zero-bias plate current, is well suited for use in low-frequency oscillator, sync-separator sync-clipper, and phase-splitter circuits.

A tentative data sheet on this new 6CU8 is available on request. Write the Electron Tube Division of the company direct. —30—

Career Opportunities

(*Continued from page* 54)

The graduate from one of these two-year technical-institute courses will find ready employment and excellent prospects for advancement. It should be pointed out, however, that this type of training introduces the student to basic calculus, algebra, vector analysis, and complex numbers as well as to electromagnetic theory, physics, and some optics.

In addition to technical institutes, there are also junior colleges which offer two-year courses, some giving a degree of Associate in Science at graduation. Another means of getting a technical background at a higher level is provided by the engineering colleges which offer part or all of their curriculum by mail, usually with some provision for a short residence at school prior to graduation. Such training is generally not accepted as equivalent to a full four-year engineering college, but it will qualify the graduate for many good positions in the electronics industry.

Many states sponsor or offer vocational training in some branch of electronics and, depending on the length of study, the person graduating from such a school will be qualified for various ones of the career opportunities listed in the table. The electronics

(*Continued on page* 130)

training offered in the armed services is rather specialized, but gives a good background and often serves as the stepping stone to further training and better jobs. In some instances, it is possible to utilize military training to the fullest by working for a firm which makes the type of equipment for which the service training was given. We know of quite a few technicians, field service engineers, and junior engineers who are currently working for a civilian contractor on the same type of radar gear, fire control systems, or other devices which they were taught to operate during their military service.

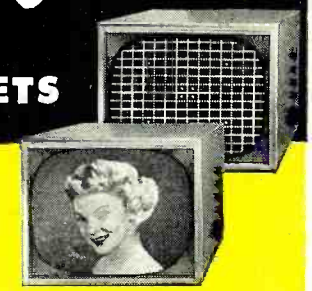
Whatever the origins of a person's technical knowledge may be, unless this knowledge is kept up-to-date, it can quickly become useless. The old-time radio amateur will hardly recognize some of the subminiaturized components, novel circuitry, and plug-in assemblies which make up transmitters today, even though basic radio theory has not changed. Probably the best way to keep abreast of new developments is by reading. Keeping up with technical magazines, books, and manufacturers' literature is indispensable for everyone in such a fast-moving industry. This is recognized by management and it is customary to circulate periodicals and other literature to all technical personnel. Most fair-sized companies maintain technical libraries, and reading up on something is not considered a sign of ignorance but rather an indication of professional procedure. The value of studying textbooks at home, over and above any courses, cannot be over estimated. Anyone in the electronics industry who wants to get ahead should devote at least a few hours every week to reading some technical literature. Aside from the direct information it presents, it also trains the reader in the logical thinking required in any technical work.

In conclusion, we would like to urge those with some qualifications who are not yet a part of electronics to enter it professionally, and also encourage those who are in it already to investigate the possibility of advancing themselves, for their own good and for that of the industry. Our investigations indicate that your present work is not making full use of your abilities and that you are ready to advance into more difficult but also more satisfactory work. Support for this conclusion is provided by the personnel manager of a well-known electronics firm: he confides that 90 per-cent of all job applicants under-rate themselves as far as technical ability is concerned. His estimate is substantiated by the fact that practically all technical people in his organization have achieved substantial promotion during the first year. While increasing technical knowledge is important to career development, the environment for acquiring it while working in the industry could not be more favorable than it is now.

-30-

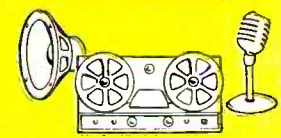
TRANSMIT PICTURE and SOUND

AT ANY TIME—TO ANY TV SETS

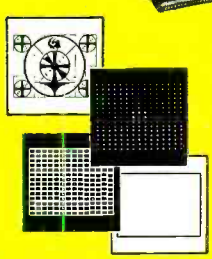


Displays any pattern, picture, or message for TV servicing or for closed-circuit telecasting

Provides crystal-controlled, full color rainbow display for complete color TV testing



Provides FM sound carrier. Has built-in audio tone generator plus input for tape, tuner, mike



3 Slide Transparencies and One Clear Acetate Supplied with Dyna-Scan

Includes one Indian Head, one White Dot, and one White Line crosshatch pattern, plus one clear acetate for messages

MODEL 1000

C15 S16

NEW MODEL 1050 B&K DYNA-SCAN

PORTABLE VIDEO and AUDIO GENERATOR

THE FLYING SPOT SCANNER produces a composite video and sync signal that operates any standard black & white or color TV receiver, at any VHF television frequency. Reproduces your own test pattern or picture on the TV screen with high definition, anytime, anywhere, from any slide transparency—or transmits messages typed or written on clear acetate. Can be used with one or more TV sets or fed into a master or community antenna system. Maximum resolution capability is well in excess of 450 lines at video.

BUILT-IN COLOR-SCAN provides crystal-controlled, full color rainbow display of orange, red, magenta, blue, cyan, green. Enables you to test color sync circuits—check range of hue control, etc.

BUILT-IN AUDIO-SCAN provides FM sound transmission exactly like a TV station, 4.5 megacycles above video carrier, with modulation from any available audio source. Enables you to combine speech or music with the video display. Can be modulated with built-in 400 cycle tone generator for test signal or from external signal source such as microphone, tape recorder, FM - AM tuner, or from audio oscillator. Has built-in audio amplifier and volume control.

Facilitates servicing, installation or demonstration of black & white and color TV receivers. Provides closed-circuit TV system with both video and audio for commercial, industrial, and educational applications. Allows convenient stand-by and break-in, or distribution line check, for community antenna system operation.

Model 1050 DYNA-SCAN complete portable video and audio generator, with built-in Color-Scan and Audio-Scan. Includes 3 test pattern slide transparencies, one clear acetate and slide holder. Comes with 6 ft. r.f. cable. Size 16½ x 10⅜ x 9½ in. Net, **$259.95**

Model 1000 DYNA-SCAN picture and pattern video generator. Has all the features of the Model 1050 above, except without the Color-Scan and Audio-Scan sections. Net, **$199.95**

Color-Scan or Audio-Scan or both can easily be added to the Model 1000 at any time.

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The Men We Hire

(*Continued from page 77*)

necessary to the efficient handling of the job as specific skills.

The fact that a man has held a number of previous jobs may raise questions, but only if he appears to be a "floater." On the other hand, it may reveal a mature recognition of actual lack of opportunity for advancement in his chosen field. The important question here is: in making job changes, did he constantly improve his situation and advance in his chosen field? A man who has done this has the kind of initiative and maturity that we are seeking.

Initiative is just as important to progress as skill and we are looking for men who have the ability to be "self-starters," to promote themselves to the higher levels of responsibility that are constantly opening up. This calls for balanced self-confidence without over-aggressiveness.

Today's field engineer may well be tomorrow's supervisor or group manager, so an applicant's leadership ability is always taken into consideration. He may have demonstrated this quality in previous supervisory jobs, in his school activities, or in some type of community or civic affairs. It is a valuable asset to bring to *IBM* or to any other company.

In appraising his manner and appearance, we ask ourselves many questions. Is his dress neat and businesslike? Is his manner poised? Is he tactful in asking and answering questions? Are his manners in line with generally accepted behavior? Affirmative answers show us that he will support our reputation in these areas, as well as by his general competence on the job.

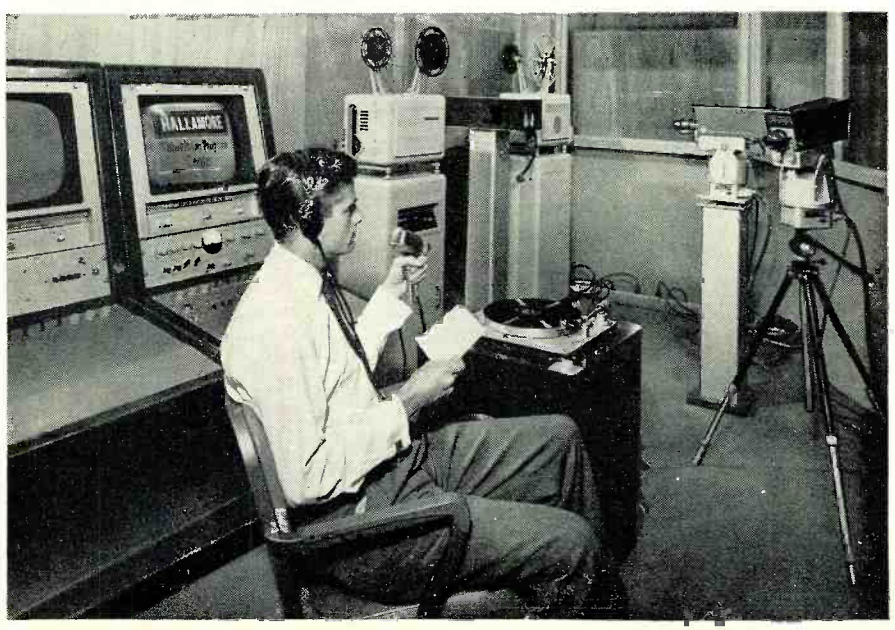
We are interested in knowing about an applicant's hobbies, even if they do not appear on the surface to be work-related. While a "radio ham," for example, has a hobby that may add to his technical knowledge, we are just as interested in the ardent sports fan, the do-it-yourself cabinet maker, or the bridge enthusiast. We feel that a man with outside interests shows a breadth of personality that makes for alertness in other areas of his life. And this means an active mind that will lead him to make use of opportunities in a way that will be helpful to both of us.

Technical jobs at *IBM* require a training period of four to eight months, depending on the particular job involved, and additional training may be required for further advancement. It is essential that a man be both willing and able to participate in this part of the program.

Such specific matters as age and marital status are not primary factors with us. When an applicant comes to us, he is given a brief screening test to determine basic skills and aptitudes. Following an interview, in which his personal qualifications are appraised, he is given aptitude tests and a physical examination, and his prior employment references must be checked. Beyond this, we have no hard and fast rules.

Fundamentally, I would say that we are looking for well-rounded, balanced personalities with certain basic skills and aptitudes, who are willing to develop these skills for our mutual benefit, and who wish to grow with a growing organization. —30—

Compact self-contained Siegler-Hallamore one-man television broadcasting unit for in-plant and local community telecasting is shown in operation. The announcer reads news bulletin facing remote camera at far right. By flicking switch on master control panel, he can turn remote camera on himself. Unit includes transcription turntable, projectors, and all audio and video equipment necessary for live and film telecasting. Cost of entire unit, designed for a wired TV system, is $15,000.



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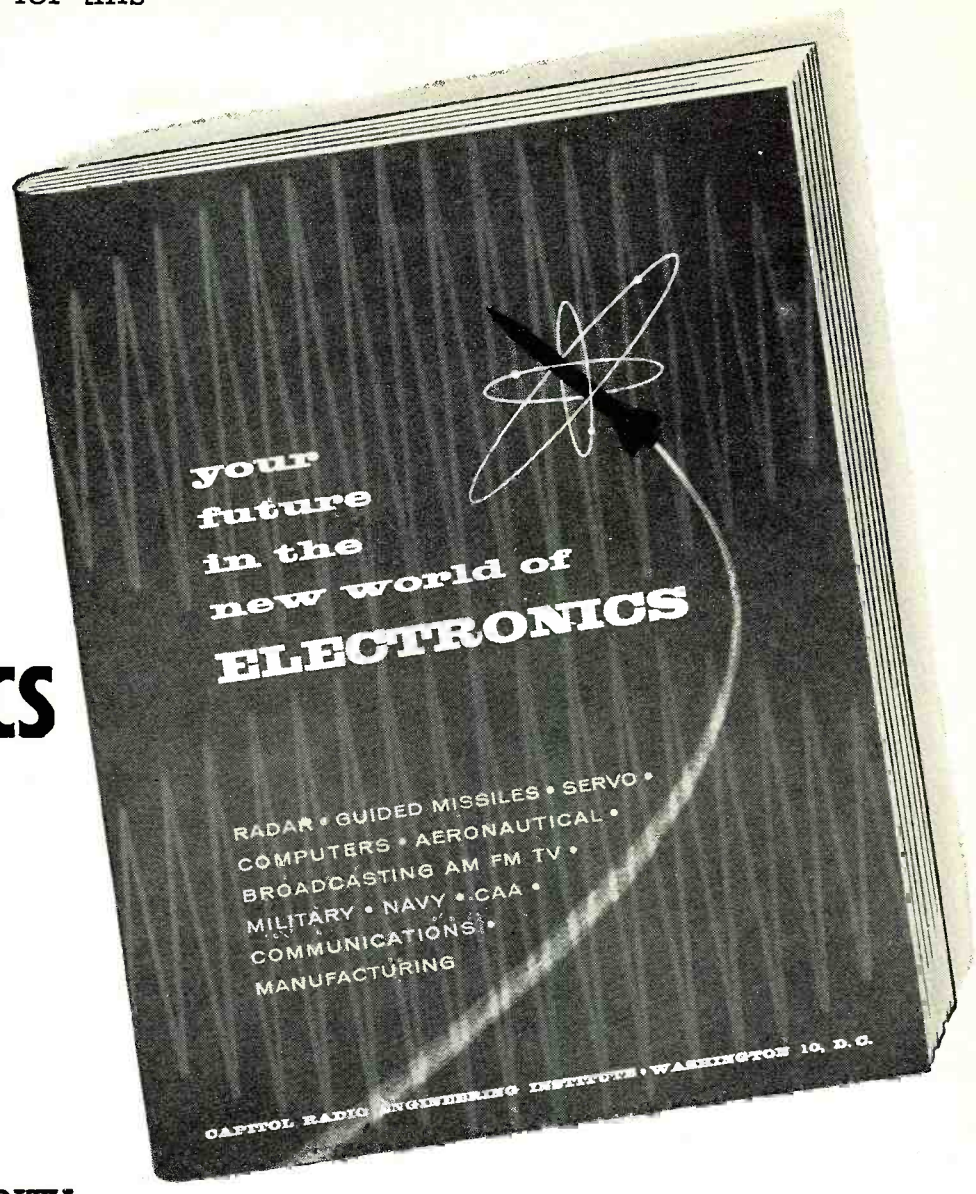

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IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED? .....

Measuring Capacitor Resistance

By **HOLGER MARCUS**

Use ordinary service V.O.M. to check leakage resistance.

IT IS a well-known fact that a plate-to-grid capacitor has to have a very high d.c. resistance—on the order of 1000 megohms. It is rarely possible to measure such high resistances with ordinary servicing instruments since most such instruments are limited to readings of about 5 megohms.

There are special vacuum-tube megohmmeters for the measurement of these high resistances but these instruments are rarely to be found in service shops. There is, however, a method of finding the insulation of a capacitor with a value above .01 μfd. using an ordinary test instrument of 20,000 ohms-per-volt and a built-in battery for resistance measurements which is described below.

When a tester is connected to a capacitor, there will occur a transient deflection proportional to the capacity. If the tester, after a time of relaxation, is again connected with the same polarity, there may or may not occur a new deflection depending on the amount of discharge through the leakage resistance and the time elapsed from the first charge.

The first charge and transient deflection is proportional to $Q_1 = C \times V_1$ where C is the capacity and V_1 is the applied voltage.

After a time of disconnection, T, the voltage across the capacitor will drop to:

$$V_2 = V_1 \ \epsilon^{-T/RC}$$

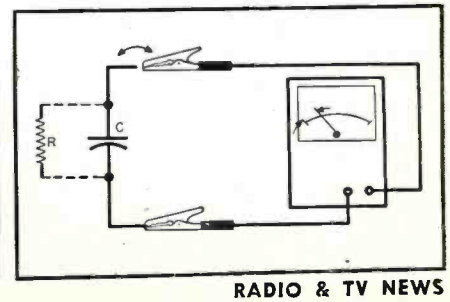
where R is the leakage resistance.

The charge indicated by the second transient deflection is proportional to:

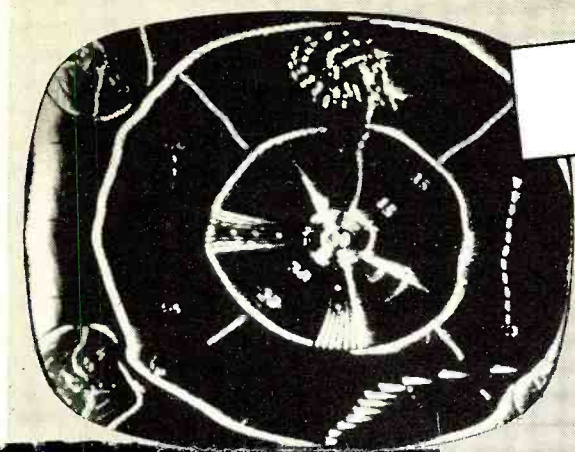
$$Q_2 = Q_1 \ (1 - \epsilon^{-T/RC}).$$

In case the time, T, has been chosen (or tried out) to give a second deflection which is 63% of the first, then you find that $R = T/C$ with T in seconds, R in megohms, and C in microfarads. If you wait until the second deflection is about ⅓ or ½ of the first,

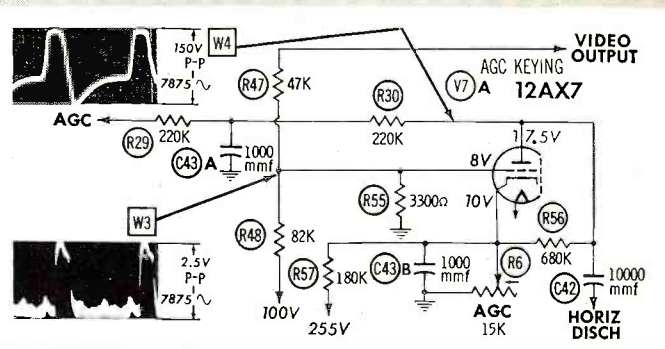
A service meter may be used in this test.



how long would it take you to solve this service problem?



SYMPTOM:
Negative Picture



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...gative picture such as ...oper AGC voltage— ...er, IF, video detector ...driven. Look for the

...adjusted
...circuit
...IF tubes
...or crystal

...(C42)
...line

...older at your finger- ...s problem in minutes.

...ossible misadjustment ...he Field" notes which ...er. (You'll easily find ...ube Placement Chart.)

Using the same chart, you will quickly locate and check the suspected tubes. Tubes and AGC adjustment okay?—then: Check waveforms W3 and W4 in the AGC Keying circuit and waveforms in the video circuit to isolate the faulty component. Example: A loss of signal waveform at W4 would indicate an open coupling capacitor (C42). Correct waveforms are always shown right on the PHOTOFACT Standard Notation Schematic.

Correct voltages, also shown on the Standard Notation Schematic, and resistances (in easy-to-read chart form) help you locate faulty components with speed. You'll find, too, how easy and fast it is to locate parts by means of the exclusive PHOTOFACT chassis photo views, with call-outs keyed to the schematic. And finally, you'll find the proper replacements for all components listed in the complete PHOTOFACT parts list.

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then it is possible to calculate: $R \cong 2\ T/C$.

For example, if you want to make sure that a capacitor of .1 μfd. between a plate at 100 volts and a grid does not give more than .1 volt across a grid resistor of 1 megohm on the tester (set for the highest resistance measurement) it may be possible to observe a first deflection of two divisions. After two minutes, *i.e.*, 120 seconds, it may then be possible to observe a second deflection of one division. The calculation gives:

$R \cong 2 \times 120/.1$ or 2400 megohms

The residual grid voltage due to leakage will thus be:

$V_g = 1/(2400 + 1) \times 100 \cong .04$ volt.

The setup for making such tests is shown in the diagram appearing on the previous page. The method is easy to use once you become accustomed to it. At least give it a fair trial. —30—

WE TRADE HIGHER!

Howdoody...

I'm Jack S., the new Vice-President in charge of eevaluatin' Trade-Ins. I haven't always been known as Jack S. ..... You see, the guy who made this name-plate for my desk said Vice-Presidents HAVE to have a middle initial. I said he could use the initial from my last name....then when he got to the last name I'd already used it and.....Like the sign fellow said, though, it's pretty darn effective!

I got this position because the old Vice-Pres. was "surprised" while making those famous "Surprise Trade-Ins"! They caught him making a profit! In the Trade-In Dept.! The Boss said this was unthinkable and what they needed was a real moron for the job. A few well-placed pulses through the eelectronic brain pointed to little old me from way down in the Ozarks as having superlative qualifications!

SOOoooooo .... just write me a letter tellin' me just what sorta store-bought stuff (made since 1945) you want to trade in.....and if you've been "Surprised" by an Ashe deal in the past....you'll flip your antenna at a Jack S. offer!

Jack S.

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3. We will ship your new gear to you via express in most instances. Where express is not available, or not practical, we will ship by truck.

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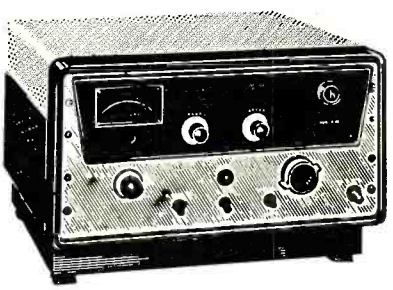

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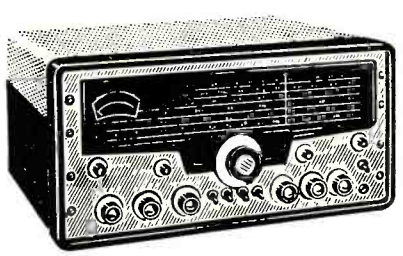

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The "Signal Finder"

(Continued from page 45)

check to make certain that the batteries are making contact inside the amplifier unit and that their rated voltages under load are correct. The "A" battery is often a mercury cell, which retains its correct voltage until the end of its life and then suddenly goes dead. The "B" battery is a standard dry-pack type, whose voltage drops off throughout its life.

Now plug in the r.f. probe and, using a radio receiver, touch the tip of the probe to the grids and plates of the r.f. and i.f. stages. You will be able to follow the signal stage-by-stage. Always ground the probe case, when doing this, by connecting the ground clip to the chassis. As you move towards the detector the volume control on the "Signal Finder" will have to be adjusted downward. When using the instrument, which usually has a clip on it, it can be slipped in your pocket or clipped to your tie, leaving your hands free.

The a.f. probe can be tested in a similar manner through the audio stages of a receiver or the deflection circuits of a TV set. A 600-volt capacitor is in this probe, but do not touch it to the plate cap of the horizontal output tube, since there are large transient voltages at this point. Touching the probe against the envelope of this tube will provide an adequate signal, however.

When employing the "Signal Finder" to position TV antennas, connect the r.f. probe and fit an alligator clip to its tip. Now clip the probe and the ground lead across the terminals of the antenna and listen for the strongest signal from the TV station as you move the antenna. The characteristic buzz of the transmitted sync pulse will be heard.

When two technicians are erecting an antenna, the "Signal Finder" works well as an intercom. Simply connect the a.f. probe with a clip on the tip across the transmission line and use a 200-ohm single headphone as a microphone. If two technicians each have a "Signal Finder," with one man at the antenna and the other at the receiver, clear two-way communication is obtained, thus speeding up the installation. Connections are shown in Fig. 7.

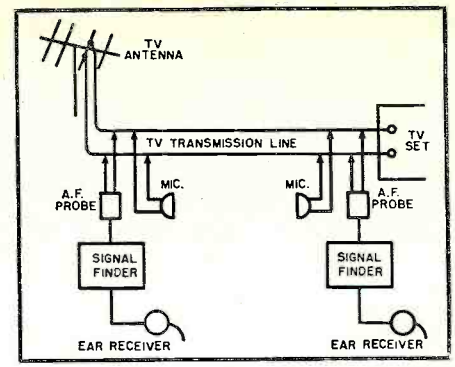


Fig. 7. Two "Signal Finders" connected across the lead-in wire can be used for set-to-roof intercommunications during two-man antenna orientation procedures.

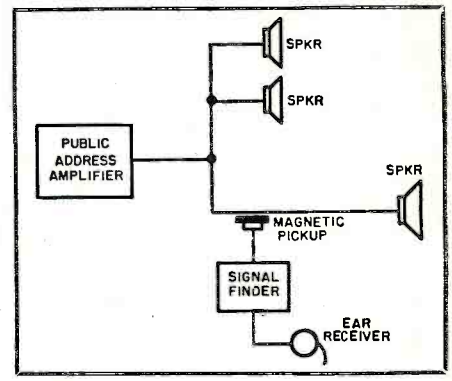


Fig. 8. The magnetic pickup can be used to check p.a. distribution cable.

Using the "Signal Finder" when installing public-address systems will also speed up the checking of distribution cables: simply connect the a.f. probe across the line at any junction point. An alternative method is to connect the magnetic pickup instead. This does not require actual contact with leads carrying the output of the p.a. amplifier. All that is needed then is to hold the pickup near a cable carrying the audio, as shown in Fig. 8. The magnetic field around the cable will induce a usable signal in the pickup.

The functions just described are only some of the ways in which you will be able to employ this useful instrument. The more you use it the more you will like it and the short time it takes to make it will be amply repaid by the ways in which it helps in the shop and in the home. —30—

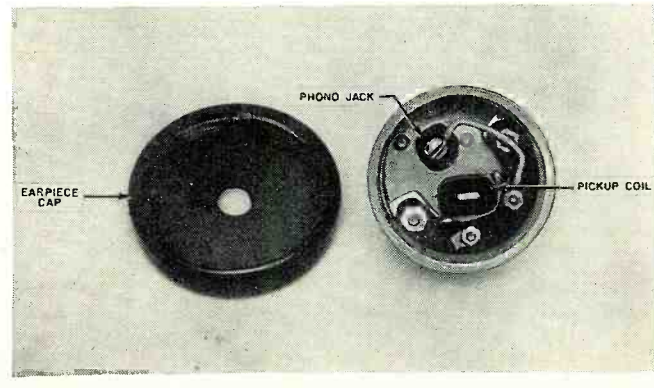
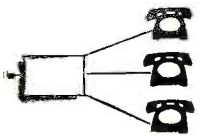


Fig. 6. An ordinary 2000-ohm earpiece from a pair of headphones is adapted to form the magnetic pickup. It can be used for many tests as well as for communications during antenna installation.

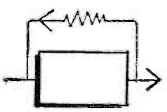
Pacemakers in the technology of our electronic age

Certain discoveries, inventions and developments of Bell Telephone Laboratories have been truly epochal in their effect upon the technology of our time. Each has come out of a single quest—a search for ways to make telephony ever better. But many have opened the way to exciting advances in TV, movies, radio, horology, astronomy. Here are ten of Bell Laboratories' contributions to the modern world.

Electronic amplifier. First high-vacuum electronic amplifier. Made possible long distance telephony and then opened the way to radio broadcasting.

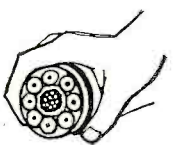


Wave filter. Precisely separates bands of frequencies. Provided major key to economical sharing of the same wires by many voices or radio programs. Indispensable control tool in radio, television and radar.



Negative feedback amplifier. Provides distortionless and stable amplification. Made possible the enormous, precisely controlled amplification needed in long distance telephone calls. The principle is now basic in high-quality amplifiers for radio, TV and high-fidelity reproduction.

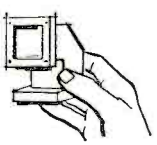
Quartz crystal. Standard super-accurate quartz crystal oscillator developed for frequency controls in radio telephony. Has also become the standard control for clocks in world's astronomical laboratories.



Coaxial cable system. Hollow tube with a central conductor was developed to transmit hundreds of voices simultaneously. Now also provides long distance carrier for TV in partnership with microwave beams.

Transistor. Tiny solid-state device uses extremely small amounts of power to amplify signals. Makes possible electronic telephone switching and much smaller hearing aids, radios, TV sets and electronic computers.

Dial system "brain and memory." Takes over your call and sees that you are connected in the best and quickest way. Newest example: Direct Distance Dialing from home telephones to any part of the nation.



Waveguide. Hollow conductor transmits high-frequency waves. From this came the "pipe" circuits that are essential to radar and very short-wave radio communications.

Microwaves. Bell Laboratories developed long distance microwave transmission. It operates by focusing radio beams from station to station, carries cross-country telephony and TV.

Radio astronomy. This great new science began in the study of radio interference at Bell Laboratories . . . with the tremendous discovery that radio waves emanate from the stars.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Spot Radio News

(*Continued from page 16*)

by helical antennas housed in two plastic radomes, which have been placed above the bridge.

The modification of the six ships and installation of the electronic equipment on them is said to have cost more than $2-million.

A NEW METHOD OF MEASURING TV broadcasting services has been devised by the Bureau of Standards laboratories in Boulder, Colorado. The method involves an area concept of service rather than the contour concept now being used. In current practice, television service is defined in terms of the contours for two grades of service; A and B. This definition has been found to present two difficulties: First, the contour does not adequately express service because it includes within it many locations that receive less than the specified grade of service, and ignores large areas outside of the contour that have the specified grade or better. Second, the experimental determination of where the contours lie is very difficult to accomplish.

Because of terrain roughness, including trees, buildings, and so on, the distribution of actual areas is not uniform. It is entirely possible for one dwelling to receive what might be termed grade 1 service (these grades were proposed by K. A. Norton and L. Gainen in 1951), while next-door neighbors receive grade 2 or 3 service. (Grade 1 service would represent the cases where the signal is sufficiently high to override thermal and man-made noise levels; grade 2 would represent a lower signal-to-noise ratio where perhaps noise is somewhat noticeable; in grade 3 the signal-to-noise level is low and a considerable amount of noise appears at reception). Within roughly 50 miles of the transmitter, time variations are relatively unimportant; but as the distance increases, tropospheric effects become more important. An expression of the time available must be therefore included in the definition of service.

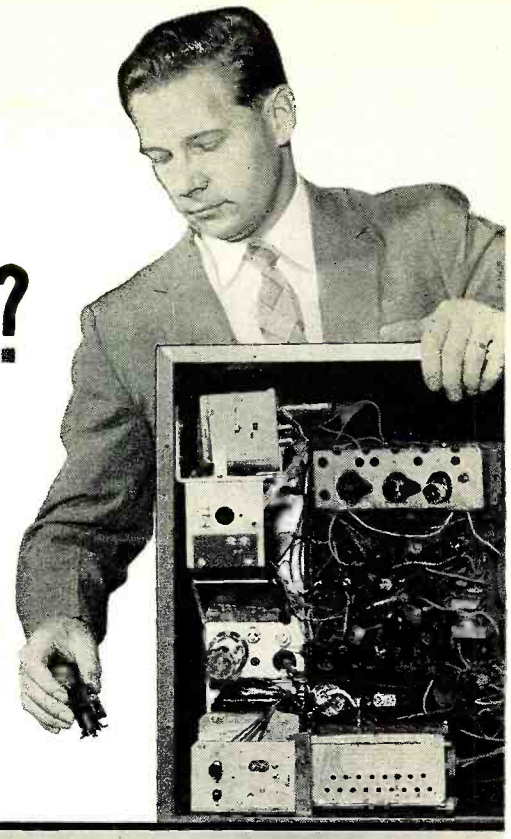
Current practice in measuring the contours of service involves recorder-tape measurements of field strength. These measurements are made in moving vehicles while driving down roads along eight or more radials from the transmitter. From these measurements the contours, where 50 per-cent of the locations receive the specified grade of service for 50 per-cent of the time, are estimated and joined together in the form of a service contour.

Aside from the fact that the contours do not give a very useful representation of service, there are many difficulties in taking measurements in this manner. First of all, it is impossible to obtain very much of this type of data using the proper height of antenna, namely, thirty feet. Most such measurements are made at ten feet and referred to the thirty-foot reference height by application of a linear height-gain function. Secondly, the routes followed usually do not represent the area very well since: (1) roads tend to follow lower levels in rough terrain, (2) they are frequently built up a few feet above surrounding terrain, and (3) they are congested with wires and other objects which modify the results. Time and space variations cannot be separated in mobile measurements.

In the new NBS approach, sample measurements are taken at fixed locations around the transmitter. These locations are established in a systematic manner so that all terrain types are equally likely and the data represents a random sample from the area. In most cases, the measurements consist of a single observation of field strength, except when time variations are involved. In these instances they represent a short recording of field strength from which the distribution with time can be estimated. A sample set of observations would be taken at a constant radius with sufficient separation to eliminate serial correlation between successive observations. The distribution obtained can be used to estimate the percentage of locations at that distance which receives service in the several grades. By joining together several such estimates made at different distances, an estimate can then be made of the total area around the transmitter for each grade of service.

COMPLETE TV RECTIFIER INTERCHANGEABILITY?

The New G-E 1N1008 Brings You Just About as Close as You Can Come.



With the introduction of its new Type 1N1008 germanium TV rectifier, General Electric offers you a miniature 400ma device which can be used as a replacement for just about any make of selenium rectifier now found in television power supplies.
The 1N1008 is a 130V-400ma half-wave rectifier. Twin 1N1008's can be used in a voltage doubler circuit.

RATINGS AND SPECIFICATIONS

	Recommended Design Center	Absolute Maximum
RMS Input Voltage	117	130 volts
Peak Inverse Voltage	340	380 volts
D-C Output Current	200-400	400 ma
Rectifier Full Load Voltage Drop*	0.28	0.30 volts
Series Surge Resistor	4	4 (min) ohms
Ambient Operating Temperature	40	55°C
Operating Fin Temperature	50	65°C

**Full Cycle Average*

This represents General Electric's latest addition to its priced-right line of *snap-in* replacement TV rectifiers. Other easy-installation G-E TV rectifiers include the 1N1005 (250ma), 1N1007 (350ma), and 1N1013 (250ma). In most cases, the G-E snap-in design permits installation in the same chassis hole used for the selenium stud or bolt.

FREE...REPLACEMENT GUIDE

The General Electric Germanium TV Rectifier REPLACEMENT GUIDE tells you exactly which model fits your customer's set, and is the result of an analysis of all leading sets built since 1953. Only proved replacements are recommended. Get your copy, *free* . . . at your G-E tube distributor now. Or, write today to *General Electric Company, Semiconductor Products, Section S5897, Syracuse, New York.*

General Electric TV rectifiers are performance-tested by Howard W. Sams & Company, Inc. Check the low prices at your nearest G-E tube distributor. Just look for the new green & black cartons.

CUSTOMER CONFIDENCE 10th ANNIVERSARY SEMICONDUCTOR PROGRESS

GENERAL ELECTRIC

The Bureau's type of analysis is said to be facilitated by the elimination of long recorder tapes. All of the scaling and some of the analysis can be done in the field. In most cases, the tabulation consists of writing down a single value read directly from the instrument and in others it involves, at most, the determination of the distribution with time from a relatively short observation. The tabulated values then might be, for example, the field strength exceeded 99, 90, and 50 per-cent of the time.

THE SUMMER LULL, prevailing in the TV-station grant quarters of the FCC, as this column was being written, dulled all activity and as a result only a few authorizations were issued, as the table on page 14 indicates.

ELECTRONICS HAS MADE enormous contributions to modern aircraft's progress. Electronics has served to improve the effectiveness of the airplane's controls, communication systems, propulsion, and materials.

In Washington recently, the Bureau of Standards found that they could now use electronics to evaluate the adhesive properties of an aircraft's protective coating, through an electronic-averaging device known as an *integrometer*. This device converts the variable stripping force measured by an adherometer (an adherometer measures the force required to strip a coating from a metal surface), into electric impulses. These impulses are then added to give a single average value which can be read directly from a standard recorder.

The integrometer contains a Wheatstone bridge circuit which includes strain gauges, an amplifier, integrating circuit, and a meter circuit. Output from a beam and strain-gauge assembly is fed to the amplifier. The integrating circuit converts the amplified electric impulses to an output voltage proportional to the average value of the variable stripping force. The integrated voltage is then applied through the meter circuit to a standard recorder. This recorder draws a straight line, the length of which, after a precisely timed interval, is proportional to

the average value of the varying voltage that has been impressed on the integrating circuit during the stripping operation.

Thus the strain and error inherent in visually observing varying gauge readings have been eliminated. Moreover, the stripping action itself is accomplished with greater ease and uniformity because the momentum and inertia effects of the pendulum method are removed.

THE FIRST AIRBORNE frequency standard is now being used by the Air Force to calibrate radios, radar, and navigation, fire control, and timing devices.

Developed as a self-contained unit, weighing only 30 pounds, the standard can operate on a battery for 2½ hours. Its output is 100 kilocycles, crystal-controlled.

A conventional frequency standard able to equal the efficiency of the new unit would be twice as large, consist of at least two or more units, and could only be used under ideal lab conditions.

All airborne electronic equipment which requires signal transmission and reception must be calibrated frequently. Present practice is to calibrate this equipment with a ground unit before take-off. The new equipment permits airborne calibration continuously, if necessary. It can also be used on the ground at radio or radar sites, or in laboratories.

According to ARDC, the new standard has successfully met the requirements of stringent tests. It has undergone temperature extremes from −55° to +70° C, has operated at 50,000 feet altitude, and has received severe vibration tests including drop tests.

Ease of maintenance has been increased by building the standard so that the various circuits and components may be replaced by plug-in counterparts.

The new instrument, on which development work began over two years ago, can be used in any type aircraft. It uses the conventional aircraft power system of 28 volts d.c. or 110 volts at 400 cps. and draws an average of 25 watts.

Another triumph for electronics. . . . . L. W.

New Tube Tester Data

Owners of Philco and Jackson tube checkers: add these settings to keep your equipment up to date.

PHILCO MODELS 7052 and 9100

Type	Fil.	R-G Bias	Fil.	Fil.	Gr.	Pl.	Sc.	C.	Su.	Press	Gm	Notes
2B3	2.0	80 0	J	R	0	0	0	0	0	P5	...	Cap-P. May show short on 3.
3AF4	3.0	85 36	J	R	2	3	0	5	0	P4	3200	
3BU8	3.0	22 0	E	V	7	8	2	1	9	P4	600	Pentode No. 1
	3.0	22 0	E	V	7	3	2	1	6	P4	600	Pentode No. 2
3C2	3.0	83 0	J	R	0	0	0	0	0	P5	...	Cap-P. May show short on 3.
3CE5	3.0	87 11	J	R	3	5	6	2	0	P4	3100	
4BC5	4.3	81 0	J	R	3	5	6	2	0	P4	2400	
4BN6	4.3	27 6	J	R	2	7	5	3	6	P4	560	Limiter Grid
	4.3	27 0	J	R	6	7	5	3	2	P4	560	Quadrature Grid
4BU8	4.3	22 0	E	V	7	8	2	1	9	P4	600	Pentode No. 1
	4.3	22 0	E	V	7	3	2	1	6	P4	600	Pentode No. 2
4BX8	4.3	86 29	E	V	7	6	0	8	0	P4	3180	Triode No. 1
	4.3	86 29	E	V	2	1	0	3	0	P4	3180	Triode No. 2
4CB6	4.3	75 19	J	R	3	5	6	2	7	P4	1760	
4CE5	4.3	87 11	J	R	3	5	6	2	0	P4	3100	
4DT6	4.3	48 11	J	R	3	5	6	2	7	P4	800	
5BQ7	6.3	88 20	E	V	7	6	0	8	0	P4	4000	Triode No. 1
	6.3	88 20	E	V	2	1	0	3	0	P4	4000	Triode No. 2
5BR8	5.0	88 21	E	V	1	2	0	3	0	P4	3350	Triode Sect.
	5.0	80 11	E	V	9	6	7	8	0	P4	2100	Pentode Sect.
5BZ7	6.3	88 20	E	V	7	6	0	8	9	P4	4000	Triode No. 1
	6.3	88 20	E	V	2	1	0	3	9	P4	4000	Triode No. 2
6BU8	6.3	22 0	E	V	7	8	2	1	9	P4	600	Pentode No. 1
	6.3	22 0	E	V	7	3	2	1	6	P4	600	Pentode No. 2
6BV8	6.3	85 25	E	V	2	3	0	1	0	P4	2920	Triode Sect.
	6.3	84 0	E	V	0	9	0	7	0	P1	...	Diode No. 1
	6.3	84 0	E	V	0	6	0	8	0	P1	...	Diode No. 2
6BX8	6.3	86 29	E	V	7	6	0	8	0	P4	3180	Triode No. 1
	6.3	86 29	E	V	2	1	0	3	0	P4	3180	Triode No. 2

JACKSON MODELS 648 and 648A

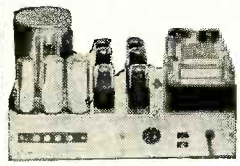
Type	Fil.	Circuit D	Circuit E	Plate Test
5BH8	5.0	A1236	AC789*	16WY
		A123	AC45	23XZ
5CQ8	5.0	A129	AB358	48V
		A124	A46	80Z
5CZ5	5.0	129	B346	32W
6CX8	6.3	A129	678*	35WZ
		124	A35	32V
6CZ5	6.3	129	B346	32W
6DA4	6.3	234	6	15W
6DA7	6.3	126	AC34	23Z
		127	A89	40V
6DB5	6.3	125	B346	25Z
6DE7	6.3	126	A45	33VW
		A127	A89	65V
8CX8	8.4	A129	678*	35WZ
		124	A35	32V
10DA7	10.5	126	AC34	23Z
		127	A89	40V
10DE7	10.5	126	A45	33VW
		A127	A89	65V
12CN5	12.6	AC123	467	65X
12DB5	12.6	125	B346	25Z
13DE7	12.6	126	A45	33VW
		A127	A89	65V
17D4	17	234	6	15W
17R5	17	C123	467	22V

22 TUBE ESPEY FM-AM HI-FI TUNER-AMPLIFIER

SALE PRICE $99.95

A REGULAR $199.50 NET VALUE COMBINATION FOR $99.95

FM/AM TUNER
ESPEY 14-TUBE MODEL 700G



ESPEY 24 WATT
MODEL 501G AMPLIFIER

MODEL 700G FM-AM TUNER AND MODEL 501G AMPLIFIER

SPECIAL SALE PRICE BOTH FOR $99.95

McGee offers you both the regular $119.50, 14 tube Deluxe FM-AM tuner and the regular $79.50, 8 tube audio amplifier for the special sale price of only $99.95. The Model 700G Espey tuner has its own built in power supply. Performance features are: Sensitivity 3mv on AM, 5 mv on FM for 30 db quieting. AM selectivity 10kc at 6 db. FM 240 kc at 6db. Audio response flat from 20 cps to 20,000 cps., with less than ¼ percent distortion with one volt audio output. Chassis is 14" long, 8½" high and 10" deep. Features a one-piece molded, gold color plastic front which makes a custom installation both extremely attractive and easy at the same time. Full tuned RF stages-AFC on FM with defeating switch for easy FM tuning. Built-in preamplifier for GE or other popular variable reluctance cartridges. Three position equalizer switch for LP, AES or European records. Separate bass and treble tone controls with 23db boost. Chassis is equipped with AC outlet jacks, auxiliary input jacks for tape recorder, etc. Has built-in ferrite loop antenna for AM broadcast band and 300 ohm input for FM band. This fine quality FM-AM tuner is second to none. It has all of the features that you might expect of a tuner that would cost as much as $200. All of the controls are on the front panel. This is a most desirable feature when the tuner is used in conjunction with a good audio amplifier, such as the 501G which was designed with no tone control or preamplifier circuits.

The model 501G, 8 tube ultra-linear high fidelity, 24 watt audio amplifier is made to match the 700G tuner. This amplifier features less than ½ percent distortion with high fidelity response from 10 cps. to 20,000 cps. Hum level so low it can be detected by electrical instruments only. Chassis size, 12"x5"x8". Output tubes: 4—6V6GT in push-pull Williamson circuit. 6SN7GT phase inverter and 2—5V4G rectifiers. Has an 8 pound potted case output transformer with specially made grain-oriented iron core. Output impedance taps of 4, 8 and 16 ohms. This output transformer alone is a $20.00 value.

Buy both the 700G FM-AM tuner and the matching 501G amplifier for only $99.95. Tuner shipping weight 20 lbs. Amplifier shipping wt. 22 lbs. See the special deals of the 700G-501G tuner-amplifier combination with record changer and GE cartridges for extra money saving values. Also, special discount on speakers and speaker systems when ordered with your Espey tuner and amplifier.

ESPEY DEAL—1A

Espey 700G-501G tuner with 24 watt amplifier plus VM-956 GE 3 speed VM on metal base—1 Mill Diamond Needle $10.00 extra. Net **$124.95**

ESPEY DEAL—2

Espey 700G-501G tuner with 24 watt amplifier plus new 456 Collaro changer equipped with a GE RPX-052A cartridge. Net **$144.95**

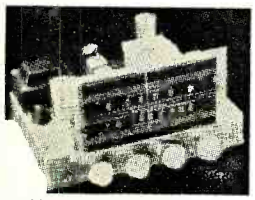
ESPEY DEAL—3

Espey 700G-501G tuner with 24 watt amplifier plus Garrard RC-98 equipped with a GE RPX-052A cartridge. Net **$174.95**

SPEAKERS RECOMMENDED

Order any of the following speakers with your Espey tuner and amplifier:
12" coaxial PM, CU-14Y—$10.00 extra
15" coaxial PM, P15-CR—$20.00 extra
Imperial IV system—$15.00.
Imperial VI system—$25.00.
Norelco 9762—12" regularly $59.50 at $30.00 extra.
EV84—15W system—$150.00 extra.

11-TUBE FM-AM HALLICRAFTERS



HALLICRAFTERS S-78A

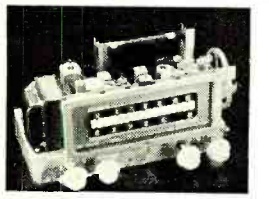
REGULAR $89.50 VALUE!

SALE PRICE $49.95

WITH MONARCH 4-SPEED RECORD CHANGER, 12" COAX. SPEAKER

$132.40 VALUE ALL FOR $86.95

Now, buy a complete FM-AM chassis with push-pull audio built-in, at less than you would pay for a tuner without audio amplification. We offer you this nationally known Hallicrafter S-78A, 11 tube FM-AM radio chassis complete with escutcheon plate and knobs, to be put in your own cabinet or mounted in your recreation room wall. Features a 11 tube power transformer operated superhet circuit with automatic frequency control on FM, push-pull 6K6 audio gives up to 12 watts peak output with response to 15,000 cps. Use with a good Hi-Fi PM speaker or speaker system. Output matches 3.2 or 8 ohms. Full bass boost tone control. Chassis size: 7⅜"x12½" long and 11" front to back. Input for record changer with crystal cartridge. (Self powered pre-amplifier for G.E. variable reluctance cartridge available at $2.95 extra). Model S-78A, 11 tube FM-AM chassis. Ship. wt. 22 lbs. Sale price, $49.95.
S-78A chassis with our CU-14Y, 12" coaxial PM speaker, both for $59.95.
S-78A chassis with our P15-CR, 15" coaxial PM speaker, both for $69.95.
S-78A with CU-14Y and UA8-H, 4 speed Monarch record changer with flip-over crystal cartridge, all for $86.95.
S-78A with CU-14Y and RC-88, 4 speed Garrard record changer with flip-over crystal cartridge, all for $115.95.

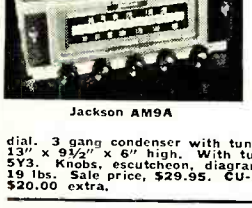


HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER

BOTH FOR $44.95

9 TUBES—PLUS 2 RECTIFIERS PHONO INPUT 10 W. AMP.

New Hi-Fi self-powered FM-AM tuner with 10 watt amplifier (push-pull 6V6's) on separate chassis. All you need is a record changer and speaker to have a complete home music system. 3 ft. cable connects tuner to amp. Tuner has input for crystal phono. (If changer with v.r. cartridge is purchased, we will include the necessary pre-amp, no charge.) Tuner has 6 tubes: 12AT7, 6BE6, 2—6BA6, 6AT6, 6AL5 and 6X4 rectifier. Amp. has 2—6V6's, 6SN7 and rectifier. Full superhet circuit with AVC, 3 position tone control. 9" illuminated slide rule dial, escutcheon and knobs. Stick loop antenna for AM. Radio-FM-AM, phono selector switch, tone control, volume control on tuner. Response 50 to 17,500 cps. Receives broadcast 540 to 1600 kc and FM 88 to 108 mc. Output matches any of the speakers shown above. No. FA9-2CR tuner and amplifier complete. Ship. wt. 22 lbs. Sale price, $44.95. CU-14Y 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.



Jackson AM9A

9-TUBE HI-FIDELITY

12 Watts Audio Dual Tone Controls

$29.95 LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

Jackson AM9A, 12 watt hi-fi audio amplifier and broadcast tuner combined. Less than you would pay for the amp alone. Push-pull 6V6's. Response 30 to 15,000 cps. Inputs for crystal or v.r. phono and crystal or dynamic mike. Separate bass boost and treble tone controls, radio-phono switch. Shielded output matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power trans. 9½" illuminated slide rule dial. 3 gang condenser with tuned R.F. and loop ant. Receives 550 to 1650 kc. Size, 13" x 9½" x 6" high. With tubes: 2—6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2—6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included. Model AM9A. Ship. wt. 19 lbs. Sale price, $29.95. CU-14Y 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.

9 TUBE—12 WATT HI-FI 8" PM—LEATHERETTE CAB. $44.95

9 tube high fidelity AM9A chassis shown above in leatherette covered cabinet with 8", 6.8 oz. PM speaker having tweeter cone in the center of large cone. Tan leatherette covered cabinet 10"x10"x24" long. Plastic grill cloth covers entire front. Stock No. CAM-98. Ship. wt. 28 lbs. Sale price, $44.95.

McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

$12.95 12-Inch Model CU-14Y

$23.95 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.
Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR. McGee's Sale Price, $23.95.
McGee's new 15" Junior coaxial PM speaker. 15" woofer has 6.8 oz. Alnico V magnet. 5" coaxially suspended tweeter with crossover. Only two wires to connect to any 8 ohm radio or amplifier. Frequency response from 40 to 15,000 cps. Model No. M15-CR, 15" Junior coax PM speaker, Sale price, $16.95.

VM HI-FI CHANGER. SALE PRICE $29.95 LESS BASE LESS CART.

VM-936HF $32.95

COLLARO 456 - $34.50

MONARCH UA8H $27.95

$45.90 WITH GE RPX-052A

4 Speed Monarch SALE PRICE $27.95 with 222 Ronette Ceramic Cart. Diamond 1 Mil Stylus $10.00 Extra

New offering of VM Hi-Fidelity, 3 speed record changer with or without metal base. A large special purchase makes this low sale price possible. Reg. net on VM-935 less cartridge was $38.97. Reg. net on VM-936 less cartridge was $45.47. The VM-935-936 Hi-Fi Series changers are equipped with two plug-in tone arm heads which will hold popular G.E. or Pickering single or dual play cartridges. Both have 4-pole motors for constant speed, hum free operation with a VR cartridge. Plays all 3 speeds and all 3 sizes. Will inter-mix 10" and 12" records of same speed. Shuts off after last record plays. Muting switch silences pickup during change cycle. Furnished with large 45 RPM spindle. Chassis size 13½ x 13¼ x 8½" high, 4½" above plate. Ship. wt. 12 lbs., with base 18 lbs.
VM-935HF, 3 speed Hi-Fi changer, less cartridge and base, only $29.95.
VM-935HF-GE with G.E. RPX-050A VR cartridge, $35.90.
VM-935HF-GED with "Golden Treasure" RPX-052A VR cartridge; 1 mil diamond and 3 mil sapphire stylii, only $45.90.
VM-936HF, 3 speed Hi-Fi changer with metal base, less cartridge, Sale price, $32.95.
VM-936HF-GE with G.E. RPX-050A VR cartridge, $38.90.
VM-936HF-GED with G.E. RPX-052A "Golden Treasure" cartridge; 1 mil diamond, 3 mil sapphire stylii, only $48.90.

4-SPEED COLLARO Latest 1957 model RC-456, Collaro 4 speed record changer. Plays all 4 speeds, 16, 33, 45 and 78 RPM both automatically and manually. Inter-mixes records of the same speed and shuts off after last record. Fast 6 second change cycle. Automatic disengagement of idler wheels eliminates flat spots that cause wow and flutter. Base size: 13½" wide, 12" deep. 4½" above motor board and 3" below. Model RC-456 Collaro 4 speed automatic record changer, less cartridge, Sale price, $34.50. RC-456 with G.E. variable reluctance cartridge with 3 mil sapphire and 1 mil diamond stylus, Sale price, $46.95. Large 45 RPM spindle, $3.30 extra.

New Model UA8, Monarch 4 speed imported High Fidelity record changer. Features a high fidelity 4 pole motor, 9" turntable with molded rubber pallet. Counter-balanced tone arm will accept any of the popular Hi-Fi cartridges. Plays all 4 speeds and all 3 sizes. Intermixes 10" and 12" records of the same speed and shuts off after last record plays. Base size, 10⅞" x 12¾". Ship. wt. 15 lbs. Large spindle for 45 RPM records, $1.88 extra.
Model UA8-H with ±222 Ronette Hi-Fi flipover ceramic cartridge, $27.95.
Model UA8-HD, same as above but with 1 mil diamond stylus, $37.95.
Model UA8-U with ±500 Goldring variable reluctance cartridge, $29.95.
Model UA8-UD, same as above but with 1 mil diamond stylus, $39.95.

4-SPEED WEBCOR New, 4 speed Model 152, Webcor "Magic-Mind" automatic record changer. Complete with G.E. RPX-050A variable reluctance cartridge. Plays all 4 speeds 16, 33, 45 and 78 RPM automatically. 7", 10" and 12" LP records can be inter-mixed. Magic-Mind feature will switch speeds automatically between 33 and 45 RPM depending on the size of the record. Has heavy 4 pole motor and 8" turntable with rubber pad. Shuts off after last record plays and has neutral position to prevent flat spots on drive wheels that cause wow and flutter. Base size, 13⅜"x12". Ship. wt. 13 lbs. Sale price, $31.95. Large 45 RPM spindle, $2.94 extra.

3-SPEED VM VM-956GE, 3 speed automatic record changer with G.E. RPX-050A variable reluctance cartridge and metal base. Plays all 3 speeds; 33, 45 and 78 RPM and all 3 size records. Will inter-mix 10" and 12" records of the same speed. Shuts off after last record. Has heavy 4 pole motor. Base size, 13-3/16"x 11⅞" deep. 7¼" high. Ship. wt. 15 lbs. Sale price, $29.95. Large 45 RPM spindle $1.88 extra.

14 TUBE ESPEY HI-FI CUSTOM FM-AM CHASSIS $69.95

★ PUSH-PULL 6V6 OUTPUT
★ TWIN CONE CONTROLS
★ INPUTS FOR CRYSTAL OR V.R. PHONO, TAPE OR TV
★ WILLIAMSON TYPE CIRCUIT
★ ULTRA-LINEAR RESPONSE

MODEL HF-250C. A FULL HIGH FIDELITY AUDIO AMPLIFIER AND FM-AM TUNER—ALL ON ONE CHASSIS

REGULAR $119.50 VALUE

SALE PRICE **$69.95** LESS SPEAKER AND CABINET

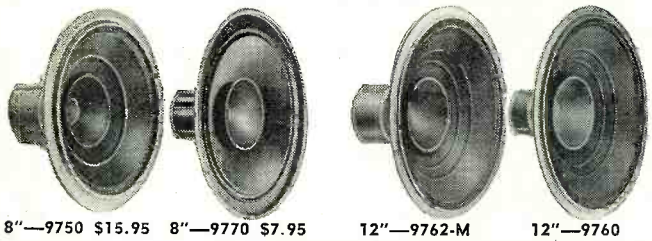
LEATHERETTE COVERED CABINET $7.85 EXTRA

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 stages for 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: 7¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable). Model HF-250C Sale price, $69.95. Espey chassis with our P15-CR, 15" coaxial PM speaker, both for $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.

Beautiful moderntone tan leatherette covered cabinet to house the HF-250C Espey chassis for custom installations. Also, will fit the 500G Espey tuner shown on the opposite page. High quality, sturdy plywood cabinet expertly covered with modern tan leathrette material. Size, 15" long, 8½" high and 10⅜" deep. Stock No. LEC-50. Custom leatherette covered cabinet. Ship. wt. 7 lbs. Order with your Espey chassis for only $7.95 extra.

SAVE ON NORELCO SPEAKERS AT McGEE

LATEST IMPORTED 8" AND 12" HI-FI PM's



8"—9750 $15.95 8"—9770 $7.95 12"—9762-M 12"—9760

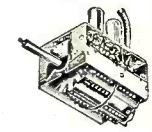
The choice of Hi-Fi PM speakers, imported from Holland. Made by the internationally famous Phillips company. Twin cones are operated by the same super high efficiency Alnico magnet. The small center cone extends the audio range and loudness above 10,000 cps. Better and more natural sound reproduction. Extra number of gauss means more bass efficiency.

World Famous Hi-Fi	Imported From Holland
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
8" Model 9770	reg. $ 9.90 Sale Price $ 7.95

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.
NORELCO Model 9770—8" wide range Hi-Fi PM speaker, res. 75 to 19,000 cps. New Alnico VI magnet gives 11,000 gauss. Reg. $9.90 net, on sale at McGEE for only $7.95; or 2 for $15.00.

NEW TYPE "T" STANDARD COIL

SINGLE STRIP TV TUNERS



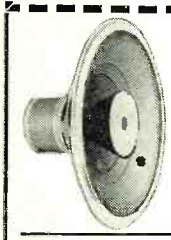
PENTODE TUNERS $9.95 CASCODE TUNERS $12.95

2 FOR $19.00 2 FOR $25.00

New, "T" type, single strip Standard Coil Cascode tuner. Available for 21 mc and 41 mc, for either series or parallel filaments with various shaft lengths. This is the latest single strip, 12 position, 12 channel VHF tuner with ¼" shaft having ⅜" concentric fine tuning shaft. You can replace all of the older model 2 strip tuners with these. Ship. wt. 3 lbs. Your choice of tuner with 1¼", 2½" or 3½" shaft length. Sale price, $12.95 each, 2 for $25.00.
Tuners with 4", 4½", 5", 6½" 7", 8¼" or 10½" shaft lengths. Sale price, $13.95 each, 2 for $27.00.
No. TCA-050, 2 tube 21 mc Cascode tuner with parallel filaments. Replaces 2000, 2200, 2300, 4200 series and others. Complete with 6BQ7 or 6BZ7 and 6J6 tubes.
No. TD-050, 2 tube 41 mc Cascode tuner with parallel filaments. Replaces TV-3000, 4400, 6000, 6500, 8000 and 8500 series. Complete with 6BZ7 or 6AT8 and 6J6 tubes.
TDS-050, 2 tube 41 mc Cascode tuner with series filaments. Complete with 4BQ7 and 5BR8 tubes.
No. TDC-050, 2 tube 41 mc Cascode tuner with series filaments. Complete with 4BQ7 and 5BR8 tubes.
No. TCS-050, 2 tube 21 mc Cascode tuner with series filaments. Complete with 4BQ7 and 5J6 tubes.

New, "T" type, single strip Standard Coil Pentode tuners. Available for 21 mc and 41 mc, for either series or parallel filaments. These are the latest single strip type tuners. 12 position, 12 channel VHF with regular ¼" shaft having ⅜" concentric fine tuning. Your choice of tuner with 1¼", 2½" or 3½" shaft length. Sale price $9.95 each, 2 for $19.00.
Tuners with 4", 4½", 5", 6½", 7", 8¼" or 10½" shaft lengths. Sale price, $10.95 each, 2 for $21.00.
No. TAA-050, 2 tube 21 mc Pentode tuner with parallel filaments. Complete with 6BC5 and 6J6 tubes. Replaces TV-100, TV-200, TV-300, TV-1200, TV-1300 and TV-1500.
No. TAS-050, 2 tube 21 mc Pentode tuner with series filaments. Complete with 3BC5 and 5J6 tubes.
No. TB-050, 2 tube 41 mc Pentode tuner with parallel filaments. Complete with 6BC5 and 6AT8 tubes.
No. TBS-050, 2 tube 41 mc Pentode tuner with series filaments. Complete with 3BC5 and 5AT8 tubes.

Set of matched knobs for above Standard Coil tuners. Molded mahogany bakelite with gold markings and metal inserts. Stock No. SCK-2 pair of knobs for channel selector and fine tuning, 59c.
Set fo matching mahogany bakelite knobs for volume and contrast, Stock No. VCK-2, 59c per pair.



FAMOUS 12" NORELCO PM SPEAKER

MODEL 9762-05 REGULAR NET WAS $59.97

McGEE SCOOP PRICE $29.95

McGee Scoop. Genuine Norelco 9762-05 extended range high fidelity 12" PM speaker. 11,000 gauss. Heavy 37 oz. Alnico V magnet. Rated 20 to 30 watts audio. Response 35 to 18,000 cps. Regular $60.00 net value. Has extended range bakelite dispersion feature built-in center of core to extend high frequency range. Never before have we had such a terrific value on this genuine Norelco 12" speaker. Made in Holland. Stock No. 9762-05. McGee's sale price, $29.95.

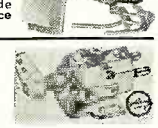
IMPORTED HI-FI HORN TWEETER UP TO 16,000 CPS—SALE PRICE $16.95

Pioneer Model PT-3, 20 watt imported Hi-Fi tweeter speaker. Frequency response flat from 1500 to 16,000 cps. Tested for us by a leading college whose response curve ran from 1500 to 20,000 cps. Finest imported tweeter we have found. Equal to American made tweeters selling up to $50.00 or more. Specify 8 or 16 ohm voice coil when ordering. Stock No. PT-3. Sale price, $16.95.

GOLDRING V. R. CARTRIDGE

WITH 2 SAPPHIRE STYLII $5.95

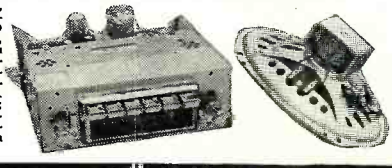
WITH 1 MIL DIAMOND, 3 MIL SAPH. $13.95

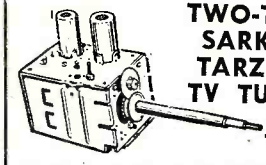


McGee offers the internationally famous Goldring variable reluctance phono cartridge, made in England and sold throughout the world to those who want the finest and most accurate music reproduction from 33⅓, 45 and 78 RPM high fidelity phono records. (Input gain and compensation similar to G.E. v.r. cartridge required.) Furnished as standard equipment with sapphire 1 and 3 mil stylii. A regular $9.90 net item on sale at McGee for $5.95. For $13.95 with a diamond 1 mil stylus. These are the latest production, individually cartoned turnover cartridge with mounting bracket. Fits tone arms on most changers. Made for and bearing the famous Wilcox-Gay Recordio name. No. 546 Goldring V.R. (Wilcox-Gay) cartridge, Net $5.95. No. D546-DS, Goldring V.R. (Wilcox-Gay) cartridge with diamond 1 mil stylus, $13.95. 1 mil diamond stylus for Goldring V.R. cartridge, purchased separately, $9.95.

NEW 8 TUBE 6 VOLT PUSH-BUTTON MODEL $37.95

New model SH-78555-X, 8-tube, 6-volt universal mounting auto radio with push buttons and 6x9 speaker. Made for Hudson cars, but their compact construction lends them to underdash installation. Has push-pull 6AQ5 high-powered audio. Stock No. 5H78-555-X with 6x9 speaker—$37.95. With 2—5x7 speakers—$39.95; with 1—5x7 speaker $37.95. Specify speaker size wanted. Three-section top cowl mounting antenna —$2.29 extra.





TWO-TUBE SARKES-TARZIAN TV TUNER WITH TUBES

21 MC PENTODE OR 41 MC CASCODE

SALE PRICE $7.95 2 FOR $14.95

No. TT-3A, 2 tube 21 mc Sarkes-Tarzian Pentode TV tuner. 12 position, 12 channel VHF complete with 6J6 and 6BC5 tubes. This popular tuner used in Arvin, Air King, Airline, CBS, Crosley, Firestone, Truetone, Hallicrafters, Westinghouse and others. Specify shaft length, 2½", 2¾" or 2⅞". Ship. wt. 2 lbs. Sale price, $7.95 ea., 2 for $14.95. Available with longer shaft 3¼" to 9" long at $1.00 extra. SCK-2, set of matching knobs for selector and fine tuning, 59c.

No. TT-2C, 2 tube 41 mc Sarkes-Tarzian Cascode TV tuner. 12 position, 12 channel VHF switch type. Complete with 6BZ7 or 6BQ7 and 6J6 tubes. This popular tuner used in many makes of TV sets; including Arvin E25702, E40128, Silvertone E40352 and Westinghouse V11485. Available with shaft 3¼", 4" 4⅛" and 4¼" long. Ship. wt. 2 lbs. Sale price, $7.95 each, 2 for $14.95. For 9" shaft, add $1.00. SCK-2, set of matching selector and fine tuning knobs. 59c.

No. ST-4B, 2 tube 41 mc Sarkes-Tarzian Pentode tuner. 12 position, 12 channel VHF complete with 6AK5 or 6BC5 and 6J6 tubes. Used in Westinghouse models V-9886, V-10750, V-10805 and V-11385-1. Shaft lengths 3¼" and 3⅜". Ship. wt. 2 lbs. Sale price. $5.95 2 for $10.95. SCK-2, set of matching selector and fine tuning knobs, 59c.

No. TT-1A, 2 tube 41 mc Sarkes-Tarzian Cascode TV tuner. 16 position switch type for 12 channel VHF and 4 positions for UHF converter (UHF converter not furnished). Complete with tubes, 6BZ7 and 6X8. Has 3¼" shaft for Westinghouse V-11333-1, etc. Sale price, $5.95 each, 2 for $10.95.

No. TT-5D, 2 tube 41 mc Sarkes-Tarzian Cascode TV tuner. 14 position switch type for 12 channel VHF and 2 positions for UHF converter. (UHF converter not furnished). Complete with tubes, 6BZ7 and 6U8 and channel selector knob. For Westinghouse models V-11794-1 and V-12400-1. Shaft length 7⅞". Sale price, $5.95 each, 2 for $10.95. Available 9¼" shaft at $1.00 extra.

No. TT-6A, 2 tube 41 mc Sarkes-Tarzian Pentode TV tuner. 16 position switch type for 12 channel VHF and 4 positions for UHF converter. (UHF converter not furnished). Complete with tubes, 6CB6 and 6X8. For Westinghouse model V-10880-2. also Arvin. Shaft length 3¼". Sale price, $5.95 each, 2 for $10.95.

MINIATURE BROADCASTING STATION FOR MICROPHONE AND PHONO WITH CRYSTAL MICROPHONE

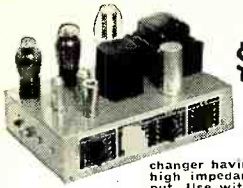
SALE PRICE $9.95

Sensational new model MCL-E3 miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like a radio station. Has input jacks for crystal mike or record player. Complete with 12K8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete wih crystal hand mike and instructions. Ship. wt. 4 lbs. Net price $9.95.

McGEE RADIO COMPANY PRICES F.O.B. KANSAS CITY SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D. TELEPHONE VICTOR 2-5092 1903 McGEE ST., KANSAS CITY, MISSOURI

AMERICA'S FINEST VALUES IN "LOW COST" HIGH FIDELITY

ECONOMY 20-WATT AMPLIFIER $24.95



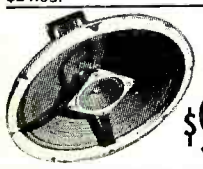
Model HF-21

$24.95

Push-Pull 6L6 Output Tubes
Response 30-15,000 cps
Bass and Treble Tone Controls
Input for Xtal or Dynamic Mike
Input for Xtal or V. R. Phono

A tremendous High Fidelity amplifier value. Response 30 to 15,000 cps. Electronic bass and treble boost by separate tone controls. Use this amplifier with any record changer having crystal or variable reluctance cartridge, radio tuner or high impedance crystal or dynamic microphone. 20-watts power output. Use with any 8-ohm speaker. Chassis size 7⅜" x 10½" x 7⅛" high. Complete with tubes: 2—6L6, 2—6C4, 12AX7 and 5U4G. This is a terrific value. A ready to use High Fidelity amplifier at less than the cost of a kit. Ship. wt. 19 lbs. Model HF-21, 20-watt Hi-Fi amplifier. Sale price $24.95.

12" COAXIAL PM SPEAKER RESPONSE 25-17,000 CPS



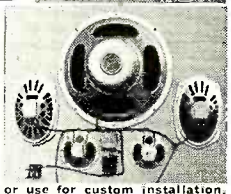
$9.95

Model 12X3Y, new 1957 12" Coaxial PM Speaker, has high efficiency 12" woofer with Alnico V magnet and coaxially suspended 3½" Alnico V tweeter. Built-in crossover with variable brilliance control on an 18" lead for remote control of the tweeter volume. 10-watts, response 25 to 17,000 cps. Ship. wt. 7 lbs. Stock No. 12X3Y, 12" coaxial PM Speaker. Sale Price $9.95.

TREMENDOUS McGEE VALUE
NEW 1957 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 LC 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



Model B-347, high fidelity 30-watt, 5-way speaker system, mounted on an 30" x 24" baffle board. Has 15" UTAH 21½-oz. woofer, 2-new high fidelity extended range 6 x 9" speakers, plus 2-5" tweeters; all with Alnico V magnets. Built-in LC crossover network with variable brilliance and presence controls. Ship. wt. 22 lbs. Stock No. B-347, 5-way, 30-watt Hi-Fi speaker system. AUDIOPHILE VALUE $59.95. SALE PRICE $39.95.

SALE PRICE $39.95

Mount these Hi-Fi speaker systems in your own cabinet or use for custom installation. Ideal for use with any radio or amplifier. Completely wired, with only 2-wires to connect to any 8-ohm output (Take 10% discount if ordered with any radio or amplifier listed hereon.) Grill cloth, 75c extra.

3 - 1957 MODEL Hi-Fi SPEAKERS

- **COMPLETE SYSTEMS WITH 4 SPEAKERS**
- **ACOUSTICALLY LINED ENCLOSURES**

The new 1957 Hollywood, 4 speaker high fidelity speaker systems are expressly designed to give realistic reproduction from your Hi-Fi amplifier or FM-AM radio. Juke box bass response with brilliant, middle and high range response. All 3 models have genuine L-C crossover networks and variable brilliance controls. Only 2 wires to connect to the 4 or 8 ohm tap on your Hi-Fi amplifier. A fine speaker system to use with our Imperial 20, 30 and 34 high fidelity amplifiers, and all FM-AM chassis in our Radio & TV News offerings. Adjusting the twin tone controls on our Imperial amplifiers along with the brilliance control on the Hollywood speaker systems you can have fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. Choice of either Mahogany or Walnut finishes. Baffles are fully enclosed and acoustically lined. Small enough in size for the average room, yet large enough for proper baffling. 35" high, 19" front to back, 25" wide. Specify cabinet finish when ordering, otherwise we will ship mahogany finish. Take $3.00 discount when you order with any of the Imperial amplifiers or Espey FM-AM chassis offered in this 3 page ad.

$39.95

Model H-4H, Hollywood 4 speaker high fidelity speaker system. 20 watts, response 20 to 17,500 cps. Choice of Mahogany or Walnut finish enclosure. Features a 12" General Electric 6.8 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance L-C crossover network. Model H-4H, Ship. wt. 55 lbs. Price, $39.95.

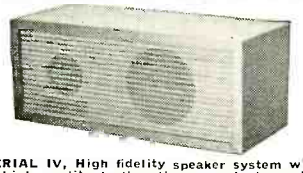
$49.95

Model Z-4Z, Hollywood 4 speaker, high fidelity speaker system. 25 watts, response from 18 to 17,500 cps. Choice of Mahogany or Walnut 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 L-C crossover network. Model Z-4Z, Ship. wt. 57 lbs. Sale price, $49.95.

NEW IMPERIAL SPEAKER SYSTEMS

Imperial IV with 8" G.E. High Fidelity Speaker

$19.95



3-Way Imperial VI with 12" G.E. Speaker

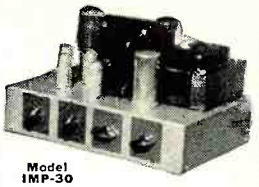
$29.95

New 1957 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 24" long. Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The IMPERIAL IV contains a General Electric Model 850 or 9770 Norelco 8" extended range high fidelity 8" PM speaker with 6.8 oz. Alnico V magnet and curvilinear cone with 8 ohm voice coil and a 5" tweeter. Response 50 to 15,000 cps. Ship. wt. 14 lbs. Model IV Imperial $19.95.

1957 Model Imperial VI. 3-way speaker system. Baffle is of heavy wood, leatherette covered. Similar in appearance to the Imperial IV pictured above, except 4" taller and 1" deeper. Equipped with 3 matched speakers. A 12" G.E. Model 1203 with 9 oz. Alnico V magnet, plus 5¼" PM for middle range and 3" tweeter. Simple to connect to any high fidelity amplifier. (8 ohms impedance). Ship. wt. 25 lbs. Stock No. IMP-VI, Sale price. $29.95. Ideal for use with HF-21 and IMP-30 amplifiers described above.

IMPERIAL 30-WATT AMPLIFIER $29.95
NEW 1957 MODEL

Push-Pull 6L6 Output Tubes
Response 15-20,000 CPS
Bass and Treble Tone Controls
Compensated Gain for G.E. Cart.
Input for Xtal or Dynamic Mike

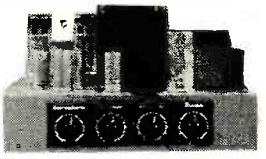


Model IMP-30

With CU-14Y, 12" Coax Speaker .$39.95
With P15-CR, 15" Coax Speaker..$49.95
With Imperial IV Speaker System.$46.95
With Imperial VI.....$55.95 With HF-33GE $76.95

New 1957 model 7 tube Imperial 30 watt High Fidelity audio amplifier. A $100.00 list value for only $29.95. Features a heavy 4 lb., specially wound high fidelity output transformer with 15% inverse feed-back; push-pull 6L6 output tubes and frequency response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. You can center your entire custom music system around this low cost 30 watt amplifier. This Imperial 30, 30 watt amplifier may be used with any radio tuner or record player. It will drive any speaker system that you may have. Use from one to ten 8" speakers or any 12" or 15" coaxial speaker or any 3-way speaker system. Tone compensated input for either a crystal phono pickup or a General Electric variable reluctance pickup. Also, has input for crystal or high impedance dynamic microphone. 4 controls are mike gain, phono gain, treble tone and bass boost tone control. This amplifier weighs 21 lbs. net. Full size transformer components would cost you up to $15.00 if purchased separately. Gold color chassis is 12¼" x 7¾" x 7¼" high. Complete with tubes: 6AT6, 12AU7, 6C4, 12AU7, 2—6L6GA, plus 5U4G rectifier. Stock No. IMP-30, 30 watt Imperial High-Fidelity amplifier complete with tubes and diagram. Ship. wt. 19 lbs., Sale price only $29.95.

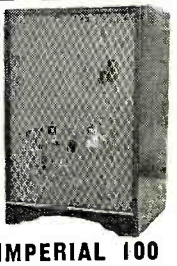
NEW IMPERIAL 24 WATT AMPLIFIER $39.95
PUSH-PULL EL-34 ENGLISH MADE MULLARD OUTPUT TUBES
WILLIAMSON TYPE CIRCUIT
RESPONSE 15-20,000 CPS



With CU-14Y, 12" Coax Speaker..$49.95
With P15-CR, 15" Coax Speaker..$59.95
With Imperial IV Speaker System..$56.95
With SP12125GR..$65.95. With HF-33GE..$86.95. Model IMP-34X

New, 1957 model Imperial 34X, 24 watt high fidelity amplifier for the audio enthusiast who wants McGee's finest amplifier. This amplifier features push-pull Telefunken or EL-34 English made Mullard output tubes in a Williamson circuit. Heavy duty 6 lb. specially wound Williamson type ultra-linear output transformer in potted case has a response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. Amplifier has input for crystal pickup and built-in pre-amplifier for the popular General Electric and Goldring variable reluctance cartridges; as well as input for crystal or high impedance dynamic microphones. 4 controls are microphone gain, phono gain and separate variable treble and bass boost tone control with off-on switch. Chassis size: 12¼" x 7¾" x 7¼" high. Complete with 7 tubes and diagram. Model IMP-34X, 24 watt high fidelity amplifier, ideal for use with any of our high fidelity coaxial or multiple speaker systems. Ship. wt. 26 lbs. Sale price, $39.95.

McGEE OFFERS A COMPLETE HI-FI SPEAKER SYSTEM
AT A PRICE YOU MIGHT PAY FOR THE ENCLOSURE ALONE!



Mahogany speaker enclosure used with the 3 Imperial systems described below. Size, 39" high, 24" wide and 23½" deep. Over 10 cu. ft. of volume in this fully enclosed speaker cabinet. Beautiful mahogany finish with matching grill cloth covering entire front. Speakers are mounted on a heavy plywood baffle. Enclosure is lined with an accoustical material. Speakers and crossover network are wired up, ready to connect to 8 ohm output.

IMPERIAL 80

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 L-C, 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 80, speaker system. Ship. wt. 80 lbs., Sale price..... **$69.95**

IMPERIAL 90

Imperial 90. 30 watt speaker system with 5 speakers. Response 18 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 L-C type, 3 way crossover network. Imperial 90, speaker system. Ship. wt. 90 lbs., Sale price..... **$89.95**

IMPERIAL 100

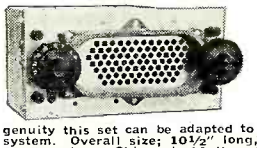
35 watts, response 18 to 20,000 cps. A complete speaker system in the above described enclosure, ready to connect to your Hi-Fi amplifier. Features the $85.00 net, Electro-Voice 15" woofer Model 15W which has a 5 lb. Alnico V magnet, plus an 8", 6.8 oz. Alnico V mid-range speaker and a horn type tweeter. Built-in L-C crossover network. The speakers in this system would cost over $109.95 if purchased separately. We offer you this complete only $119.95. Stock No. system with enclosure for Imperial 100. Ship. wt. 100 lbs., Sale price **$119.95**

5 Station Intercom Master
Sale Price $19.95
Sub Stations $3.95 Each
3 for $10.00

New, 1958 model office and business intercom master for use with up to 5 sub stations. Selective type, to call from 1 to 5 subs privately or together. Talk-listen switch gives master control of conversation. Made for 110 volt AC-DC operation. Complete with 3 tubes including rectifier. Housed in an attractive modern design proxilin covered wood cabinet, 5¼" high, 11" long and 8" front to back. Stock No. MMS-5, 5 station intercom master. Sale price. $19.95.

Small square matching sub-station with "call-in" switch. Stock No. NN-5. $3.95 each, 3 for $10.00. 3 wire intercom cable for use with above system, $1.95 per 100 ft., 500 ft. for $8.95.

GENERAL PURPOSE AUTO-RADIO



SALE PRICE $17.95

$49.95 list value auto radio. Nash Model NH3C for '53 Nash Rambler, made by Motorola. Works on 6 volt storage battery. Custom built, 5 tube superhet receiver. Broadcast range 540 to 1600 KC. Complete with tubes; 6AV6 det. AVC amplifier, 6BA6 I.F. amplifier, 6BE6 converter, 6A55 audio output and 6X4 rectifier. Has built-in 4x6" PM speaker. With some ingenuity this set can be adapted to fit many other auto installations which have 6 volt system. Overall size; 10½" long, 5¼" high, 4½" deep (5" with knobs.) Knobs on 8½" centers. Ship. wt. 10 lbs. Stock No. NH3C, General purpose 6 volt auto radio. Sale price, $17.95 each, 2 for $34.00.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

Computer Employment

(*Continued from page 41*)

tronics, but a person lacking in analytic abilities will never be a good service engineer. The employment manager of one company says, "One applicant in five passes our electronics test, but only one in twenty passes *both* quizzes!"

Training

If you are a successful applicant for a maintenance engineering job, your new employer will put you through an extensive educational program that may last from 4 to 9 months. Instructors are excellent and the latest teaching aids are used. This education would cost an individual thousands of dollars if he had to pay for it himself. Companies estimate that a trained man, ready to accept responsibilities in the field, has cost them $5000 to $12,000 upon completion of the education program. In addition to this training, most companies pay *per diem* living expenses as well as salary during the training period.

The first thing the trainee must learn is the over-all organization of the electronic computer and how it operates. The "how" involves the "commands," or the programming instructions, which control the machine operations. Put in another way, the trainee must learn to speak the computer's language.

Once programming of the machine is mastered, the next step is to understand the circuitry which translates a program instruction into a series of coded, timed pulses which generate the required action within the machine. Since computers are essentially pulse-controlled devices, the kinds of circuits which are studied include pulse generators, wave-shaping circuits, triggers, flip-flops, and electronic gates.

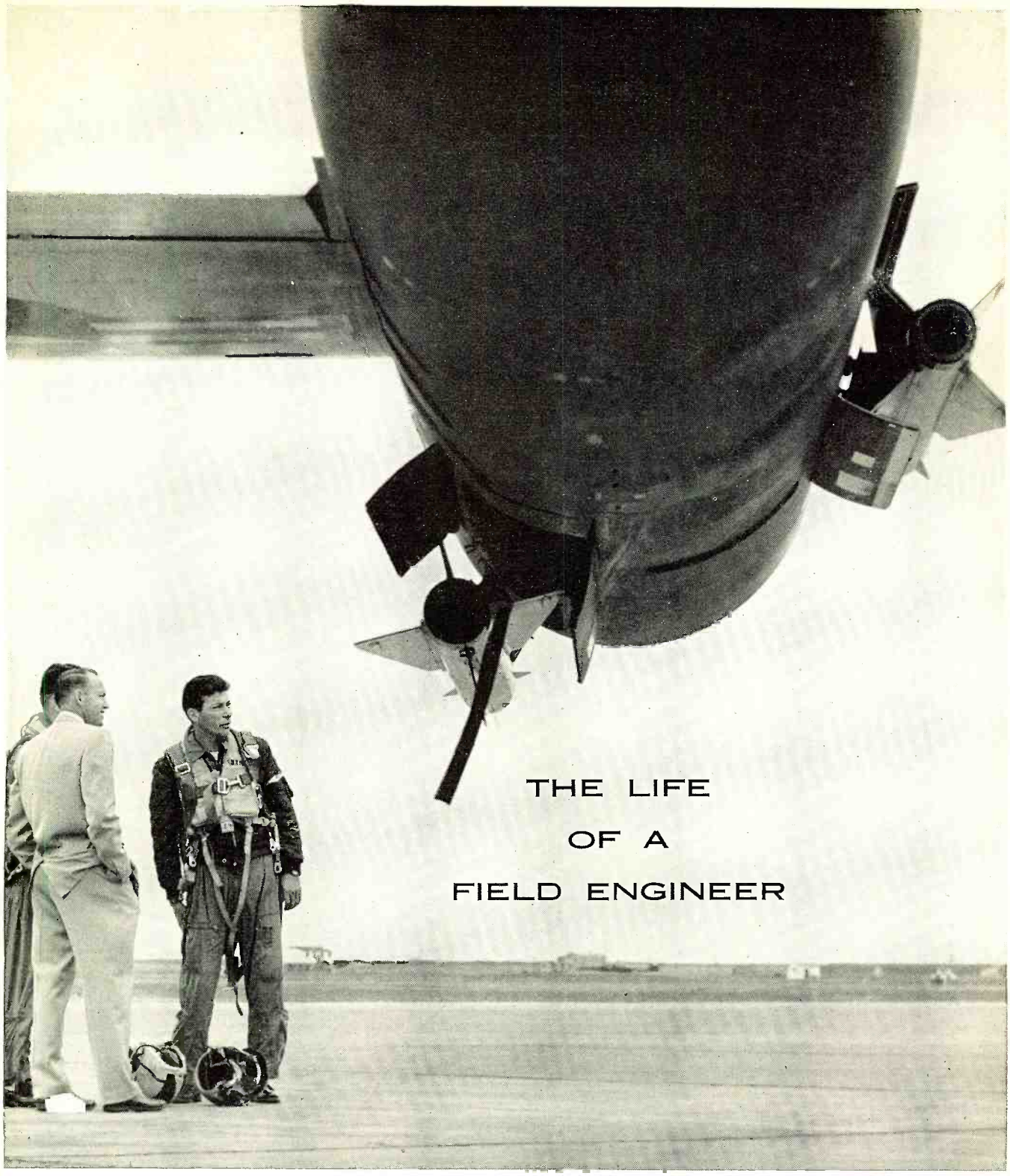
The most difficult part of the educational program is learning the logics of the machine. Instead of a circuit diagram showing tubes, resistors, transformers, and the like, the computer engineer works with *logical* diagrams which show the functional parts of the machine as symbols representing gates, inverters, flip-flops, and others.

A subject which is new to most trainees is Boolean algebra, which is a mathematics of logic. This technique permits expressing the logical, functional operations of the computer in terms of equations. Once learned, the Boolean technique is a superior method of analyzing machine troubles. Not all companies, however, use Boolean algebra for service engineering.

On the Job

Once training is completed, engineers are assigned responsibility for maintaining equipment in the field. Typically, several engineers report to a working supervisor. When new systems are delivered to customers, there is the big job of connecting all of the

Life of a Field Engineer, number 1 of a series



THE LIFE OF A FIELD ENGINEER

George Tally is one of the Hughes Field Engineers assigned to an Air Force base in California. He is highly respected, for, to the personnel of this base, he represents all the technical knowledge of the Hughes Aircraft Company.

Hughes Field Engineers are responsible for all phases of support for the maximum field performance of Hughes electronic armament controls systems and guided missiles. The background and experience they gain by such activities provide an over-all systems knowledge which is unsurpassed. Their training assures them an unlimited future in the field of electronics.

IF YOU ARE AN ENGINEER OR PHYSICIST interested in this stimulating and rewarding type of work, send a brief outline of your experience to the address below.

The West's leader in advanced electronics

HUGHES

RESEARCH & DEVELOPMENT LABORATORIES *Scientific Staff Relations, Hughes Aircraft Co., Culver City, California*

subassemblies, checking out all operations, and, finally, turning over the machine to the customer. The more usual job is the day-to-day operations necessary to guarantee an efficiently running machine. About 1 hour during or before a shift will be spent on preventive maintenance, which involves making marginal checks by varying voltages and other circuit parameters and by running "diagnostic" routines, which are programs that logically check all of the different machine functions and print out results that expose the malfunction of any part of the machine. The rest of the working day is devoted to aligning, adjusting, and performing other maintenance functions on peripheral equipment which can be released from the main computer operation, overhauling plug-in components which have failed and been removed, doing advanced computer study, developing new analytic techniques, and maintaining operational reports.

Of course, the service engineer really goes to work when the machine breaks down unexpectedly. Something within the computer fails—checking circuits or the machine program automatically find the error, recovery procedures fail to correct the difficulty, and the machine stops, with a glowing red light on the console which shouts *trouble!* Operating personnel stand about with folded hands, scheduled work is delayed, and money is going down the drain at a rate of hundreds of dollars per hour. This is the time when the service engineer really earns his money. His ability to find the trouble and put the machine back in business determines the over-all efficiency of an installation and the satisfaction of the customer with the equipment. The better the preventive maintenance, the fewer unexpected breakdowns will occur.

Obviously, the service engineer plays a very important part in computer operations. We asked many supervisors the question, "How long does a man have to work in the field to become a truly competent, well-rounded service engineer?" There was general agreement on the answer: "Two or three years, in most cases."

Remuneration

Finally—what about pay? Field engineering jobs are salaried positions. While there are variances among companies, trainees are usually hired at $325 to $450 per month. Some employers are more liberal than others in recognizing previous experience in establishing a flexible starting salary. After training, $400 to $500 is a typical bracket of salaries paid. For field-experienced, well-qualified service engineers the range is $500 to $750. Supervisory and administrative salaries go to $1000 per month. Fringe benefits include overtime pay, insurance plans, retirement funds, paid vacations, and military-leave arrangements.

Advancement within the company is stressed by all employers, and the door is open to management, sales, design engineering, and manufacturing positions to those who prove their abilities and have interest in these areas.

In this day of engineering shortages, there are employment opportunities that pay more for starting jobs. However, if you are looking to the future, today's needs in the computer industry present a rare chance to improve your electronic knowledge and get in on the ground floor of a skyrocketing new industry. —30—

What is claimed to be the world's largest magnetic tape plant has been put into 24-hour-a-day production by the Minnesota Mining and Manufacturing Co. in St. Paul, Minn. Built and maintained almost like a hospital in order to achieve near-sterile conditions required for producing magnetic tape for such critical applications as video tape recording, electronic computers and instrumentation recording, the plant incorporates many unusual production line features. Shown in the photo is the isolated packaging area where 10½" reels of "Scotch" brand tape are packaged and demagnetized by a continuous belt. Under the table is an electromagnet for bulk-erasing to provide tape signal free for most critical applications.

COMIN' SOON

HI-FI DIRECTORY & BUYERS' GUIDE

The world's first **complete** listing of all HI-FI equipment on the market!

And . . . expert professional advice on how to select the unit for **your** needs.

This one-of-a-kind directory presents for the first time a thorough report on **every piece of high fidelity** equipment being produced today! It covers every aspect of HI-FI equipment: specification, manufacturers, performance capacities, prices. Each product is clearly illustrated, and is described completely.

Here is the information you need to choose and buy the components that offer you the perfection in sound you demand, and the true enjoyment of high fidelity!

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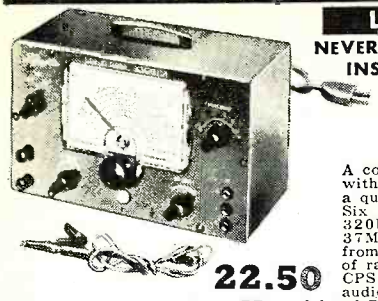
LAFAYETTE SIGNAL GENERATOR



NEVER BEFORE HAS A COMPLETELY WIRED AND TESTED INSTRUMENT OF SUCH ACCURACY AND QUALITY BEEN OFFERED AT SUCH A PRICE!

- FREQUENCY 120 KC TO 260 MC
- 120 KC TO 130 MC ON FUNDAMENTALS
- LABORATORY ACCURACY AND QUALITY

22.50

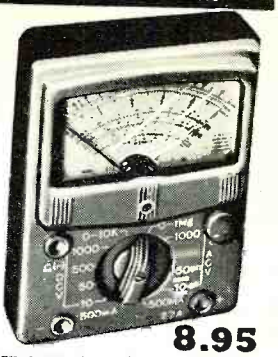
A completely wired and tested instrument not to be confused with units sold in kit form at almost the same price, but with a quality and accuracy of instruments 3 to 4 times its price. Six overlapping ranges generate signals of 120KC — 320KC, 320KC—1000KC, 1MC—3.2MC—11MC, 11MC—38MC and 37MC—130MC all on fundamentals with calibrated harmonics from 120MC to 260MC. Selector switch gives instant choice of ranges. Switch gives choice of internal modulation of 400 CPS or use of any external source at other frequencies. For audio testing the 400 cycle signal can be used separately. Outputs are unmodulated RF, modulated RF and 400 CPS audio. RF output is in excess of 100,000 microvolts and jacks are provided for choice of either high or low RF output. Stability is insured by special circuit design. Has a fine adjustment RF control. AF output is 2-3 volts. AF input is 4 volts across 1 megohm. Large clear 5 inch etched dial plate and pointer are protected by transparent plastic bezel. Common AF terminals for EXT-MOD input and INT-AF for audio tests eliminate need for special AF output connectors. Machine engraved panel lettering. Handsome gray metal case with carrying handle. Measures 6½" x 10" x 4½". Comes complete with pair of leads. AC line cord and plug. Operates on 105-125V 50-60 cycle AC. Shpg. wt., 8 lbs.

LAFAYETTE LSG-10 SIGNAL GENERATOR 22.50

NEW POCKET AC-DC VOM MULTITESTER

2,000 ohm per volt Sensitivity on both DC and AC

160 ua 3" METER
1% PRECISION RESISTORS
SILVER CONTACT SELECTOR SWITCH



8.95

FULL SCALE RANGES

DC Volts: 0-10; 0-50; 0-500; 0-1000 Volts — ***AC Volts:*** 0-10; 0-50; 0-500; 0-1000 Volts—***DC Current:*** 500 ua and 500 ma — ***Resistance:*** 0-10K; 0-1 Meg — ***Decibels:*** —20 to +22; +20 to 36 db (0 db — 0.775 V)—***Capacity:*** 250 mmfd to .2 mfd—.005 mfd to 1 mfd—***Output Ranges:*** 0-10; 0-50; 0-500; 0-1000 volts

Best Buy in America! A very accurate and sensitive VOM. This Multitester is a complete instrument (not a kit) with high quality and sensitive 160 microamp meter; 2000 ohm per volt on both AC and DC. Single selector switch, 1% precision resistors, 3" meter. Features extreme versatility, accuracy and ruggedness. In attractive plastic front panel, with metal bottom for ruggedness and shielding. First capacity range requires 50 volt AC source. Second capacity range requires 10 volt AC source. Size 4¼"x3½"x1⅝". Complete with test leads and batteries. Shipping weight 4 lbs.

RW-27A ..... Complete 8.95

NEW! LAFAYETTE CAPACITANCE-RESISTANCE TESTER WITH "IN-SET QUICK CHECK"

COMPLETELY WIRED AND TESTED

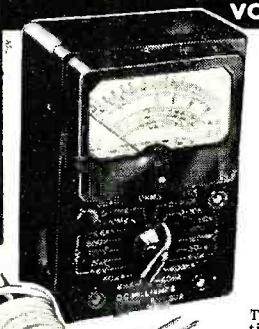
- TWO INSTRUMENTS IN ONE
- CHECKS ELECTROLYTIC, PAPER, MICA AND CERAMIC CONDENSERS
- 4 DIRECT READING CAPACITY SCALES FROM .00001 MFD TO 1000 MFD
- CHECK FOR OPEN SHORTS, LEAKAGE AND INTERMITTENTS
- 2 RESISTANCE RANGES FROM 100 TO 5 MEGOHM

34.50

Here is a "must" for servicemen and lab technicians. A completely self-contained AC operated capacitance and resistance bridge, plus a quick check for in the set testing. Large 5 direct reading scale has 4 ranges of .00001-.005 MFD, .001-.5 MFD, .1-50 MFD and 20-1000 MFD. Resistance ranges are 100-50,000 OHMS and 10,000 to 5 megohm. Quick check feature enables you to check capacitors for shorts, open or intermittent while in circuit—no need to remove them from the set till you're sure they need replacement. Leakage test switch gives you choice of 25, 150, 250, 350 or 450 volts for checking leakage under correct potential. Separate power factor control with continuous settings from 0 to 50%. Operation is simple and accurate, using a magic-eye tube as the null detector. Attractively finished steel case with etched panel and rounded corners, measures 14½"L x 8¼"H x 5"D. Shpg wt. 19 lbs.

MODEL LC-4 ..... NET 34.50

HIGH SENSITIVITY 20,000 OHM PER VOLT DC 10,000 OHM PER VOLT AC MULTITESTER



LOOK AT THESE FULL SCALE RANGES!

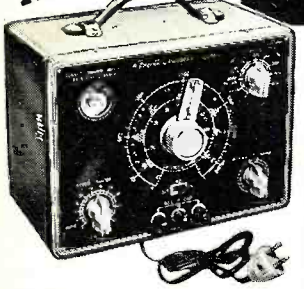
D.C. Volts: 0-6; 0-30; 0-120; 0-600; 0-1200; 0-6000 Volts — A.C. VOLTS: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts — RESISTANCE: 0-10K; 0-100K; 0-1 Meg; 0-10 Megohms— D.C. CURRENT: 0-60 Microamp; 0-6; 0-60; 0-600 Milliamps — DECIBEL: —20 to +7 db (0 db—0.774V) — CAPACITY: .0001-.01; .005-.15 mfd — INDUCTANCE: 20-2000 henrys —OUTPUT RANGES: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts

19.95

The new Lafayette high sensitivity Multitester is a complete instrument (not a kit). In addition to its unusual sensitivity of 20,000 OHMS PER VOLT ON D.C. AND 10,000 OHMS PER VOLT ON A.C., and the extraordinary number and scope of its ranges, it is packed with features that would make it cost at least twice as much if made in this country. Uses 1% precision resistors, silver contacts on selector switch, 35 ua 3" meter. Dependable, rugged and accurate. Even the test leads are heavy duty with high voltage insulation. Voltage source required for low capacity range is 120V A.C., for high range capacity and inductance scale is 6V A.C. Attractive plastic front with metal bottom. Size 6¼"x4¼"x2½". Complete with batteries and leads. Shipping weight 4½ lbs.

RW-30A ..... Singly, Each 19.95
In lots of 3, Each 19.25

NEW! LAFAYETTE CAPACITOR-RESISTANCE TESTER COMPLETELY WIRED AND TESTED



21.50

COMPLETELY WIRED AND TESTED

- CHECKS ALL TYPES OF CONDENSERS FOR CAPACITY, LEAKAGE, OPEN SHORTS OR INTERMITTENT CONDITION
- DIRECT READING SCALES FROM .00001 TO 1000 MFD AND 100 TO 5 MEGOHMS

A stable and accurate bridge type circuit measures capacitance in 4 ranges of .00001-.005 MFD, .001 to .5 MFD, .1 to 50 MFD and 20 to 1000 MFD. Two resistance ranges of 100-50,000 and 10,000 to 5 megohms. Check leakage under actual load with choice of 25, 150, 250, 350 or 450 volts available by selector switch. Power factor control from 0 to 50%. Checks for leakage, open, short, or intermittent operation. All readings taken directly off scales after setting magic eye to maximum. Completely self-contained power supply. Attractively finished steel case with rounded corners and etched panel. Operates from 110V AC. Size 9⅜"L x 7⅛"H x 5¼"D. Shpg. wt. 10 lbs.

MODEL LC-15 ..... NET 21.50

Lafayette Import Special! TRANSCRIPTION TYPE MANUAL PLAYER

- MAGNETIC BRAKE FOR FINE ADJUSTMENT OF EACH SPEED
- 4-POLE, HEAVY DUTY TRANSCRIPTION-TYPE MOTOR
- STYLUS WEIGHT ADJUSTMENT SCREW ON TONE ARM

Complete Turntable and Tone Arm Assembly at the lowest price Ever for Such High Quality

25.95
Less Base

with TWO PLUG-IN HEADS

Here is a new manual player for the audiophile who wants noiseless, "wow-free" and rumble-free reproduction of recorded music at nominal cost. All the important features of professional transcription players have been incorporated in this precision turntable. The lightweight pickup arm is an integral part of the mounting plate and requires no installation. Player is equipped with a heavy duty, 4-pole, 3-speed motor for 78, 45 and 33⅓ RPM records. An exclusive magnetic brake controlled by knob on the base plate, permits instantaneous fine adjustment of each speed. Stroboscope disc included with unit, checks speeds. Extremely smooth and quiet operation. No hum even with the most sensitive cartridges. Speed selector safety switch protects mechanism by making it necessary to pass through an OFF position when switching from one speed to another.

10" diameter, heavy turntable is supplied with a rubber traction mat for positive grip of record. Stylus pressure adjustment can be made easily and quickly with the conveniently located adjusting screw on the underside of the tone arm. Mounting plate is also equipped with pickup rest and ON-OFF switch. Dimensions of mounting plate: 12-15/16" left to right, and 10⅞" front to rear. Requires 2¾" clearance below motor board and 3" above. Supplied with AC line cord, two plug-in heads, output cable for connection to amplifier and 45 RPM adapter. For 105-120 volts, 60 cycle AC. Shpg. wt., 12 lbs. Less cartridge. (NOTE: For protection in shipping, tone arm is separate. Just fasten to mounting plate.)

PK-160 Manual Player ..... Net 25.95

PK-164. Same as above except equipped with genuine GE triple-play magnetic cartridge and dual diamond-sapphire styli ..... Net 36.50

Wood base, cut out for PK-160 Manual Player. Top quality veneer attractively finished in mahogany or blonde (Specify).

PK-162. Shpg. wt., 5 lbs. ..... Net 3.95

Unfinished mounting board only, cut out for PK-160 player. Strong, durable ⅝" gumwood, ready for stain or paint.

PK-163. Shpg. wt., 1 lb. ..... Net .95

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DEPT. RI-1

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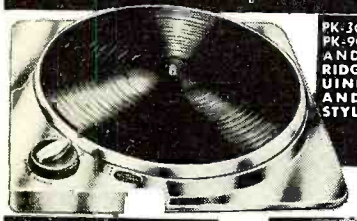
PROFESSIONAL TRANSCRIPTION TURNTABLE AND VISCOUS-DAMPED TONE ARM

THE FINEST TRANSCRIPTION TURNTABLE AND TONE ARM FOR THE PROFESSIONAL USER AND THE AUDIOPHILE



PK-300 TURNTABLE, PK-90 TONE ARM AND G.E. CARTRIDGE WITH GENUINE DIAMOND AND SAPPHIRE STYLI.

72.50

PK-300 COMBINATION DEAL

ILLUMINATED BUILT-IN STROBOSCOPE & VIEWER

PK-90

LATEST IMPROVED MODEL PK-300 TRANSCRIPTION TURNTABLE

New 3-speed instrument with built-in stroboscope and viewer for exact speed determination, and magnetic brake for instantaneous speed variation. Precision engineered to meet professional standards for wow, rumble and flutter content. Heavy 12" cast aluminum rim-driven turntable. Variable speed control permits adjustment of each speed within ± 7% using efficient frictionless magnetic brake. Heavy-duty constant speed 4-pole induction motor freely suspended and isolated by shock-mountings to eliminate vibration transferral. R-C filter network suppresses "pop" in speaker. Truly a delight for the connoisseur. Size: 13½" x 14" and requires 2¾" clearance above and 3¾" below motorboard. For 110-130V and 60/50 cycle AC. Power consumption 12 watts. Handsome hammertone gray finish. Shpg. wt., 20 lbs.

PK-300 ..... Net **49.50**

PK-90 VISCOUS-DAMPED TONE ARM

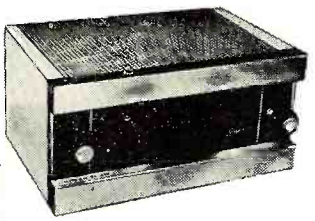
This transcription arm assures dependable and stable operation, utilizing the "floating action" principle of "viscous-damping." The arm is supported at a single point by a pivot and jewel bearing having negligible friction. Damping is accomplished by a silicone fluid occupying the gap between a ball and socket. This damping control permits high compliance and negligible tracking error, and prevents damage to either record or stylus should the tone arm be accidently dropped. Low frequency resonance, skidding and groove-jumping are likewise minimized. The tone arm accepts all records up to 12" and accommodates virtually all hi-fi cartridges by means of precisely engineered adapters which simplify installation and provide proper stylus pressure.

This tone arm is a quality companion to the PK-300 with matching finish. Shpg. wt., 2½ lbs.

PK-90 ..... Net **15.95**

LAFAYETTE'S FM-AM TUNER KIT

- SIMPLIFIED DETAILED INSTRUCTION MANUAL
- MEETS FCC REQUIREMENTS FOR RADIATION
- GROUNDED GRID TRIODE AMPLIFIER
- ARMSTRONG FM CIRCUIT WITH FOSTER-SEELEY DISCRIMINATOR
- AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL



The excellence of its design and the quality of its components combine to provide this compact high-fidelity FM-AM tuner with superb characteristics normally found in units costing several times as much, and with performance unbelievable at this low price. Features Armstrong FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counterweighted mechanism. AFC defeat circuit combined with tuning control. Attractive etched copper-plated and lacquered finish.

SPECIFICATIONS

FREQUENCY RANGE: FM, 88-108 MC; AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms; AM, Ferrite loopstick and high impedance external antenna. **CONTROLS:** 2—a function control for AM, FM, PHONO, TV and a tuning/AFC defeat control. **DISTORTION:** Less than 1% rated output: **FREQUENCY RESPONSE:** FM, ± .5 db 20 to 20,000 cps; AM, ± 3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 μv for 30 db quieting; AM, Loop sensitivity 80 μv/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down — 375 KC FM discriminator peak to peak separation; AM, 8 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation. **TUBE COMPLEMENT:** 2-12AT7, 1-6BA6, 1-6BE6, 2-6AU6, 1-6AL5 plus 1-6X4 rectifier. **SIZE:** 5¼" high x 9⅝" wide x 9⅛" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Less metal case. Shpg. wt., 9 lbs.

KT-100 kit, less cage ..... Net **34.95**

ML-100—Metal cage for above, shpg. wt., 3 lbs. ..... Net **5.00**

NEW! IMPORTED 12" HI-FI COAX. SPEAKER

- FREQUENCY RANGE 30-15000 CPS
- HANDLES 20 WATTS OF POWER
- COMPLETE WITH LEVEL CONTROL
- POWERFUL TSK-5 MAGNETS
- SPECIAL SHEEPSKIN-EDGED CONE

Reg. Price 44.50 Net **29.50**

A Lafayette exclusive import and exceptional value. Consists of a 12" woofer, coaxially mounted 2½" tweeter and a built-in crossover network. The specially processed fibre cone has a sheepskin edge to suppress unwanted nodal vibrations and insure beautiful tone quality. Highly efficient TSK-5 magnets. Level control provides variation to 6 db cut. Maximum input 20 watts. Impedance 8 ohms. Rugged all-metal frame. If made in this country, would cost at least $49.50. Shpg. wt., 11 lbs.

SK-58 ..... Net **29.50**

LAFAYETTE HI-FI LP TEST RECORD

Ideal for audiophile who is building a bass reflex speaker enclosure, or wants to check the components already in use. Two-side, 12" LP record covers cartridge and stylus test, turntable rumble test, average and minimum recording levels, stylus and tone arm resonance check, equalization checks, sound effects, tuning bass reflex enclosures, and a group of delightful music box selections. Specially recorded with painstaking care at 33⅓ RPM, and master cut on a mechanism that produces the quietest grooves in the industry. Complete with instructions for use and colorful protective envelope. Shpg. wt., 1 lb.

PR-10. Hi-Fi Test Record ..... Net **2.25**

New! LAFAYETTE MASTER AUDIO CONTROL CENTER WITH BINAURAL CHANNEL AND DUAL VOLUME CONTROL

$39.50 IN KIT FORM KT-300

$59.50 WIRED & TESTED LT-30

YEARS AHEAD OF EVERY OTHER PREAMPLIFIER CONTROL UNIT

The Lafayette Master Audio Control Center is not only the finest high fidelity preamplifier, 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.

FEATURES

- Incorporates an extra channel and dual volume control for binaural reproduction.
- DC on all tube filaments for minimum hum, and negative feedback in every stage.
- IM distortion and harmonic distortion so low, it is practically unmeasurable at normal operating level. IM is below 0.09% at 1V; HM approximately ¼ of 1% even at 5V.
- Dual cathode follower output stages.
- High gain for low level pickups.
- Separate turnover and roll-off controls —24 positions of equalization.
- Printed circuit construction.
- Tasteful styling, brilliantly executed.
- Designed for ease of installation and operation.

SPECIFICATIONS

INPUTS: 7 inputs accommodate every type of phono, tuner and tape. **CONTROLS:** 9 front and 2 rear panel controls make for utmost versatility. **FREQUENCY RESPONSE:** Uniformly flat frequency response over the entire audible spectrum. **TAPE EQUALIZATION:** Tape head playback equalization both NARTB and adjustable. **SENSITIVITY-GAIN:** 54db on magnetic input (2mv input produces 1V output); 14db on radio tape and auxiliary inputs (0.2V produces 1V output). **HUM & NOISE:** 80db below 3V output at full gain on radio, tape and auxiliary inputs; better than 60db below effective program level at full gain with 10mv input. **TUBES:** 3 premium type ECC83 tubes plus 2 selenium rectifiers. **POWER SOURCE:** 105-125V 50-60 cycles AC. **SIZE:** 12¾" L x 3¾" H x 9⅛" D from front panel to rear jacks—knobs project 1". Shpg. wt., 10½ lbs.

FOR FURTHER DETAILS WRITE FOR BULLETIN ST-74.

Lafayette Radio
DEPT. RI-2
165-08 LIBERTY AVE.
JAMAICA 33, N. Y.

NAME _____

ADDRESS _____

CITY _____

ZONE _____

STATE _____

SEND FREE LAFAYETTE CATALOG

CUT OUT AND MAIL TODAY!

Practical Color TV

(*Continued from page 63*)

fier, and then fed to the 3.58-mc. color-reference subcarrier oscillator. Here it performs its important function of synchronizing that oscillator.

The chrominance signal, after leaving the bandpass amplifier, is passed on to the two color-signal demodulators. In this receiver, they are the *B-Y* and *G-Y* demodulators. *Y* stands for the black-and-white (or luminance or brightness) component. *B, G,* and *R* stand for the three primary colors, blue, green, and red, used in color television, from which all other colors and color combinations are made. *B-Y*, then, would stand for all blue signal information minus the information concerning its brightness, or the amount of black or white with which it is mixed. (The latter, of course, is inserted separately by the monochrome that is supplied and which is then "painted over" with the appropriate colors.) Similarly, *G-Y* and *R-Y* stand for the green-only and red-only information.

After the *B-Y* and *G-Y* (or blue and green) information has been removed from the total chrominance information found in the transmitted signal, it is possible to develop the *R-Y* signal from what remains without resort to a separate demodulator. These three *color-difference* signals, as they are called, are subsequently applied to the three guns in the picture tube.

Much detailed information concerning the exact nature of the color signals has been left out deliberately. It is hoped that enough information has been covered, however, to give a broad understanding of what these signals are and to assist in understanding receiver function with respect to them.

(*To be continued*)

UNSTABLE 6BX7-GT

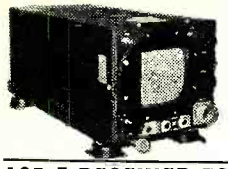
By BOB ELDRIDGE

IN SOME quarters of the service industry, the 6BX7-GT, frequently used as a combined vertical oscillator and vertical-output tube, has been gaining a reputation for poor stability. Some specimens are completely reliable, but others, when installed as replacements, are simply invitations to free call-backs.

To be sure a new tube is acceptable, it should be checked out when it is put into the set. The method is simple: just insert the new 6BX7-GT, turn on the set, and lock the picture in the normal manner with the hold control. Next, tap the tube lightly for a few seconds. If the tube is a good one, the picture will remain in sync. If the tube's structure is faulty, the picture will begin to roll when the tube is tapped, and the roll will become faster with each successive tap. If the tapping is continued, the tube will break down altogether.

The observant technician may note that such defective tubes occur in runs; that is, one manufacturer may have a bad run, with all of these tubes appearing in his brand over a given period showing a high rate of rejects. —30—

JUST RECEIVED! ASB-5 'SCOPE INDICATOR



BRAND NEW, including all tubes, together with 5BP1 'Scope Tube. Originally used in Navy Aircraft RADAR equipment. Easily converted for AC operation.
VALUE $250.00!
OUR LOW PRICE **$15.95**

ASB-5 RECEIVER FOR 420 Mc BAND!

As featured in "CQ" for October 1956. Easily converted, makes a marvelous receiver for 420 Mc band, with RF amplifier! Supplied complete with all tubes.
OUR LOW PRICE **$14.95**
Tuning Knob for ASB-5 Receiver $1.29

MN26Y BENDIX DIRECTION FINDER

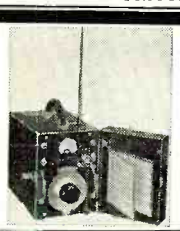
150-325 Kc; 325-695 Kc; 3.4-7 Mc. Complete with tubes, motor.
BRAND NEW **$26.95**
Used, like new, incl. tubes and dynamotor . . **$18.95**

BENDIX DIRECTION FINDER

12-tube remote control Navigation Direction Finder and communications receiver. 150 to 1500 Kc in 3 bands, 28 V. DC input. Ideal 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 RCVR-XMTR

The Receiver Four band, 195 to 9050 Kc. Low Freq. Ship, Broadcast, 40 to 80 meters. Includes tubes and dynamotor for 24 V operation. Easily converted for 110 V, 12 V or 6 V. Schematic included. BRAND NEW. Overall 8¼ x 7¼ x 15¼". Wt. 30 Lbs. Complete with all tubes.
The Transmitter, tunes 3000 to 9050 Kc and 2300 to 4200 Kc. Massive, fully encased unit, complete with all tubes. Three completely integrated tuning units included. All Brand New.
The Xmitter Dynamotor has input of 27.5 V DC @ 7.4 A; output: 425 V DC @ .320 A, with Filter Base. Brand New.
Complete Assembly,
OUR SPECIAL PRICE **$88.50**



BC-906 FREQ. METER—SPECIAL!

Cavity type, 145 to 235 Mc. BRAND NEW in original factory packing, complete with antenna. Manual included.
OUR LOW PRICE **$8.88**

BC-221 FREQ. METER **$129.50**

BC-221 FREQ. METER CASE

Aluminum Case for BC-221 or TS-164 Freq. Meters. Shock Mounted. BRAND NEW **$3.99**
(add 50¢ for packing)
Original 1000 Kc Crystal for BC-221. BRAND NEW **$8.45**
DYNAMIC HANDMIKE, with "Press-to-talk" Switch, cord and plug—BRAND NEW, only **$2.95**
DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special **$3.95**
HI-LO IMPEDANCE MATCHING TRANSFORMER for headphones. 600 ohms to 8000 ohms. With plug and jack. Instructions included. BRAND NEW. **97c**

HI-FI DYNAMIC HEADSET with Cushions
Freq. Range: 40-14000 CPS. No Distortion.
BRAND NEW **$6.95**

MICROPHONES

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike	$5.45	$7.95
T-30	Carbon Throat Mike	.33	.79
T-45	Army and Navy Lip Mike		1.33
RS-38	Navy Type	2.45	4.95
T-24	Carbon Mike		5.95
TS-9	Handset		4.95

HEADPHONES

Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	$2.25	$4.35
HS-33	Low Impedance	1.99	4.65
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

2 VOLT BATTERY "PACKAGE"

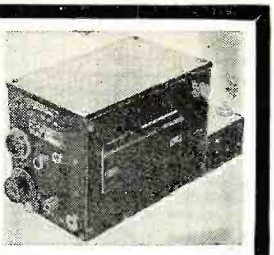
1—2V. 20 Amp. Hr. Willard Storage Battery $2.79
1—2V. 7 prong Synchronous Plug-in Vibrator 1.49
1—Quart Bottle Electrolyte (for 2 cells) 1.45
ALL BRAND NEW!
Combination Price $4.99

Willard 6-Volt Midget Storage Battery
3 Amp. Hour. **BRAND NEW.** 3⅝" x 1-13/16" x 2⅜". Uses Standard Electrolyte . . . . . Only $2.45

FREE!

Schematic Diagram included **FREE** with each piece of equipment shown on this page. Schematics for any of these units also available separately at 50c each.

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

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES

Type	Description	Excellent Used	Brand NEW
BC-453	Receiver 190-550 KC . . .	$9.95	$11.95	$14.95
BC-454	Receiver 3-6 Mc	7.19	8.29	11.95
BC-455	Receiver 6-9 Mc	5.25	7.95	9.95
BC-456	Modulator	2.24	2.75	4.24
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 **$11.95**
ARC-5/T-19 TRANSMITTER—3 to 4 Mc. BRAND NEW complete with all tubes & crystal **$8.88**

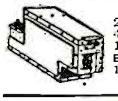
110 VOLT AC POWER SUPPLY KIT

For All 274-N and ARC-5 Receivers

Can be assembled quickly and easily, on predrilled chassis. Plugs into the rear of any model 274-N receiver and delivers 24 volts as well as "B" voltage. Complete kit of parts with metal case, instructions. Factory wired, tested, ready to operate **$7.95** **$11.50**
SPLINED TUNING KNOB for 274-N and ARC-5 RECEIVERS. Fits BC-453, BC-454 and others. **Only** **49c**

SCR-522 2-METER RIG!

Terrific buy! VHF Transmitter-receiver, complete with all components. 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.
COMBINATION . . . . Special $33.33
Receiver Only, with all tubes . . $19.50
Transmitter Only, with all tubes . $22.25



ARC-5/R28 RECEIVER

2-meter Superhet, 100 to 156 Mc in 4 crystal channels. Complete with 10 Tubes.
BRAND NEW **$18.95**
110 V AC Power Supply Kit for above $9.75

ARC-5/T-23 TRANSMITTER

100-156 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**

LORAN APN-4

FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or plane! Complete, BRAND NEW installation consists of: ID-6B/APN-4 Indicator; R-9B/APN-4 Receiver; PE-206 Inverter; Set of Plugs; Visor for Indicator; Operation manual.
COMPLETE, BRAND NEW **$129.50**

SPECIAL APN-9A LORAN Receiver Indicator, less tubes, NEW (demilitarized) **$29.50**

Please include 25% Deposit with order—Balance C.O.D. 50c Handling Charge on all orders under $3.00 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.

SIG. CORPS FIELD INTERPHONE KIT

Sensational Value!

Cost to Govt. More than $500.
OUR PRICE **$12.95**
BRAND NEW
In Original Packing

Here's what you get: H-22/U Handset with 5' Kinkless cord, equipped with "talk-listen" butterfly switch, PL-68 plug and PJ-055B plug; 14' flexible plated steel conduit, ¾" diam.; All-steel control box with switches, binding posts, pilot indicator; 3-lb. box of costly hardware; many accessories and spares, including: 4 indicator lamps, 2-oz sealing compound, toggle switches, gaskets, large roll friction tape, complete technical manual—and it's all yours, for only $12.95.

RADIO RECEIVER NAVY TYPE RAY-3

Made by Doolittle Radio, this dandy receiver is a terrific buy at our low price.
Model AN-PR7NA is for 28V DC operation.
Model AN-PR6N is for 14V DC operation.
These receivers are supplied complete with built-in dynamotor, 11 tubes. Weston output meter on front panel, as well as coax antenna and output connection, phono jack, on-off switch.
WHILE THEY LAST . . . . . Our Price **$13.95**

Ham Special! Famous BC-645 XMITTER-RECEIVER

With MANUAL for Easy Conversion to CITIZENS' BAND!

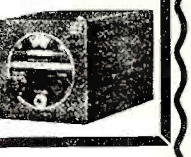
BRAND NEW

Makes wonderful mobile rig for 420-500 Mc. Easy to convert for phone or CW 2-way communication. This swell rig originally cost over $1000—yours for practically a song! You get it all, in original factory carton, BRAND NEW, complete with 17 tubes, less power supply. **Conversion Instructions Included.** **$29.50**
Shpg. wt. 25 lbs. . . . . .

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**

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. BRAND NEW.. $8.88
Brand New, less tubes . . $5.95
USED, with tubes $5.95
USED, less tubes 2.95



BRAND NEW SPECIAL PURPOSE TUBES

in Original Individual Packing
JAN CRP-730A MAGNETRON, Raytheon $3.45

Type	Each	Lots of 12	Lots of 100
6J6W	$.45	$5.15	$41.00
1625	.26	2.75	21.50
1626	.16	1.75	13.50
1629	.27	3.05	23.95
826	.44	4.95	39.50
2/724B	.35	3.95	29.50
VR105	.79	8.88	70.00
VR150	.79	8.88	70.00
8002R	5.95	...	....
RK65	7.25	...	....

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

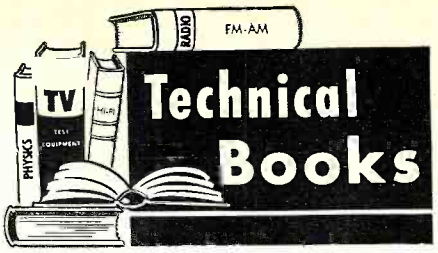
DYNAMOTOR VALUES!

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

BD-77C DYNAMOTOR, input: 14V DC @ 39 A. output: 1000V DC @ .35 A. With Filter. Like New! Special $22.50

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 **$2.24**



Technical Books

"PROCEEDINGS OF THE SECOND RETMA SYMPOSIUM ON APPLIED RELIABILITY". Published by *Engineering Publishers,* GPO Box, 1151, New York 1, N. Y. 93 pages. Price $5.00. Paper bound.

This proceedings contains the full versions, with illustrations, of fourteen papers delivered at the Second RETMA Symposium held in Syracuse, June 10 and 11, 1957. The basic theme of the Symposium was the achievement of reliability in electronic equipment by emphasis on mature design. The papers deal with this concept.

* * *

"SEMICONDUCTOR ABSTRACTS" compiled by Battelle Memorial Institute. Published by *John Wiley & Sons, Inc.,* New York. 322 pages. Price $10.00. Vol. 3, 1955 issue.

This is the third volume in the current series of Electrochemical Society Semiconductor Abstracts and like the previous publications is designed to assist those persons concerned with the growing field of industrial and scientific endeavor. The tremendous expansion in literature covering semiconductor and luminescent materials has dictated the need for collating these articles. The abstracts for 1955, the year covered by this volume, number 1258 as against 765 for 1954.

Germanium; silicon; carbon, selenium, and other elemental semiconductors; intermetallics, sulfides, selenides, and tellurides; oxides, halides, arsenates, phosphates, and tungstates; and organics are all covered with a special section devoted to theory. Subject and author indexes are especially valuable additions which contribute to the general, over-all usefulness of this specialized volume.

* * *

"ACOUSTICAL ENGINEERING" by Harry F. Olson. Published by *D. Van Nostrand Co., Inc.,* Princeton, N. J. 718 pages. Price $13.50.

The work on which this present volume is based certainly needs no introduction to the serious audiophile. "Elements of Acoustical Engineering," originally published in 1940 and revised in a second edition that appeared in 1947, has had an honored place in the libraries of many whose vocation or avocation is audio. This, then, is the third edition of a book that has been considered by many to be a classic in its field.

The momentous strides taken in recent years by modern acoustic science has made this up-to-date and greatly enlarged edition imperative. From fundamentals to practical applica-

tions, it now presents complete working methods covering the entire field of acoustical engineering. Much material has been added on complete sound reproducing systems and communications systems. Information is also included on underwater acoustics, ultrasonics, architectural acoustics, and new musical instruments. The advanced hi-fi enthusiast will be especially interested in the material on loudspeakers, speaker baffles and enclosures, audio measurements, and the information on speech, music, and hearing.

For radio, television, sound motion picture and recording engineers, architects and musicians, here is an invaluable reference that reflects the most up-to-date information available today.

* * *

"TRANSISTOR CIRCUIT ENGINEERING" edited by Richard F. Shea. Published by *John Wiley & Sons, Inc.*, New York. 444 pages. Price $12.00.

Despite the rather awe-inspiring title, this book is a thoroughly practical exposition of transistor practice. Written by eight engineers from *General Electric's* Electronics Laboratory in Syracuse, the text covers characteristics and characteristic curves, equivalent circuits, bias and its stabilization, audio amplifiers, d.c. amplifiers and their applications, tuned amplifiers, video amplifiers, oscillators, modulation-mixing detection, transient response and pulse circuit systems, and special circuits.

Although the treatment is somewhat mathematical there is a wealth of material that the build-it-yourself enthusiast will find of interest. An extensive bibliography is appended which supplements the specific references at the end of each chapter. Matrix algebra of two-port devices is covered in a separate appendix for those interested in this information.

* * *

"RADIO OPERATOR'S LICENSE Q & A MANUAL" by Milton Kaufman. Published by *John F. Rider Publisher, Inc.*, New York. 680 pages. Price $6.60. Sixth Edition.

The material in this newest edition of a standard study manual has been revised to conform to the "FCC Study Guide" which is being used as the basis for radio license examinations.

The new operating procedures and new frequency assignments have been included in this up-to-the-minute text and obsolete material has been dropped. The questions have been renumbered to conform to the latest edition of the "Study Guide." Discussions have been amplified to assist the student in grasping the reasons behind the selection of the answer indicated as correct.

As is customary with such texts, the material is divided by exam elements with five appendices covering rules governing commercial operators, extracts from radio laws, conventional abbreviations and Morse Code, small vessel direction finders, and automatic alarm. A complete and comprehensive subject index is included. —30—

SOLAR BATTERIES FOR SATELLITES

THE Army Engineering Laboratories at Fort Monmouth, N. J. are currently conducting a series of tests which seem to indicate that solar batteries may provide an ideal power source for satellite instrumentation because of their indefinite life. Test cells attached to skin of "Aerobee-Hi Rocket" operated perfectly at altitudes up to 190 miles. —30—

HALLICRAFTERS' SINGLE-SIDEBAND MONTH

HAMS from coast to coast will have a chance to evaluate the advantages of single-sideband operation during the month of September. Major distributors throughout the country will demonstrate SSB by means of specially installed, complete amateur stations as part of Single-Sideband Month, sponsored by The Hallicrafters Co. of Chicago.

Highlight of the event will be local distributor contests, open to all amateurs attending a demonstration, in which the winner selected by each distributor will receive an SX-101 receiver. More than 50 such awards will be made. Basis for selection will be a 25-word statement on SSB. Local winners will compete in a national contest. The winner of this event will receive, in addition to the SX-101 receiver, an HT-32 transmitter and HT-33 kilowatt amplifier, completing the basic equipment necessary to operate an SSB amateur station. —30—

Satellite Magnetometer to Measure Earth's Field

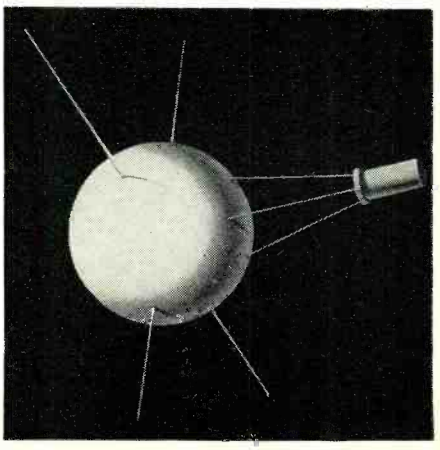
Magnetic field above the ionosphere to be checked.

A VARIAN magnetometer, to be carried in the earth satellite, will provide a record of the earth's magnetic field above the ionosphere and is expected to answer many questions concerning magnetic disturbances. The instrument is able to transmit its measurements in the form of precession frequency which can be measured and recorded on the ground.

The magnetometer operates by using the gyromagnetic properties of the nucleus of an atom. The device itself consists mainly of a coil of wire immersed in a bottle of liquid containing hydrogen atoms such as water, kerosene, gasoline, or alcohol. A light hydrocarbon with low freezing point will be used for the satellite flight.

Since protons act as if they were tiny spinning bar magnets, their function can be compared to that of the armature of a generator. As they precess like gyros about the earth's magnetic field, these protons induce a current in the surrounding coil just as the turning armature induces a current in its coil. Actual measurement of the magnetic field is made by determining the frequency of the induced current. This frequency is directly proportional to the strength of the earth's magnetic field. The current induced in the *Varian* magnetometer in the satellite is expected to range in frequency between 800 and 2200 cycles while circling at various heights above the earth. —30—

Artist's concept of satellite carrying minified magnetometer, resembling a little hat.



ONE PR CE FOR EVERY TYPE OF TUBE

Apology to Readers of Radio & TV News

Due to the tremendous response to our wonderful values in tubes, our huge staff at Video Electric Co. was unable to adhere to our Same Day Shipment policy. For this reason, some orders were delayed a number of days. We at Video wish to offer our profound apologies for any inconvenience caused our customers. We are attempting to remedy the situation at once.

PROMPT SHIPMENT ON ALL ORDERS

DON'T PAY MORE FOR SET TESTED LONG LIFE DEPENDABLE RADIO & TV TUBES • BUY VIDEO INDIVIDUALLY BOXED • ALL GUARANTEED FOR ONE YEAR OR YOUR MONEY BACK

Some Standard Brand—Others With Famous VIDEO Brand

0A2
0A3
0A4
0B2
0C3
0Z4
1A7GT
1B3GT
1C7G
1F4
1H4
1H5GT
1J6GT
1L4
1L6
1LA6
1LC5
1LH4
1LN5
1N5GT
1S4
1S5
1T4
1U4
1U5
1V2
1X2
2A7
2D21
2X2
3A4
3A5
3AL5
3AU6
3BC5
3CB6
3Q4
3Q5GT
3S4
3V4
4B27
4B97
5AM8
5AN8
5AQ5
5AT8
5AW4
5AZ4
5J6
5T4
5T8
5U4G
5U8
5V4G
5V6GT
5Y3
5Y4G
6AB4
6AC7
6AG5
6AF4
6AH4GT
6AK5
6AL5
6AM8
6AN4
6N8
6AQ5
6AQ7GT
6AS5
6AS7G
6AT6
6AU4GT
6AU5GT
6AU6
6BU5GT
6AV6
6AX4GT
6AK5GT
6BA6
6BC5
6BC7
6BE6
6BF5
6BG6G
6BH6
6BJ6
6BK5
6BK7
6BL7GT
6BN6
6BQ6GT
6BQ7
6BY5G
6BZ7
6C4
6CB6
6CD6G
6CF6
6CS6
6CU6GT
6E5
6H6GT
6J4
6J5GT
6J6
6K6GT
6L6
6N7GT
6S4
6S7G
6SA7
6SB7Y
6SC7
6SF5
6SF7
6SG7
6SH7
6SJ7GT
6SK7GT
6SL7GT
6SN7GT
6SQ7
6SS7
6SV7
6T8
6U4GT
6U7G
6U8
6V3
6V6GT
6W4GT
6W6GT
6X4
6X5GT
6X8
6Y6G
7A5
7A7
7B5
7B7
7C5
7C6
7C7
7F7
7F8
7N7
7Q7
7Y4
7Z4
12A6
12AH7GT
12AT6
12AT7
12AU6
12AU7
12AV6
12AV7
12AX4GT
12AX7
12AZ7
12B4
12BA6
12BE6
12BH7
12BY7
12CU6
12SA7
12SG7
12SH7
12SJ7GT
12SK7
12SN7GT
12SQ7
12V6GT
12X4
14A7
14B6
14Q7
19BG6G
19T8
24A
25AV5GT
25BQ6GT
25CD6G
25CU6
25L6GT
25W4GT
25Z6GT
35L6GT
35W4
35Y4
35Z3
35X5GT
50A5
50B5
50C5
50L6GT
80
117N7GT
117P7GT
117Z3

ANY TUBE ORDER OF $7.00 OR MORE!!
FREE RCA "CHEATER" CORD GIVEN WITH

40¢ FOR ANY TUBE

$37.00 PER HUNDRED

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	19"	$58.00
12"	$28.00	20"	$64.00
14"	$33.00	21"	$72.00
16"	$40.00	24"	$99.00
17"	$46.00		

When ordering TV's, state whether table model or console is desired. Also preference on make of set. All TV's sent railway express F.O.B. Newark. On any quantity WIRE or CALL today!

FREE BONUS ANTENNA GIVEN WITH ANY TV SET ORDER!!

SEND for our **FREE** complete TUBE & PARTS LIST and order blank.

Brand New Factory Seconds! Electrically Perfect Factory Seconds! Used Tubes! New and Used Jan Surplus Tubes!

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.

VIDEO ELECTRIC COMPANY

79 CLINTON PL. NEWARK, N. J. Phone HUmboldt 4-9848

Model TD-55 — Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.

Model TW-11 — Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

Model TV-12 — Terms: $22.50 after 10 day trial then $10.00 per month for 5 months.

Model TV-40 — Terms: $3.85 after 10 day trial then $4.00 per month for 3 months.

SHIPPED ON APPROVAL

NO MONEY WITH ORDER

NO C.O.D.

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.
- The Professional Serviceman, who needs an extra Tube Tester for outside calls.
- 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. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin or even the "top-cap."

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. Continuity between various sections is individually indicated. This is important, especially in the case of an element terminating at more than one pin. In such cases the element or internal connection often completes a circuit.

Elemental switches are numbered in strict accordance with R.M.A. specification. One of the most important improvements, we believe, is the fact that 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 TV-40

PICTURE TUBE TESTER

Not a Gadget—Not a Make-Shift Adapter, but a Wired Picture Tube Tester With a Meter for Measuring Degree of Emission—at Only $15.85

Of course you can buy an adapter for about $5—which theoretically will convert your standard tube tester into a picture-tube tester; or a neon type instrument which sells for a little more and is supposed to be "as good as" a metered instrument. Superior does not make nor do they recommend use of C.R.T. adapters or neon gadgets because a Cathode Ray Tube is a very complex device, and to properly test it, you need an instrument designed exclusively to test C. R. Tubes and nothing else.

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well-established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Only..... **$15.85 NET**

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

TESTING TUBES

- Employs improved TRANS-CONDUCTANCE circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- NEW LINE VOLTAGE ADJUSTING SYSTEM. A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.
- SAFETY BUTTON—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.
- NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY. Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

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.

The Model TV-12 will accommodate all transistors including NPN's, PNP's Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Housed in hand-rubbed oak cabinet..... **$72.50 NET**

Superior's New Model TW-11

STANDARD PROFESSIONAL TUBE TESTER

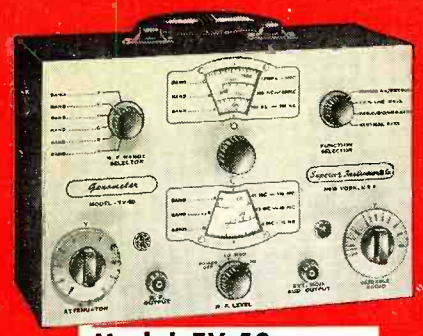
- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE: SEPARATE SCALE FOR LOW-CURRENT TUBES. Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

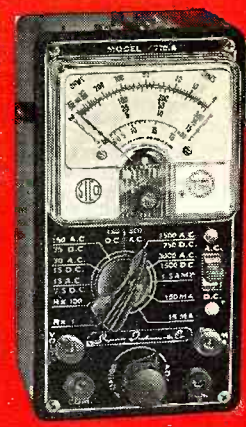
Housed in hand-rubbed oak cabinet..... **$47.50 NET**

USE APPROVAL FORM ON NEXT PAGE

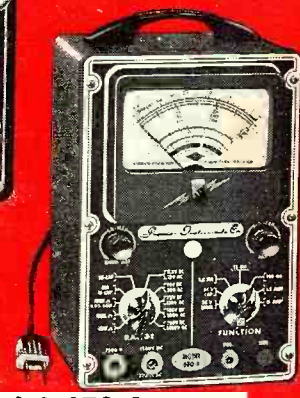


Model TV-50 — Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

Model 76—Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.



Model 770-A — Terms: $3.85 after 10 day trial then $4.00 per month for 3 months.



Model 670-A — Terms: $7.40 after 10 day trial then $3.50 per month for 6 months.

TRY FOR 10 DAYS

before **you buy!** ***then*** **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

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: 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).

$47.50 NET

Complete with shielded leads.....

Superior's New Model 670-A SUPER-METER

A Combination VOLT-OHM MILLIAMMETER *PLUS* Capacity, Reactance, Inductance and Decibel Measurements.

ADDED FEATURE: Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: −6 db to + 18 db, + 14 db to + 38 db, + 34 db to + 58 db.

$28.40 NET

Complete with test leads.....

Superior's New Model 76

- ✓ 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.

$26.95 NET

Complete with R.F. and A.F. probes and test leads.....

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 and for the first time it is now possible to obtain *measurements instead of approximations.*

● Compact—measures 3⅛" x .57⅛" x 2¼". ● Uses "Full View" 2% accurate, 850 Microampere D'Arsonval type meter. ● Housed in round-cornered, molded case. ● Beautiful black etched panel.

Specifications: 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.

$15.85 NET

Complete with test leads.....

We invite you to try before you buy any of the models described on this and the preceding 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.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-379, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....

Address .....

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

All Prices net. F.O.B. N.Y.C.

- ☐ Model TW-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model 76.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TD-55.....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.
- ☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 670-A.....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.
- ☐ Model 770-A.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model TV-12.....Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

Mac's Service Shop

(*Continued from page 72*)

this purpose, and they will just perform the conversion without first restoring the radio to good operating condition. Is that one working all right now?"

"Just listen," Barney said as he tuned off the station. Instantly there was a loud and discordant howl from the speaker. When the set was retuned to the station, everything was silent.

"That station is about 120 miles away," Barney remarked. "All I had to do was replace that one little capacitor and re-align all the tuned circuits. But since you are so nosey about what I am doing, what is that manual you were reading? I caught a glimpse of a circuit in there and it didn't look like any radio or TV circuit I ever saw."

"It's not. It's a circuit of an electronic timer control for an automatic welder. As you know, from time to time we get calls from small industrial concerns around here asking us to service various electronic devices they use. A service call of this kind can be a real pain in the neck and most technicians simply refuse to go in. In the first place, the technician is normally totally unfamiliar with the equipment that is out of order. He has no time to sit down and carefully study it out because a production line is often being held up by the defective electronic unit and there is terrific pressure on him to hurry. Finally, special tubes used may not be readily available, nor can he check them with his equipment.

"I got tired of this state of affairs and I also got tired of being taunted by some of the plant owners for being afraid to tackle something new. I told them that if they wanted me to service their equipment, I wanted them to furnish me with complete maintenance manuals on every bit of equipment they expected me to work on.

"I must have made my point because the manuals are starting to trickle in. I want you to read them, too. Study them until you understand exactly what each device is supposed to do and how it does it. Some of them have a list of symptoms and probable causes of trouble. Study these, too. I also intend to try and have a small stock of tubes and other special items that may give trouble."

"Do you think we'll get enough of this kind of business to make it worth while?" Barney wanted to know.

"Yes, I do. Electronics is playing a more important part in production every day. Small concerns are not able to afford a full-time electronic technician and they desperately need someone they can depend on for rapid reliable service. They are quite willing to pay well for this kind of service, with special pay for working at odd hours, as it is often necessary to do."

"Is most of the equipment complicated?"

"Actually it's not, once you become familiar with the thyratrons, selsyns, photoelectric tubes, and other pieces of electronic equipment with which you are now unfamiliar. Compared to a TV receiver, most of the industrial electronic gadgets are comparatively simple. They only seem complicated because the circuits are new to you."

"There's another angle, too," Barney pointed out. "When we casually drop into a factory and repair in a few minutes an electronic gadget that has several dozen employees sitting around doing nothing, that is not going to hurt our reputation a bit!" —30—

Transistorized Ham Receiver

(*Continued from page* 61)

should be taken to insure that regeneration is obtained for all settings of C_1 before L_1 is glued into place.

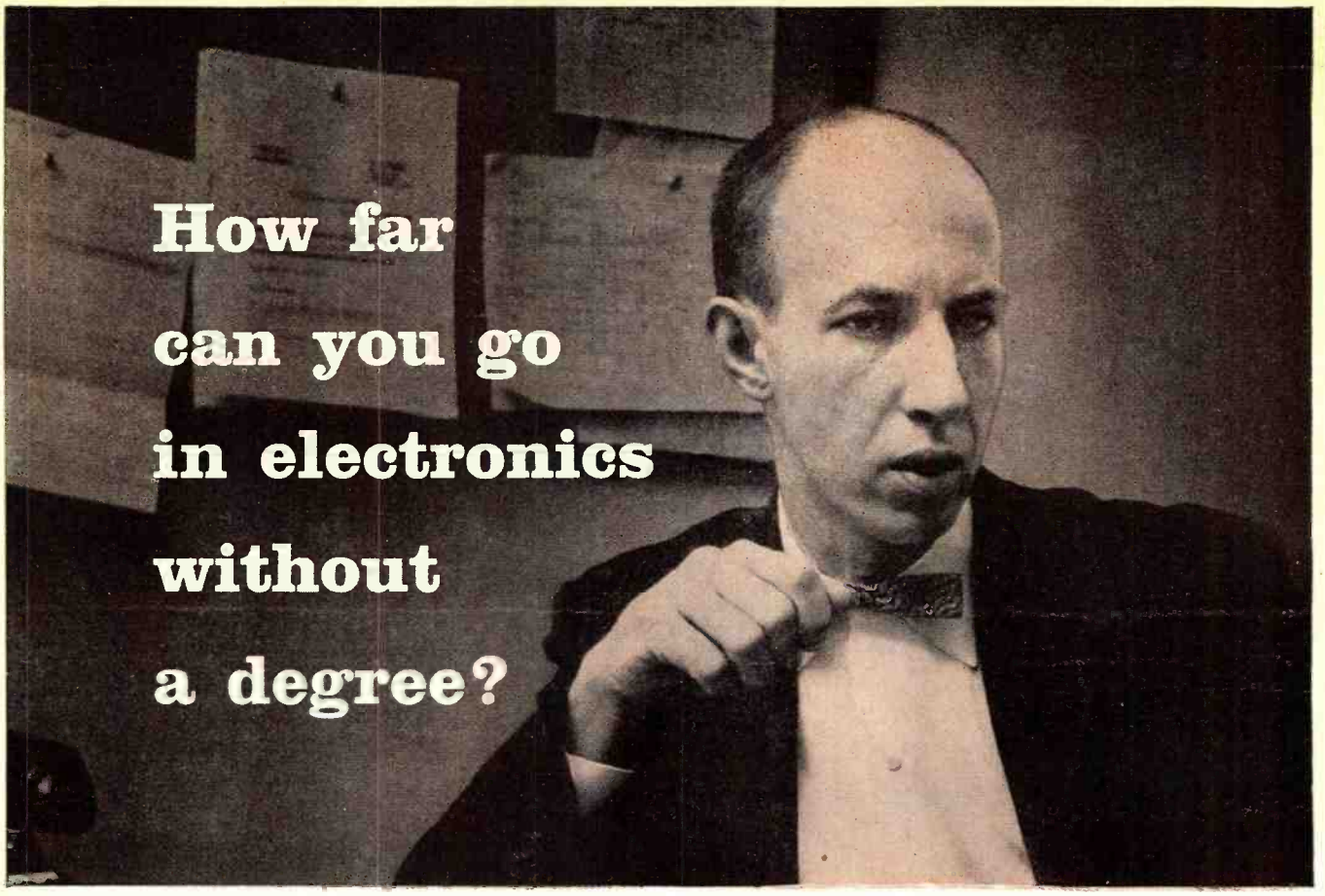
Coil L_2 consists of 13 turns of ½" diameter, 32-turns-per-inch *B & W* "Miniductor" Type 3004, with the tap at the center. The .002 μfd. capacitor, C_6, between the emitter and collector of the 2N107 is for r.f. bypassing. The value of capacitor C_2 is determined by experimentation (approximately 7 μμfd.) and a value selected so that the tuning range of C_1 will cover the 10-meter band. The tuning range of the receiver is about 28 to 35 mc.

The second method of construction, shown in the photographs, utilizes a printed circuit board. The circuit can be chemically etched or cut from a copper laminated board with a razor blade if chemical etching equipment is not available. Other than the points just noted, construction of the balance of the circuit is similar to the first method described except that all the components are mounted on one side of the board, as shown.

At this point it would be advisable to state that almost any of the *p-n-p* type transistors could have been used for the audio portion of the receiver; the 2N107 was chosen because of its low cost. The SB-100, however, has very few equivalents since it is a surface-barrier transistor. The *Philco* types 2N128, 2N129, and AO-1, all of the surface-barrier type, have similar characteristics and ratings and could be used instead.

Power requirements for the receiver are very modest. The circuit calls for the use of one 6-volt battery and has a current drain of approximately 1.5 ma. The battery used by the authors was cut from a 67½-volt *Eveready* Type 467 "B" battery, but any small 6-volt battery could be used instead.

Reception on the 10-meter amateur band has been gratifying. Stations on both the east and west coasts, as well as Honolulu and several Central American countries, have been received. Due to the small size and weight of the receiver and its low power requirements, this circuit should be ideal for use as the receiver portion of a compact two-way unit. —30—



Bill Miles talks frankly about the technicians' biggest problem

2 years ago, degreeless Bill Miles had reached a blind alley in his career. Yet today, with IBM, he's actually supervising engineers in America's biggest electronics project. Here's how this technician broke through the "education barrier."

"*Training* and *local assignments*," recalls Bill Miles, "were what caught my eye when I saw an IBM ad in 1955. So I investigated. Now here I am with an advanced electronics education under my belt—and responsibility as a Group Supervisor in Project Sage. I work on the world's largest and most advanced computer. I live in my home town. And my future in the company is what I make it. Yet only 2 years ago, I thought I'd gone as far as a technician ever could!"

Becomes radar technician

Bill's background is typical of thousands of capable, ambitious technicians who never acquired a formal engineering degree. His interest in electronics, aroused in Camden, New Jersey, high school, was nourished by a 3-year stint as Aviation Radar Technician in the Navy's "Black Cat" air-sea rescue squadron.

Takes night courses

Discharged in 1946, Bill married a girl he'd known in high school. During the next 9 years, Bill was teacher in a radio-TV institute, TV service man, TV company technician, and chief supervisory TV technician. All the while he pursued an engineering education at night. But growing family responsibilities made it more and more difficult.

Finds doors barred

However, feeling he was equipped for greater responsibility, Bill, now 30, investigated several companies but found that, while they liked his abilities, his lack of degree barred the door to any significant future advancement.

Enters IBM school

In May, 1955, when he moved his family to Kingston, New York, and started at IBM, Bill wasn't quite sure what to expect. The 8-month training course—valued at many thousands of dollars per man—had been the big magnet for him. He hoped the future would match his expectations.

Meets head of school

"Sixty of us started school at IBM, attending class 8 hours a day. The course consisted of about 20 subjects, mostly dealing with computer circuits and units, and maintenance techniques. The teaching was adult, superb. During training, we received a living expense allowance, over and above salary. We kept our own grades, and every 6 weeks when we reviewed them with the instructors, *they* asked *us* for ways to improve the course. I expected a casual 'hello' when I met the Division Manager of Education, but he talked to me for an hour about myself and my interests. The real concern IBM has for you as an individual, both before and after they hire you, is undoubtedly one reason why we all began to take a lot of pride in this outfit."

Joins home-town computer site

Bill had joined IBM as a Field Systems Engineer. After graduation, when 10 of his classmates were immediately promoted to specialized assignments, Bill was assigned to a computer site near his home in Mt. Holly, New Jersey, with IBM paying his moving expenses. For the first two months he helped install the SAGE computer, an important link in America's air defense. Ultimately, such computers will ring America's entire air defense perimeter. Looking back, Bill notes, "I'll admit the work was laborious and difficult, but still I have a sense of great accomplishment. Together we all helped create something of value from almost nothing."

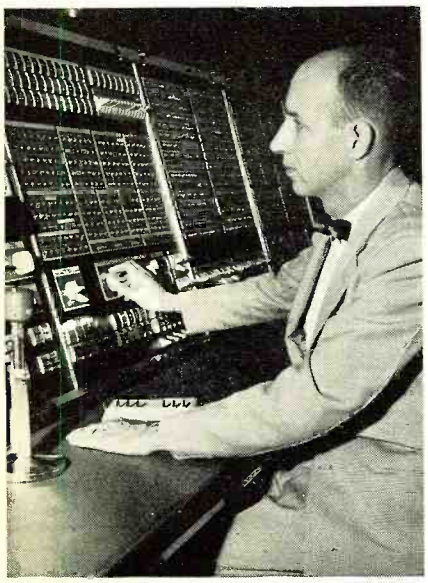
World's largest computer

"The computer is probably the largest one in the world, with over a million components. Flattened out, it would probably fill a ball field. The computer analyzes radar data on every object in the sky. Then it checks each object against available traffic information and identifies it as either friendly or hostile. It can make suggestions, but it can't send a Nike missile against what it thinks is a 'baddie.' Only airmen can make that decision."

Bill gets electronic computer education at IBM Kingston

Supervises fifteen

Recently promoted to Group Supervisor, Bill now directs an entire shift of 15 men, reporting to a Group Manager. His job: to maintain the computer in combat readiness. "I have to be familiar with the entire system. I rely on two types of specialists to help me: computer units men who are specialists in certain areas; systems engineers for the over-all computer."



Miles does diagnostic programming on the Operating Console of the Sage Computer

Miles nails down problem with Site Manager R. Schimmel

Buys house, car

Bill has bought a 7-room house in Mt. Holly. When not busy with his son and twin daughters, he likes to bowl. He drives a new automobile. He's enjoying the good life, and expects it to get even better. His employee benefits alone represent a cash value of many hundred dollars a year. He expects the IBM-sponsored General Education Program will prepare him for higher management responsibilities. Later, Bill's manager said, "He's currently assuming the responsibilities of an electrical engineer."

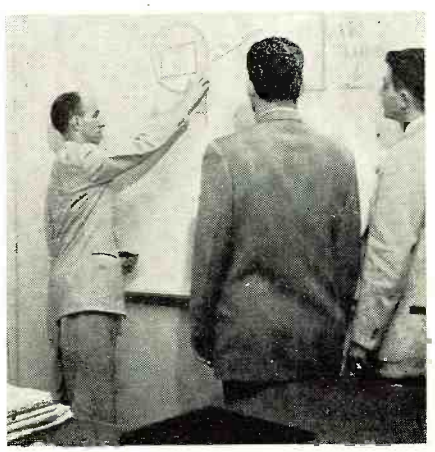
But the question remains: Is Bill really an engineer?

The "professional" engineer

"No, I certainly don't consider myself a 'professional' engineer, qualified to design machines, for instance. But the point is, I'm doing work ordinarily done by engineers . . . work usually denied to men without a degree."

IBM upgrades technicians

Could he do this elsewhere? "Of all the companies I know, IBM appears to be one of the few upgrading the technician to the level of engineering responsibility. Fortunately for me, IBM had the imagination to get men without degrees and encourage them to rise in responsibility and income to the level of their native talents . . . not what their formal education dictates."



"Student" Bill Miles diagrams computer circuit

Both titles gain

Is this a sign that the educational system is wrong? "Not at all," answers Bill Miles. "A Doctor's, a Master's, a B.S. degree stand for something and always will. But if a technician can perform many jobs that traditionally belong to the engineer, they both stand to gain. The technician, because he gets much of the engineer's salary, satisfaction and recognition; the engineer, because he is free to do work which *only* a man with his formal training can do. When everybody wins, and nobody loses, it's the sign of a good thing."

Since Bill Miles joined IBM, opportunities in the Project Sage program, destined for long-range national importance, have grown more promising than ever. If IBM considers your experience equivalent to an E.E., M.E. or Physics degree, you'll receive 8 months' training, as a Computer *Systems Engineer*. If you have 2 years' technical schooling or the equivalent experience, you'll receive 6 months' training, as a Computer *Units Field Engineer*, with opportunity to assume full engineering responsibility. Assignment in area of your choice. Every channel of advancement in entire company open—and IBM is leader in a field that's skyrocketing in growth. All the customary benefits and more. WRITE to Mr. Nelson O. Heyer, Room No. 4309, IBM, Kingston, New York. You'll receive a prompt reply.

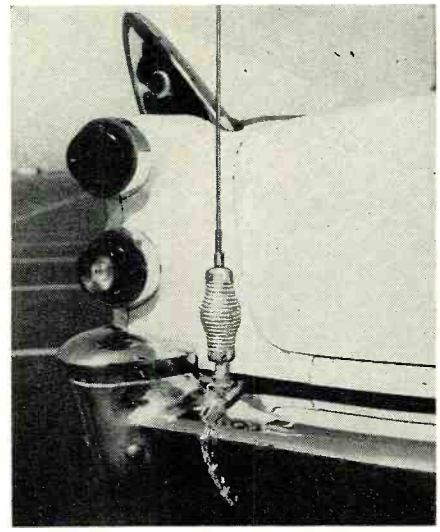
Home-town assignment pleased Miles' wife, son, twin girls

SWIVEL AUTO ANTENNA

Tenna Mfg. Co. of Cleveland, Ohio, offers a novelty in auto aerial design. The "Bullet" antenna has a swivel base that permits the unit to be mounted to the top or side. Available in six models, the "Bullet" may be obtained with vertical masts for front mounting or angular masts for rear mounting. With the swivel feature and a mounting pad, which is provided, the antenna can be attached to a variety of surfaces on the car.

QUICK-MOUNT MOBILE ANTENNA

Antenna Specialists Co., Cleveland, Ohio, has an answer for those who would like a mobile communications antenna that can be attached quickly and easily to bumper mounts of cars without the need for drilling holes. Model M-2, engineered for transmitting and receiving in amateur mobile, industrial service, emergency communications, and broadcast reception, uses a special chain-type bumper mount that holds securely a heavy-duty spring and stainless-steel whip. The antenna is available as a complete unit or separate parts, for example, the mount, the spring, and the whip, are available separately.



Also available is Model ASP 157, a mobile type for temporary mounting that uses a gutter clamp. The antenna can be quickly snapped on to the rain gutter that runs just over the top edge of the doors of a car.

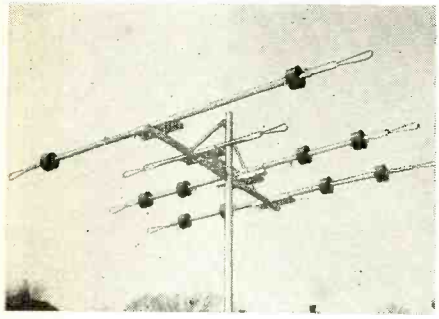
TV POWER-LINE ANTENNA

Zenith Radio Corp., Chicago, Ill., is using its new "Wavemagnet" indoor TV antenna on several of its new portable receivers and also making it available as a separate accessory for use with all types of TV sets. About the size of a large box of kitchen

matches, the unit mounts out of sight on the back of the receiver near the top. It makes use of the power cord and electrical wiring in the home as an active antenna element. A three position selector switch permits adjustment for optimum reception on different TV channels.

THREE-BAND ANTENNAS

Hy-Gain Antenna Products of Lincoln, Nebraska announces a series of "Triple Spanners" available with 1, 2, 3, or 5 elements. These tri-band beams work on 10, 15, and 20 meters. Pretuned and pre-matched, they may be erected with no further adjustment. Three active elements are used on each band for maximum gain, and s.w.r. is



1.65 to 1 or better on any band. Antenna will handle one kilowatt on all bands.

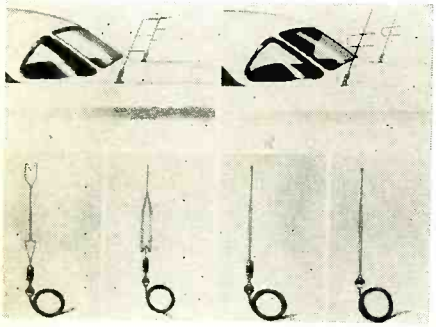
"Triple Spanners" feature adjustable trap assemblies completely enclosed in weatherproof covers. Adjustable capacitors are coded for phone or c.w. operation. The boom is of hot-dip galvanized steel. Element clamps are ¾" wide with ¼" plated bolts. These antennas are guaranteed for one year against defects in materials or workmanship.

WARD SELLS TV LINE TO GC

Ward Products Corp., Cleveland, Ohio, has announced the sale of its TV antenna business to *Telco Electronic Mfg. Co.*, a division of the *General Cement Co.*, Rockford, Ill. At the same time, *Ward* is expanding its line of communications antennas.

AUTOMOBILE AERIALS

Electrend Products Corp., St. Joseph, Michigan, now furnishes a complete line of "Fidelitrend" antennas



and boosters for car-radio use. Distinctively styled models are available for cowl, rear-deck, and dual-fender mounting. All use the patented "Coil-

tenna," which permits high signal gain with antenna heights of approximately 17 inches. With this height, the antennas are kept from extending above the level of the car top, avoiding damage by overhead garage doors, overhanging branches, and other obstacles. Also eliminated is the need for extending and retracting the antenna.

All models are available either as complete units including mount and cable, or as replacements designed to use the existing mount and antenna stub.

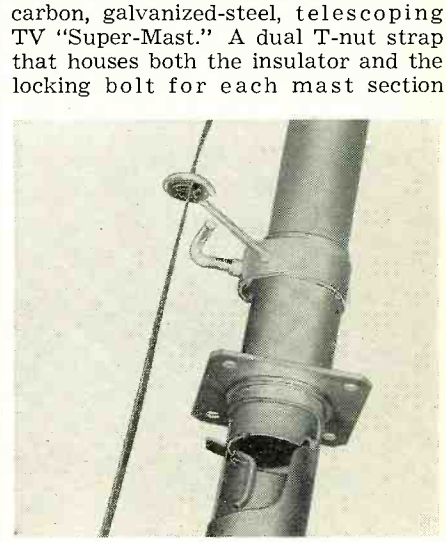
MANUFACTURER EXPANSION

Tele-Beam Industries, Napa, California, one of the leading western manufacturers of TV antennas, announces plans for expansion and public financing. The company has developed a line of antennas for use in mobile and marine communications which are being supplied to manufacturers of such equipment.

In addition, the company is manufacturing transmitting and receiving equipment as well as antenna systems for the amateur market. It is also mapping out a marketing program to select new outlets for its products. Expansion plans include renovation of the company's existing plant.

TELESCOPING MASTING

Channel Master Corp., Ellenville, N. Y., has introduced a line of high-carbon, galvanized-steel, telescoping TV "Super-Mast." A dual T-nut strap that houses both the insulator and the locking bolt for each mast section

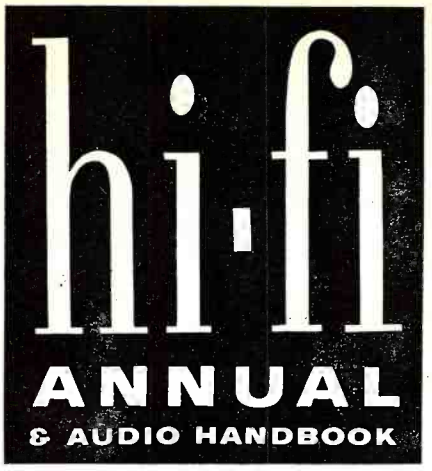


eliminates the use of two separate nut buckle straps. A free-turning, jamproof guy ring and bearing is used for each section. Each ring is positioned below the joint, enabling the technician to collapse the mast quickly without fear of jamming the sections.

INDOOR TV ANTENNA

Snyder Mfg. Co., Philadelphia, Pa., is marketing a dipole antenna designed to attach to and fold away behind a portable TV receiver. This do-it-yourself unit, the "Indoor Torque TV Tenna," can be fixed to the rear of the set *via* a twin-screw attachment. The staffs can rotate in complete circles for best reception. —30—

C MING
SC ON!



(compiled by the editors of *Radio & TV News*)

Authoritative, comprehensive guide to hi-fi construction, maintenance and equipment . . . compiled by top authorities in the field. Includes complete instructions and plans for setting up your own system—covers preamps, equalizers, amplifiers, tape recorders, speakers, enclosures and stereophonic sound.

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- **Do's and don'ts of amplifiers.**
- **Latest techniques and ideas on stereophonic sound.**
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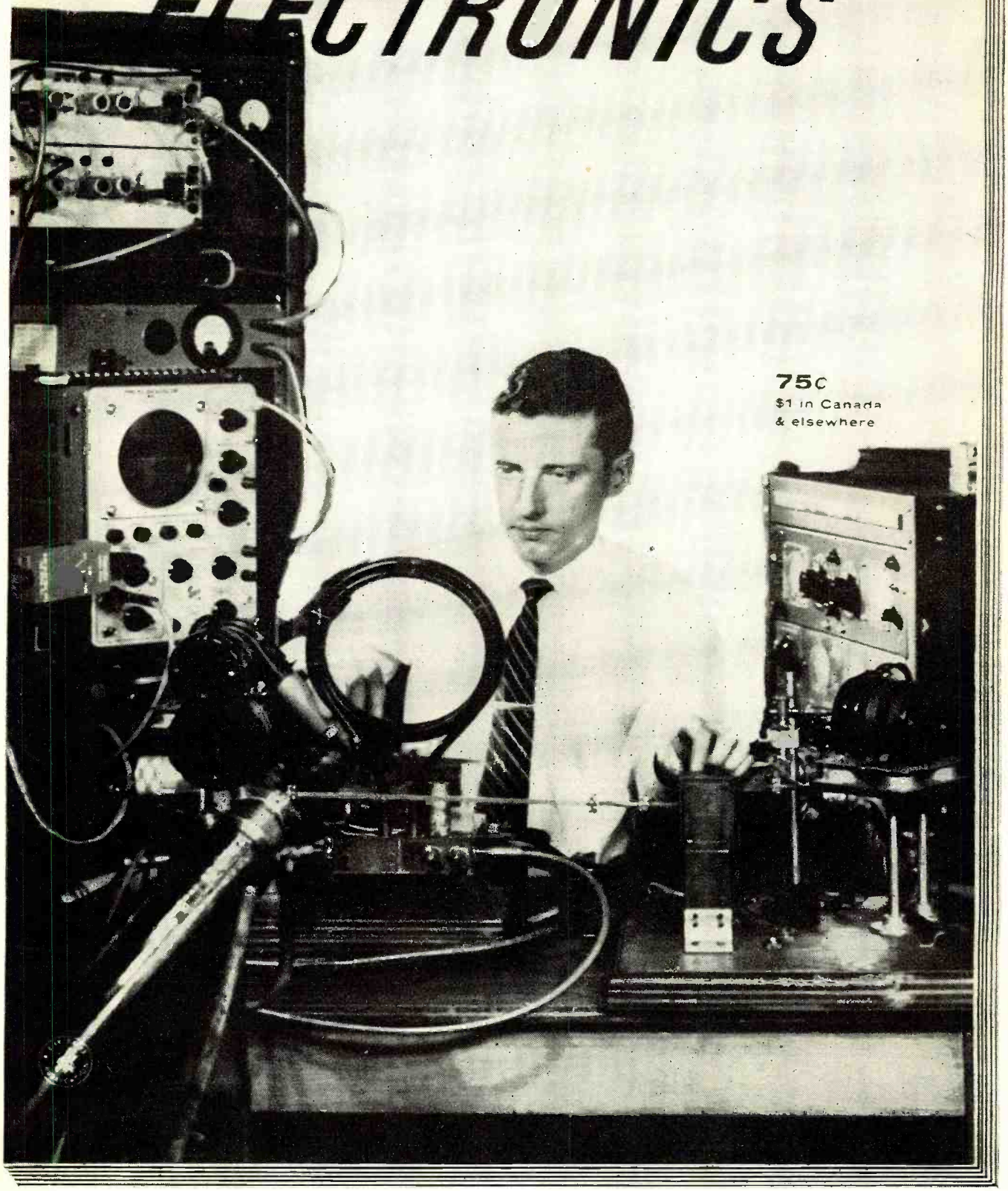


75c
$1 in Canada
& elsewhere

CENTURY TEST GEAR

Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y. has issued a colorful 6-page data sheet covering its line of test equipment for the service technician.

Illustrated and described in some detail are the firm's Model ALT-1 antenna line tester, the Model CT-1 in-circuit capacitor tester, the Model CRT-1 tester-rejuvenator, the Model SS-1 speaker substitute, as well as the "Rejuva-Check" Model RJC-1, the "Transistor-Check" Model TC-1, and the "TV Dynatracer" Model TVD-3.

A copy of this data sheet will be forwarded without charge upon written request.

J. W. MILLER CATALOGUE

J. W. Miller Company, 5917 S. Main St., Los Angeles 3, Calif. has issued a new general catalogue, No. 58, which lists nearly 1000 different replacement coils for television receivers, radios, and other electronic gear.

Listed for the first time is a new series of transistor antenna rods, oscillator coils, and i.f. transformers. The firm's line of adjustable r.f. coils and chokes is covered in detail.

A complete index and price list makes this catalogue especially useful to the ham, experimenter, hobbyist, engineer, and designer. The company will forward a free copy on request.

TRANSISTOR WALL CHART

General Transistor Corporation, 91-27 138th Place, Jamaica 35, N. Y. has compiled a handy wall chart which shows at a glance the applications, maximum ratings, and typical characteristics at 25 degrees C for some 56 types of germanium junction alloy transistors.

The chart also includes a handy interchangeability table, outlines of five different transistor cases, diagrams of various circuits, and standard IRE symbols and definitions.

The Promotion Department of the company will fill requests for this free chart.

INSTRUMENT CATALOGUE

Trio Laboratories, Inc., 4025 Merrick Road, Seaford, N. Y. has just issued an elaborate 36-page catalogue and designer's guide with photos, outline drawings, description, theory of operation, mounting details, and complete specifications on its entire line of miniature, panel-mounting electronic instruments.

The catalogue, sectioned for fast reference, includes a.c. and d.c. vacuum-tube voltmeters, power supplies,

and special instruments such as multi-channel v.t.v.m.'s, phase meters, null meters, etc.

The designer's guide section assists in the selection and application of v.t.-v.m.'s to measurement or monitoring problems and discusses the "how-to" phase of building electronic instruments into system equipment.

Requests for this catalogue should be addressed to John Van Putten, technical promotion manager.

MUELLER CLIPS

Mueller Electric Company, 1558Y East 31st St., Cleveland 14, Ohio has recently released an 8-page catalogue which provides a complete description and illustration of every clip in the company's line. Emphasis is on alligator-type and miniature test clips, including the new low-cost "70 Series" alligators.

New, easy to find, faster reading format provides quick visual and factual index to the entire line. The factory will forward a free copy of the catalogue to those requesting it direct. A free sample "70 Series" clip will accompany the catalogue.

ANDREW SUPPLEMENT

Andrew Corporation, 363 E. 75th St., Chicago 19, Ill. has published a 32-page supplement covering products recently developed by the company.

Included is data on such items as the new 9-inch u.h.f. transmission line, 3⅛-inch u.h.f. coaxial switch, and the expanded and improved line of microwave and communications antennas.

Copies of this well-illustrated supplement (21-S), as well as copies of Catalogue No. 21, are available on request to the manufacturer.

EICO ROLLCHART

Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City, N. Y. has announced publication of a new rollchart, the #666-02.

Incorporating listings for the newest tubes which have appeared on the market since the firm's Model 666 dynamic conductance tube and transistor tester was introduced, the rollchart also includes listings from the earlier #666-01 chart.

For complete information on obtaining this newest chart, write the company direct.

FREQUENCY CALIBRATION

Specific Products, 21051 Costanso, Woodland Hills, Calif. has issued an informative 4-page folder describing the calibration of r.f. and a.f. signals with standard frequency transmissions which it is offering free as a service to the industry.

Designated Bulletin 557, "Using Standard Time and Frequency Broadcasts", the booklet details a number of methods for utilizing the standard transmissions from stations WWV and WWVH, National Bureau of Standards. It discusses, with diagrams, such topics as calibration of low fixed-frequency sources, upward extension

of standard frequencies, audio frequency comparisons, and the use of standard time pulses.

The bulletin also covers the program schedules of WWV and WWVH in considerable detail, using diagrams. It also includes a short discussion on code symbol notices of propagation disturbances as well as the conditions necessary for obtaining various levels of signal accuracy.

"1957 MASTER INDEX"

Supreme Publications, 1760 Balsam Road, Highland Park, Ill., has announced publication of its "1957 Master Index"—a 48-page listing of all the material which has appeared in this company's seventeen radio manuals and all TV volumes from 1948 through 1957.

Although each of the service manuals published by the firm has its own index, this master listing will save time by giving direct reference to the volume involved and the page on which the material appears.

Copies of the index are available for 25 cents in coin. Postage will be paid by the publisher.

POWER RECTIFIERS

The Rectifier Division of *Sarkes Tarzian, Inc.,* 415 N. College Ave., Bloomington, Ind. has just issued four new data sheets covering its line of power rectifiers.

Sheet #16 gives data on the Type S-5011 full-wave silicon rectifier (1N-1150); #17 on the Type R silicon rectifiers (1N1157, 1N1158, 1N1159, and 1N1160); #18 on the Type S silicon rectifiers (1N1161, 1N1162, 1N1163, and 1N1164); and #19 on the Type V units (1N1165, 1N1166, 1N1167, and 1N1168). All of the sheets carry full specs, features, characteristics, dimensions, etc. on each of the units.

Write the manufacturer for any or all of these data sheets.

EIMAC CATALOGUE

Eitel-McCullough, Inc., San Bruno, Calif., has recently issued a "Quick-Reference Catalogue" covering its line of tetrodes, triodes, klystrons, high vacuum rectifiers, mercury vapor rectifiers, vacuum capacitors, vacuum switches, vacuum gauge, finger stock and heat dissipating connectors, sockets, etc.

The material is presented in compact tabular form and summarizes the electrical characteristics of all current commercial tube types in the *Eimac* line, including several new items not yet catalogued in the company's master listing.

Write the manufacturer direct for a copy of this up-to-date catalogue.

JOHNSON'S HAM GEAR

E. F. Johnson Company, 126 Second Ave., S.W., Waseca, Minn., has issued a colorful four-page pamphlet which illustrates and describes its line of ham gear in some detail.

Included are the "Aventurer", "Ranger", "Valiant", "Five Hundred", "Mo-

bile", "6N2", and "Pacemaker" transmitters; the "Kilowatt" amplifier; pretuned beams; "Rotomatic" rotator; and "Match-Stick" antenna system; as well as a variety of station accessories.

For a copy of this listing of products in the *"Viking"* line or for more complete details on any specific item, write the company direct.

"HIPERSIL" MANUAL

A new 24-page booklet entitled "Type C *Hipersil* Core Design and Application Manual" is now available from *Westinghouse Electric Corporation,* P.O. Box 2099, Pittsburgh 30, Pa.

Designated as Booklet B-7048, this new publication is written for production and design people concerned with the manufacture of transformers and reactors. It is illustrated with photographs, diagrams, and data charts which explain what the type "C" core is, how these cores are made, and how they are best applied. Examples are given to illustrate how transformer cost can be reduced through use of the *"Hipersil"* cores. Techniques of banding the cores are discussed in detail along with recommended methods of mounting the cores.

SPRAGUE WALL CHART

A new and revised edition of the firm's "Ceramichart" has just been published by *Sprague Products Company,* North Adams, Mass.

The new chart, M-726, provides a complete background in ceramic capacitors and printed circuits at a glance. Measuring 17"x22" and brightly printed in orange and blue on durable paper, the chart has been designed for maximum usefulness.

Schematic diagrams show where each kind of ceramic is used in four typical TV receiver sections and two typical radio circuits. There is a complete rundown on the major ceramic types, including general application, high dielectric constant, and temperature compensating "Cera-Mite" capacitors, "Bulplate" multiple capacitors and printed circuits, and the new "Universal" ceramics recently introduced.

The charts are free to all independent service dealers from the company's distributors or direct from the company for 10 cents.

WIRE AND CABLE DATA

Belden Manufacturing Co., Chicago 80, Ill., has just released a new electronic wire and cable catalogue, #857.

The new publication lists many additions to the firm's line, including new audio cables, new mike cables, new hook-up wire conforming to MIL specification 16878-B, and others. For quick and easy reference, the wires and cables listed in this new publication are grouped according to use and application.

SENCORE LINE FOLDER

Service Instruments Corp., 171 Official Road, Addision, Ill., has announced publication of a new two-color folder covering its line of low cost, time-saving equipment.

Write the company for details on obtaining a supply of these folders.

PC-SCREEN RESIST

Techniques, Inc., 52 Jackson Ave., Hackensack, N. J., is now offering a copy of its four-page information sheet covering *"Supracote* Blacktop #3", an improved screen resist for printed circuits.

The publication lists general and specific information on the product as well as data on methods of application, drying, removal, and screening. Manufacturers using printed circuitry in their production runs are invited to obtain a copy of this release.

TRANSISTOR APPLICATIONS

Raytheon Manufacturing Company has announced publication of Volume 2 of its "Transistor Applications Book."

This new volume supplements and broadens the scope of the predecessor book. It contains 60 pages of all new transistor circuits with full construction details. Circuits employing the company's r.f. transistors as well as the popular CK722's are featured.

The book is divided into application sections on receivers, amplifiers, ham gear, service equipment, and gadgets.

Copies of this new publication are available from the company's tube distributors for 50 cents each. —30—

The Diplexer Coupler

(Continued from page 69)

the line, the paralleled impedances of the two receivers have to be stepped up to 600 ohms each. As any antenna handbook tells us, the impedance (Z_o) required of a quarter-wave section to match two other impedances may be determined by multiplying the two impedances to be matched (300 ohms and 600 ohms) and then finding the square root of this product. The impedance of the transformer is thus found to be 425 ohms.

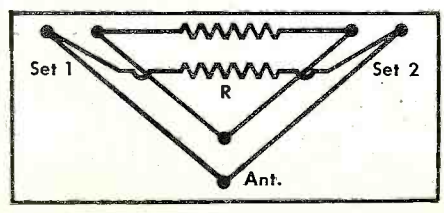
With this value, the antenna and line then see 300 ohms at the point where the line joins the matching sections. However, when we go to other calculations to determine what impedance each set sees at the point where it terminates, through the transmission line, at the junction, we find this value to be 900 ohms. This is a 3:1 mismatch. This mismatch may be corrected by inserting two resistors between the terminals of the sets, as shown in Fig. 4. Note that, since these resistors are not in series with signal from the antenna, they create no additional losses.

These resistors, equal in value, perform another important function. Although they do not drop signal from the antenna, they do provide a lossy path for any signal, such as interference, from one set to the other. They are actually in shunt with another path between the sets, provided by the two quarter-wave sections.

Through the latter path, it is possible for interference originating at one set to reach the other but, when it does, an interesting thing takes place. Since signal going from one set to the other through the two matching sections must travel a half-wavelength, it arrives 180 degrees out of the phase it had at the point of origin. However, signal traveling over the alternate resistive path remains in-phase. Thus, the two signals cancel each other. As a result, signal isolation between the sets is high.

With the five electrical requirements for good coupler performance thus achieved, there remained the physical problem of reducing 46-inch lengths of 425-ohm transmission line (quarter-wavelengths at 65 mc.) to reasonable size. These were replaced by two pairs of coils (Fig. 1) carefully designed to simulate the distributed constants of the transmission-line sections. In production, these coils are adjusted under test conditions. —30—

Fig. 4. Equivalent circuit for the coupler, with isolating resistors.



Sun	Mon	Tue	Wed	Thu	Fri	Sat
			2	3	4	5
						12
						19
						26

CALENDAR of EVENTS

AUGUST 28, 29, 30

Pacific General Meeting. Sponsored by the American Institute of Electrical Engineers. Pasco Senior High School, Pasco, Washington. Inspection trips to McNary Dam and Ice Harbor Dam have been scheduled. Further information available from A.I.E.E. headquarters in New York.

SEPTEMBER 4, 5, 6

Special Technical Conference on Magnetic Amplifiers. Sponsored by PGIE and A.I.E.E. Penn Sheraton Hotel, Pittsburgh, Pa. Information regarding program available from G. F. Pittman, Jr., % Westinghouse Electric Corp., P. O. Box 10596, Pittsburgh 35, Pa.

SEPTEMBER 8-14

National Television Week. Sponsored by RETMA, NARTB, NARDA, and Television Bureau of Advertising.

SEPTEMBER 8, 15, 22, 29

MARS Eastern Technical Net. Special series of technical sessions with outstanding speakers. Net time is Sundays at 2 p.m. (EDT) on 3295 kc. and 7540 kc. Harvey McCoy, AF2IYX, is net director. Contact him for further details on the specific programs.

SEPTEMBER 13, 14, 15

Sixth Annual Chicago High Fidelity Show. Sponsored by Magnetic Recording Industry Association and International Sight & Sound Exposition, Inc. Palmer House, Chicago, Ill.

SEPTEMBER 17, 18, 19, 20, 21

First Chicago Show. Sponsored by the Institute of High Fidelity Manufacturers. Morrison Hotel, Chicago. September 17, for trade only. Open to public balance of run. Further information from Sanford Cahn, director of shows for the Institute, 125 E. 23rd St., New York 10, N. Y.

SEPTEMBER 24, 25

Sixth Annual Industrial Electronics Symposium. Sponsored by A.I.E.E., IRE, and Chicago sections of both societies. Morrison Hotel, Chicago, Ill. Further details from E. A. Roberts, % Union Thermoelectric Corp., 2001 Greenleaf, Evanston, Ill.

OCTOBER 7, 8, 9

National Electronics Conference. Sponsored by A.I.E.E., IRE, Illinois Institute of Technology, University of Illinois, and Northwestern University. Hotel Sherman, Chicago, Ill. Inquiries should be addressed to NEC, 84 E. Randolph St., Chicago 1, Ill.

OCTOBER 7-12

New York High Fidelity Show. Sponsored by the Institute of High Fidelity Manufacturers. New York Trade Show Building, New York City. Contact Institute at 125 E. 23rd St., New York 10, N. Y.

OCTOBER 9-12

1957 Convention. Sponsored by Audio Engineering Society. New York Trade Show Building, New York City. Sherman Fairchild, president of Fairchild Recording Equipment Co., Long Island City, N. Y., is chairman of the convention committee.

Service Industry News

THE MEMBERS of the Electronic Service Dealers Association of Western Pennsylvania, Inc., have been deeply disturbed over the invasion of self-service tube testers in that area. In urging its members to install testers in their shops to meet this competition, the editor of their monthly newsletter said recently:

"We are all aware that manufacturers and distributors are exploiting the public *via* tube sales in general retail stores. We also know that the end effect will be hundreds of drug and retail stores polluted with these things selling tubes like eggs and eventually tearing the price structure right out from under our feet.

"There are those who rest on their large, chubby undersides and tell us that they must sell and we can help them sell by working for free so that they may acquire more-so chubby undersides. Some of us are doing just that.

"As it now stands, we can only meet this competition by installing these checkers in our own shops to at least get the consumer into our stores. Let them check their own tubes. If they desire assistance then assess them a regular fee for your time and check the tubes on your own efficient tube checker. Take advantage of the offers made by a couple of our good distributors who will install these checkers in your shops at their cost. Keep this service business in your shop where it belongs."

Indianapolis, Indiana, was the first city in the country to have almost complete saturation of self-service tube testers in drug stores. At the present time, practically every drug store in the city, irrespective of its location, has a self-service tube tester prominently displayed. The men who handle these checkers are giving location owners up to 35% of tubes sold.

In the light of this widespread competition from non-electronic retailers the following article, under the heading "Voice From Gobblers Knob," which appeared in the first issue of the monthly IESA house organ, *The Hoosier Test Probe*, is an interesting reflection of service thinking in that area about competing with self-service testers:

"Hit bein' a warm summer day an me havin' my work caught up, I ambled down the road apiece ta my cousin Luke's shop which is on the other side of town. Luke's my only competitor in these here parts, an havin' the TV service business all in one family can be kinda nice.

"As I walked in the front door, I could tell somethin' were wrong. Luke

was a standin' by his counter an' his face was the brightest shade of purple ever I've seen. I jist waited an purty soon he simmered down, returnin' to his natural color again.

"'If that customer don't beat all,' sputtered Luke, 'makin' me quit diggin' fishin' worms to test some tubes for him, then gettin' mad when I asked him to pay a little somethin' fer my time.'

"Well sir, that made me think a bit. Ya see, I'd noticed how things were up in the city, what with drug stores, super markets, an all, havin' tube testers an' sellin' tubes in competition with fellows in the service business.

"'Luke,' I says, 'there's real money to be made sellin' tubes providin' we don't let the business git away from us. In return for this extra profit, which we've been takin' pretty much for granted, maybe we owe these customers a little bit of our time. If we don't do this an keep 'em comin' in here for their tubes somebody else may do it for themselves.'

"'We don't have any big drug stores or super markets here, but the feller that runs the fillin' station out at the crossroads is a real go-getter. I can jist imagine him with a tube tester and big signs up, a takin' all our tube customers away.'

"Luke and I decided right that afternoon to paint big signs on the front windows of both our stores announcin' that we test tubes *free*. Bet those service fellers in the city wished they'd a thought of that afore it was too late. Ya know, still might not be too late for them."

Many service dealers who initially were "up in arms" when self-service testers appeared in their areas later took a second look at the do-it-yourself trend and adopted it to the benefit of their own businesses. They found that, while a large segment of the public is interested in doing its own home repair work, these people welcome and appreciate expert advice. The result is that many electronic service shops have become real "service centers" in their communities by handling a variety of small tools and fittings that are needed in home maintenance work, as well as offering free tube-testing facilities.

Consumer spending for services has been climbing rapidly since 1948. According to a survey conducted by *Newsweek* magazine, the boom in spending for service has been accelerating upward since 1948. The *Newsweek* report said, "Since last December, service spending by consumers alone (not counting services bought by business) has topped an annual rate of $100 billion—more than the entire national gross product in 1939—and accounted for nearly two-thirds of all consumer spending."

As it absorbs an increasing share of the national income, service will be under mounting pressure to improve its efficiency to give a better value for each dollar spent on service labor and parts. Dealers who adjust their busi-

nesses to permit economy-minded set owners to save money on labor charges are gearing their businesses to flow with the economic tide.

Five-Day Service Week

In a move to give members an opportunity to spend more time with their families during the slow business months, the Radio Television Guild of Long Island endorsed a 5-day, 40-hour week plan. The *Guild News* said, in reporting on this development:

"In an effort to enjoy life and family during the slower months of the year, a number of service dealers in the community surrounding Mineola and New Hyde Park are locking their doors on Wednesdays.

"Led by Guild member Bill Dore of *Airway Television*, Mineola, twelve dealers have signed agreements to maintain the Wednesday off schedule from June 1 to August 31.

"It has been reported that many other dealers are participating in the program of 'going fishin' Wednesdays.' The Radio Television Guild membership supported and encouraged the practice of service centers closing their doors for one day each week during the slower months of the year." Could this be a trend?

Contract Service

The Television Service Association of Michigan recently instituted a one-year standard maintenance contract plan for the use of its members, according to the *TSA News*. The new plan is aimed at giving TSA members a contract service plan that is competitive to those offered by contract service firms and factory service.

All prices for consumer contracts are set by the individual servicing members. Although all contracts are sold and issued by the individual participating members, the work is guaranteed by TSA. Prices per year on sets up to and including 21-inch, range from $34.95 to $44.95 per year, with service calls from $3.95 to $4.95. There is a small extra charge for 24- and 27-inch sets.

Association Roster

NATESA is trying to maintain a National Registry of Active Associations throughout the country, whether they are affiliated with the NATESA national apparatus or not. To this end, registration cards are being circulated to service groups throughout the nation. The need for contact on universal industry problems is given as the reason for this effort. —30—

NEW MERCHANDISING AIDS

Weller Electric Corp. has announced the availability of its Distributor Replacement Parts Kit and a colorful, three-dimensional plastic distributor identification sign. In addition, the popular "Tip Bucket Deal," to boost the sale of replacement tips for soldering guns, has been revived at a special price.

The parts kit (RPK-1) features an assortment of 64 soldering gun parts and is factory-packed in a two-drawer merchandiser. The cost to distributors is $28.24.

The "Tip Bucket Deal," is available to distributors for $42.00. It includes 150 packages of No. 7250 soldering tips, 150 packages of No. 7135 tips, two "Tip Buckets," and one display sign.

* * *

TV WIRE DISPLAY RACK

Channel Master Corp. has announced the introduction of a new display rack for TV wire hanks.

The attractive three-color rack is made of durable heavy gauge metal and makes an ideal permanent point-of-sale merchandiser. It can also be used as a compact storage unit to stock a variety of TV wire. The rack

has four prongs with a capacity of 12 hanks each. It measures 23" high and 24" across.

This new unit was created to satisfy dealer requests for a sales aid to capitalize on the increasing volume of over-the-counter TV wire sales, with hank packaging the leading consumer preference.

* * *

RAYTHEON CAMPAIGNS

Two new promotion campaigns were announced recently by the distributor sales department of *Raytheon Mfg. Co.*

The program for service dealers provides a collection of window displays and streamers, indoor and outdoor signs, sales helps, advertising aids, shop aids, business supplies, and service aids.

The electronic technician plan is a long-range sales building program pro-

vided for qualified service technicians through the firm's sponsoring bonded distributors. The service dealer is pledged to adhere to a strict code of business ethics through one of the country's largest insurance companies. This bond gives solid support to independent service dealers' repair work on all makes and models of TV and radio receivers.

* * *

ANTENNA PROMOTION

In order to give antenna replacement business a boost in its area, the *Bluefield Supply Co.*, West Virginia distributor of *JFD* antennas and accessories, decided to mount a miniature "Star Helix Colortenna" on a rotator atop its delivery and pick-up truck. The installation has attracted considerable interest among TV owners in many parts of the city by focusing attention on the importance of the TV antenna in good reception.

Accordingly, it has produced a marked increase in outdoor antenna business for service technicians and dealers.

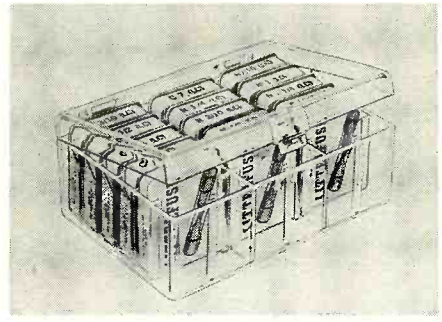
* * *

NEW FUSE CADDY

Littelfuse, Inc. is now producing a new plastic-packaged fuse caddy which is designed to fit into a compartment in the service technician's tube caddy.

It contains an assortment of 15 limited-current fuse types which will cover 94% of all service requirements for this new type of fuse, plus three spare compartments for the carrying of additional fuses.

The company points out that widespread use of a fuse of this type is relatively recent and the technician



may not have stocked the complete range he will encounter. The fuse caddy is designed to save him valuable time by making the complete range available in a convenient package.

* * *

MONTHLY PRODUCT BARGAINS

General Cement Mfg. Co. has inaugurated a year-long program of specially priced and packaged items for radio and television service technicians. These will be made available to them through their electronic parts distributors.

This new program, called "Profitunity" was originated as a means of introducing important new servicing

aids to service technicians everywhere and making it worth their while to buy these items at reduced prices for a limited time.

Each month a different product or kit will be on sale at distributors all across the country and technicians are urged to take advantage of the offer while stocks are available. Once they have sold out, these specials will revert to their regular catalogue prices.

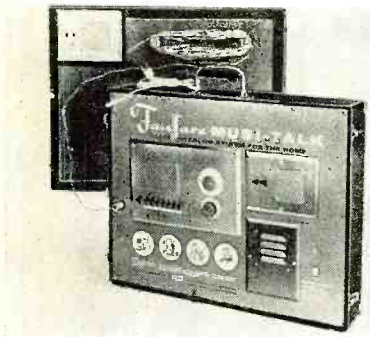
* * *

DEMONSTRATOR KIT

Fanon Electric Co. has introduced a "Musi-Talk" demonstrator kit to the trade.

The kit incorporates the company's "Musi-Talk" radio-intercom system, which is mounted on an attractive display board and housed in a luggage-type carrying case. It comes ready to operate and in order to fully demonstrate all the features of the system, one remote station is mounted in the removable case-cover.

Although originally designed for use by the firm's own sales representatives, the sales potential envisaged for



the system has caused jobbers to order the units for use by their own salesmen. The demonstrator lends itself admirably as a counter display, as well as a forceful selling tool in demonstrating the system to contractors and builders at their offices.

* * *

JOBBER PROGRAM

Colorful and attractive merchandising aids are receiving the attention of the *General Transistor Distributor Corp.* as one of the strong points of the organization's positive jobber program.

The company plans to supply its jobbers with a complete merchandising package. The items to be included are: a functional point-of-purchase counter display which will store a complete inventory of transistors packaged in eye-catching, sturdy boxes; a self-dispensing counter display card to hold the individually packaged transistors of the most popular types (including schematic diagrams for experimenters); a laminated "authorized distributor" plaque; a supply of distinctive window stickers; envelope stuffers provided with space for imprint; multi-colored window streamers; and an attractive and colorful "take-one" box to be used for dispensing the free technical literature made available to the company's distributors from the factory. -30-

Within the Industry
(*Continued from page 30*)

port-export companies, *R. I. Mendels, Inc.*, and *Rimenco, Inc.*

Mr. Mendels is a graduate of the Amsterdam Technical College and holds degrees in mechanical and electrical engineering.

* * *

WILL A. CONNELLY has been appointed to the post of sales manager of *Metzner Engineering Corp.* . . . **RICHARD C. BRUBAKER** has been appointed controller for the audio and Recordata divisions of *American Electronics, Inc.* . . . The appointment of **WILLIAM S. IVANS, JR.** as vice-president in charge of engineering for *Kim Tel,* a division of *Cohu Electronics, Inc.,* has been announced . . . **HERBERT A. BODKIN** is now sales manager of *Electrovox Co., Inc.* . . . *Westinghouse Electric Corp.* has named **E. W. SEAY** manager of general advertising . . . *Magnetic Amplifiers, Inc.* has elected **HAROLD A. GOLDSMITH** president and **HERBERT HERZ** executive vice-president. **S. M. KELLEN,** former president, was elected chairman of the board of directors . . . **MORTON G. SCHERAGE** has been named instrument product manager of *Allen B. Du Mont Laboratories, Inc.* . . . *Jerrold Electronics Corporation* announces the election of **BERNARD E. NARIN** as treasurer of the firm . . . *International Resistance Company* announces the resignation of **IRWIN W. BRAUN** as president of its St. Petersburg, Florida subsidiary, *Circuit Instruments Inc.* . . . **JOHN F. EATON** has been appointed sales manager of the *United States Dynamics Corp.* . . . **ROBERT M. FICHTER** is now television sales manager for the television-radio division of *Westinghouse* . . . **J. C. KEITH** has resigned as vice-president in charge of sales of *Howard W. Sams & Co., Inc.* He will be succeeded by **JOE E. MORIN** as general sales manager . . . **DR. O. G. VILLARD, JR.** has been named to the board of directors of *Ling Electronics, Inc.* . . . The election of **SIGURD F. VARIAN** to vice-chairman of the board, and **H. MYRL STEARNS** as president of *Varian Associates* has been announced by the firm . . . **JOHN MESSERSCHMITT** has been appointed assistant to the vice-president and general sales manager of *Amperex Electronic Corp.* In addition, **GEORGE ELLIOT** has been named manager of export and tube industry sales for all of the firm's products . . . **DR. MYLES L. MACE,** vice-president, has been promoted to the position of chairman of the management committee of *Litton Industries* . . . **HOMER S. MYERS** has been elected to fill the newly created post of vice-president for marketing, *Tracerlab, Inc.* . . . *Tobe Deutschmann Corp.* announces the promotions of **JOHN M. GLYNN** and **JOSEPH R. RICHMOND** to the positions of assistants to sales manager . . . **L. S. BILLMAN** has been named chief engineer of the power factor capacitor division of *Cornell-Dubilier* . . . **WARREN HOWE** has been promoted to the position of

market analyst of *Belden Manufacturing Company* . . . The appointment of **R. H. GOODWIN** as general sales manager of *Electronic Wire & Cable Corp.* has been announced . . . **JACK C. HOUSEMAN** has been named assistant sales manager for the home products division of *Packard-Bell Electronics* . . . **DAVID A. HARKAVY** has been named to the newly created position of industrial products advertising manager for both the *DeJur-Amsco Corp.* and *Continental Connector Corp.* . . . *Simpson Electric Co.* has added **JOHN F. SCHIPITZ** and **ROBERT VANDERVOORT** to its sales staff . . . **ROBERT F. MARLIN** has been appointed purchasing agent for the parts division of *Sylvania Electric Products Inc.* . . . *Quam-Nichols Company,* oldest speaker firm continuously operated under the same family management, recently celebrated the one-third century mark since its entry into the field . . . **MAX L. HAAS,** chairman of the board of *Bud Radio, Inc.,* recently passed away at age of 61 . . . **JOHN O. GREEN, JR.** has been appointed to the board of directors of the *Permacel Tape Corp.* . . . *Waters Manufacturing, Inc.* has named **WILLIAM W. BARTELL** to the post of general sales manager . . . The board of directors of *Tracerlab, Inc.* announces that **SAMUEL S. AUCHINCLOSS** has been elected president and chairman of the board . . . *Symphonic Radio and Electronic Corp.* has appointed **ALBERT LEON** advertising and sales promotion manager.

* * *

THE MAGNETIC RECORDING INDUSTRY ASSOCIATION elected the following new officers at its annual meeting in Chicago:

Irving Rossman, *The Pentron Corp.,* president; Arnold Hultgren, *American Molded Products Co.,* vice-president; Herman Kornbrodt, *Audio Devices, Inc.,* secretary; Charles Dwyer, *Webcor, Inc.,* treasurer; Victor Machin, *Shure Brothers, Inc.* and Joseph Hards, *Magne-Tronics, Inc.,* members of the board of directors.

In addition, the association also discussed the establishment of technical standards for the industry and the possibility of consumer shows for the purpose of acquainting the public with the full scope of the magnetic field.

* * *

ORRADIO INDUSTRIES, INC. has broken ground for its new plant which will manufacture magnetic recording tape for television, instrumentation purposes, and sound recording. The one-story brick building will cover 37,000 square feet . . . **NESHAMINY ELECTRONIC CORP.,** producers of "JansZen" loudspeakers, is adding to its present plant facilities at Neshaminy, Pa. . . . **LE-HI ELECTRICAL COMPANY** has moved to 604 Market Street, Newark, N. J. . . . **SPERRY RAND CORPORATION** has finalized the leasing of 11,000 square feet of temporary space in Dunedin, Fla. Construction of a new plant of 75,000 square feet has already begun . . . **BOMAC LABORATORIES, INC.,** Beverly, Mass., is building a new, million dollar plant at its Route 128 site which

will virtually double the company's present engineering and manufacturing facilities . . . **FANON ELECTRIC COMPANY** announced the opening of the firm's new export department at 15 Moore Street, New York 4, N. Y. All foreign advertising, sales promotion, inquiries, and shipments will be handled by this new department . . . **PERMA-POWER COMPANY** recently completed a move to its own new and larger building. The organization is now located at 3100 North Elston Avenue, Chicago, Ill. . . . The Pittsburgh, Pennsylvania district office of **THE BRISTOL COMPANY** recently moved into a new building at 2250 Noblestown Road. In addition, the firm has opened a new branch factory and repair laboratory for its components at 3617 West Alabama, Houston, Texas.

* * *

REK-O-KUT, INC. has purchased the **AUDAK COMPANY.** The trademark, "Audax", will be continued and a new corporation, to be known as **AUDAX, INC.**, will be formed as a division of the parent organization . . . **MINNEAPOLIS-HONEYWELL REGULATOR COMPANY** has purchased from **RAYTHEON MANUFACTURING COMPANY** the latter's 40 per-cent stock interest in **DATAMATIC CORPORATION.** With this purchase, the firm now owns all the outstanding stock in the corporation . . . **PHILIPS ELECTRONICS, INC.** and **A. HOLLANDER & SON, INC.** have announced their merger. The former concern is a factory subsidiary of **PHILIPS INDUSTRIES, INC.** . . . **SERVICE INSTRUMENTS CORP.** recently purchased **H AND S MACHINE PRODUCTS CO.** The new fabricating shop will be operated as a second corporation under the name of **ELECTRONIC METALS INC.** . . . **TUNGSOL ELECTRIC INC.** has purchased **CHATHAM ELECTRONICS** from **GERA CORPORATION.** —30—

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ERRATA

In the article "The SR-200 Hi-Fi Control Amplifier" (June, 1957 issue) there was an incorrect tube designation in Fig. 1 (page 50). The tube shown as the tone control preamp should have been a 12AU7 instead of a 12AX7. The phono preamp is a 12AX7 as shown.

* * *

The letters "C" and "M" used to designate the various sections of the test cord in Fig. 5, page 51 of the July issue ("Summer Service: Room Air Conditioners") should be interchanged. Our apologies for the error.

Classified

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RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 18 or 21 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

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.

BLONDER-TONGUE CAM 1 4; DAS 1; MA4 1; CS 2, 4, 5, 7, 1 Jerrold B26 low strip; 2000 ft. RG11U good cond used ½ net price. W6QJV, 19980 Gist Rd., Los Gatos, Calif.

COLLECTORS—1923 Crosley Model V1, XJ, X. Original cartons. Box A, Otter Lake, N. Y.

PRINTED Circuits: Design your own. Materials and complete instructions $2.00. Free literature. Dawntronics, SDM, 2051 Lansing, Denver 8, Colorado.

SURPLUS Electronics parts, equipment, etc. approximately 100 pounds $9.95 F.O.B. Dayton. A.C. line cords 6 ft. 6 for $1.00. Jumbo 4-pin Transmitting tube Sockets 4 for $1.00. Parts assortment package, condensers, volume controls, resistors, sockets etc. all new $5.00 postpaid. Remittance with order. Alpine Products, Dept. 9D, 2236 Hepburn, Dayton 6, Ohio.

MARINE Crystals Since 1933. Dealer Discounts. Prepaid Airmail delivery. Literature. C-W Crystals, Box 2065, El Monte, Calif.

DIAGRAMS—Radios, Amplifiers, Changers, $1.00 Each. Television Service Data $2.00. Unknown Models. Give Tube Layout and Part Numbers. Cable Electronics Corp., 851 10th Ave., New York, N. Y. (Formerly Kramer's Radio Service.)

DIAGRAMS! Service Data! Radios $1.00. Televisions $1.50. TV Tube Layouts, with First Aid Service Hints, 50¢. Give Make, Model. TV Miltie, Box 101 Rt., Hicksville, New York.

FREQUENCY Modulation Tuners, 88-108 Megacycle, Complete with 4 tubes, $12.95. Grutman, One East 167th Street, Bronx, New York.

WANTED

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. Box 50 % RADIO & TV NEWS.

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., 15 East 40th St., New York City, telephone LExington 2-6254.

WANTED: Signal Generators TS-403, TS-497, TS-621, SG-3/U, TS-437, TS-510, TS-588, TS-608, etc.; TS-186 Frequency Meters, AN/APR-4 Tuning Units, other "APR-" Receivers, ARC-3, other Surplus; also Hewlett-Packard and other laboratory quality equipment. Weston, etc. instruments; technical manuals; for quick cash or swap for Zenith Transistor Portables, etc. Littell, Firhills, Box 26, Dayton 9, Ohio.

EARLY battery radios, crystal sets, parts, magazines, tubes, etc. Paul Thompson, 1300 So. Main, Las Vegas, Nevada.

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.

REPAIRS AND SERVICING

HIGH Fidelity Speakers Repaired. Amprite Speaker Service, 70 Vesey St., N. Y. 7, N. Y. Ba. 7-2580.

TAPE RECORDERS

RECORDERS, HiFi, Tapes, Free Wholesale Catalog. Carston, 215-R E. 88 St., N. Y. C. 28.

TAPE Recorders, Tape. Unusual Values. Free catalog. Dressner 69-02 R, 174 St., Flushing 65, N. Y.

POCKET Tape Recorder Mohawk Midgetape with carrying case, earphones microphone, batteries, tapes, AC converter, foot controlled transcriber. Sacrifice. Complete, $200.00. Taylor Devices, North Tonawanda, New York.

WHOLESALE Catalog 10¢. Recorders. Tapes. Typewriters. Watches. Towers, #155, Philadelphia 5.

HIGH FIDELITY

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3C31	1.00	*750TL	30.00	5881	2.80
3C45	6.75	803	1.50	5910	.45
3J30	25.00	805	4.00	5915	.50
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	Write	807W/5933	1.50	6112	4.50
*4-65A	15.00	813	7.75	6130/3c45	4.75
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6C21/450TL		918	1.10	9003	1.25
	13.50	927	.95	9004	.25
6J4	1.70	954	.10	9005	Write
15E	1.00	955	.30	9006	.30
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*35TG	2.00	957	.30	And others (Surplus)	
VC50/32V	8.00	958A	.35		
RK-60/1641		991	.20		
	1.15	CK1005	.30		
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Immediate Delivery

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2 COLOR TUBE CARTONS

Keeps your tube stock neat. New safety partition prevents tube breakage. Distinctively lithographed in glossy red and black. The most distinctive tube carton available today. Minimum quantity: 100 of any one size. Write for case lot prices.

SIZE FOR TUBE	PER 100
Miniature...6AU6, etc....	$1.00
GT .....6SN7, etc.....	1.25
Large GT ....1B3, etc.....	1.50
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Completely blank. No printing or color. Otherwise same as above. Same high quality, same low prices. Specify "WHITE" when ordering. When color is not stated, 2 color cartons will be shipped.

TUBE STACKERS

White glossy only. Ministacker holds 10 Mini. tube cartons; "GT" stacker holds 10 "GT" cartons.

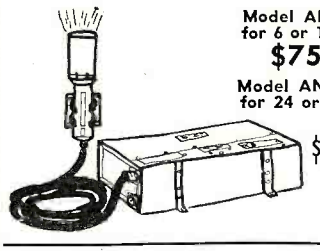
SIZE	PER EACH
Ministacker	1½c
GT	02

$10.00 Per Case of 1,000 F.O.B. N.Y.C.

(All cartons & stackers f.o.b. NYC)

AIRPORT or PHOTOGRAPHIC FLASH EQUIPMENT

Flash visible up to 3 miles, even in bright sunlight. May be used for portable (48 lbs.) photo-flash, visual signals, experiments, etc. Consists of a very high voltage converter, electronic flash lamp & holder, cables, mounting brackets, spare parts kit with extra flash lamp included, and detailed technical manual. Unused, complete. Some require paint touch-up. Can be made to operate from 115 VAC, 60 cycles with circuit modifications. All tested & working when shipped.



Model AN/VVX-1 for 6 or 12 v. DC

$75.00

Model AN/VVX-1X for 24 or 48 VDC

$65.00

WRITE FOR "BARRY'S GREEN SHEET" FREE!

NOTE: Even Barry is not infallible! Try as we might to prevent it, on rare occasions, our sources of supply do send in a bad tube that escapes our careful examination. So, if at any time one does slip by to you, please advise us at once so that we can make prompt and cheerful correction.

TERMS: 25% deposit with order, balance C.O.D. All merchandise guaranteed. F.O.B. N.Y.C. Subject to price variation and stock depletion

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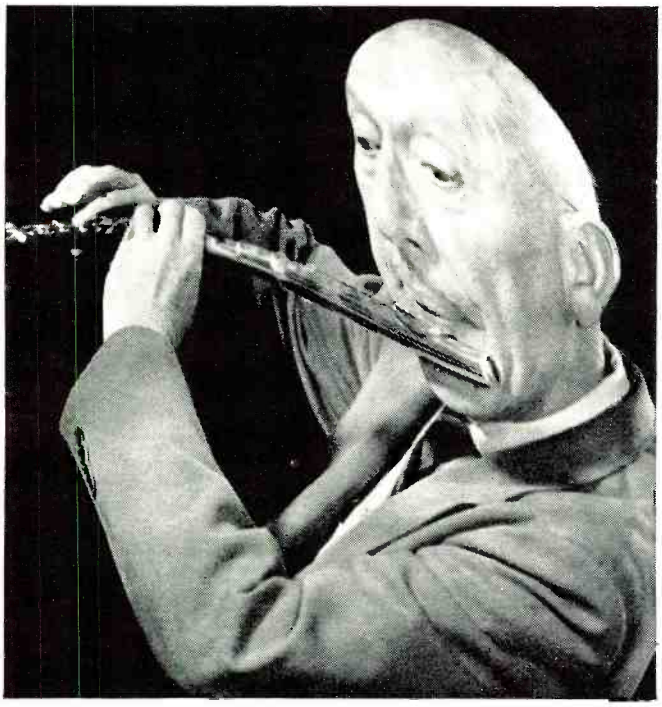
INDEX OF *Advertisers*

SEPTEMBER, 1957

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.

PRINTED IN U.S.A.

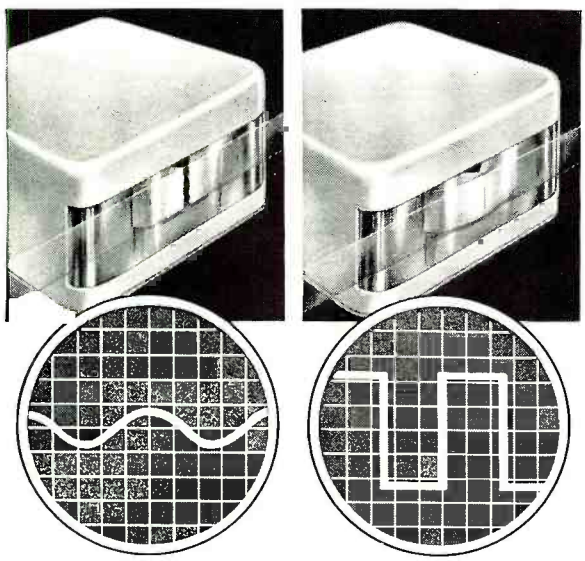
SOLVED!



A recorder head worn by conventional tape can cause you to hear the same lack of sharpness you see here.

"Scotch" Brand Magnetic Tape reduces head abrasion to assure years of clear audio pleasure.

End loss of resolution, reduce head wear with "Scotch" Brand's built-in dry lubrication



Sound signal at left, which has lost its shape, is made by machine with worn magnetic head. Clearly defined square wave signal at right was made by identical type recorder whose head is "Scotch" Brand-protected.

You asked for it and "Scotch" Brand is first to bring it to you! Built-in silicone lubrication to minimize loss of resolution, absolutely eliminate tape squeal and save your machine's delicate magnetic head from abrasion.

Only "Scotch" Brand Magnetic Tapes perform this essential lubricating job for you, because only "Scotch" Brand has silicone lubrication that lasts the life of the tape. And what a difference this built-in safety feature makes! "Scotch" Brand Magnetic Tapes glide smoothly, easily over your recorder head, while the head itself is protected from the abrasive action you get with conventional tapes.

Treat your machine to a reel of "Scotch" Brand soon and hear the difference. FREE TAPE TIPS . . . write Dept. PF-97.

ONLY "SCOTCH" BRAND HAS SILICONE LUBRICATION

SCOTCH BRAND Magnetic Tapes

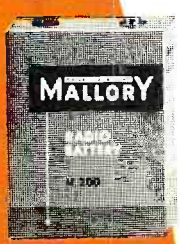
Tops in performance and value for today's growing market...

Mallory *Mercury* Batteries...

To get your share of the growing, profitable battery market—sell the batteries that helped make the new transistor radios possible. Amazing Mercury Batteries, pioneered by Mallory, lead all others in small size, long life, fade-free performance. No wonder they're the leading choice of set manufacturers and distributors!

Mallory Mercury Batteries stay at full strength for months on the shelf. They last far longer and cost far less per hour of use. They deliver the unequalled performance that builds repeat sales. And they're backed by consistent Mallory promotion and strong Mallory advertising in the Saturday Evening Post, Time, Newsweek and Business Week.

Get full facts today from your Mallory distributor, on the TWIN-LINE of Mallory Mercury and Zinc-Carbon Batteries... leaders in profit and performance for both transistor and vacuum-tube portable radios.



For vacuum tube radios—Mallory Zinc-Carbon Batteries.

- Capacitors • Vibrators • Switches • Controls
- Resistors • Rectifiers • Power Supplies
- Filters • Mercury and Zinc-Carbon Batteries

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